Functional Servicing Report

1521 Sunningdale Road

October 28, 2021

Prepared for:

Auburn Developments Inc.

Prepared by:

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FUNCTIONAL SERVICING REPORT

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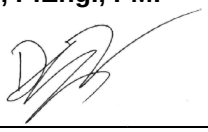
Mohammad Meqdad, MEng., P.Eng., PMP



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Tim Stubgen, P.Eng.

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1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION

Stantec has been retained by Auburn Developments Inc. to prepare a Functional Servicing Report (FSR) for the draft plan of Subdivision for the subject lands located at 1521 Sunningdale Road in London, Ontario. This report will outline the Functional Servicing strategy for the proposed development.

The site is located just within the northwest quadrant of the City of London development boundary with frontage on Hyde Park Road to the west and Sunningdale Road to the south. The subject site existing land use is primarily agricultural encompassing an area of 20.54 ha and proposed to include 6.22 ha of low-density single-family homes, 8.29 ha of medium density townhouses, 4.32 ha of road including right of ways, 0.92 ha of parkland and open-space, and 0.79 ha of SWM block. An external area of about 24.66 ha is tributary to the site and is accounted for in this report. Refer to Figure 1 for the site location.

A Draft Plan of Subdivision for the proposed development has been prepared by Stantec Consulting Ltd. and forms the basis for the proposed servicing concepts. Proposed draft plan is included in Appendix ‘A’.

Stantec has previously prepared a servicing report for the proposed development based on a former proposed subdivision draft plan. This report will assess the servicing of the proposed site based on the revised draft plan. Refer to Appendix ‘B’ for the previously drafted servicing report.

1.2 LIMITATIONS OF THE REPORT

The information presented in this report is based on the review of the following information:

- 1521 Sunningdale Road West Concept Draft Plan as prepared by Stantec (Aug 2021);
- Preliminary Servicing Feasibility Study by Stantec (Sep 2018);
- Hydrogeological Assessment by EXP (Oct 2021);
- Hydrogeological Investigation completed by Golder Associates (June 1998);
- Northwest Trunk Watermain Phase 3 Plan and Profile by Parker Consultants (Dec 1996);
- Fox Hollow Trunk Sanitary Sewer Drainage Area Plan and Sanitary Design, Stantec (April 2011);
- Creek View Subdivision Phase 3 Sanitary Area Plan by MTE Consultants (June 2018);
- Foxwood Subdivisions Ph. 3 Storm Area Plan and Design by Dillon Consulting (Dec 2018); and
- City of London Design Standards and Specifications (Aug 2019).

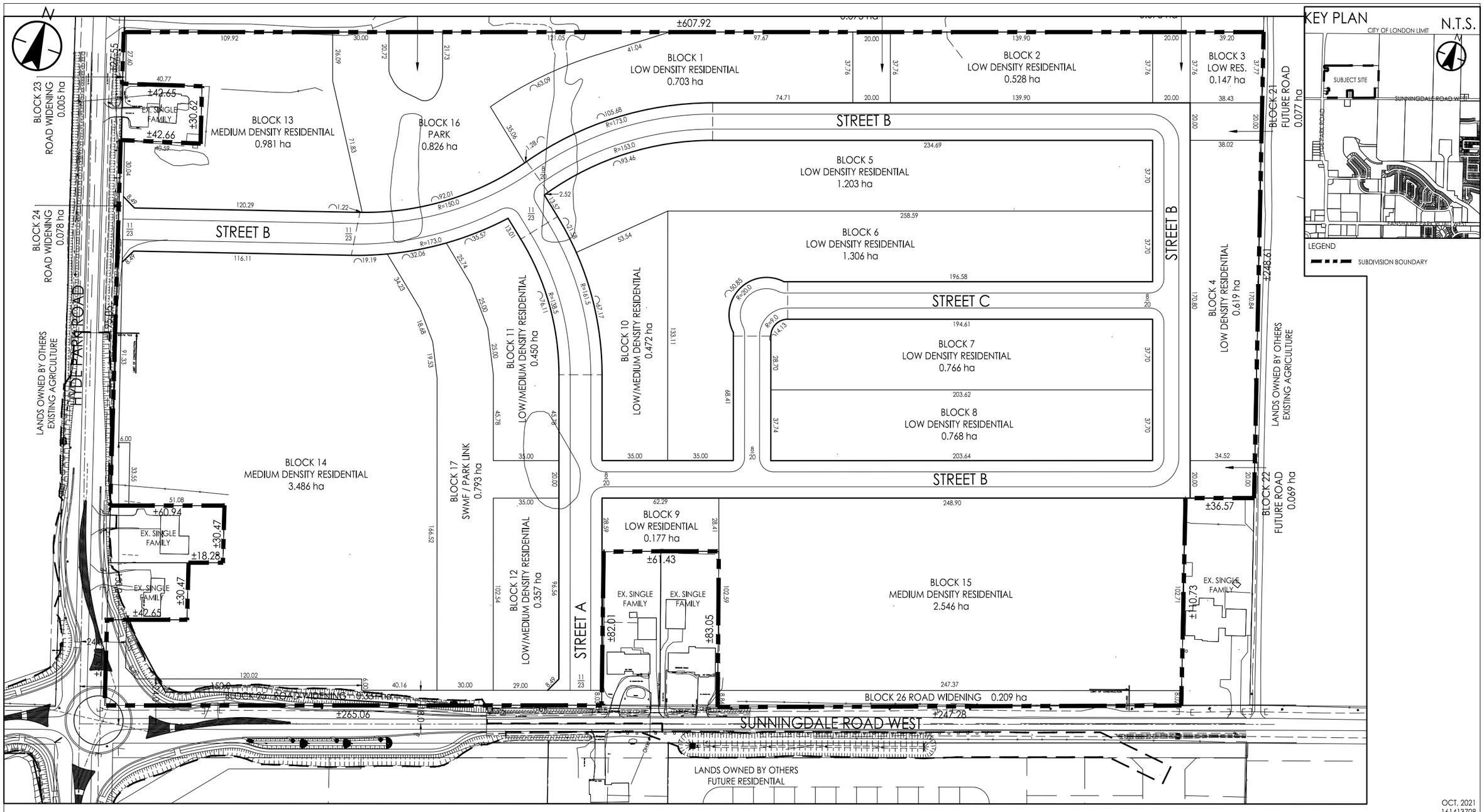

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Figure No.
1.0

Title
LOCATION PLAN

2.0 EXISTING CONDITIONS

2.1 TOPOGRAPHICAL INFORMATION

Existing topographic information was obtained from the Ontario Base Map (OBM). In the existing condition, surface runoff from the Site generally drains from northeast to southwest. As shown on the servicing area plans, external areas (Estimated total area of approximately 24.66 ha) located to the north of the site currently flow through the Site. Servicing of this external area will have to be accounted for in the design.

The existing topography slopes from a high point in the northeast (approximate elevation of 283m) towards the southwest property line of the site (approximate elevation of 277m). The elevation difference from east to west is approximately 6.0m over a span of 714m. The average slope of the site under existing conditions is approximately 0.84%.

2.2 HYDROGEOLOGICAL INFORMATION

2.2.1 Golder Investigation

In June of 1998, Golder Associates carried out a hydrogeological investigation for the proposed site. The fieldwork for the investigation involved water well survey of the adjacent residences, drilling, and installation of 18 groundwater monitors in 13 locations across the site, sampling, and analysis of groundwater from 4 of the installed monitoring wells, and monitoring of water level elevations in the wells.

Based on the results of Golder detailed hydrogeological investigation, the subsurface stratigraphy at the site generally consists of topsoil overlaying finer grained soils comprised of clays and silts with relatively low permeability. Some boreholes intersected strata of silt in the shallow subsurface, while other encountered more granular, predominantly sandy soils in the deeper deposits.

Groundwater was encountered at depths ranging from 1.1-7.3 m. The elevation of the encountered groundwater ranged from 281.7-271.7 m. The investigation suggest that the groundwater is relatively high in the east end of the site, within 0.3 to 0.5 meters of ground level, and deepens to the west where up to 3.5 meters of unsaturated soils are present. In June 1998 when the driest conditions were monitored, depths to measured water levels increased by over 1.0 m between 1.3 and 1.7 m in the east and greater than 4.7 m in the west. For further information, the Hydrogeological Investigation completed by Golder can be found in Appendix ‘C’.

2.2.2 EXP Assessment

In October of 2021, EXP Services carried out a hydrogeological assessment of the proposed development. The objective of the assessment was to examine the hydrogeological characteristics of the site. EXP completed a review of their previous Hydrogeological Investigation from 2019 and the Preliminary Geotechnical and Hydrogeological Investigation completed at the site in 2020.

As part of the Preliminary Geotechnical and Hydrogeological Investigation completed by EXP in 2020, a total of 6 boreholes were advanced with monitoring wells installed in 4 of the boreholes. These monitoring wells were used as part of the 2021 monitoring program. Water levels were collected from the monitoring wells for 6 months in 2020 (January to June 2020) and from February to September 2021 to identify seasonal fluctuations in the groundwater elevations and the hydroperiod of the wetland. In addition, a piezometer was installed in the wetland feature in the northwest portion of the site during the 2020 investigation. The piezometer was monitored for 6 months from January to June 2020. For the 2021 investigation, the piezometer was re-installed into the wetland feature along with a staff gauge to monitor surface water elevations from February to September 2021.

As part of the 2021 field study, infiltration testing was also completed in select areas across the Site. Water levels were measured, groundwater and surface water samples were collected, and dataloggers were installed in select wells for the purposes of characterizing the hydrogeological conditions at the Site.

Based on the results of EXP detailed hydrogeological assessment, the subsurface stratigraphy at the site generally consists of topsoil overlaying a layer of silty sand/sandy silt/silt. A deeper layer ranging in depth and thickness was observed in some boreholes. In general, the layer was described as brown with trace to some clay, trace to some gravel and very loose to very dense.

Groundwater is found with 1 to 5 meters below ground surface across most of the site. Shallower conditions are found in the southern portion of the site. Infiltration testing was completed in the surficial clayey silt till at 4 locations across the site and resulted in an average hydraulic conductivity of 1.26 x 10-7 m/s. Factored infiltration rates were found to range from 1.6 to 2.6 mm/hour. For further information, the Hydrogeological Assessment completed by EXP can be found in Appendix ‘C’.

2.3 EXISTING SERVICING

2.3.1 Water

An existing 300mm PVC watermain along Fair Oaks Boulevard and a 900mm CPP watermain are currently available in the vicinity of the site along Sunningdale Road West right of way. The proposed development is expected to receive its water supply by connecting to the existing 300mm diameter WM on Fair Oaks Boulevard. Refer to Appendix ‘D’ for the existing water service plans.

Under existing condition, the subject site lands are not serviced by London’s water distribution system.

2.3.2 Storm

Under existing conditions, a poorly defined roadside ditch separate the Site from the existing Sunningdale Road West. At the south side of the Site, corrugated metal culverts were used on both driveways and gravel drives crossings. At about 180m east of Hyde Park Road and Sunningdale Road intersection, a 300mm diameter corrugated metal culvert is identified crossing north to south underneath Sunningdale Road.

Stantec has prepared a Stormwater Management (SWM) report and will be submitting to the City of London for review and approval (attached in Appendix 'E'). The SWM is to address the stormwater strategy for the proposed site while being compatible with the approved Fox Hollow Stormwater Management System Functional Design Report (Stantec, February 2011), the latest Fox Hollow Stormwater Management System - Stormwater Management Facility No. 1 Modifications Brief by Stantec Consulting Inc., and Foxwood Developments Subdivision Functional Storm/Drainage and SWM Letter Report (AECOM, May 2013). On the south side of Sunningdale Road, south of Foxwood Subdivision Phase 3, a SWM facility 1N has accounted for the proposed site and will provide a designated quantity and quality control treatment. SWMF 1N has been designed such that it will have capacity for providing appropriate quantity control as long as the runoff coefficient for subject site does not exceed 0.41 as allocated for catchment 2011. Refer to Appendix 'D', for the storm area plan which shows the existing storm sewer and SWM system available to service the site.

2.3.3 Sanitary

Sanitary treatment for this area is to be provided by the Greenway/Adelaide Pollution Control Plant.

There is currently existing municipal sanitary sewer located at Jordan Boulevard, and at Tokala Trail.

The planned sanitary outlet available for the subject lands including external lands north of Sunningdale Road that are within the urban growth boundary is the existing trunk sanitary sewer within the Foxhollow SWMF3. This local sanitary connection doesn't have any consideration for any external lands outside the urban growth boundary for the City of London. Based on current conditions the outlet available for these lands is the existing 375mm sanitary sewer at Tokala Trail and Bridgehaven Drive connecting to the 450mm diameter trunk sanitary sewer within the Foxhollow SWMF3 that ultimately outlets to the 600mm diameter sanitary trunk at Medway Crescent. The future extension of a 375mm diameter sanitary sewer within Creekview Subdivision going north to Sunningdale Road is expected to be by way of a future oversizing (OS) claimed sanitary sewer.

As per the ECA approved external sanitary area plan as set out by City Project #ES3020-FH3 as part of Fox Hollow Community SWM System Contract the Fox Hollow Sanitary Trunk has capacity allocated to the subject site. The existing 375mm sanitary sewer connection has an accounted for area of 139.62ha and a population of 8,129 people. Refer to Appendix 'D' for the existing sanitary services and sanitary area plans.

2.3.4 Roads

Two surrounding roads defining this subdivision include:

• Hyde Park Road, an arterial road that runs north/south at the west boundary of the subdivision.

• Sunningdale Road, an arterial road that runs west/east at the south boundary of the subdivision.

3.0 PROPOSED GRADING AND SERVICING STRATEGY

Since this subject site is at the limit of the City of London development boundary, external works will be required to bring service to this proposed development. The information detailed in the following sections include services plans and show the available infrastructure for the subject site and is included in both Figure 2, Figure 3, and Figure 4.

Conceptual grading and servicing strategies for the proposed development have been developed based on the draft plan in conjunction with the OBM survey, centerline of roads elevations and requirements for the storm flows from the site to the existing storm sewer on Jordan Boulevard, and SWMF 1N.

3.1 PROPOSED GRADING

The proposed development will include 6.22 ha of low-density single-family homes, 8.29 ha of medium density townhouses, 4.32 ha of road including right of ways, 0.92 ha of parkland and open-space, and 0.79 ha of SWM block. An external area of about 24.66 ha is tributary to the site and is accounted for in the design. The external area on the north will be accounted for in the SWM strategy of the proposed site.

The proposed grading strategy will respect the existing grades along all property lines. The site will be raised on the south part of the site to sit above the centerline of Sunningdale Road and to ensure positive drainage flows from the Site and external lands to the proposed SWM Pond. Refer to Appendix ‘E’ for the conceptual grading and routing design which shows the proposed drainage from the site.

3.2 PROPOSED SERVICING

3.2.1 Proposed Water and Fire Servicing

The existing water infrastructure in the area around these lands includes a low-level (HGL of 301.8m) 900mm diameter watermain within the north side of the Sunningdale Road right-of-way fronting the development. The elevations throughout the subject lands generally fall above the elevation of 273.0 m, thus the subject lands are not anticipated to be serviceable from the low-level system. Figure 2 shows the existing and the proposed watermains.

The proposed development is located within the City of London water distribution system. Stantec proposes to provide water service to the development by primary connecting to the high-level existing 300mm diameter watermain on Fair Oaks Boulevard (south of the check valve chamber).

In order to service the subject site, the watermain would need to be extended by approximately 730m from Fair Oaks Boulevard along Sunningdale Road to Street ‘A’. The 300mm diameter watermain is serviced from the Hyde Park Pumping Station which is part of the high-level distribution system (HGL of 317.0m) and is thus able to service the entire site.

The subject lands are anticipated to have more than 80 units proposed, resulting in a requirement of two water service connections. The secondary connection is expected with the 900mm diameter watermain within the north side of the Sunningdale Road right-of-way fronting the proposed development via Street ‘B’ at Hyde Park Road. This would require installing a high-level watermain approximately 250m in length along east side of Hyde Park Road to Street ‘B’. This connection would complete a loop between the high- and low-level water system and thus would require a check valve chamber such that the low-level connection would only provide supply under emergency condition (high-level system failure). The check valve chamber would also be fitted with by-pass valve such that water turnover is maintained in the proposed Hyde Park watermain.

Stantec has performed a water and fire flow analysis for the site demonstrating the capacity of the existing water mains and the Hyde Park Pumping Station. Simulation results from the analysis indicate that the existing watermain installed and existing Hyde Park Pump Station is able to service 1521 Sunningdale Road West development with sufficient capacity to meet the City of London water system performance standards under design peak hour and fire flow conditions. Additionally, lands north and east of the proposed development have the potential to be developed in the future, as a result these lands have been accounted for in the capacity analysis performed by Stantec for the existing watermain and Hyde Park Pump Station. Refer to Appendix ‘E’ for Water Servicing Memo for the water and fire servicing analysis. Stantec has advised Water Engineering Division of anticipated demand from proposed development for consideration in the Hyde Park Pumping Station expansion study, Refer to Appendix ‘E’.

A water servicing report will be provided during detail design stage that provides the modelling demonstrating the capacity of the proposed water mains, which will have consideration for demand requirements from external properties to the north and east.

3.2.2 Proposed Storm

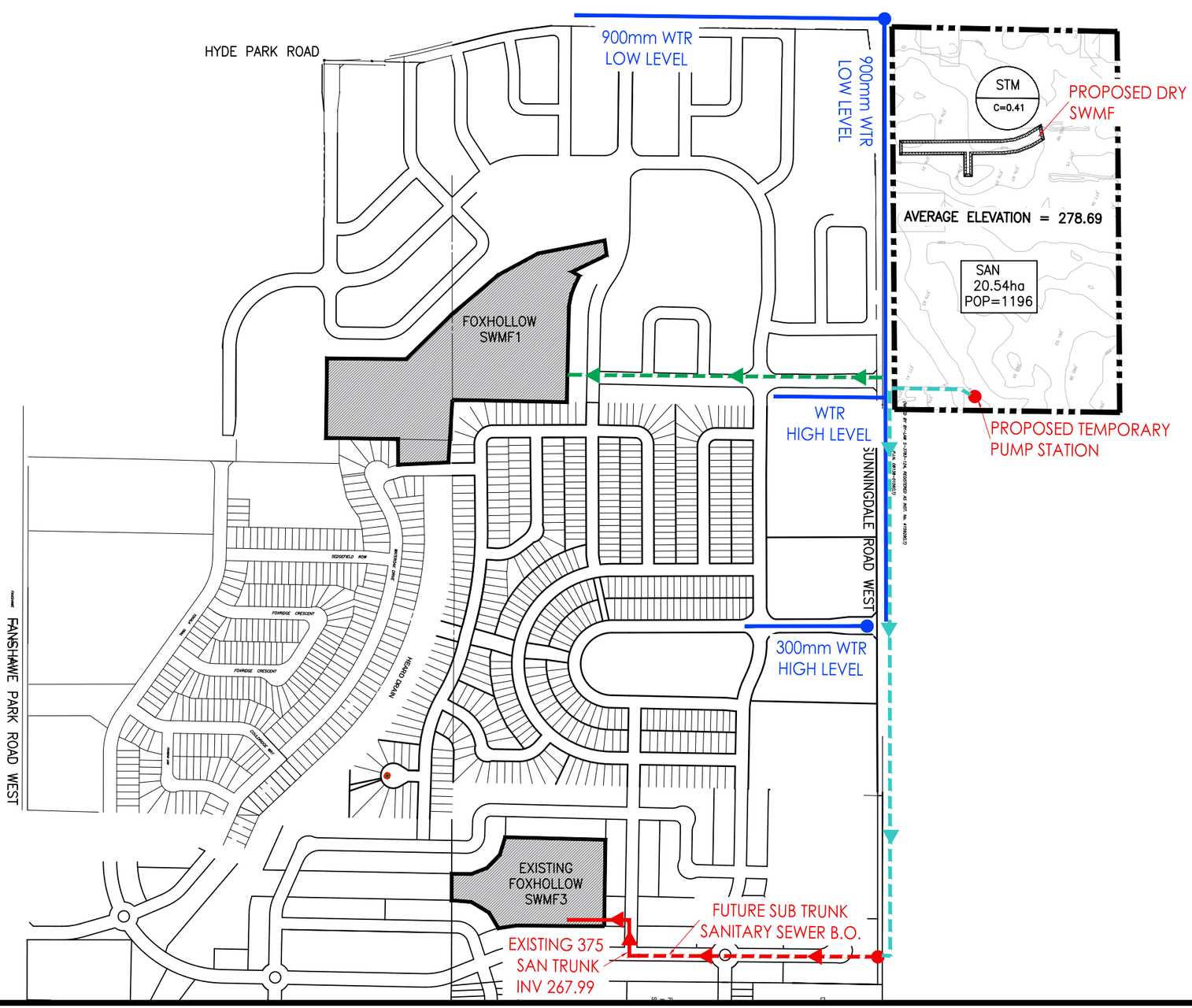
Based on the preliminary analysis and findings in the preliminary SWM report, a SWM Dry Pond is proposed to provide attenuation and control of the post-development minor and major flows. The local onsite dry SWM pond is proposed to offset increased runoff coefficients beyond SWMF 1N design allocation. The interim and ultimate, major (100 & 250 year) flows (including flows external to the site) will be contained within the municipal right-of-way throughout the site and safely conveyed to the proposed SWMF Block 17.

The discharge from the SWM pond will be directed to the existing 1345 x 2110m storm sewer located at Jordan Boulevard. A 1,800mm circular orifice plate is proposed to be used to attenuate the post-development flows from all storm events from 2-years through 250-years to be less than or equal the accounted for capacity in the existing storm sewer and the design flow allocated for in SWMF 1N. The major flows from the proposed development will therefore cross Sunningdale Road west by pipe instead of surface flows.

The proposed outlet from the proposed SWM pond will be routed through Street B and will go south through a proposed easement just west of the Medium Density Block 15. Refer to Figure 3 for further information about the major and minor storm flow routing within the site and preliminary grading details. Consideration for the proposed extension of the trunk storm sewer to the SWMF Block 17 from Jordan Boulevard and the construction of dry SWMF should be captured in future DC studies.

The proposed SWM Dry Pond will provide quantity control to attenuate peak flows from 2-years storm events through 250-years storm events. The pond will provide storage and control of up to 4,414 m^3 to attenuate minor and major flows and release to the existing storm sewer on Jordan Boulevard. This storage is provided to control major flows and discharge to the existing storm sewer. This drainage approach is proposed to be adopted to avoid the crossing of major flows through Sunningdale Road. The size of the SWM Dry Pond and SWM block would be significantly less if the pond is designed to control flows up to 50-year storm events. The estimated storage requirement for controlling storm events up to 50-year is about 3058 m^3, whereas controlling storm events up to 250-year would require a storage of 4414 m^3. Controlling major overland flows from 50-year up to 250-year storm events in the SWM Pond instead of crossing Sunningdale Road would require a designated storage of 1356 m^3.

Under existing surface conditions, EXP hydrogeological assessment suggest that the groundwater found to be high in the east end of the site and deepens to the west. The proposed SWM pond bottom is proposed to be at an approximate elevation of 274.16. From EXP seasonal groundwater monitoring data, it was identified in BH10/MW that the groundwater is ranging between 271.02 to 272.05m, adjacent to the proposed SWM Pond. Thus, it is concluded that the SWM Pond will have the required clearance of about 1.0m from the highest seasonal groundwater level to the bottom of the pond, thus clay liner is not required. Refer to Appendix ‘C’, for the detailed Hydrogeological Assessment completed by EXP in October 2021.



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October, 2019
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Legend

- SITE BOUNDARY
- EXISTING TRUNK SAN SEWER
- EXISTING WTR
- FUT. SAN FORCEMAIN OPTION 1 (1070m)
- FUT. SAN SEWER B.O.
- FUT. STM SEWER - FLOWS UP TO 50YR (502m)

POP = EXISTING SANITARY SEWERSHED ALLOCATED SANITARY POPULATION
C = STORMWATER RUNOFF COEFFICIENT ALLOCATED BY SWMF1
INV = INVERT ELEVATION

HORZ - 1 : 7500
50 0 100m

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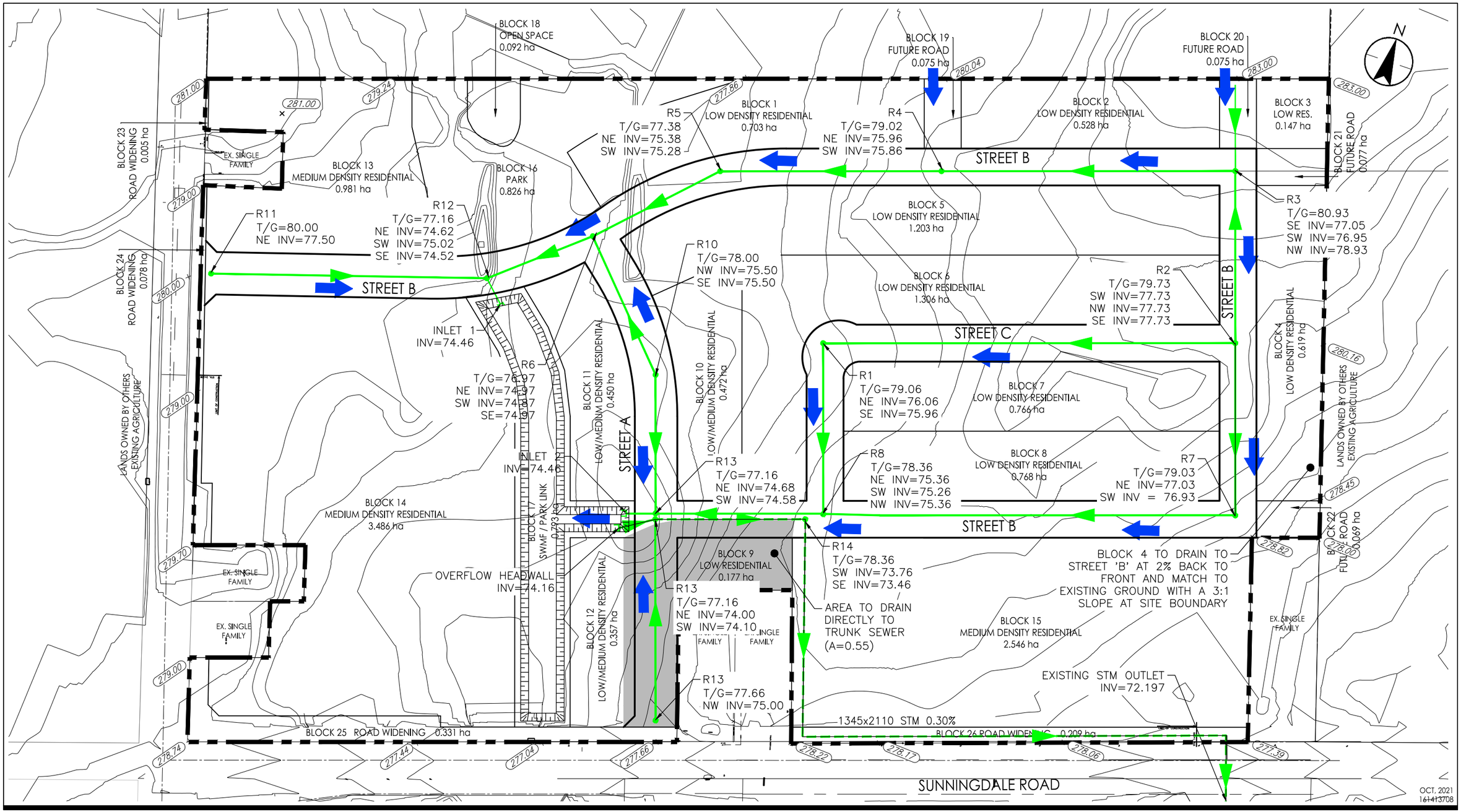
London, ON Canada

Figure No.
1

Title
SERVICING FEASIBILITY AREA PLAN



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Legend

- SITE BOUNDARY
- PROPOSED STORM SEWER
- PROPOSED STORM TRUNK SEWER
- EXISTING STORM TRUNK SEWER
- OVERLAND FLOW
- INV = INVERT ELEVATION
- 278.31 × EXISTING GROUND ELEVATION PER 2019 OBM

1:2000 0 20 60 100m

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Figure No.
3.0

Title
PRELIMINARY GRADING & STORM SERVICING ROUTING PLAN

3.2.3 Proposed Sanitary

The proposed subdivision is within the Fox Hollow Community Sanitary EA catchment area and the approved design for the ultimate sanitary outlet that is designed, approved, and partially constructed south of Sunningdale Road within the Creek View Subdivision Phase 3.

As part of this report, Stantec proposes an interim temporary servicing strategy and an ultimate servicing strategy for sanitary servicing of proposed development. The ultimate routing strategy is the extension of a future CSRF Trunk Sanitary sewer along Sunningdale Road from future Tokala Trail within Creek View Subdivision at Sunningdale Road. Consideration for this Sunningdale Road future ultimate sanitary sewer should be captured as part of future DC studies such that it could be captured with Sunningdale Road West reconstruction project by City Transportation Division. The future oversized sewer within Creek View Subdivision along the future Tokala Trail to Sunningdale Road is anticipated to be constructed by Creek View Subdivision. Creek View subdivision and the future oversized sanitary sewer is expected to be completed in advance of proposed development. The interim temporary servicing strategy is the construction of a temporary pumping station and temporary force main along Sunningdale Road (at the developers cost) to the current termination point of the sanitary system. These options are both viable and can both be implemented and are consistent with the City of London Standard.

The temporary measures would be decommissioned once the gravity outlet becomes available in the immediate vicinity of the subject lands and the local sanitary sewer will be designed to allow for transition to gravity outlet at the location of the temporary pump station. The lands north of Sunningdale and east of subject site are outside of the urban growth boundary, as a result the timing of the ultimate gravity sewer availability and decommissioning of temporary measures is uncertain.

The sanitary area plan from Creek View Subdivision Phase 3, shows that an existing 375mm diameter sanitary cap has accounted for an area of 139.62ha and a population of 8,129 people. The allocation available is estimated at 58.2 people/hectare. As a result, the future oversized sanitary sewer once extended by future developments to south-east can service the 20.54ha subject site for population up to 1,196, further investigation will be required at later stages of the design process to confirm the unallocated capacity of the downstream system.

The future sanitary sewer will capture sanitary sewage from the proposed site, Creek View Subdivision, and the external lands north of Sunningdale Road. The sanitary sewer is proposed to be extended from Tokala Trail within Creek View Subdivision with a 375mm diameter sanitary sewer along Sunningdale Road West which will reduce to a size of 300mm diameter as its tributary area decreases and as it enters the subject site.

Refer to Appendix ‘E’ for the proposed sewer routing details, including depth and how the intended lands which include lands currently outside the urban growth boundary can ultimately flow by way of a gravity sewer to the existing 375mm diameter sanitary sewer at Tokala Trail. The existing lots that currently front Sunningdale Road and Hyde Park can also be serviced in future with local gravity sewers within the subject subdivision at Street ‘A’ and Street ‘B’ as illustrated in Appendix ‘E’.

It is preferred to have a CSRF funded regional trunk sanitary sewer that will accommodate future growth sanitary servicing requirements as well as subject lands. A City funded sanitary trunk sewer along Sunningdale Road would allow for ultimate sanitary servicing strategy timing to be advanced and would benefit the City from avoiding having to remove and replace sanitary infrastructure in the future or add redundant infrastructure.

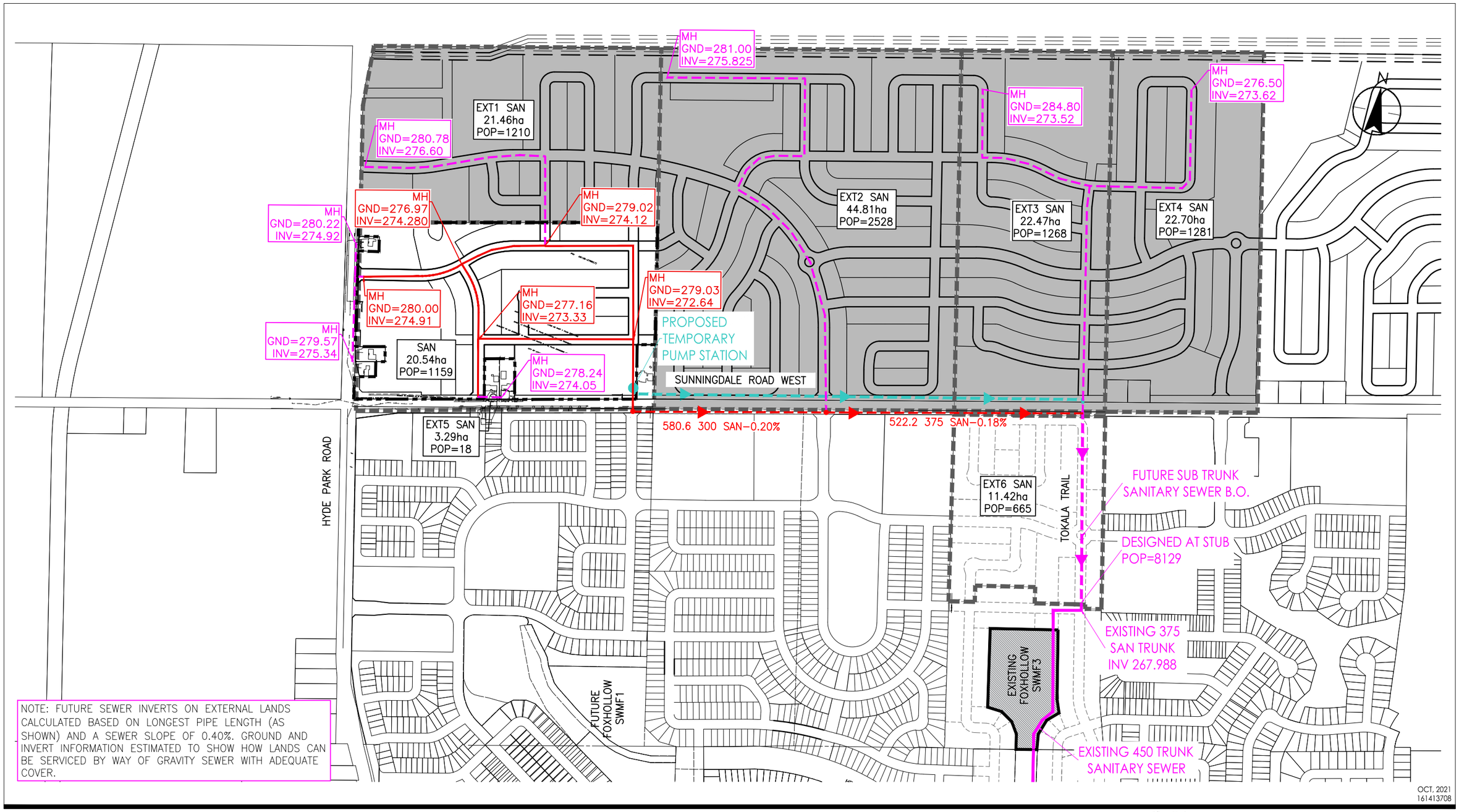
Alternatively, ultimate sanitary servicing strategy would have a local sanitary sewer along Sunningdale Road that is funded by the developer. This option would provide sanitary servicing for the proposed site without consideration for any of the external land outside the City of London Urban Growth Boundary.

3.2.4 Roadworks

The proposed development will involve municipal road widening on Sunningdale Road West which comprises of both Block 25 and Block 26 as depicted in the proposed draft plan of the subdivision.

Site access is provided from Sunningdale Road West at Street ‘A’ and Hyde Park Road at Street ‘B’. A sightline analysis to ensure the proposed access location can provide desirable decision sight distances as per City standards will be provided with design studies.

Based on the findings and conclusion of the Transportation Impact Assessment prepared by Paradigm Transportation Solutions Limited (2021) a southbound left-turn lane with 25m of storage on Hyde Park Road at Street ‘B’; and an eastbound left-turn lane with 25m of storage on Sunningdale Road at Street ‘A’ will be warranted. In addition, temporary street lighting will be required at the intersection of Sunningdale Road West at Street ‘A’ and on Hyde Park Road at Street ’B’.



NOTE: FUTURE SEWER INVERTS ON EXTERNAL LANDS CALCULATED BASED ON LONGEST PIPE LENGTH (AS SHOWN) AND A SEWER SLOPE OF 0.40%. GROUND AND INVERT INFORMATION ESTIMATED TO SHOW HOW LANDS CAN BE SERVICED BY WAY OF GRAVITY SEWER WITH ADEQUATE COVER.

OCT, 2021
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- SITE BOUNDARY
- EXISTING TRUNK SAN SEWER
- PROPOSED SANITARY GRAVITY SEWER
- ULTIMATE TRUNK SANITARY GRAVITY SEWER
- INTERIM SANITARY FORCEMAIN
- FUT. SAN SEWER B.O.

POP = EXISTING SANITARY SEWERSHED ALLOCATED SANITARY POPULATION
INV = INVERT ELEVATION

- SANITARY DRAINAGE AREA TRIBUTARY TO EXISTING STUB ON TOKALA TRAIL
- CONCEPTUAL DRAFT PLANS TO BE DEVELOPED BY OTHERS

HORZ - 1 : 7500
50 0 100m

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Figure No.
2

Title
SANITARY SERVICING ROUTING AREA PLAN

4.0 FINANCIAL IMPLICATION

An estimate of claimable costs and revenues for the proposed development has been completed in accordance with the City of London Estimate of Claimable Works and Revenues Worksheet. Preliminary financial calculations are included in Appendix F of this document.

The identified works eligible for reimbursement from the applicable City Services Reserve Fund (CSRF) should be captured within the registered Development Agreement.

Where not already included, applicable works should be considered in the capital budget to facilitate growth in the City of London. Depending on timing It may be cost effective to include the Sunningdale Road West underground improvements and channelization required for growth as part of the arterial upgrade construction (Hyde Park Road to Wonderland Road North) scheduled for 2025.

4.1 SUMMARY OF REVENUES

Based upon the Development Charge rates (effective January 1, 2021) and assuming typical density (uph) and land use as per the Draft Plan of Subdivision concept plan prepared by Stantec, the proposed development will generate the following revenues:

Land Use	Estimated CSRF Revenues
Low Density	$ 8,961,693
Medium Density	$12,150,023
Total	**$21,111,715.38**

Note: See “Initial Proposal Report (IPR) Claimable Works & DC Revenue Estimate Worksheet” in Appendix ‘F’ for additional details.

4.2 SUMMARY OF CLAIMABLE WORKS

A summary of major claimable works associated with the proposed development are as follows:

Description	Estimated CSRF Claims
Channelization on Arterial Road	$838,860
Road Oversizing	$30,000
Wastewater Oversizing	$39,060
Storm Sewer Oversizing	$457,840
Watermain Oversizing	$66,000
Trunk Sewer	$4,185,640
Major SWM Works	$2,680,277
Total	**$8,297,677**

Note: See “Initial Proposal Report (IPR) Claimable Works & DC Revenue Estimate Worksheet” in Appendix ‘F’ for additional details.

5.0 CONCLUSION

This report was prepared to provide an assessment of the existing water, storm, and sanitary servicing infrastructure. Based on the foregoing analysis, it is concluded that:

- A SWM dry pond is proposed to attenuate the post-development flows to be less than or equal the accounted for flow in the existing storm sewer on Jordan Boulevard;
- Quality and quantity control measures of the controlled flow from the proposed site are proposed to be provided in the existing SWMF 1N;
- An extension of the existing high-level 300mm watermain on Fair Oaks Boulevard can meet the entire site demands provided it loops with the existing 900mm watermain fronting the site on Sunningdale Road;
- Given the capacity of the downstream storm and sanitary systems on Jordan Boulevard and Tokala Trail, respectively, we believe the development may be supported by existing infrastructure provided investment into the extension of existing sewers to bring them to the site bounds or development timing of future developments coincides with development timing of subject site;
- LID measures may be implemented where possible to reduce runoff volume from the proposed site and promote infiltration.

Additional grading, servicing and SWM details will be provided during detailed design.

We trust this meets with your requirements. Should you have any question, or require further information, please contact the undersigned.

Sincerely,

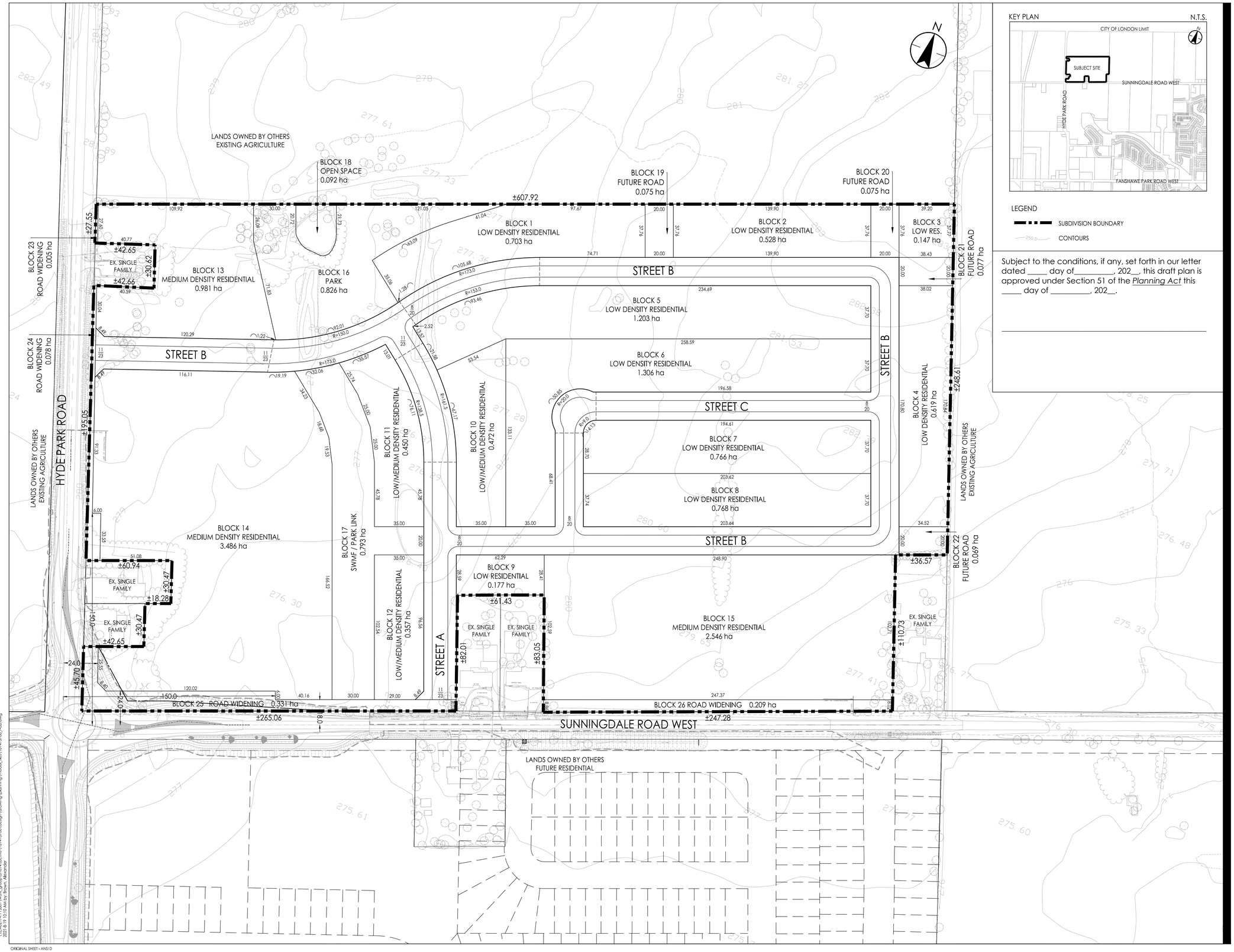
STANTEC CONSULTING LTD.

Mohammad Meqdad, MEng., P.Eng., PMP. LEED Green Associate
Project Manager, Community Development
Tel: (519) 645-2007
Fax: (519) 645-6575
Email: Mohammad.Meqdad@stantec.com

APPENDICES

Appendix ‘A’, ‘B’, ‘C’, ‘D’, and ‘E’

Appendix A DRAFT PLAN OF SUBDIVISION



KEY PLAN N.T.S.

LEGEND

SUBDIVISION BOUNDARY

250.0 CONTOURS

Subject to the conditions, if any, set forth in our letter dated _____ day of_____, 202__, this draft plan is approved under Section 51 of the *Planning Act* this _____ day of _____, 202__.

_____

Stantec

Stantec
600-171 Queens Avenue
London ON N6A 5J7
Tel. 519-645-2007
www.stantec.com

Liability Note

The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing - any errors or omissions shall be reported to Stantec without delay.

DRAFT PLAN OF SUBDIVISION MOUNT PLEASANT LANDS

PART OF
LOT 24
CONCESSION 6
IN THE
CITY OF LONDON
COUNTY OF MIDDLESEX

INFORMATION REQUIRED UNDER SECTION 51(17) OF THE PLANNING ACT

A: AS SHOWN ON DRAFT PLAN
B: AS SHOWN ON DRAFT AND KEY PLAN
C: AS SHOWN ON DRAFT AND KEY PLAN
D: ACCORDING TO LAND USE SCHEDULE
E: RESIDENTIAL, AGRICULTURAL
F: AS SHOWN ON DRAFT PLAN
G: AS SHOWN ON DRAFT AND KEY PLAN
H: MUNICIPAL PIPED WATER TO BE INSTALLED
I : T.B.D.
J: AS SHOWN ON DRAFT PLAN
K: MUNICIPAL SANITARY AND STORM SEWERS TO BE INSTALLED
L: AS SHOWN ON PLAN

SCHEDULE OF LAND USE

LOW DENSITY RESIDENTIAL	- BLOCKS 1 - 9	6.217 ha
LOW/MEDIUM DENSITY RESIDENTIAL	- BLOCKS 10 - 12	1.279 ha
MEDIUM DENSITY RESIDENTIAL	- BLOCKS 13 - 15	7.013 ha
PARK	- BLOCKS 16	0.826 ha
SWMF / PARK LINK	- BLOCK 17	0.793 ha
OPEN SPACE	- BLOCK 18	0.092 ha
FUTURE ROAD	- BLOCK 19 - 22	0.296 ha
ROAD WIDENING	- BLOCK 23 - 26	0.623 ha
ROADS		3.404 ha
	TOTAL	20.543 ha

OWNER'S AUTHORIZATION

THE UNDERSIGNED AUTHORIZES THE PREPARATION AND SUBMISSION OF THIS DRAFT PLAN OF SUBDIVISION.

JAMIE CRICH, PRESIDENT
AUBURN DEVELOPMENTS INC.
AUTHORIZING AGENT — DATE

SURVEYOR'S CERTIFICATE

I HEREBY CERTIFY THAT THE BOUNDARIES OF THE LAND TO BE SUBDIVIDED, AS SHOWN ON THIS PLAN, AND THEIR RELATIONSHIP TO ADJACENT LANDS ARE ACCURATELY AND CORRECTLY SHOWN.

JEREMY C.E. MATTHEWS O.L.S.
STANTEC GEOMATICS — DATE

File Name: 161413708_r-db	RT	BB	RT	21.07.30
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Client/Project

AUBURN DEVELOPMENTS INC.

1521 SUNNINGDALE ROAD WEST

London, ON Canada

Title

DRAFT PLAN OF SUBDIVISION
AUGUST 19, 2021

Project No.	Scale	HORZ – 1 : 1250
161413708		12.5 0 25m
Drawing No.	Sheet	Revision
1	1 of 1	

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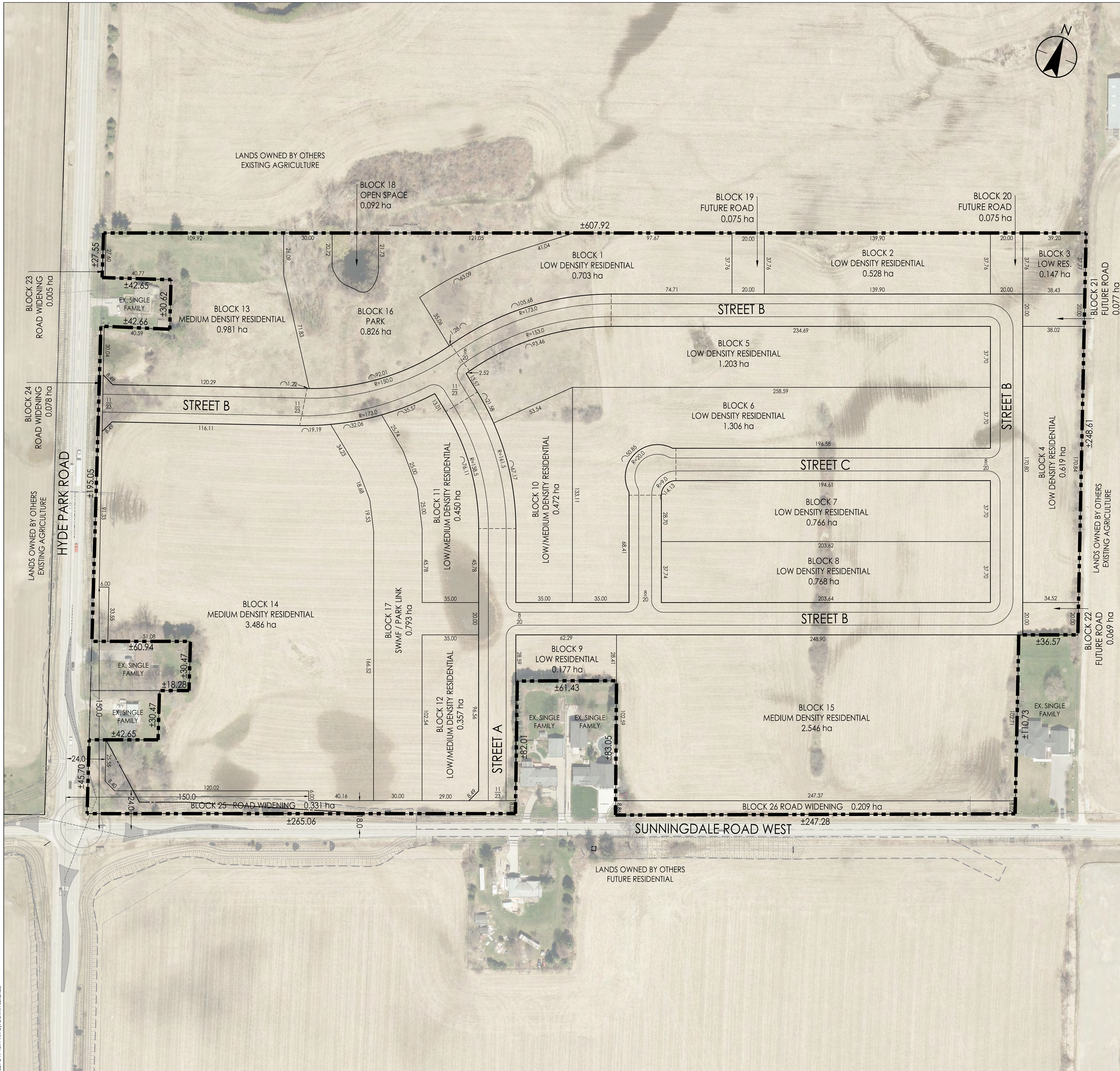
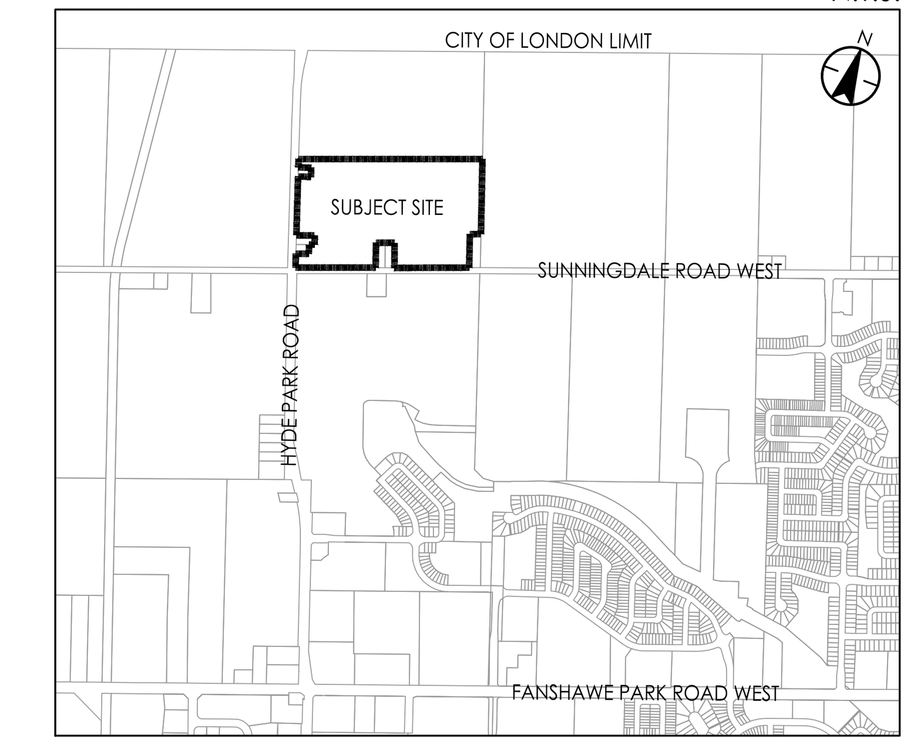


KEY PLAN N.T.S.



LEGEND

SUBDIVISION BOUNDARY

CONTOURS

Subject to the conditions, if any, set forth in our letter dated _____ day of_________, 202__, this draft plan is approved under Section 51 of the *Planning Act* this _____ day of _________, 202__.

Stantec

Stantec
600-171 Queens Avenue
London ON N6A 5J7
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Liability Note

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DRAFT PLAN OF SUBDIVISION
MOUNT PLEASANT LANDS

PART OF
LOT 24
CONCESSION 6
IN THE
CITY OF LONDON
COUNTY OF MIDDLESEX

INFORMATION REQUIRED UNDER SECTION 51(17) OF THE PLANNING ACT

A: AS SHOWN ON DRAFT PLAN
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	TOTAL	20.543 ha

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JAMIE CRICH, PRESIDENT
AUBURN DEVELOPMENTS INC.
AUTHORIZING AGENT

DATE

SURVEYOR'S CERTIFICATE

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JEREMY C.E. MATTHEWS O.L.S.
STANTEC GEOMATICS

DATE

File Name: 161413708_r-db	RT	BB	RT	21.07.30
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Client/Project

AUBURN DEVELOPMENTS INC.

1521 SUNNINGDALE ROAD WEST

London, ON Canada

Title

DRAFT PLAN OF SUBDIVISION
AUGUST 19, 2021

Project No. 161413708

Scale HORZ – 1 : 1250 (12.5 0 25m)

Drawing No. 1

Sheet 1 of 1

Revision

Appendix B PRELIMINARY SERVICING FEASIBILITY REPORT

Preliminary Servicing Feasibility Study

1521 Sunningdale Road

(Mt. Pleasant)

Auburn Developments Inc.

161413708

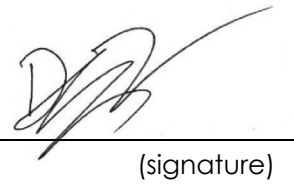
Prepared for:
Auburn Developments Inc.

Prepared by:
Stantec Consulting Ltd.
171 Queens Ave.
London, ON N6A 5J7
Tel: 519-645-2007
Fax: 519-645-6575

September 25, 2018

Sign-off Sheet

This document entitled Preliminary Servicing Feasibility Study was prepared by Stantec Consulting Ltd. for the account of Auburn Developments Inc. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any unauthorized use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on unauthorized use of this document.

Prepared by 
(signature)

Dan Vucetic, MESc., P.Eng.

Reviewed by 
(signature)

Tim Stubgen, P.Eng.

Table of Contents

LIST OF APPENDICES

1.0 Introduction

1.1 PURPOSE OF REPORT

The water, sanitary and storm servicing study has been prepared for the proposed development of lands located just within the northwest quadrant of the City of London development boundary with frontage on Hyde Park Road to the west and Sunningdale Road to the south, herein referred to as the site. The subject site existing land use is primarily agricultural encompassing 21.88 ha.

Specifically, this report shall provide an inventory of existing storm and sanitary outlets for the site and consider the capacity of the downstream sanitary sewer system. Furthermore, this report will identify nearest existing water servicing infrastructure connection points.

Therefore, the purpose of this report is to assess the servicing feasibility of the subject site.

1.2 LIMITATIONS OF THE REPORT

The information presented in this report is based on the review of the following information:

- 1521 Sunningdale Road West Concept Plan as prepared by Stantec Consulting Ltd. (included in appendix)
- As-constructed and accepted drawings on file with the City of London for the external services on nearby roads;
- Fox Hollow Stormwater Management System Functional Design Report by Stantec Consulting Ltd. (2011);
- Fox Hollow Community SWM System – SWMF #3 Project# ES3020-FH3 contract drawings; and
- City of London Design Standards and Specifications.

2.0 Existing External Services

Since this subject site is at the limit of the City of London development boundary, significant external works will be required to bring service to this future development.

The information detailed in the following sections is accompanied by Figure 1 "Servicing Feasibility Area Plan" which overviews the available infrastructure for the subject site and is included in the Appendix A.

2.1 SANITARY

Sanitary treatment for this area is anticipated to be provided by the Greenway/Adelaide Pollution Control Plant. Flows will be directed to Greenway/Adelaide treatment plant likely by external CSRF sewers.

Available sanitary infrastructure in the vicinity of the site includes the existing 375mm Fox Hollow Trunk Sanitary Sewer located within the Creek View Subdivision just north of the existing Fox Hollow Stormwater Management Facility 3, approximately 1250m south-east of the subject site. As per the ECA approved external sanitary area plan as set out by City Project #ES3020-FH3 as part of Fox Hollow Community SWM System Contract the Fox Hollow Sanitary Trunk has capacity allocated to the subject site. The allocation available is 66.1 people/hectare. As a result, the Fox Hollow Sanitary trunk once extended by future developments to south-east can service the 21.88 ha subject site for population up to 1448 (equivalent to approximately 483 single family lots).

In addition to the above is the existing 450mm diameter Heard Drain Trunk sewer available within Wateroak Drive in the Claybar Subdivision to the south of the subject site. This trunk is part of the same sewershed as trunk detailed above, therefore it has same capacity allocated for subject site. This trunk sanitary sewer just south-east of the SWM block abutting the Foxwood Subdivision is approximately 992m away from the south east corner of the subject site by routing through Foxwood Subdivision via SWM block and future local roads. Only the south cell of Foxhollow SWMF1 is presently constructed, the north cell of SWMF1 and north half of the Foxwood Subdivision is under design. The design presently underway will need to be revised prior to construction which will require coordination between all stakeholders including City (Development Services, SWM unit, etc.) and Foxwood Subdivision.

Given the distance to these outlets from the site and undevelopable lands surrounding the subject site the following connection strategies are under consideration, as illustrated in Figure 1 of appendix:

1. **Option 1** – Installation of approximately 1040m of CSRF sanitary sewer from subject site through adjacent lands east, running cross-country, crossing Sunningale Road at Creek View subdivision to outlet to Fox Hollow Sanitary sewer future sub trunk;

2. **Option 2** – Installation of approximately 1070m of sanitary forcemain from subject site going east along Sunningdale Road within the right-of-way crossing south to Creek View subdivision to outlet to Fox Hollow Trunk Sanitary sewer future sub trunk. The onsite temporary pump station would be in operation until such time as CSRF sewer is extended by developers to the east at which times the flows would be rerouted via gravity;

3. **Option 3** – Installation of approximately 992m of CSRF sanitary sewer from subject site outleting south through future internal local roads of Foxwood Subdivision and through Foxhollow SWMF1 block to existing 450mm Heard Drain Sanitary Trunk sewer; and

4. **Option 4** – Installation of approximately 1060m of CSRF Sanitary sewer from subject site going east along Sunningdale Road within the right-of-way crossing south to Creek View subdivision to outlet to Fox Hollow Trunk Sanitary sewer future sub trunk.

Alternatively, there is an existing 825mm Stanton Sanitary Trunk Sewer located within the Hyde Park Rotary Link corridor just south of the existing Hyde Park North Stormwater Management Facility as discussed in the 1700 Sunningdale Road West Preliminary Servicing Feasibility Report prepared by Stantec. The subject site does not fall within the drainage area allocated for this trunk and as a result has no allocated capacity. However, based on the preliminary servicing report prepared by Stantec Consulting Ltd. the development at 1700 Sunningdale Road West has allocated contribution room for population of 2429 of which per the concept plan servicing for 1766 people is required the remaining unallocated capacity of 663 people could be utilized by the subject site. Based on the concept plan for the subject site only about half of the development (664 people) would be serviceable by the Stanton Sanitary Trunk via the proposed development at 1700 Sunningdale Road. Supporting calculations are provided in table below.

Table 1. Sanitary Contribution Estimate

	Site Area	Saleable Frontage (m)	Med.Den Area (ha)	Vacant Land Area (ha)	Retirement Block Area (ha)	Density (uph)	Lot Frontage Width (m)	# Lots	# Units	Total Population	Stanton Sanitary Trunk Available Capacity (pop.)	Redistributed Capacity (pop.)
1700 Sunningdale Rd	34.457	2758.3	8.282	3.144	1.548	75 uph for Retirement, rest of blocks as per concept plan	12	230	448	1766	2429	1766
1521 Sunningdale Rd	20.543	1575.9	5.732			as per concept plan	12	132	311	1143		663
Total										**2909**	**2429**	**2429**

Note:

1. Population per City of London Standards, 3 people per lot and 2.4 people per medium density unit.
2. Areas, units and saleable frontage as per Stantec Concept Plans included in appendix.
3. Density based on typical retirement block.
4. Lot frontage width is minimum width prior to lot being classified as small residential lot and requiring Parking Plan as per Small Lot Study (City of London, 2001).

The sanitary drainage area plans and design sheets for the aforementioned sanitary connection points are included in the Appendix A.

2.2 STORM

Stormwater management quantity and quality control for this development is to be entirely provided by the future Fox Hollow Stormwater Management Facility 1N (SWMF 1N) within Foxwood Subdivision which outlets to the Heard Drain. SWMF 1 has been designed for quality and quantity control. SWMF 1N has been designed such that it will have capacity for providing appropriate quantity and quality control as long as the runoff coefficient for subject site does not exceed 0.41 as allocated for catchment 2011. Consideration may be made for increased runoff coefficient allocation for the subject site to 0.63 assuming remainder of catchment will have runoff coefficient of 0.2 which is supported by current land use. Alternatively, local onsite storage control or LIDs could be utilized to offset increased runoff coefficients beyond SWMF 1N design allocation.

The major and minor flows conveyed from the subject site are to be split at Sunningdale Road, with flows up to the 50-year flow routed south to the north cell of SWMF 1 via future storm sewer and larger flows routed to the west cell of SWMF 1N via overland flow along roadways. In order to service the site approximately 525m of future storm sewer will be required to be installed within Foxwood Subdivision by others, as a contingency should construction timing not align with subject site requirements an easement should be sought after from Foxwood Subdivision with their drawing approval.

2.3 WATER

The existing water infrastructure in the area around these lands includes a 900mm diameter watermain within the north side of the Sunningdale Road right-of-way fronting the development. This area is currently serviced from the low-level distribution system (HGL of 301.8m). The elevations throughout the subject lands generally fall above the elevation of 273.0 m, thus the subject lands are not anticipated to be serviceable from the low-level system.

However, there is an opportunity to extend the future watermain anticipated to be available within the future development (Foxwood Subdivision), south of Sunningdale Road and west of the Kent Subdivision. Should this connection be available to service the subject site it would require approximately a 30m extension to cross Sunningdale Road. Otherwise should construction timing of Foxwood Subdivision not align with subject site requirements an easement should be sought after from Foxwood Subdivision with their drawing approval. Alternatively, there is an opportunity to extend the 300mm watermain on Fair Oaks Boulevard within the Kent Subdivision. In order to service the subject site, the watermain would need to be extended by approximately 400m from Fairoaks Boulevard along Sunningdale Road.

These watermains are serviced from the Hyde Park Pumping Station which is part of the high-level distribution system (HGL of 317.0m) and is thus able to service the entire site.

The Sunningdale Road and Fair Oaks Boulevard plan and profile drawings showing the aforementioned watermains are included in the Appendix A.

2.4 ROADS

Two surrounding roads defining this subdivision include:

- Hyde Park Road, an arterial road that runs north/south at the west boundary of the subdivision.

- Sunningdale Road, an arterial road that runs west/east at the south boundary of the subdivision.

3.0 Conclusion

This report was prepared to provide an assessment of the existing water, storm and sanitary servicing infrastructure. Overviewing the capacity of the downstream storm and sanitary system we believe the development may be supported by existing infrastructure provided significant investment into the extension of existing sewers to bring them to the site bounds or development timing of future developments coincides with development timing of subject site. Similarly, an extension of the existing high-level 300mm watermain on Fair Oaks Boulevard can meet the entire site demands provided it loops with the existing 900mm watermain fronting the site on Sunningdale Road.

Figure 1 "Servicing Feasibility Area Plan" overviews the available infrastructure for the subject site and is included in the Appendix A.

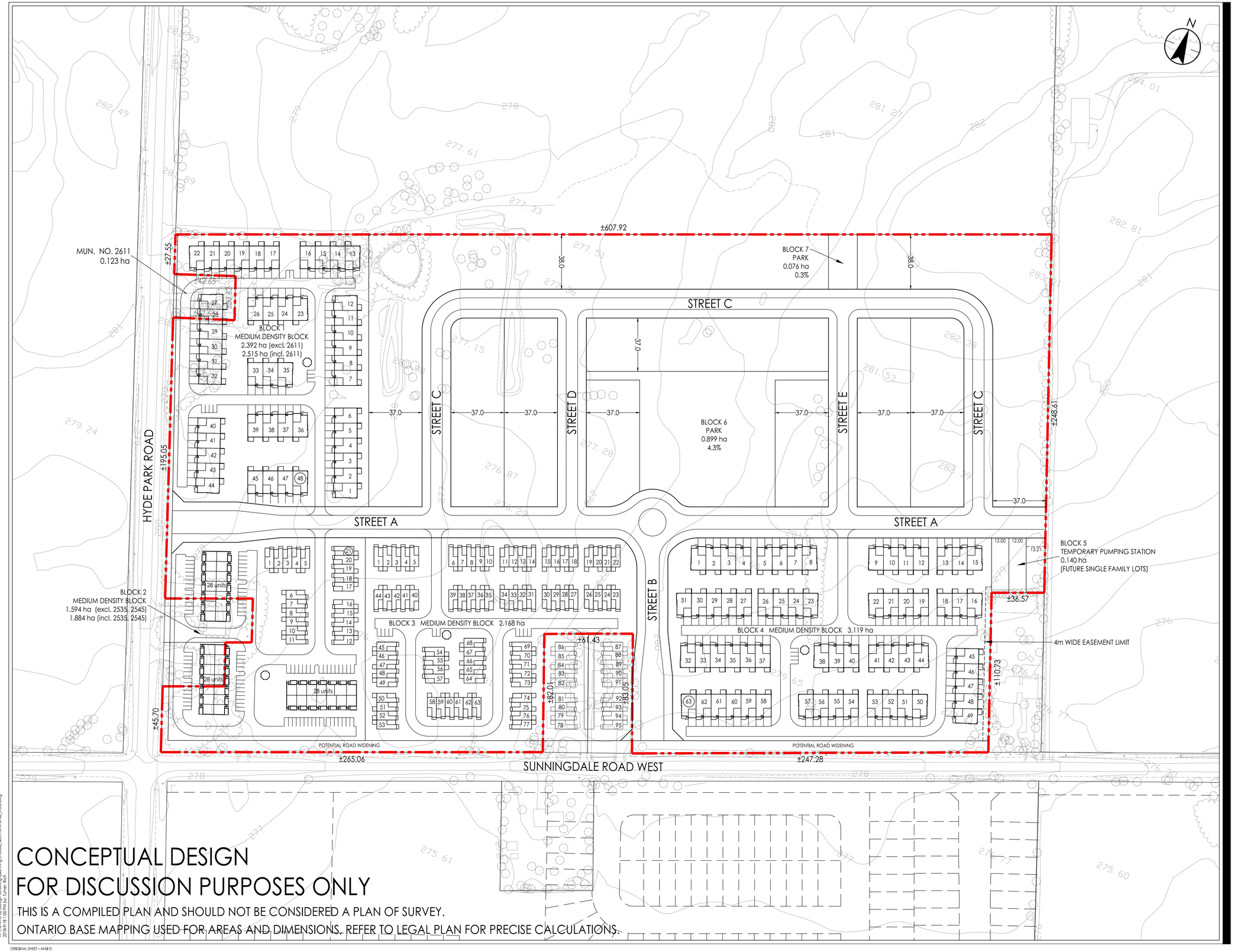
We trust this meets with your requirements. Should you have any question, or require further information, please contact the undersigned.

Sincerely,

STANTEC CONSULTING LTD.

Dan Vucetic, MESc., P.Eng.
Project Engineer, Community Development
Tel: (519) 645-2007
Fax: (519) 645-6575
Dan.Vucetic@stantec.com

APPENDIX A



CONCEPTUAL DESIGN
FOR DISCUSSION PURPOSES ONLY

THIS IS A COMPILED PLAN AND SHOULD NOT BE CONSIDERED A PLAN OF SURVEY.
ONTARIO BASE MAPPING USED FOR AREAS AND DIMENSIONS. REFER TO LEGAL PLAN FOR PRECISE CALCULATIONS.

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Stantec

Stantec
600-171 Queens Avenue
London ON N6A 5J7
Tel. 519-645-2007
www.stantec.com

Liability Note

The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing - any errors or omissions shall be reported to Stantec without delay.

Design Data

Site Area = 20.543 ha

Saleable Frontage = 1,575.9 m
Centreline of Road = 1,650.4 m

Medium Density - 9.274 ha
Road Widening - 0.502 ha

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

File Name: 161413708_r-db	RT Dwn.	BB Chkd.	RT Dsgn.	18.08.02 YY.MM.DD

Permit-Seal

Client/Project
AUBURN DEVELOPMENTS INC.

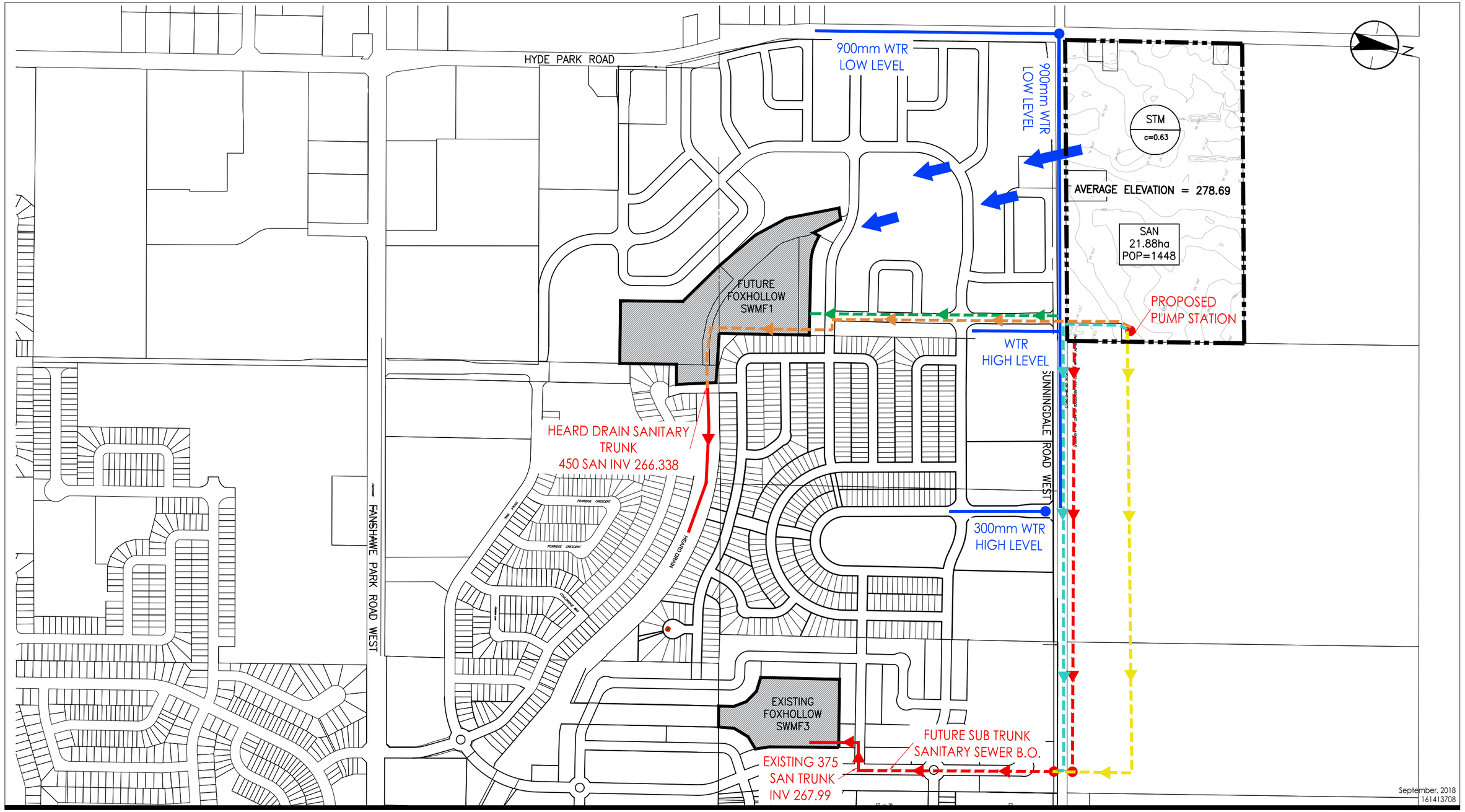
1521 SUNNINGDALE ROAD WEST

London, ON Canada

Title
CONCEPT PLAN

Project No.	Scale	Sheet	Revision
161413708	HORZ – 1 : 3000 (30 0 60m)	1 of 1	0

Drawing No. 1



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Stantec
600-171 Queens Avenue
London ON N6A 5J7
Tel. 519-645-2007
www.stantec.com

Legend

- SITE BOUNDARY
- EXISTING TRUNK SAN SEWER
- EXISTING WTR
- FUT. SAN SEWER OPTION 1 (1040m)
- FUT. SAN FORCEMAIN OPTION 2 (1070m)
- FUT. SAN SEWER OPTION 3 (992m)
- FUT. SAN SEWER OPTION 4 (1060m)
- FUT. STM SEWER - FLOWS UP TO 50YR (502m)

POP = EXISTING SANITARY SEWERSHED ALLOCATED SANITARY POPULATION
C = STORMWATER RUNOFF COEFFICIENT ALLOCATED BY SWMF1
INV = INVERT ELEVATION
OVERLAND FLOW - FLOWS GREATER THAN 50YR

*STM WATER GREATER THAN 50 YEAR IS OVERLAND FLOW
*ALL DIMENSIONS IN METRES

HORZ - 1 : 7500
50 0 100m

Client/Project
AUBURN DEVELOPMENT INC.
MT. PLEASANT CEMETERY
London, ON Canada

Figure No.
1

Title
SERVICING FEASIBILITY
AREA PLAN

September, 2018
161413708

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					DRAWN BY	DJL				
					CHECKED	NO				
					APPROVED	NO				
					DATE	MARCH 2017				

CONSULTANT OR DIVISION

Stantec

600 - 171 Queens Avenue
London, ON. N6A 5J7
www.stantec.com

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LICENSED PROFESSIONAL ENGINEER
N. OLIVEIRA
100067337
MARCH 16/17
PROVINCE OF ONTARIO

London CANADA

CORPORATION OF THE CITY OF LONDON

SCALE
HORZ – 1 : 5000
50 0 100m

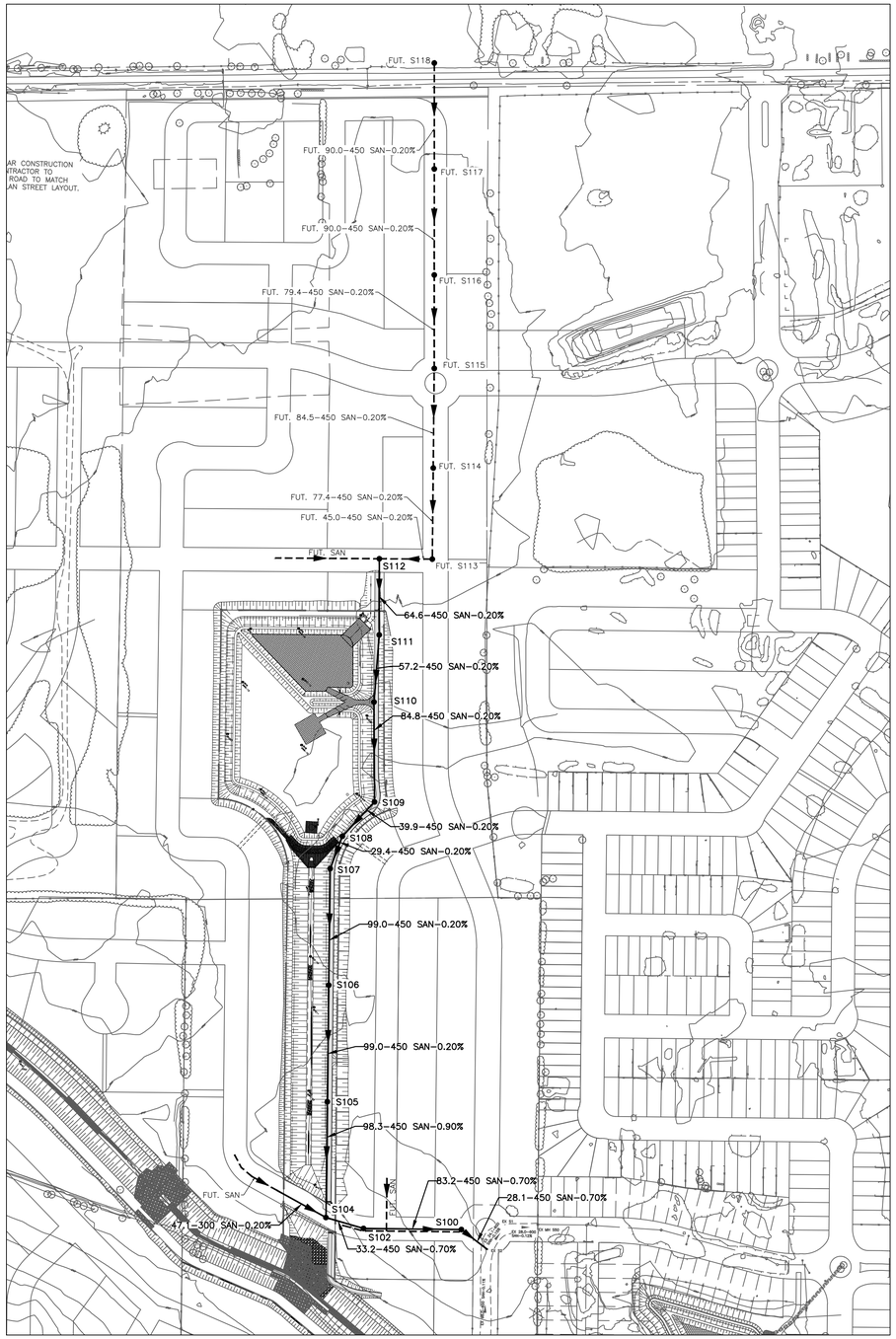
TITLE
FOX HOLLOW COMMUNITY SWM SYSTEM
THE CORPORATION OF THE CITY OF LONDON

EXTERNAL SANITARY DRAINAGE AREA PLAN

PROJECT No. 1656–30086

SHEET No. 13 of 19

PLAN FILE No.



RESIDENTIAL COMMERCIAL AND INSTITUTIONAL POPULATION DENSITIES

THE FOLLOWING POPULATION ALLOWANCES WILL APPLY WHEN DESIGNING SANITARY SEWERS:

LOW DENSITY (SINGLE-FAMILY / SEMI-DETACHED)	= 30 UNITS / HECTARE @ 3 PEOPLE / UNIT
MEDIUM DENSITY (MULTI-FAMILY / TOWNHOUSE / ROWHOUSE)	= 75 UNITS / HECTARE @ 2.4 PEOPLE / UNIT
HIGH DENSITY (APARTMENTS)	= 150 - 300 UNIT / HECTARE @ 1.6 PEOPLE / UNIT
COMMERCIAL / INSTITUTIONAL	= 100 PEOPLE / HECTARE
SECONDARY SCHOOL	= 1500 PEOPLE
ELEMENTARY SCHOOL	= 400 PEOPLE

SANITARY SEWER DESIGN SHEET
CITY OF LONDON

DESIGN CRITERIA
SEWAGE = 230 LITRE / CAPITA / DAY
INFILTRATION = 8640 LITRES / HECTARE / DAY
PEAKING FACTOR = $\frac{1 + 14}{4 + P^{0.5}}$

DATE: September 9, 2016
DESIGNED BY: DJL

PROJECT NAME: FOX HOLLOW TRUNK SANITARY SEWER

PROJECT FILE NO. 165630086

LOCATION				AREA			POPULATION						SEWAGE FLOWS			SEWER DESIGN						PROFILE				
																									INVERT ELEVATION	
AREA No.	STREET	FROM MANHOLE	MANHOLE	NET OR GROSS	HECTARES	TOTAL HECTARES	HECTARE	PER LOT	NO. OF LOTS	DELTA POP.	TOTAL POP.	PEAKING FACTOR	INFILT L / s	SEWAGE L / s	Q TOTAL L / s	PIPE SIZE mm	n	SLOPE %	CAP L / s	VELOCITY m / s	LENGTH m	FALL IN SEWER	HEADLOSS IN U.S. MH	DROP IN MANHOLE	U.S.	D.S.
EXT 3		-	EX S3		0.00	111.57				9830	9830	2.96	11.16	85.26	96.42											
EXT 1a	Auburn	-	-		39.26	39.26				3108	3108	3.43	3.93	31.21	35.14											
EXT 1b	Southside	-	-		3.50	3.50				315	315	4.07	0.35	3.75	4.10											
EXT 1		STUB	S104		0.00	42.76				0	3423	3.39	4.28	34.01	38.29	300	0.013	0.20	43.24	0.61	47.1	0.094	0.000	0.030	265.193	265.099
EXT 2a	Lands North of Sunningdale	-	-		135.27	135.27				8950	8950	3.00	13.53	78.69	92.21											
EXT 2b	Southside	-	-		16.70	16.70				1503	1503	3.68	1.67	16.19	17.86											
EXT 2			S112		0.00	151.97				0	10453	2.94	15.20	89.85	105.05											
	SWMF 3 block	S112	S111		0.00	151.97				0	10453	2.94	15.20	89.85	105.05	450	0.013	0.20	127.50	0.80	64.6	0.129	0.000	0.450	267.576	267.447
	SWMF 3 block	S111	S110		0.00	151.97				0	10453	2.94	15.20	89.85	105.05	450	0.013	0.20	127.50	0.80	57.2	0.114	0.000	0.030	267.417	267.302
	SWMF 3 block	S110	S109		0.00	151.97				0	10453	2.94	15.20	89.85	105.05	450	0.013	0.20	127.82	0.80	84.8	0.171	0.000	0.030	267.272	267.102
	SWMF 3 block	S109	S108		0.00	151.97				0	10453	2.94	15.20	89.85	105.05	450	0.013	0.20	127.50	0.80	39.9	0.080	0.000	0.030	267.072	266.992
	SWMF 3 block	S108	S107		0.00	151.97				0	10453	2.94	15.20	89.85	105.05	450	0.013	0.20	127.50	0.80	29.4	0.059	0.000	0.030	266.962	266.903
	SWMF 3 block	S107	S106		0.00	151.97				0	10453	2.94	15.20	89.85	105.05	450	0.013	0.20	127.50	0.80	99.0	0.198	0.000	0.030	266.873	266.675
	SWMF 3 block	S106	S105		0.00	151.97				0	10453	2.94	15.20	89.85	105.05	450	0.013	0.20	127.50	0.80	99.0	0.198	0.000	0.030	266.645	266.447
	SWMF 3 block	S105	S104		0.00	151.97				0	10453	2.94	15.20	89.85	105.05	450	0.013	0.90	270.47	1.70	98.3	0.885	0.000	0.030	266.417	265.533
	Southside	S104	S102		0.00	194.73				0	13876	2.81	19.47	114.27	133.74	450	0.013	0.70	238.87	1.50	33.2	0.233	0.000	0.150	264.949	264.716
	Southside	S102	S100		0.00	194.73				0	13876	2.81	19.47	114.27	133.74	450	0.013	0.70	238.53	1.50	83.2	0.582	0.000	0.030	264.686	264.103
EXT 4	Southside		S100		7.33	7.33				147	147	4.19	0.73	1.81	2.54											
	Southside	S100	EX S2		0.00	202.06				0	14023	2.81	20.21	115.29	135.50	450	0.013	0.70	238.53	1.50	28.1	0.197	0.000	0.030	264.073	263.877
		EX S3	EX S2		0.00	111.57				0	9830	2.96	11.16	85.26	96.42	600	0.013	0.11	203.64	0.72	98.0	0.108	0.000	0.150	263.565	263.457
		EX S2	EX S1		0.00	313.63				0	23853	2.58	31.36	179.92	211.28	600	0.013	0.15	237.80	0.84	24.1	0.036	0.000	0.600	263.427	263.390
EXT 5			EX S1		2.75	2.87				132	132	4.21	0.29	1.63	1.91											
-	Medway Park Drive (Trunk)	EX S1	EX S50		0.00	316.50				0	23985	2.57	31.65	180.75	212.40	600	0.013	0.12	212.69	0.75	28.0	0.034	0.000	0.600	263.360	263.327

* THE PIPE BETWEEN EX MH S53 AND S7A DOES NOT CURENTLY HAVE ENOUGH CAPACITY TO ALLOW FOR MORE THAN 7500 POPULATION FOR THE LANDS NORTH OF SUNNINGDALE
THE CAPACITY FOR THIS PIPE IS 204.64 l/s

Calculation of area EXT 2a **135.27**
Area is not part of the urban growth boundary
We have estimated the areas per below

		Area (Ha)	Population
5%	Parks	6.76	0.00
16%	Open Space	21.64	0.00
2%	High Density	2.71	757.51
15%	Medium Density	20.29	3652.29
35%	Low Density	47.34	4251.01
0%	School	0.00	0.00
2%	Commercial	2.71	270.54
20%	Roads	27.05	0.00
5%	Wooded area	6.76	0.00
100%		135.27	8941.35

EXISTING SERVICES	DRAWING #, SOURCE	DATE	CONSTRUCTED SERVICES	COMPLETION

DETAILS	
DESIGN	DJL
DRAWN BY	DJL
CHECKED	NO
APPROVED	NO
DATE	MARCH 2017

No.	REVISIONS	DATE	CONSULTANT
1.	ISSUED FOR MOECC APPROVAL	MAR. 16, 2017	DJL/NO

CONSULTANT OR DIVISION

Stantec

600 - 171 Queens Avenue
London, ON N6A 5J7
www.stantec.com

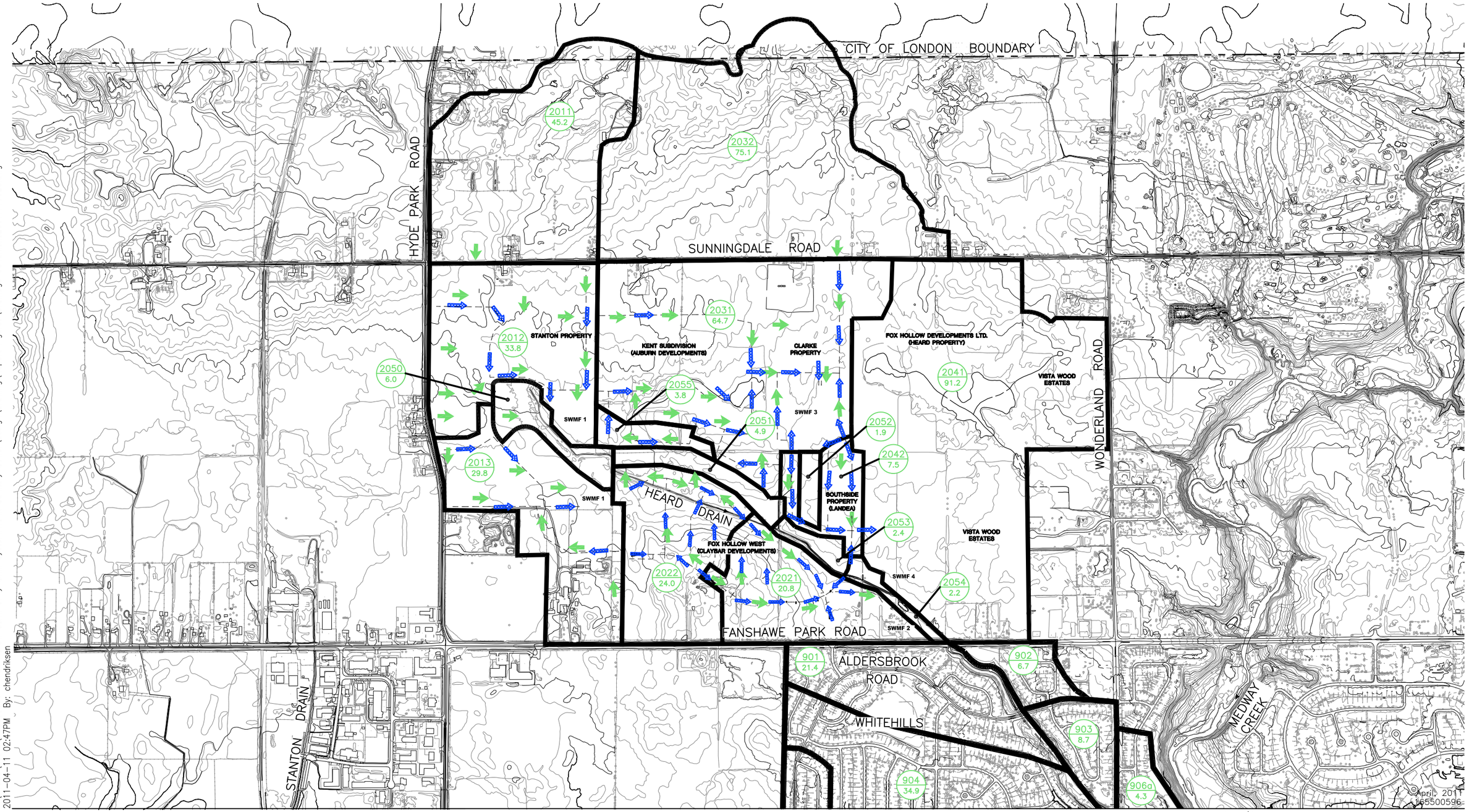
ENGINEER'S STAMP
LICENSED PROFESSIONAL ENGINEER
N. OLIVEIRA
100067337
MARCH 16/17
PROVINCE OF ONTARIO

London CANADA
CORPORATION OF THE CITY OF LONDON

SCALE
HORZ – 1 : 2500
25 0 50m

TITLE
FOX HOLLOW COMMUNITY SWM SYSTEM
THE CORPORATION OF THE CITY OF LONDON
SANITARY DESIGN SHEET

PROJECT No. 1656-30086
SHEET No. 14 of 19
PLAN FILE No.



V:\01655\active\165500596 - Fox Hollow Community SWM System.Trunk Sanitary Sewer\design\drawing\Report Figures\Drainage Conditions2007.110325.dwg
2011-04-11 02:47PM By: chendriksen

Stantec Consulting Ltd.
49 Frederick Street
Kitchener ON Canada
N2H 6M7
Tel. 519.579.4410
Fax. 519.579.6733
www.stantec.com

Legend

- POST-DEVELOPMENT DRAINAGE BOUNDARY
- 201 / 5.18 — SUBCATCHMENT IDENTIFICATION NUMBER / SUBCATCHMENT AREA (HECTARES)
- OVERLAND FLOW DIRECTION
- MINOR FLOW DIRECTION

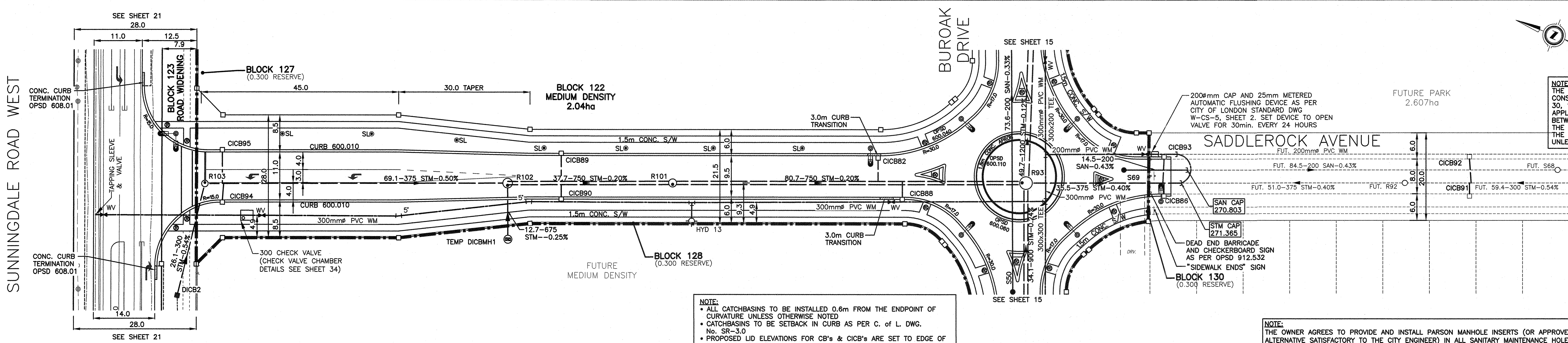
1:17500 0 175 525 875m

April, 2011
165500596

Client/Project
FOX HOLLOW AREA
FUNCTIONAL S.W.M. PLAN

Figure No.
3.0

Title
POST-DEVELOPMENT DRAINAGE PLAN



FAIR OAKS BOULEVARD

BARRIER CURB WITH WIDER GUTTER AS PER OPSD 600.010

NOTE:
- ALL CATCHBASINS TO BE INSTALLED 0.6m FROM THE ENDPOINT OF CURVATURE UNLESS OTHERWISE NOTED
- CATCHBASINS TO BE SETBACK IN CURB AS PER C. of L. DWG. No. SR–3.0
- PROPOSED LID ELEVATIONS FOR CB's & CICB's ARE SET TO EDGE OF PAVEMENT GRADES
- ALL WATER SERVICES WILL BE 25mm IN SIZE. (TYPICAL)
- STORM & SANITARY PRIVATE DRAIN CONNECTIONS ARE TO HAVE A MIN. OF 500mm CLEARANCE UNDER/OVER MAINS
- ALL SANITARY PDCs TO BE PROVIDED WITH CLEANOUTS AS PER SW–6.4

NOTE:
THE OWNER AGREES TO PROVIDE AND INSTALL PARSON MANHOLE INSERTS (OR APPROVED ALTERNATIVE SATISFACTORY TO THE CITY ENGINEER) IN ALL SANITARY MAINTENANCE HOLES WITHIN THIS PLAN, UNLESS APPROVED OTHERWISE BY THE CITY ENGINEER, AT THE TIME OF THE INSTALLATION OF THE SANITARY MAINTENANCE HOLE. THE OWNER FURTHER AGREES THAT THESE INSERTS ARE TO REMAIN IN PLACE UNTIL ASSUMPTION OF THE SUBDIVISION, AND THAT THEY WILL BE REMOVED, BY THE OWNER, AT NO COST TO THE CITY.

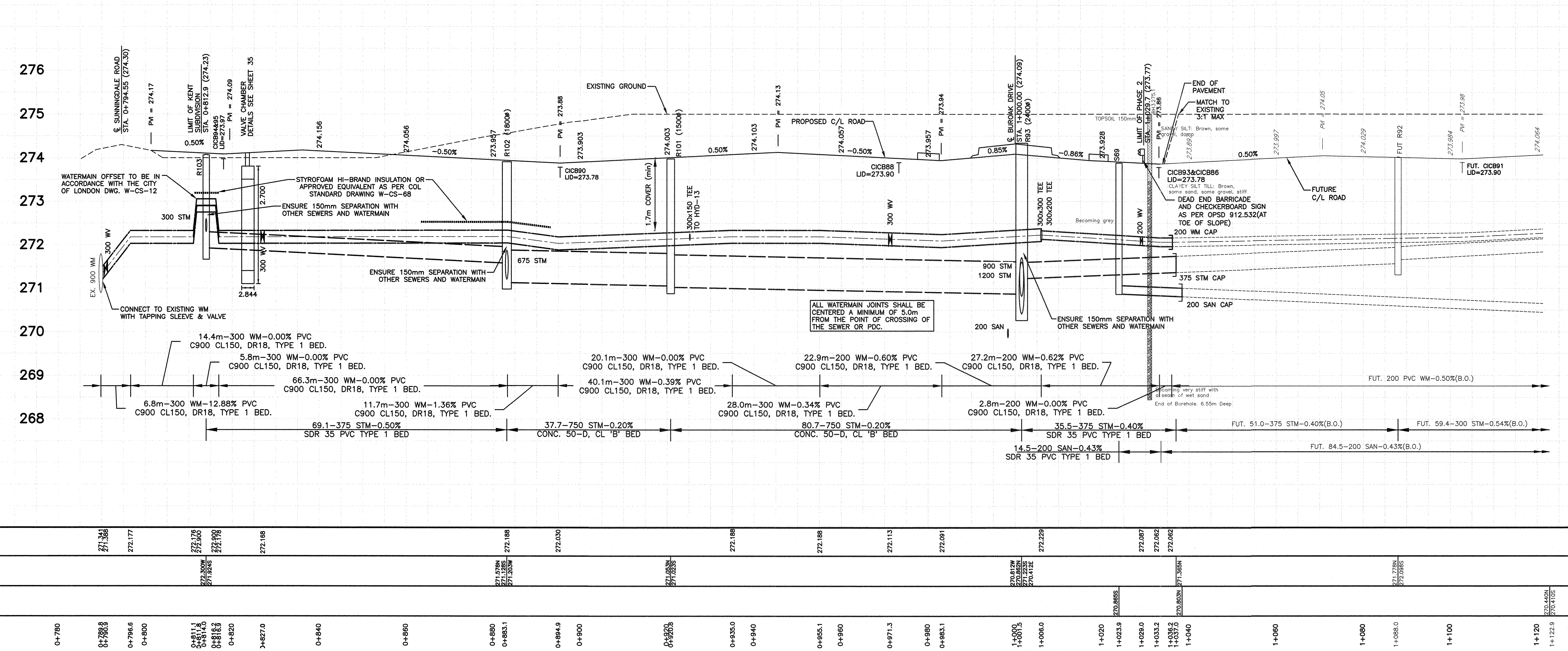
NOTE:
THE STANDARD CONTRACT DOCUMENTS FOR MUNICIPAL CONSTRUCTION PROJECTS, AS ADOPTED BY THE COUNCIL ON MAY 30, 1994 AND LAWS AMENDED FROM TIME TO TIME, ARE TO BE APPLIED TO THIS PROJECT. WHERE ANY DISCREPANCY EXISTS BETWEEN THE ADOPTED STANDARD CONTRACT DOCUMENTS AND THE STANDARDS AND SPECIFICATIONS NOTED ON THESE DRAWINGS, THE CURRENT STANDARD CONTRACT DOCUMENTS WILL GOVERN UNLESS OTHERWISE APPROVED BY THE CITY ENGINEER.

NOTE:
MANHOLE JOINT WRAPPING REQUIRED WHERE GROUNDWATER IS ENCOUNTERED DURING EXCAVATION/INSTALLATION

NOTE:
WATER SERVICES ADJACENT TO A SANITARY/STORM MANHOLE ARE TO BE INSULATED WITHIN 1.5m FROM THE EXTERIOR OF THE MANHOLE

NO PDC's ARE TO GO INTO SANITARY MH's

⌖	DENOTES 3–WAY FIRE HYDRANT C/W STORZ CONNECTION
BH4	DENOTES BOREHOLE LOCATION
®	DENOTES SIDEWALK RAMP AS PER CITY OF LONDON SPECIFICATION SR–1.2 c/w TACTILE PLATES AS PER CoL SPECIFICATION 2.1.15
151	DENOTES REGISTERED PLAN LOT/BLOCK NUMBERS
4	DENOTES PROPOSED REGISTERED PLAN LOT/BLOCK NUMBERS
CMB	DENOTES COMMUNITY MAILBOX LOCATION



V:\01614\active\161413447\design\drawing\civil\sheet_files\161413447_C-ST_FAIR OAKS BOULEVARD.dwg
7/13/2018 1:19:20 PM by:Childs, Jason

EXISTING SERVICES	DRAWING #, SOURCE	DATE	CONSTRUCTED SERVICES	COMPLETION

DETAILS	
DESIGN	JBH
DRAWN BY	JBH
CHECKED	TJS
APPROVED	TJS
DATE	JULY–2017

No.	REVISIONS	DATE	CONSULTANT
1.	1st SUBMISSION COMMENTS	NOVEMBER 2017	
2.	2nd SUBMISSION COMMENTS	FEBRUARY 2018	
3.	3rd SUBMISSION COMMENTS	APRIL 2018	
4.	4th SUBMISSION COMMENTS	JUNE 2018	
5.	5th SUBMISSION COMMENTS	JULY 2018	

CONSULTANT OR DIVISION

Stantec

600 - 171 Queens Avenue
London, ON, N6A 5J7
www.stantec.com

ENGINEERS STAMP
LICENSED PROFESSIONAL ENGINEER 7/13/2018 D. VUCETIC 100209129 PROVINCE OF ONTARIO

London CANADA
CORPORATION OF THE CITY OF LONDON

SCALE
HORZ – 1 : 500 (5 0 10m)
VERT – 1 : 50 (0.5 0 1m)

TITLE
KENT SUBDIVISION – PHASE 2
FOXHOLLOW NORTH KENT DEVELOPMENTS INC.

FAIR OAKS BOULEVARD
STA 0+780 TO STA 1+120

PROJECT No. 1614–13447
SHEET No. 17 of 40
PLAN FILE No.

SUNNINGDALE ROAD WEST
FAIR OAKS BOULEVARD
DITCH RESTORATION:
RESTORE ALL DITCH SLOPES WITH 300mm TOPSOIL AND EROSION CONTROL BLANKET (NORTH AMERICAN GREEN SC150) OR APPROVED EQUIVALENT
LEGEND
EXISTING EDGE OF PAVEMENT
PROPOSED EDGE OF PAVEMENT
EXISTING GRAVEL SHOULDER
PROPOSED GRAVEL SHOULDER
EXISTING DITCH
PROPOSED DITCH
EXISTING WM
PROPOSED PAVEMENT MARKINGS
271.61 EXISTING CENTERLINE ELEVATION
NOTE: GRANULAR BASE AND SUBBASE IN EXISTING ROADWAY TO BE VERIFIED BY GEOTECHNICAL ENGINEER AT TIME OF CONSTRUCTION
NOTE: EXISTING ASPHALT TO BE SAW CUT AND MILLED AS PER SR-13.1 (50mm DEEP x 500 WIDE)
NOTE: THE STANDARD CONTRACT DOCUMENTS FOR MUNICIPAL CONSTRUCTION PROJECTS, AS ADOPTED BY THE COUNCIL ON MAY 30, 1994 AND LAWS AMENDED FROM TIME TO TIME, ARE TO BE APPLIED TO THIS PROJECT. WHERE ANY DISCREPANCY EXISTS BETWEEN THE ADOPTED STANDARD CONTRACT DOCUMENTS AND THE STANDARDS AND SPECIFICATIONS NOTED ON THESE DRAWINGS, THE CURRENT STANDARD CONTRACT DOCUMENTS WILL GOVERN UNLESS OTHERWISE APPROVED BY THE CITY ENGINEER.
NOTE: PRIOR TO ANY WORK ON THE SITE THE OWNER SHALL INSTALL SIGNAGE ADVISING CONSTRUCTION TRAFFIC THAT LOADS ON SUNNINGDALE ROAD WEST ARE RESTRICTED TO A MAXIMUM WEIGHT OF FIVE(5) TONNES PER AXLE FOR ANY VEHICLE TRAVELING ON THIS ROAD DURING THE PERIOD MARCH 1 TO APRIL 30, INCLUSIVE IN ANY YEAR.
NOTE: REFER TO SHEET 30-32 FOR PAVEMENT MARKING DETAILS AND TMP CROSS SECTIONS
NOTE: PERMISSION MUST BE OBTAINED FROM PRIVATE LANDOWNERS FOR ANY GRADING OR OTHER WORKS BEYOND THE LIMITS OF THIS SUBDIVISION.
DENOTES 3-WAY FIRE HYDRANT C/W STORZ CONNECTION
DENOTES BOREHOLE LOCATION
151 DENOTES REGISTERED PLAN LOT/BLOCK NUMBERS
4 DENOTES PROPOSED REGISTERED PLAN LOT/BLOCK NUMBERS
DENOTES SIDEWALK RAMP AS PER CITY OF LONDON SPECIFICATION SR-1.2 c/w TACTILE PLATES AS PER CoL SPECIFICATION 2.1.15
CMB DENOTES COMMUNITY MAILBOX LOCATION
BLOCK 123 ROAD WIDENING
BLOCK 142 (0.300 RESERVE)
BLOCK 128 (0.300 RESERVE)
BLOCK127 (0.300 RESERVE)
BLOCK 122 MEDIUM DENSITY 2.04ha
FUTURE MEDIUM DENSITY
129.2m PROPOSED DIVERSION SWALE
69.7m PROPOSED DIVERSION SWALE @ 0.50%
346.3m INTERIM CHANNEL 1.0m WIDE BOTTOM W/ 3:1 SIDE SLOPES, BOTTOM SLOPE = 0.50% SEE DETAIL SHEET 26
TEMPORARY OVERLAND FLOW CHANNEL TO BE FILLED WHEN BLOCKS DEVELOP AND ALL APPURTENANCES TO BE REMOVED.
SEDIMENT BASIN OPTION B TO BE CONSTRUCTED IF BLOCK 121 IS DEVELOPED
INSTALL TEMP DICB2 (600x600mm) 3:1 GRATE (600x600) LID ELEVATION = 273.60 INVERT = 271.66
300 CHECK VALVE (CHECK VALVE CHAMBER DETAILS SEE SHEET 34)
SEE SHEET 17
MATCH TO EXISTING C/L OF NORTH DITCH ELEV=273.64
MATCH TO EXISTING C/L OF SOUTH DITCH ELEV=274.40
MATCH TO EXISTING C/L OF NORTH DITCH ELEV=272.90
MATCH TO EXISTING C/L OF SOUTH DITCH ELEV=272.83
PIPE CONNECTION AND OUTLETS AS PER OPSD 207.044
EX. 373.5m-900mm CPP WM-1.05% A.W.W.A. C301-(L) CL-14
EX. 63.6m-900mm CPP WM-0.86% A.W.W.A. C301-(L) CL-14
EX. 122.4m-900mm CPP WM-0.33% A.W.W.A. C301-(L) CL-14
EX. 399.8m-900mm CPP WM-0.13% A.W.W.A. C301-(L) CL-14
CONSULTANT'S COPY
CITY OF LONDON DEVELOPMENT SERVICES ACCEPTED JUL 13 2018 SUBJECT TO THE CONDITION(S) IDENTIFIED IN THE ACCEPTANCE LETTER OF THE SAME DATE
SUBJECT TO THE ISSUANCE OF THE ENVIRONMENTAL COMPLIANCE APPROVAL FROM THE MINISTRY OF ENVIRONMENT

No.	REVISIONS	DATE
1.	1st SUBMISSION COMMENTS	NOVEMBER 2017
2.	2nd SUBMISSION COMMENTS	FEBRUARY 2018
3.	3rd SUBMISSION COMMENTS	APRIL 2018
4.	4th SUBMISSION COMMENTS	JUNE 2018
5.	5th SUBMISSION COMMENTS	JULY 2018

DETAILS	
DESIGN	JBH
DRAWN BY	JBH
CHECKED	TJS
APPROVED	TJS
DATE	JULY 2017

Stantec

CORPORATION OF THE CITY OF LONDON

SCALE: HORZ – 1 : 500; VERT – 1 : 50

KENT SUBDIVISION – PHASE 2

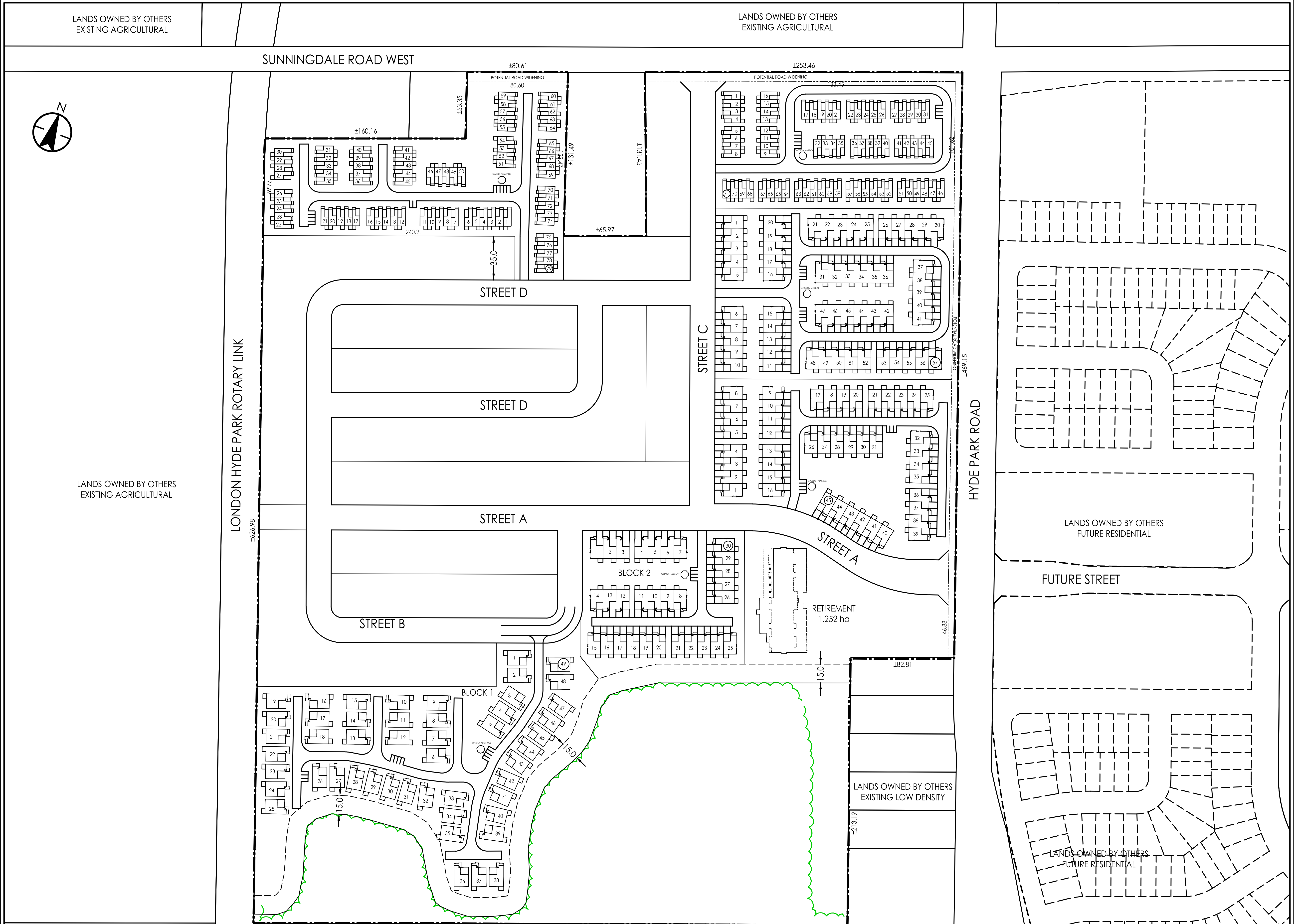
FOXHOLLOW NORTH KENT DEVELOPMENTS INC.

SUNNINGDALE ROAD WEST

STA 4+740 TO STA 5+120

PROJECT No. 1614-13447

SHEET No. 21 of 40



CONCEPTUAL DESIGN
FOR DISCUSSION PURPOSES ONLY

Stantec
600-171 Queens Avenue
London ON N6A 5J7
Tel. 519-645-2007
www.stantec.com

Liability Note

The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing - any errors or omissions shall be reported to Stantec without delay.

Design Data

Site Area = 34.457 ha

Saleable Frontage = 2,758.3 m
Centreline of Road = 1,969.7 m

Medium Density - 8.282 ha
Vacant Land Condominium - 3.144 ha
Retirement Block - 1.548 ha
Park - 0.145 ha
Walkway - 0.043 ha
Woodlot - 5.416 ha
Woodlot Buffer - 1.056 ha
Road Widening - 0.507 ha

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

File Name: 161413706_ndb	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Permit-Seal

Client/Project
AUBURN DEVELOPMENTS INC.

1700 SUNNINGDALE ROAD WEST

London, ON Canada

Title
CONCEPT PLAN

Project No. 161413706
Scale HORZ 1 : 3000

Drawing No. 1
Sheet 1 of 1
Revision 0

LEGEND

- EXTERNAL SANITARY DRAINAGE BOUNDARY
- SANITARY DRAINAGE SUB-BOUNDARY *
- FUT1 — EXTERNAL SANITARY AREA I.D.
- A1 — POPULATION AND AREA TABLE REFERENCE I.D.*
- ASSESSMENT PROPERTY BOUNDARY
- *(FROM CCL ENGINEERING DESIGN REPORT, APRIL 2001)

NOTE:

LAND USE BASED ON DEC. 21, 1999 LAND USE PLAN FOR THE HYDE PARK COMMUNITY PLAN.

POPULATION AND AREA TABLES

LAND USE DESIGNATION	UNITS PER HEC.	P PER UNIT	P PER HEC.	A1		A2		A3		A4		A5		A6		A7		A8		A9		A10	
				AREA ha	Pop.	AREA ha	Pop.	AREA ha	Pop.	AREA ha	Pop.	AREA ha	Pop.	AREA ha	Pop.	AREA ha	Pop.	AREA ha	Pop.	AREA ha	Pop.	AREA ha	Pop.
LOW DENSITY RESIDENTIAL	30	3.0	90	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	10.5	945	0.0	0	0.0	0	2.6	234
MULTI-FAMILY, MEDIUM DENSITY RESIDENTIAL	75	2.4	180	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	8.8	1,584
MULTI FAMILY, HIGH DENSITY RESIDENTIAL	150	1.6	240	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
ASSOCIATED SHOPPING AREA COMMERICAL	---	---	100	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	6.0	600	0.0	0	9.7	970
RESTRICTED SERVICE COMMERCIAL	---	---	100	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	9.2	920	0.0	0	3.9	390	0.0	0
BUSINESS DISTRICT	---	---	100	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
OFFICE BUSINESS PARK	---	---	100	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
LIGHT INDUSTRIAL	---	---	68	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
PARKS	---	---	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
OPEN SPACE	---	---	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
ENVIRONMENTAL REVIEW	---	---	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
SWM PONDS	---	---	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.9	0
COMMUNITY FACILITIES - ELEMENTARY SCHOOLS	---	400	---	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
COMMUNITY FACILITIES - SECONDARY SCHOOLS	---	1200	---	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
FUTURE GROWTH AREAS	---	---	55	73.0	4,015	15.5	853	271.7	14,944	40.8	2,244	22.1	1,216	17.0	935	0.0	0	0.0	0	0.0	0	0.0	0
				73.0	4,015	15.5	853	271.7	14,944	40.8	2,244	22.1	1,216	17.0	935	19.7	1,865	6.0	600	3.9	390	22.0	2,788

LAND USE DESIGNATION	UNITS PER HEC.	P PER UNIT	P PER HEC.	A11		A12		A13		A14		A15		A16		A17		A18		A19		A20	
				AREA ha	Pop.	AREA ha	Pop.	AREA ha	Pop.	AREA ha	Pop.	AREA ha	Pop.	AREA ha	Pop.	AREA ha	Pop.	AREA ha	Pop.	AREA ha	Pop.	AREA ha	Pop.
LOW DENSITY RESIDENTIAL	30	3.0	90	0.0	0	0.0	0	0.0	0	0.0	0	3.6	324	0.0	0	0.0	0	0.0	0	0.0	0	26.5	2,385
MULTI-FAMILY, MEDIUM DENSITY RESIDENTIAL	75	2.4	180	0.0	0	0.0	0	8.3	1,494	0.0	0	10.8	1,944	0.0	0	0.0	0	0.0	0	0.0	0	11.4	2,052
MULTI FAMILY, HIGH DENSITY RESIDENTIAL	150	1.6	240	0.0	0	0.0	0	0.0	0	0.0	0	0.3	72	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
ASSOCIATED SHOPPING AREA COMMERICAL	---	---	100	0.0	0	0.0	0	9.0	900	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
RESTRICTED SERVICE COMMERCIAL	---	---	100	3.7	370	3.2	320	6.1	610	2.8	280	0.0	0	4.9	490	2.8	280	2.8	280	25.8	2,580	0.0	0
BUSINESS DISTRICT	---	---	100	0.0	0	0.0	0	0.0	0	0.0	0	1.2	120	0.0	0	0.0	0	0.0	0	1.4	140	0.0	0
OFFICE BUSINESS PARK	---	---	100	0.0	0	0.0	0	4.6	460	0.0	0	0.0	0	0.0	0	0.0	0	2.5	250	0.0	0	0.0	0
LIGHT INDUSTRIAL	---	---	68	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	11.7	796	0.0	0	0.0	0
PARKS	---	---	0	0.0	0	0.0	0	0.0	0	0.0	0	2.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
OPEN SPACE	---	---	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	2.0	0	2.6	0	1.0	0
ENVIRONMENTAL REVIEW	---	---	0	0.0	0	0.0	0	6.6	0	0.0	0	2.2	0	0.0	0	0.0	0	0.7	0	0.0	0	0.0	0
SWM PONDS	---	---	0	0.0	0	0.0	0	2.2	0	0.0	0	2.0	0	0.0	0	0.0	0	0.0	0	1.8	0	0.0	0
COMMUNITY FACILITIES - ELEMENTARY SCHOOLS	---	400	---	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
COMMUNITY FACILITIES - SECONDARY SCHOOLS	---	1200	---	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	2.1	1,200
				3.7	370	3.2	320	36.8	3,464	2.8	280	22.1	2,460	4.9	490	2.8	280	19.7	1,326	31.6	2,720	41.0	5,637

LAND USE DESIGNATION	UNITS PER HEC.	P PER UNIT	P PER HEC.	A21		A22		A23		A24		A25		A26		A27		A28		A29		A30	
				AREA ha	Pop.	AREA ha	Pop.	AREA ha	Pop.	AREA ha	Pop.	AREA ha	Pop.	AREA ha	Pop.	AREA ha	Pop.	AREA ha	Pop.	AREA ha	Pop.	AREA ha	Pop.
LOW DENSITY RESIDENTIAL	30	3.0	90	17.1	1,539	56.2	5,058	1.6	144	0.9	81	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
MULTI-FAMILY, MEDIUM DENSITY RESIDENTIAL	75	2.4	180	7.6	1,368	6.5	1,170	3.9	702	2.7	486	0.0	0	0.0	0	0.4	72	0.0	0	0.0	0	0.0	0
MULTI FAMILY, HIGH DENSITY RESIDENTIAL	150	1.6	240	0.0	0	0.0	0	0.0	0	0.0	0	0.6	144	3.6	864	8.4	2,016	0.0	0	0.0	0	0.0	0
ASSOCIATED SHOPPING AREA COMMERICAL	---	---	100	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
RESTRICTED SERVICE COMMERCIAL	---	---	100	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
BUSINESS DISTRICT	---	---	100	0.0	0	0.0	0	0.0	0	0.0	0	2.7	270	4.1	410	2.5	250	5.2	520	3.0	300	5.7	570
OFFICE BUSINESS PARK	---	---	100	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.3	30	0.0	0	0.4	40
LIGHT INDUSTRIAL	---	---	68	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
PARKS	---	---	0	2.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
OPEN SPACE	---	---	0	6.9	0	0.0	0	0.0	0	0.0	0	2.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
ENVIRONMENTAL REVIEW	---	---	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
SWM PONDS	---	---	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
COMMUNITY FACILITIES - ELEMENTARY SCHOOLS	---	400	---	0.8	400	1.6	400	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
COMMUNITY FACILITIES - SECONDARY SCHOOLS	---	1200	---	0.0	0	0.8	400	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
				35.1	3,307	58.6	7,028	5.5	846	5.7	567	3.3	414	7.7	1,274	11.3	2,338	5.5	550	3.0	300	6.1	610

LAND USE DESIGNATION	UNITS PER HEC.	P PER UNIT	P PER HEC.	A31		A32		A33		A34	
				AREA ha	Pop.	AREA ha	Pop.	AREA ha	Pop.	AREA ha	Pop.
LOW DENSITY RESIDENTIAL	30	3.0	90	0.0	0	0.0	0	0.0	0	0.0	0
MULTI-FAMILY, MEDIUM DENSITY RESIDENTIAL	75	2.4	180	0.0	0	0.0	0	0.0	0	0.0	0
MULTI FAMILY, HIGH DENSITY RESIDENTIAL	150	1.6	240	0.0	0	0.0	0	0.0	0	0.0	0
ASSOCIATED SHOPPING AREA COMMERICAL	---	---	100	0.0	0	0.0	0	0.0	0	0.0	0
RESTRICTED SERVICE COMMERCIAL	---	---	100	0.0	0	0.0	0	0.0	0	0.0	0
BUSINESS DISTRICT	---	---	100	0.0	0	0.3	30	0.0	0	0.0	0
OFFICE BUSINESS PARK	---	---	100	0.0	0	8.6	860	0.0	0	0.0	0
LIGHT INDUSTRIAL	---	---	68	0.0	0	0.0	0	0.0	0	2.7	184
PARKS	---	---	0	0.0	0	0.0	0	0.0	0	0.0	0
OPEN SPACE	---	---	0	0.0	0	0.0	0	0.0	0	3.4	0
ENVIRONMENTAL REVIEW	---	---	0	0.0	0	0.0	0	0.0	0	0.0	0
SWM PONDS	---	---	0	0.0	0	0.0	0	0.0	0	0.0	0
COMMUNITY FACILITIES - ELEMENTARY SCHOOLS	---	400	---	0.0	0	0.0	0	0.0	0	0.0	0
COMMUNITY FACILITIES - SECONDARY SCHOOLS	---	1200	---	0.0	0	0.0	0	0.0	0	0.0	0
FUTURE GROWTH AREAS	---	---	55	9.8	540	0.0	0	9.6	528	0.0	0
				9.8	540	8.9	890	9.6	528	6.1	184

AS CONSTRUCTED NOTES	AS CONSTRUCTED SERVICES	COMPLETION
1. SEE DRAWING FOR FURTHER DETAILS.		
2. SEWER DESIGN: TRANSITION WIDTH OR AS NOTED.		
3. REFERENCE B.M. V94-43 ELEVATION: 272.915m		

		No.	REVISIONS	DATE	BY
DESIGN	MJJ	1	ISSUED FOR M.O.E. APPROVAL	JULY 2 2002	AH
DRAWN	PS	2	AS PER CITY OF LONDON (S&D)	JULY 18 2002	AH
CHECKED	AHG	3	AS PER CITY OF LONDON (S&D)	AUG. 2 2002	AH
APPROVED					
DATE	DEC '00				

CONSULTANT OR DIVISION

Stantec Consulting Ltd.
171 Queens Avenue, 8th Floor
London ON Canada N6A 5J7
Phone: (519) 645-2007
Fax: (519) 645-6575
E-mail:london@stantec.com

ENGINEER'S PROFESSIONAL ENGINEER — LICENSED — A. H. GOBBELS — Mar 25, 03 — PROVINCE OF ONTARIO

CORPORATION OF THE CITY OF LONDON

London CANADA

DIVISION MANAGER ..... CITY ENGINEER

SCALE 100m 0 200m

TITLE FIRST LONDON NORTH DEVELOPMENTS INC. SANITARY TRUNK SEWER CONTRACT No. 1

POPULATION AND LAND USE

PROJECT No. 614-00381

SHEET No. 2 of 10

PLAN FILE No. 17,323

POPULATION DENSITIES

SINGLE FAMILY	3	PP / UNIT
SEMI DETACHED	3	PP / UNIT
TOWNHOUSES	2.4	PP / UNIT
APARTMENTS- AVERAGE	1.6	PP / UNIT
I.C.I. FLOW	100	PP/ HA EQUIVALENT
SCHOOLS- ELEM.	400	P
INFILTRATION ALLOWANCE	8640	L/ GROSS HA/ DAY
AVERAGE FLOW	250	L/ PP / DAY

SANITARY SEWER DESIGN SHEET

CITY OF LONDON

FOXWOOD DEVELOPMENTS SUBDIVISION

Foxwood Developments Subd.
PROJECT NO. 60237554
DRAINAGE AREA 52.98 ha
DESIGNED BY RJG
CHECKED BY PAM
DATE 09/19/14

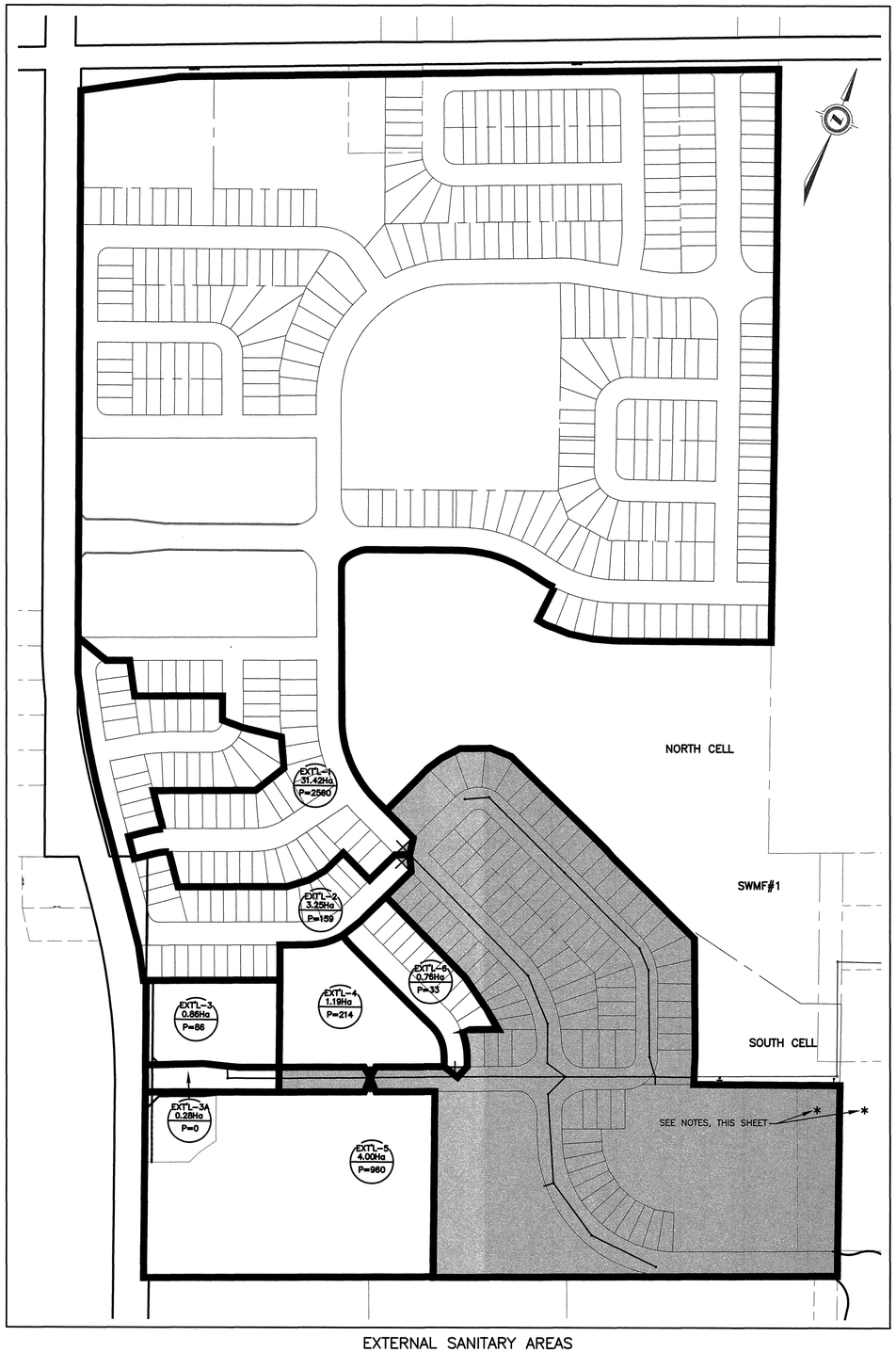
SEWER LOCATION				AREA			TOTAL	RESIDENTIAL AREA & POPULATION					HARMON	SEWAGE FLOW			SEWER DESIGN					PROFILE				
AREA NO.	STREET	FROM MH	TO MH	NET AREA ha.	GROSS AREA ha.	CUM. AREA ha.	CUM. AREA ha.	PER ha.	PERS. PER LOT	NO. OF LOTS	POPUL.	TOTAL CUM. POPUL.	PEAKING FACTOR	INFILT. l/s	SEWAGE l/s	TOTAL l/s	"n"	NOM. PIPE D mm	PIPE SLOPE %	CAPACITY Q l/s	VELOCITY (0.60 min.) m/s	LENGTH m	SEWER FALL m	DROP IN MANHOLE m	INVERT ELEVATION U.S. m	INVERT ELEVATION D.S. m
EXT'L-1	TOKALA TRAIL	PLUG	101	31.42			31.42		3.0		2560	2560	3.8500	3.14	28.52	31.66	0.013	250	0.30	32.58	0.66	13.0	0.039		268.750	268.711
EXT'L-2	STREET J	PLUG	101	3.25			3.25		3.0		159	159	4.6010	0.33	2.12	2.44	0.013	200	0.33	18.84	0.60	13.5	0.045		270.045	270.000
A-1	TOKALA TRAIL	101	102	0.56			35.23		3.0	11	33	2752	3.8214	3.52	30.43	33.95	0.013	250	0.35	35.19	0.72	73.2	0.256	0.025	268.686	268.430
A-2	TOKALA TRAIL	102	103	0.59			35.82		3.0	12	36	2788	3.8162	3.58	30.79	34.37	0.013	250	0.35	35.19	0.72	73.2	0.256	0.025	268.405	268.149
A-3	TOKALA TRAIL	103	104	0.39			36.21		3.0	7	21	2809	3.8132	3.62	30.99	34.61	0.013	250	0.35	35.14	0.72	45.0	0.157	0.025	268.124	267.967
A-4	TOKALA TRAIL	104	105	0.25			36.46		3.0	3	9	2818	3.8119	3.65	31.08	34.73	0.013	250	0.35	35.19	0.72	34.2	0.120	0.025	267.942	267.822
A-5	TOKALA TRAIL	105	106	0.03			36.49		3.0	0	0	2818	3.8119	3.65	31.08	34.73	0.013	250	0.35	35.09	0.71	19.3	0.067	0.025	267.797	267.730
EXT'L-3	FIRE/EMS STATION	EX.	106A	0.86			0.86	100			86	86	4.6870	0.09	1.17	1.25	0.013	150	1.00	15.23	0.86	10.3	0.103		272.173	272.070
EXT'L-3A	DYER DRIVE	106A	107	0.28			1.14		3.0	0	0	86	4.6870	0.11	1.17	1.28	0.013	200	0.50	23.20	0.74	47.1	0.236	0.050	272.020	271.785
A-6	DYER DRIVE	107	108	0.16			1.30		3.0	0	0	86	4.6870	0.13	1.17	1.30	0.013	200	2.66	53.50	1.70	76.7	2.040	0.030	271.755	269.714
EXT'L-4	FUTURE M.D. RES.	PLUG	108	1.19			1.19	180			214	214	4.5507	0.12	2.82	2.94	0.013	200	1.00	32.80	1.04	9.3	0.093		271.093	271.000
EXT'L-5	FUTURE H.D. RES.	PLUG	108	4.00			4.00	240			960	960	4.1925	0.40	11.65	12.05	0.013	200	0.50	23.20	0.74	12.3	0.062		269.226	269.164
A-7	DYER DRIVE	108	109	0.15			6.64		3.0	0	0	1260	4.1063	0.66	14.97	15.64	0.013	200	0.33	18.87	0.60	73.8	0.244	0.600	269.114	268.870
EXT'L-6	STREET M	PLUG	109	0.05			0.76		3.0	11	33	33	4.7827	0.08	0.46	0.53	0.013	200	0.43	21.51	0.68	13.0	0.056		271.076	271.020
A-8	DYER DRIVE	109	106	0.29			7.69		3.0	3	9	1302	4.0954	0.77	15.43	16.20	0.013	200	0.60	25.41	0.81	95.3	0.572	0.025	268.845	268.273
A-9	TOKALA TRAIL	110	111	0.65			0.65		3.0	5	15	15	4.8356	0.07	0.21	0.27	0.013	200	0.61	25.62	0.82	62.2	0.379		270.037	269.658
A-10	TOKALA TRAIL	111	112	0.27			0.92		3.0	4	12	27	4.7981	0.09	0.37	0.47	0.013	200	0.43	21.51	0.68	56.2	0.242	0.025	269.633	269.391
A-11	BLOCK 98 - H.D. RES.	PLUG	112	1.75			1.75	240			420	420	4.4132	0.18	5.36	5.54	0.013	200	1.00	32.80	1.04	6.6	0.066		269.482	269.416
A-12	TOKALA TRAIL	112	113	0.34			3.01		3.0	4	12	459	4.3924	0.30	5.83	6.13	0.013	200	0.33	18.84	0.60	77.0	0.254	0.025	269.366	269.112
A-13	TOKALA TRAIL	113	106	0.04			3.05		3.0	0	0	459	4.3924	0.31	5.83	6.14	0.013	200	0.50	23.22	0.74	21.3	0.107	0.130	268.982	268.875
A-14	DYER CRESCENT	106	114	0.40			47.63		3.0	6	18	4597	3.6065	4.76	47.97	52.74	0.013	300	0.35	57.22	0.81	78.2	0.274	0.050	267.680	267.406
A-15	DYER CRESCENT	115	116	0.52			0.52		3.0	3	9	9	4.8608	0.05	0.13	0.18	0.013	200	0.61	25.62	0.82	21.5	0.131		271.525	271.394
A-16	DYER CRESCENT	116	117	0.78			1.30		3.0	14	42	51	4.7443	0.13	0.70	0.83	0.013	200	0.50	23.20	0.74	92.1	0.461	0.030	271.364	270.903
A-17	DYER CRESCENT	117	118	0.74			2.04		3.0	13	39	90	4.6814	0.20	1.22	1.42	0.013	200	0.50	23.22	0.74	92.1	0.461	0.025	270.878	270.417
A-18	DYER CRESCENT	118	119	0.16			2.20		3.0	2	6	96	4.6732	0.22	1.30	1.52	0.013	200	0.50	23.20	0.74	20.8	0.104	0.025	270.392	270.288
A-19	DYER CRESCENT	119	119A	0.55			2.75		3.0	9	27	123	4.6396	0.28	1.65	1.93	0.013	200	0.85	30.22	0.96	75.0	0.637	0.030	270.258	269.621
A-19a	DYER CRESCENT	119A	114	0.12			2.87		3.0	0	0	123	4.6396	0.29	1.65	1.94	0.013	200	0.50	23.20	0.74	17.8	0.089	0.025	269.596	269.507
A-20	BLOCK 97 & 99- M.D. RES.	PLUG	114	2.60			2.60	180			468	468	4.3877	0.26	5.94	6.20	0.013	200	1.00	32.80	1.04	6.5	0.065		268.715	268.650
	BLOCK 100 - PARK	114	PLUG	0.00			52.98		3.0	0	0	5188	3.5531	5.30	53.34	58.64	0.013	375	0.15	67.91	0.61	32.7	0.049	0.279	267.127	267.078
	SWM BLOCK	PLUG	*EX. S18*	0.00			52.98		3.0	0	0	5188	3.5531	5.30	53.34	58.64	0.013	375	0.15	67.91	0.61	23.2	0.035	0.000	267.078	267.043
A-21	BLOCK 99 - SCHOOL BLOCK	PLUG	EX.S19	0.52			0.52	72			72	72	4.7080	0.05	2.94	2.99	0.013	200	1.00	32.80	1.04					

Notes:
1. School block equivalent population based on total population of 600 persons at 30 L/pp/day = 72 persons. Peaking factor based on 72 persons. Resulting 24 hour sewage flow then applied over an 8 hour day = 0.625 L/s x 24/8 x 4.708 = 2.94 L/s.
2. A-20 includes block 99 should it be developed in combination with block 97.

Population Densities as per C.of.L Design Criteria:
Medium Density Residential = 75 units/hectare @ 2.4people/unit = 180 people/hectare
High Density Residential = 150 units/hectare @ 1.6 people/unit = 240 people/hectare
Fire Station (Commercial/Institutional) = 100 people/hectare

* NOTE: IF BLOCK 99 IS TO BE PURCHASED BY THE SCHOOL BOARD, SANITARY SERVICE SHALL BE ROUTED THROUGH THE LANDS ADJACENT TO THE EAST BOUNDARY OF 33R-17347. IF BLOCK 99 DEVELOPS INDEPENDENTLY, IT MAY BE SERVICED THROUGH THE SWM FACILITY LANDS. IF BLOCK 99 IS NOT PURCHASED, IT IS TO BE SERVICED IN COMBINATION WITH BLOCK 97 AS MED. DENSITY.

* NOTE: SHOULD THE SCHOOL BLOCK OWNED BY OTHERS (33R-17347) DEVELOP INDEPENDENTLY AND NOT AS PART OF A FUTURE SCHOOL BLOCK, SANITARY FLOWS SHALL BE ACCOMMODATED THROUGH THE EXISTING SWM BLOCK SANITARY SEWER SYSTEM, ALL TO BE CONFIRMED BY OTHERS UPON DEVELOPMENT OF SAID BLOCK.



EXTERNAL SANITARY AREAS
SCALE 1:2500

EXISTING SERVICES	DRAWING #, SOURCE	DATE	AS CONSTRUCTED SERVICES	COMPLETION

DETAILS	
DESIGN	RJG
DRAWN BY	RJG
CHECKED	DCC
APPROVED	PAM
DATE	JUNE 2013

No.	REVISIONS	DATE	CONSULTANT
1.	1st SUBMISSION REVIEW	JUNE 24, 2013	*AECOM*
2.	REVISED AS PER CofL COMMENTS	NOV 6, 2013	*AECOM*
3.	REVISED AS PER CofL COMMENTS	MAR 25, 2014	*AECOM*
4.	REVISED AS PER CofL COMMENTS	JUL 11, 2014	*AECOM*
5.	REVISED AS PER CofL COMMENTS	SEPT 15, 2014	*AECOM*
6.	REVISED LOTS 10-12 & 78-95	FEB 11, 2015	*AECOM*
7.	RECORD DRAWING	MARCH 2015	*AECOM*

AECOM
London, Ontario
519.673.0510

ENGINEER'S STAMP
LICENSED PROFESSIONAL ENGINEER
P. A. McALLISTER
PROVINCE OF ONTARIO

London CANADA
CORPORATION OF THE CITY OF LONDON

SCALE: AS NOTED

TITLE
FOXWOOD SUBDIVISION–PHASE 1
FOXWOOD DEVELOPMENTS (LONDON) INC.
SANITARY SEWER DESIGN SHEET & EXTERNAL SANITARY AREA PLAN

PROJECT No. 60237554
SHEET No. 5
PLAN 26381

Appendix C HYDROGEOLOGICAL INVESTIGATION

Golder Associates Ltd.

500 Nottinghill Road
London, Ontario, Canada N6K 3P1
Telephone (519) 471-9600
Fax (519) 471-4707

REPORT ON

HYDROGEOLOGICAL INVESTIGATION
MOUNT PLEASANT CEMETERY LANDS
HYDE PARK AND SUNNINGDALE ROADS
LONDON, ONTARIO

Submitted to:

Mount Pleasant Cemetery
c/o Hilton Landmarks Inc.
Landscape Architects
155 Frobisher Drive
Suite J-102
Waterloo, Ontario
N2V 2E1

DISTRIBUTION:

4 Copies - Mount Pleasant Cemetery
2 Copies - Golder Associates Ltd.

June 1998

971-3223

Golder Associates Ltd.

500 Nottinghill Road
London, Ontario, Canada N6K 3P1
Telephone (519) 471-9600
Fax (519) 471-4707

June 26, 1998 971-3223

Mount Pleasant Cemetery
c/o Hilton Landmarks Inc.
Landscape Architects
155 Frobisher Drive
Suite J-102
Waterloo, Ontario
N2V 2E1

Attention: Mr. R.E. Hilton, CSLA

RE: HYDROGEOLOGICAL INVESTIGATION
MOUNT PLEASANT CEMETERY LANDS
HYDE PARK AND SUNNINGDALE ROADS
LONDON, ONTARIO

Dear Sirs:

This report presents the results of a hydrogeological investigation carried out at the site of the proposed cemetery development at Hyde Park and Sunningdale Roads in the City of London. The location of the site is shown on the Key Plan on Figure 1. The purpose of the hydrogeological investigation was to determine the subsurface soil and groundwater conditions at the site and assess local groundwater use for private domestic potable supplies immediately adjacent to the site.

Authorization to proceed with the investigation, as outlined in our letters dated October 10 and November 14, 1997, was provided by Mr. R.E. Hilton of Hilton Foster Limited.

1.0 PROCEDURES

The field work for this investigation was carried out in several phases and included the following:

- a water well survey of the adjacent residences to the west and south along Hyde Park and Sunningdale Roads, respectively,

- the drilling and installation of eighteen groundwater monitors in thirteen locations across the site, including soil sampling and laboratory analyses,
- the sampling and analysis of groundwater from four of the installed monitoring wells, and
- the monitoring of water level elevations in the wells on a monthly basis.

In addition to the field investigation, a literature search of several computerized data bases was carried out for scientific studies on the potential groundwater impacts of cemeteries and the Ontario Ministry of the Environment guideline on proposed cemetery sites was reviewed.

1.1 Water Well Survey

The water well survey comprised a review of available water well records for the vicinity of the subject lands on file with the Ministry of the Environment (MOE) in London, Ontario, supplemented by a door-to-door inventory conducted in November 1997 of the ten residences located adjacent to the subject site.

1.2 Monitoring Well Installations

In order to assess the subsurface soil and groundwater conditions across the subject site, a total of eighteen boreholes were drilled at thirteen locations, as shown on Figure 1. The boreholes were advanced using a track mounted power auger drill rig supplied and operated by K & S Drilling Ltd. of Milton, Ontario, a specialist drilling contractor. Standard penetration testing and sampling was carried out at regular intervals of depth in the boreholes using 35-millimetre internal diameter, split-spoon sampling equipment. All of the samples obtained were brought to our laboratory for further examination and testing. All drilling was supervised by a member of Golder Associates Environmental Division staff.

Monitoring wells were installed in all boreholes, with paired installations being installed at the locations of boreholes 1, 2, 3, 4 and 9. Monitors at boreholes 1 through 4 consisted of 50-millimetre diameter PVC well pipe and machine slotted screens, with the screened interval of each well backfilled with filter sand. Each of these monitors was sealed with a bentonite plug and completed at surface with a lockable steel protective casing cemented in place over the monitor. The remaining monitors comprised 13-millimetre diameter PVC pipe equipped with a

0.3 metre long microporous filter tip at the base, backfilled with filter sand and completed with a bentonite seal in the borehole annulus and at surface.

All borehole locations and monitors were located and surveyed for elevation by Golder Associates staff. The elevations are referenced to a local datum provided by Parker Consultants of London, Ontario, and described as a square iron bar located at the southwest corner of the intersection of Hyde Park and Sunningdale Roads and understood to be referenced to a geodetic datum. Details of the installations are shown on the Record of Borehole sheets following the text of this report.

1.3 Groundwater Monitoring and Sampling

Groundwater levels were measured in all the installed monitors on three occasions; November 29 and December 19, 1997 and January 19, 1998. It is intended that the monitoring will continue on a monthly basis into June 1998 with the data provided in a future addendum to this report.

Groundwater samples were collected on December 17, 1997 from four of the on-site monitors for chemical analysis. Prior to collecting the samples, each of monitors MW1S, MW1D, MW3S and MW4D were initially purged of approximately three well volumes of water or until dry, allowed to recover and then sampled directly into laboratory containers. All purging and sampling was conducted using dedicated Waterra inertial pumps and polyethylene tubing installed in each monitor. The samples were kept chilled until delivery under chain-of-custody to the Philip Analytical Services Corp. (Philip) laboratory in London, Ontario, for analysis of a broad suite of chemical parameters associated with general water chemistry.

2.0 SITE DESCRIPTION

The site is located on Part of Lot 24, Concession VI in the City of London, and, as shown on Figure 1, is a rectangular parcel of land with an area of approximately 20 hectares. The site is bounded to the south by Sunningdale Road, to the west by Hyde Park Road and to the north and east by primarily agricultural lands and woodlots. Several privately owned residential properties are also present along the west and south sides of the site, as indicated on Figure 1. The site is currently used for agricultural purposes.

The topography of the site is rolling and variable, with the maximum height of land in the northeast and predominantly low lying areas in the west and, to a lesser degree, southeast corner of the property. Based on topographic mapping for the region of the site, drainage appears to be in several directions from the site, with the main components toward a low lying area west of the site, a drainage system southeast of the site and a wet bushlot and creek to the northeast. More specifically, drainage on the subject lands is controlled by topography and is variable across the rolling site, again with major components to the west across the site and southeast in the southeast corner. Drainage ditches associated with the adjacent roads were located along the west and south limits of the property.

3.0 GEOLOGY

Based upon Ontario Division of Mines Preliminary Map P.1048, Quaternary Geology, Lucan Area, the site is predominantly sandy silt loam till, related to a till moraine which crosses the property, but also includes some ice-contact till in the northwest corner and some lacustrine silty sand or clayey silt along the east boundary.

Water well records for the vicinity of the site and on file with the MOE indicate that the local overburden stratigraphy consists of predominantly clayey soils with lesser stone, gravel and sand fractions with water generally obtained from granular units within the overburden below 6.1 metres depth. Additional details of the water wells in the area of the site are included below.

4.0 WATER WELL INVENTORY

The results of a door-to-door water well inventory carried out for the adjacent residences to the site along Sunningdale Road and Hyde Park Road are provided in Appendix A, while the approximate locations of the wells included in the inventory are shown on Figure 1. Twelve wells, one of which is represented by two well records due to a redrilling and deepening, were identified in the area of the site. Relevant details of the MOE water well records search and the door-to-door survey are summarized in Table I.

Of the twelve surveyed wells, eleven corresponding water well records were identified from files with the MOE. Seven were 127 millimetre (mm) diameter steel-cased drilled wells (reference

numbers 1, 6, 7, 9, 10, 11 and 12). Records 3 and 13, for the same well, identified it as a 152 mm diameter steel-cased drilled well. The remaining four wells (wells 2, 4, 5 and 8) were identified during the water well survey as 914 mm diameter bored wells. It should also be noted that the inventory observations indicated that two residences located at 2611 and 2631 Hyde Park obtained their water from well number 3, located at 2535 Hyde Park Road.

Based upon the accumulated information, nine of the twelve wells utilize a shallow aquifer and reportedly obtain water for domestic purposes from depths within 11.5 metres of surface. Only three of the wells were identified as acquiring water from deeper aquifers, ranging from 18.2 to 36.1 metres depth. However, all of the identified wells reportedly obtain water from below surficial, relatively low permeability soils, described as being predominantly clay with minor amounts of stones, gravel and sand, varying in thickness from 4.5 to 35.8 metres. This would serve to maintain a relatively secure water supply, with potential surficial impacts unlikely to have significant adverse effects on the aquifer.

5.0 SUBSURFACE CONDITIONS

The soil and groundwater conditions encountered in the boreholes advanced at the site are shown in detail on the Record of Borehole sheets following the text of this report. The following sections have been simplified in terms of major soil strata for the purpose of hydrogeological discussion. The soil boundaries indicated have been inferred from observations of drilling and sampling resistance in the boreholes, and visual observations made during sample collection. They typically represent a transition from one soil type to another and should not be interpreted to represent exact planes of geological change. Further, the subsurface conditions will vary between and beyond the borehole locations.

5.1 Soil Conditions

The soil conditions encountered in the boreholes were variable, but consisted predominantly of finer grained soils comprised of clays and silts with relatively low permeabilities. Some boreholes intersected strata of silt in the shallow subsurface, while others encountered more granular, predominantly sandy soils in the deeper deposits.

Samples of soil from the clayey silt till in boreholes 3 and 6 and from the granular units in boreholes 3 and 4 were submitted for grain size analyses in order to estimate the hydraulic conductivity of the strata. The results of the grain size determinations are presented on Figures 5 and 6. Based upon the results and using the Hazen formula, estimated conductivities for the granular units and the till units are approximately 3×10^{-2} and 9×10^{-8} centimetres per second (cm/sec), respectively. It should be noted, however, that shallow fractured glacial till soils commonly have an estimated horizontal conductivity on the order of 10^{-5} to 10^{-6} cm/sec, and a vertical conductivity generally one tenth that of the horizontal, or 10^{-6} to 10^{-7} cm/sec.

Additional details of the stratigraphy are provided in the following sections.

5.1.1 Topsoil

Layers of silty topsoil were encountered at ground surface in all boreholes in the investigation, to a depth of approximately 0.6 metres, except in BH11 where it was only 0.3 metres deep.

5.1.2 Silt and Silty Sand

Beneath the surficial topsoil, relatively thin layers of silt or silty sand were encountered in the majority of boreholes, including boreholes 1, 3, 5, 7, 10 and 12, ranging in thickness from 0.8 to 1.5 metres.

5.1.3 Clayey Silt Till

With the exception of borehole 12, all boreholes encountered strata of clayey silt till with some local variations of silty clay till. The penetrated thickness of these relatively low permeability deposits was generally between 2.1 and 6.1 metres. Borehole 7 was terminated after penetrating only 0.6 metres of clayey silt till; at this location, however, the till likely extends to a greater depth at this location based upon the other boreholes in this area of the site. All boreholes except for numbers 2, 3 ,4 and 12 were terminated in these low permeability soils at depths of between 2.7 and 9.6 metres.

5.1.4 Sand and Gravel

Granular deposits comprising sand in borehole 4 and sand and gravel in borehole 12 were encountered during drilling. This unit was 2.3 metres thick in borehole 12 and was underlain

by 0.9 metres of silty clay that was penetrated at the bottom of the borehole. Borehole 4 penetrated 4.5 metres of sand beneath the overlying till and was terminated in this material. Based upon the data from these boreholes and the intervening boreholes 3, 5 and 11, it appears that these granular units are not continuous.

5.1.5 Layered Strata

Boreholes 2 and 3 were terminated in generally fine grained, lower permeability, layered soils typically described as silty clay and clayey silt. Borehole 3 penetrated 0.9 metres of sand at its base; however it was overlain by a 5.2 metre thick layer of clayey silt till. Borehole 2 penetrated 0.6 metres of clayey silt at its base.

5.2 Groundwater Conditions

Groundwater was encountered in all the boreholes except borehole 6 which was dry during drilling. Where present, groundwater was encountered at depths ranging from approximately 1.1 metres in borehole 13 to 7.3 metres in borehole 4D. The elevations of encountered groundwater ranged from 281.7 to 271.7 metres in boreholes 7 and 4D, respectively.

Based upon the highest water table data acquired (March 30, 1998), a contour plan of unsaturated soil depths (or depth to measured water level) is shown on Figure 4. The plot indicates that groundwater is relatively high in the east end of the site, within 0.3 to 0.5 metres of ground level, and deepens to the west where up to 3.5 metres of unsaturated soils are present. In June 1998 when the driest conditions were monitored, depths to measured water levels increased by over 1 metre to between 1.3 and 1.7 metres in the east and greater than 4.7 metres in the west.

5.2.1 Groundwater Elevations and Flow

Monitoring of groundwater levels was conducted in all of the installed monitors on generally monthly intervals from November 1997 through to June 1998. Monitor MW4S was dry during each monitoring event except for February and March 1998, and monitors in BH10 and BH11 were dry in June 1998. Generally, the water level elevations were considered to reach equilibrium (static) conditions by the end of 1997, and showed an increase from January to March 1998 and decreased through to June 1998.

The groundwater elevation data from the paired monitor installations at the monitoring well (MW) locations (except MW4 where the shallow monitor was dry) and also at borehole 9 indicated a downward vertical hydraulic gradient of between 0.13 at MW1 and 1.10 at MW2.

The water level results from the highest and lowest groundwater elevations during monitoring in March and June 1998, respectively, are summarized in Table II as groundwater elevations, and presented graphically as contour plans on Figures 2 and 3, respectively. The results indicate that shallow groundwater flow on the subject lands generally mirrors topography, with a major component westerly across the majority of the site at a horizontal gradient of approximately 0.05. There was a lesser southeasterly component of groundwater flow in the southeast area of the site. Average groundwater velocity in the predominantly fine-grained shallow soils across the site is estimated at 0.6 metres per year using Darcy's Law, an hydraulic conductivity value of 10^{-5} centimetres per second and assuming a porosity of 25 per cent. At this rate, groundwater travelling in the clayey silt till would take approximately 50 years to cross a 30 metre buffer zone.

Based on the deep monitor water elevations determined for monitors MW1D, MW2D, MW3D and MW4D, deeper groundwater flow appears to be consistently northwest across the site, from MW1D to MW4D, at a horizontal gradient of 0.006. Average horizontal groundwater flow velocity in the deeper saturated granular zones is estimated at 60 metres per year using Darcy's Law, an hydraulic conductivity value of 10^{-2} centimetres per second and assuming a porosity of 30 percent.

Based on the conditions at MW3, for example, and assuming a burial depth of 2.0 metres, groundwater would have to travel through approximately 4.6 metres of fine grained clayey silt till soils at a velocity of 0.4 metres per year (using the vertical hydraulic gradient for MW3 of 0.33 and an approximate vertical hydraulic conductivity of 10^{-6} centimetres per second, or 11.5 years, to reach the more permeable soils. Where such soils exist, the subsequent travel time through the more permeable soils to cross a 30 metre buffer zone would be 0.5 years at 60 metres per year, for a total travel time of 12 years. This assumes that the more permeable units are continuous across the buffer zone and in the direction of deeper groundwater flow, which has not been shown to be the case in this area based upon the site investigation.

5.2.2 Groundwater Quality

The analytical results from the four groundwater samples collected from monitors MW1S, MW1D, MW3S and MW4D, are summarized in Table III and included in Appendix B, and are also compared to the MOE Ontario Drinking Water Objectives (ODWO), Revised 1994. The results indicate generally good quality water in both the shallow and deep monitors sampled, with no significant variations between the data. Analyte concentrations which exceed the ODWO include hardness and turbidity in all monitors, manganese in the shallow monitors and aluminum in monitor MW4D. It should be noted that these parameters with the exception of turbidity, are considered not health related and are commonly elevated in groundwater supplies throughout southern Ontario. In addition, the excessive turbidity levels are a reflection of the type of installation (i.e. monitoring well), which is not a properly constructed domestic water supply well. Turbidity is only considered health related in treated drinking water.

6.0 POTENTIAL GROUNDWATER IMPACTS

In addition to defining geological and hydrogeological conditions on the site, a review of potential groundwater impacts from cemeteries was carried out by reference to an MOE guideline, as well as a computer data base search on this subject.

MOE Guideline

The "Guideline for Reviewing Proposed Cemetery Sites" was issued by the MOE to the Ontario Medical Officers of Health in 1983 (see Appendix C). The guideline states, in part, the following:

> "A comprehensive hydrogeological investigation to determine soil and ground-water characteristics as they relate to contaminant discharge from proposed cemeteries is seldom warranted. Although contaminant discharges from cemeteries have been reported in the literature, the magnitude of the impact was very small, even under conditions very amenable to contamination. Impacts are no doubt minimized by the procedures and precautions usually taken as part of the burial procedure in Ontario, particularly:
>
> 1) the bacterial disinfection of a body by embalming, and
> 2) the containment of a body in a coffin and in a concrete vault.

The MOE guidelines also include the following:

1. Minimal environmental precautions need to be taken where proposed sites are to be located in areas of low permeable surface soils, such as those characterized by clay and silt.

2. For small cemeteries in areas where the surface soils are permeable, such as sands and/or gravels, and ground water is used nearby for water supplies, a separation distance similar to that applied to septic tile fields is advisable. It is suggested therefore that the bottom of a grave be a minimum of 0.5 metres above the highest watertable and that a grave be a minimum of 30 metres from a well used for drinking purposes. This horizontal spacing guideline is also appropriate relative to the position of a grave with respect to any surface waters.

3. In cases where large cemeteries are proposed in permeable ground and nearby ground-water supplies are being or are likely being used, some specific consultation should be obtained... In most situations, the separation distances referred to above would apply...

4. The position of the water-table with respect to grave depth is probably more related to ease of excavation of the grave then to environmental concerns..."

Based on the MOE guidelines, the vast majority of the proposed Mount Pleasant Cemetery site would be considered under Category 1, i.e. "an area of low permeable surface soils, such as clay and silt" and minimal environmental precautions would be necessary. However, there are a few isolated areas of more permeable surface soils such as silty sand which might be considered to fall under Category 2. In such areas, the guideline calls for a 0.5-metre separation from the water table and a 30-metre setback from drinking water wells, which could be readily complied with at this site.

Data Base Search

A "groundwater / cemeteries" search was carried out on December 9, 1997 of several primarily environmental computer data bases, including NTIS, Compendex Plus, GeoRef, Water Resources Abstracts, Enviroline, and Pollution Abstracts. The following relevant documents were identified:

"Level I Assessments of Cemetery Properties: Looking for Buried Risks" A.L. Wendling (1991); Association of Groundwater Scientists and Engineers Conference Proceedings

"Cemeteries - A Potential Risk to Groundwater" A. Pacheco, et al (1991); Water Science and Technology, V.24, No. 11

"Cemeteries and Groundwater: An Examination of the Potential Contamination of Groundwater by Preservatives Containing Formaldehyde" G. Soo Chan, et al (1992); Ontario Ministry of the Environment.

In addition, the following study by Beak Consultants Limited was brought to our attention:

"Soil and Groundwater Quality Study of the Mount Pleasant Cemetery" (July 1992).

The 1991 study by A.L. Wendling summarizes the findings of environmental site assessments of five existing cemetery properties in the state of Michigan. This paper states that:

"The two most important issues when considering possible contamination caused by decaying bodies in cemeteries are: 1) synthetic organics or toxic pollutants and 2) water quality degrading pollutants such as sulfates, nitrates, nitrites, ammonium, etc. The toxic pollutant of concern is formaldehyde or formalin, a carcinogen that is the major constituent of embalming fluid. Formaldehyde is water miscible so it will migrate in water fairly quickly, but it is also very degradable either oxidatively or bio-oxidatively and it will quickly go to formic acid."

Wendling cites a 1972 study by Schraps (cited by Bower) of a cemetery in West Germany in which groundwater samples were collected at different distances from 0.5 to 5.5 metres downgradient from a row of graves in "unconsolidated alluvium". The results of bacteria counts and ammonia, nitrate and COD analysis "showed contamination in the immediate vicinity of the graves but rapid attenuation with departure". The data showed reductions in bacteria counts, for example, of from 6,000 per millilitre immediately below the graves to 180 per millilitre at 5.5 metres downgradient.

The Wendling report concludes that:

"In the United States it would appear that the risk of groundwater contamination caused from decaying bodies and formaldehyde from cemeteries is low."

The A. Pacheco (1991) study monitored the bacteriological quality of shallow groundwater in three cemeteries in Brazil using 67 samples from 36 shallow monitoring wells. The results of this limited study indicated a relationship between bacteria numbers and types and both the soil type and the depth to water table; however, no specific criteria or recommendations were provided.

As the title of the G. Soo Chan, et al (1992) report indicates, the focus of this MOE study was on "the effect of burial preservatives on groundwater quality". The report includes the results of a literature study, a survey of "standard burial practices", and the sampling and analysis of water wells at six sites in Ontario. The results of "two extensive literature surveys" were unsuccessful in finding previous studies in North America; however, one publication from Holland was identified and incorporated in the report.

According to the report, the sampled water wells were located for the most part in "sandy shallow aquifers down gradient of cemeteries." The results of well sampling revealed "extremely low levels of formaldehyde" which may or may not have actually originated in the cemeteries. The report also included an estimate of potential aquifer loading of formaldehyde from a cemetery over a 10 to 15 year period which resulted in a concentration of 50 parts per billion, prior to dilution in the typical aquifer. While there is no Ontario Drinking Water Objective for formaldehyde, the report states that the National Academy of Sciences has recommended a standard of 110 ppb.

Finally, the Soo Chan report concluded:

> "The analysis of groundwater samples collected at wells located downgradient of six cemeteries sites in Ontario, indicated that cemeteries are not a significant source of groundwater contamination by formaldehyde. In addition, the calculated loading estimates for formaldehyde and nitrates being released from cemeteries supports a low potential for groundwater contamination."

The Beak Consultants (1992) study included the drilling and sampling of boreholes and monitoring wells at the Mount Pleasant Cemetery in Toronto, Ontario, a cemetery containing graves from less than 10 to greater than 90 years old. The study concluded, in part:

> "Based on the analysis results, there does not appear to be an occurrence of elevated levels of concern for the parameters tested in either the groundwater or the soils at the cemetery. These parameters include formaldehyde, methanol, arsenic, DOC and TOC. At all three locations, levels of metals in the soils were below the O. Reg. 309 leach criteria and the analysis results for metals in the groundwater did not indicate anything of environmental significance."

Discussion

The available studies of groundwater impacts from cemeteries confirm that they are a potential source of local groundwater impacts from such contaminants as bacteria, nitrogen compounds, sulphate, organic carbon, chemical oxygen demand, methanol and formaldehyde. However, documented groundwater impacts are reportedly very limited due to natural attenuation of these contaminants at any significant distance from the cemeteries.

The Ontario Ministry of the Environment guideline, while released prior to the studies summarized above, remains consistent with these findings. Although the guideline does not require specific setbacks from water supplies in areas of "low permeability soils" such as at the Mount Pleasant Cemetery site in question, it does recommend "minimal environmental precautions" in such areas. It also "suggests", for areas of permeable soils, a 0.5-metre separation of a grave from the high water table and a 30-metre setback from a drinking water well or surface water body. Use of a 30-metre buffer zone is estimated to provide a minimum of between 12 and 50 years travel time between the cemetery and the property line which should provide sufficient time for biodegradation and other natural attenuation mechanisms to take place.

7.0 CONCLUSIONS AND RECOMMENDATIONS

1. Based on the results of the on-site hydrogeological investigation, soil conditions on the proposed Mount Pleasant Cemetery site consist predominantly of finer grained soils comprised of clays and silts with relatively low permeabilities. Apparently discontinuous strata of more granular soils including sand and gravel were encountered locally.

2. The depth to the water table, based on measurements in March 1998 which are considered to represent the peak seasonal water table conditions, was quite variable across the site, ranging from approximately 0.3 to 0.5 metres on the east to over 3.7 metres on the west. The shallow groundwater flow direction is generally reflective of topography, with predominantly westerly flow across most of the site and a southeasterly component in the southeast area of the property. It appears that shallow groundwater from the latter may eventually discharge to a drain in the wet bush area north of the central portion of the property.

3. The horizontal hydraulic conductivity of the fine grained clayey silt till is on the order of 10^{-7} centimetres per second based on its grain size characteristics, but is more realistically on the order of 10^{-5} to 10^{-6} centimetres per second due to fractures in the shallow till. The vertical hydraulic conductivity in similar soils is generally much lower than the horizontal, say 10^{-6} to 10^{-7} centimetres per seconds The hydraulic conductivity of the on-site sands is up to 10^{-2} cm/sec. based on the grain size characteristics.

   Based on the measured gradients, the horizontal groundwater velocity in the till would thus be only centimetres per year. If the hydraulic conductivity reaches 10^{-5} cm/sec, for example due to fracturing, the velocity increases to approximately 0.6 metres per year for a corresponding travel time of 50 years in the shallow zone through a hypothetical 30 metre wide buffer. Based on measured vertical hydraulic gradients, the estimated downward velocity through the underlying till would be approximately 0.4 metres per year for a travel time of 11.5 years where the confining layer is 4.6 metres thick. The horizontal velocity in the granular layer, however, is much higher at about 60 metres per year. If these strata are continuous to a property boundary, this would allow a total travel time of approximately 12 years.

4. Based on a review of MOE water well records and completion of a door-to-door well inventory, there are twelve private wells in the immediate area of the proposed Mount Pleasant Cemetery. Nine of the twelve wells obtain water from granular zones within 11.5 metres of the surface. The other three obtain water from deeper aquifers ranging from 18.2 to 36.1 metres below surface. All of these wells obtain water from below surficial, low permeability soils greater than 4.5 metres in thickness, which would serve to protect them from surficial sources of impacts.

5. A review of relevant scientific literature shows cemeteries to be potential sources of bacteria, nitrogen compounds, sulphate, organic carbon, chemical oxygen demand, methanol and formaldehyde to groundwater. However, documented groundwater impacts are very limited due to modern burial practices and to natural attenuation of these contaminants at any significant distance from the cemeteries. A minimum 12 to 50 year travel time should permit sufficient time for biodegradation and other natural attenuation mechanisms to take place.

6. The MOE Guideline for Reviewing Proposed Cemetery Sites (1983) does not require setbacks form water supplies or water table in areas of low permeable soils such as at the proposed Mount Pleasant Cemetery, but recommends "minimal environmental precautions". For areas of permeable soils, however, it suggests a 0.5 metre separation of a grave from the high water table and a 30-metre setback from a drinking water well or surface water body. Considering that there are a few local deposits of sand on the site and that several domestic wells are presently in use around the perimeter of the Mount Pleasant Cemetery site, it is recommended that these criteria be complied with in the development of the cemetery.

7. This hydrogeological assessment of the proposed Mount Pleasant Cemetery site, including a survey of existing water wells, a review of available literature, and consideration of the Ontario Ministry of the Environment cemetery guideline indicates that existing groundwater supplies in the area will be protected from significant impacts if the cemetery is developed using the recommended MOE setbacks.

8.0 LIMITATIONS AND USE OF THE REPORT

This report was prepared for the exclusive use of Mount Pleasant Cemetery (London) Inc. and its authorized agents and others specifically authorized in writing by Golder Associates Ltd. to rely on this report.

In evaluating the property, Golder Associates has relied in good faith on information provided by individuals and agencies noted. We assume that the information provided is factual and accurate.

The site conditions between sampling locations have been inferred based on the conditions observed at borehole and monitoring well locations; however, it should be noted that conditions between and beyond sampling locations can vary substantially, both vertically and horizontally. In addition, the assessment is dependent upon the accuracy of the analytical data generated through sample analysis and is limited to determining the presence of chemical parameters for which analyses have been conducted.

Where references have been made to regulatory guidelines and documents, it should be noted that regulatory statutes and guidelines are subject to interpretation and these guidelines and their interpretation may be subject to change over time. Therefore, it is recommended that the client consult with their attorney in respect of these matters.

If new information is discovered during future work, including excavations, borings or other studies, Golder Associates Ltd. should be contacted to re-evaluate the conclusions presented in this report and to provide amendments, as required.

We trust that this report provides all of the hydrogeological information required to complete the design of the proposed development. Should any point require clarification, please contact this office.

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Attachments:

Tables I to III
List of Abbreviations
List of Symbols
Records of Boreholes
Figures 1 to 6
Appendices A to C

TABLE I

SUMMARY OF WATER WELL RECORDS

Mount Pleasant Cemetery Lands
Hyde Park and Sunningdale Roads
London, Ontario

REF. NO.	MOE NO.	RESIDENT	GROUND SURFACE ELEVATION (m)	CASING DIAMETER (mm)	DEPTH WATER FOUND (m)	STATIC LEVEL (m)	STATIC ELEVATION (m)	STRATIGRAPHIC LOG DEPTH TO (m)	STRATIGRAPHIC LOG DESCRIPTION	PUMP TEST RATE (L/min)	CURRENT RESIDENT COMMENTS (from survey)
1	2152	CONKEY	278.8	127	11.5	6.7	272.1	0.0	BRWN CLAY	45.0	Conc 6 Lot 24
								5.5	CLAY STNS		
								11.5	BRWN CSND		
								12.7	BRWN MSND SILT		
								14.2	EOH		
2	8399	JOHNSTON	273.6	914	3. 7.9	2.1	271.5	0.0	BRWN CLAY PCKD	135.0	Conc 6 Lot 24
								2.7	GRVL LOOS		
								3.0	BLUE CLAY PCKD		
								7.9	GRVL BLDR LOOS		
								8.8	EOH		
3	2150	ELDERHORST	279.1	152	31.2	10.6	268.5	0.0	CLAY	22.5	Conc 6 Lot 24
								5.5	CLAY STNS		2535 Hyde Park Rd.
								12.7	GRVL		high iron, hardness
								18.2	QSND		no quantity problems reported
								19.1	CLAY STNS		supplies water to 2611 and
								30.3	GRVL		2631 Hyde Park Rd.
								31.2	EOH		
4	8452	DZIADURA	279.1	914	11.5	9.1	270.0	0.0	BRWN CLAY SNDY PCKD	112.5	Conc 6 Lot 24
								3.6	BLUE CLAY PCKD		2701 Hyde Park Rd.
								10.9	GRVL LOOS		no quantity problems reported
								12.1	EOH		no quality problems reported

SUMMARY OF WATER WELL RECORDS

REF. NO.	MOE NO.	RESIDENT	GROUND SURFACE ELEVATION (m)	CASING DIAMETER (mm)	DEPTH WATER FOUND (m)	STATIC LEVEL (m)	STATIC ELEVATION (m)	STRATIGRAPHIC LOG DEPTH TO (m)	STRATIGRAPHIC LOG DESCRIPTION	PUMP RATE (L/min)	RESIDENT COMMENTS (from survey)
5	8453	DZIADURA	279.1	914	6.1	6.1	273.0	0.0	BRWN CLAY SNDY PCKD	112.5	Conc 6 Lot 24
								2.7	BLUE CLAY PCKD		2739 Hyde Park Rd.
								6.1	GRVL LOOS		no quantity problems reported
								9.7	BLUE CLAY PCKD		no quality problems reported
								11.5	EOH		
6	9161	SWETLISHNOFF	275.8	127	35.8	10.3	265.5	0.0	BRWN CLAY STNS	45.0	Conc 6 Lot 24
								5.5	BRWN CLAY GRVL		
								10.3	BLUE CLAY STNS		
								35.8	GREY SAND		
								40.6	EOH		
7	5652	VERDEL	276.4	127	18.2	8.2	268.2	0.0	TPSL	13.5	Conc 6 Lot 24
								0.3	BRWN CLAY STNS		1535 Sunningdale Rd.
								1.8	BRWN MSND CLAY SILT		no quantity problems reported
								7.3	GRVL		no quality problems reported
								7.6	BLUE CLAY STNS		do not want municipal water
								18.2	BRWN MSND		
								19.1	HPAN		
								19.7	EOH		
8	2151	CLARE	275.2	914	4.5	1.2	273.9	0.0	BRWN CLAY	-	Conc 6 Lot 24
								3.0	BLUE CLAY		1445 Sunningdale Rd.
								4.5	BLUE CLAY MSND		sulfur taste and odour
								7.3	BLUE CLAY		very hard, iron, bacteria
								8.5	EOH		no quantity problems reported
9	4571	ARMSTRONG	275.2	127	11.5	4.5	270.6	0.0	BRWN CLAY	67.5	Conc 5 Lot 24
								4.5	BRWN CLAY GRVL		1550 Sunningdale Rd.
								7.6	BRWN CLAY MUCK		no quantity problems reported
								11.5	CSND		no quality problems reported
								14.8	EOH		

SUMMARY OF WATER WELL RECORDS

REF. NO.	MOE NO.	RESIDENT	GROUND SURFACE ELEVATION (m)	CASING DIAMETER (mm)	DEPTH WATER FOUND (m)	STATIC LEVEL (m)	STATIC ELEVATION (m)	STRATIGRAPHIC LOG DEPTH TO (m)	STRATIGRAPHIC LOG DESCRIPTION	PUMP RATE (L/min)	RESIDENT COMMENTS (from survey)
10	4570	ARMSTRONG	275.8	127	11.5	4.5	271.2	0.0	BRWN CLAY	112.5	Conc 5 Lot 24
								4.5	BRWN CLAY GRVL		1550 Sunningdale Rd.
								7.6	GREY MSND MUCK		no quantity problems reported
								11.5	GREY CSND		no quality problems reported
								14.8	EOH		
11		SHIPLEY	279.1	127	36.1	9.4	269.7	0.0	PREVIOUSLY DRILLED	45.0	Conc 6 Lot 24
								31.2	GREY CLAY STNS SAND		high iron, hardness
								35.8	GREY SAND SILT		no quantity problems reported
								40.0	GREY CLAY STNS		supplies water to 2611 and
								40.6	EOH		2631 Hyde Park Rd.
12		VLASMAN	-	127	10.6	5.9	-	0.0	BROWN CLAY STNS	54.0	Conc 6 Lot 24
								9.7	BRWN SAND		1545 Sunningdale Rd.
								11.2	EOH		no quantity problems reported
											no quality problems reported
13	N/A	WAY (no well record)	-	152	-	-	-	-	-	-	2545 Hyde Park Rd.
											deep well, hard water
											no quantity problems reported
14	N/A	BORROWMAN (no well)	-	-	-	-	-	-	-	-	2611 Hyde Park Rd.
											water from 2535 Hyde Park Rd.
											sulfur, iron
											very hard
											would like municipal water

June 1998

971-3223

TABLE II

SUMMARY OF GROUNDWATER ELEVATION MONITORING

Mount Pleasant Cemetary Lands
Hyde Park and Sunningdale Roads
London, Ontario

MONITOR NUMBER	GROUND ELEVATION [1] (m)	TOP OF PIPE ELEVATION [2] (m)	GROUNDWATER ELEVATION (m) [3] (11-27-97)	(12-19-97)	(01-19-98)	(02-28-98)	(03-30-98)	(04-29-98)	(05-20-98)	(06-13-98)
1S	277.12	278.17	277.07	276.67	276.42	276.85	276.87	276.35	276.03	275.71
1D	277.12	277.74	276.51	276.55	275.81	276.22	276.32	275.86	275.49	275.26
2S	279.47	280.51	279.06	278.77	278.70	279.38	279.11	278.57	278.17	277.83
2D	279.47	280.39	276.88	274.18	274.17	274.27	274.61	274.79	274.59	274.29
3S	277.48	278.41	272.65	273.04	274.44	274.60	275.68	274.28	273.75	273.37
3D	277.48	278.35	272.37	272.55	273.20	273.45	274.24	273.59	273.20	273.02
4S	278.98	280.18	274.24 [4]	274.24 [4]	274.24 [4]	277.79	277.13	274.24 [4]	274.24 [4]	274.24 [4]
4D	278.98	280.08	271.56	271.63	272.26	272.51	273.31	273.21	272.91	272.54
5	276.86	277.75	273.18	272.82	273.46	273.56	274.41	273.77	- [5]	273.41
6	279.85	280.94	278.17	278.96	278.35	279.31	279.47	279.03	278.76	278.20
7	282.93	283.57	282.25	282.27	282.20	282.55	282.62	281.89	281.46	281.13
8	278.73	279.41	278.19	277.96	277.35	278.37	278.19	277.58	277.17	276.82
9S	282.31	283.10	278.5	279.49	281.19	281.80	281.80	281.17	280.79	280.56
9D	282.31	282.93	278.13	279.32	279.68	279.86	279.68	279.30	278.94	278.51
10	277.69	278.13	274.08	273.92	273.89	274.55	275.93	274.47	273.69	273.00 [4]
11	278.58	279.40	274.58	275.03	273.99	274.07	274.85	274.24	274.02	273.99 [4]
12	276.23	277.10	272.55	272.71	274.26	274.59	275.61	274.08	273.98	273.19
13	279.05	279.59	278.73	278.75	278.17	278.61	278.74	278.19	277.91	277.76

NOTES:

1. Ground surface elevation surveyed by Golder Associates and referenced to a local geodetic datum.
2. Reference elevation represented by top of pipe of groundwater monitor installation.
3. Groundwater elevation measured below reference elevations.
4. Monitor dry to completed elevation.
5. Monitor obstructed; no data.
6. Table to be read in conjunction with accompanying report.

Golder Associates

TABLE III

COMPARITIVE SUMMARY OF
GROUNDWATER ANALYTICAL RESULTS

Mount Pleasant Cemetery Lands
Hyde Park and Sunningdale Roads
London, Ontario

PARAMETER[1]	SAMPLE DESCRIPTION MW1S	MW1D	MW3S	MW4D	MOE CRITERIA[2]
Sodium Na	7.18	4.73	3.98	14.3	200
Potassium K	2.35	3.42	4.68	1.62	-
Calcium Ca	72.0	109	94.6	90.4	-
Magnesium Mg	27.9	19.3	20.0	24.6	-
Hardness as $CaCO_3$	295	352	319	327	80-100
Alkalinity $CaCO_3$	250	256	280	250	30-500
Sulphate SO_4	31	45	27	24	500
Chloride Cl	17	21	6	47	250
Phosphorus, Diss. Ortho. P	<0.01	<0.01	<0.01	<0.01	-
Phosphorus Total P	0.20	0.15	0.12	0.23	-
Nitrite N	0.06	0.05	<0.01	<0.01	1
Nitrate N	0.44	2.42	1.50	7.89	10
Ammonia N	0.14	0.08	0.07	0.06	-
Colour (TCU)	<5	5	5	<5	5
Turbidity (NTU)	19.6	19.4	14.8	14.0	5
Conductivity	518	540	491	678	-
pH Value (pH units)	7.64	7.54	7.50	7.61	6.5-8.5
Carbon Diss. Org. C	1.1	1.2	0.9	0.6	5.0
Iron Fe	0.18	0.08	0.07	0.23	0.3
Manganese Mn	0.25	0.04	0.09	0.02	0.05
Copper Cu	<0.02	<0.02	<0.02	<0.02	1.0
Zinc Zn	0.12	<0.01	<0.01	<0.01	5.0
Calculated T.D.S.	323	377	339	397	500
Aluminum Al	<0.05	<0.05	<0.05	0.12	0.10
Barium Ba	0.12	0.13	<0.04	0.06	1.0
Boron B	0.03	<0.02	<0.02	0.35	5.0
Strontium Sr	0.62	0.23	0.14	0.14	-

NOTE: 1. All units in milligrams per litre (mg/l), unless otherwise specified.
2. Ontario Drinking Water Objectives, Revised 1994.
3. Table to be read in conjunction with accompanying report.

LIST OF ABBREVIATIONS

The abbreviations commonly employed on each "Record of Borehole", on the figures and in the text of the report, are as follows:

I. SAMPLE TYPES

AS auger sample
CS chunk sample
DO drive open
DS Denison type sample
FS foil sample
RC rock core
ST slotted tube
TO thin-walled, open
TP thin-walled, piston
WS wash sample

II. PENETRATION RESISTANCES

Dynamic Penetration Resistance:
The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) to drive uncased a 50 mm (2 in.) diameter, 60° cone attached to "A" size drill rods for a distance of 0.3 m (12 in.).

Standard Penetration Resistance, N:
The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) drive open sampler for a distance of 0.3 m (12 in.).

WH sampler advanced by static weight-weight, hammer

PH sampler advanced by hydraulic force

PM sampler advanced by manual force

III. SOIL DESCRIPTION

(a) *Cohesionless Soils*

Relative Density	"N" Blows/0.3 m or Blow/ft.
Very loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very dense	over 50

(b) *Cohesive Soils*

Consistency	"Cu" kPa	"Cu" psf.
Very soft	0 to 12	0 to 250
Soft	12 to 25	250 to 500
Firm	25 to 50	500 to 1000
Stiff	50 to 100	1000 to 2000
Very stiff	100 to 200	2000 to 4000
Hard	over 200	over 4000

IV. SOIL TESTS

C consolidation test
H hydrometer analysis
M sieve analysis
MH combined analysis, sieve and hydrometer [1]
Q undrained triaxial [2]
R consolidated undrained triaxial [2]
S drained triaxial
U unconfined compression
V field vane test
Chem chemical analysis

NOTES:

1. Combined analyses when 5 to 95 per cent of the material passes the No. 200 sieve.
2. Undrained triaxial tests in which pore pressures are measured are shown as Q or R.

LIST OF SYMBOLS

I. GENERAL

$\pi = 3.1416$
e = base of natural logarithms 2.7183
$\log_e$ a or ln a, natural logarithm of a
$\log_{10}$ a or log a, logarithm of a to base 10
t time
g acceleration due to gravity
V volume
W weight
m mass
M moment
F factor of safety

II. STRESS AND STRAIN

u pore pressure
σ normal stress
σ' normal effective stress (σ is also used)
τ shear stress
ε linear strain
ε_{sy} shear strain
υ Poisson's ration (μ is also used)
E modulus of linear deformation (Young's modulus)
G modulus of shear deformation
K modulus of compressibility
η coefficient of viscosity

III. SOIL PROPERTIES

(a) *Unit weight*

γ unit weight of soil (bulk density)
γ_s unit weight of solid particles
γ_w unit weight of water
γ_d unit dry weight of soil (dry density)
γ' unit weight of submerged soil
G_s specific gravity of solid particles $G_s = \gamma_s/\gamma_w$
e void ratio
n porosity
w water content
S_r degree of saturation

(b) *Consistency*

w_L liquid limit
w_P plastic limit
I_P plasticity index
w_S shrinkage limit
I_L liquidity index $= (w - w_p)I_p$
I_C consistency index $- (w_L - w)/I_p$
e_{max} void ratio in loosest state
e_{min} void ratio in densest state
D_r relative density $= (e_{max} - e)/(e_{max} - e_{min})$

(c) *Permeability*

h hydraulic head or potential
q rate of discharge
v velocity of flow
i hydraulic gradient
κ coefficient of permeability
j seepage force per unit volume

(d) *Consolidation (one-dimensional)*

m_v coefficient of volume change $= -\Delta e/(1+e)\Delta\sigma'$
C_c compression index $= -\Delta e/\Delta\log_{10}\sigma'$
c_v coefficient of consolidation
T_F time factor $= c_v t/d^2$ (d, drainage path)
U degree of consolidation

(e) *Shear strength*

τ_f shear strength
c' effective cohesion intercept
ϕ' effective angle of shearing resistance, or friction

(in terms of effective stress $\tau_f = c' + \sigma'\tan\phi$)

c_u apparent cohesion*
ϕ_u apparent angle of shearing resistance, or friction

(in terms of total stress $\tau_f = cu + \sigma\tan\phi_u$)

μ coefficient of friction
S_t sensitivity

*For the case of a saturated cohesive soil, $\phi_u = 0$ and the undrained shear strength $\tau_f = c_u$ is taken as half the undrained compressive strength.

PROJECT: 971-3223

RECORD OF BOREHOLE 1

SHEET 1 OF 2

LOCATION: - REFER TO PLAN FIGURE 1 -

BORING DATE: NOV. 25, 1997

DATUM: GEODETIC

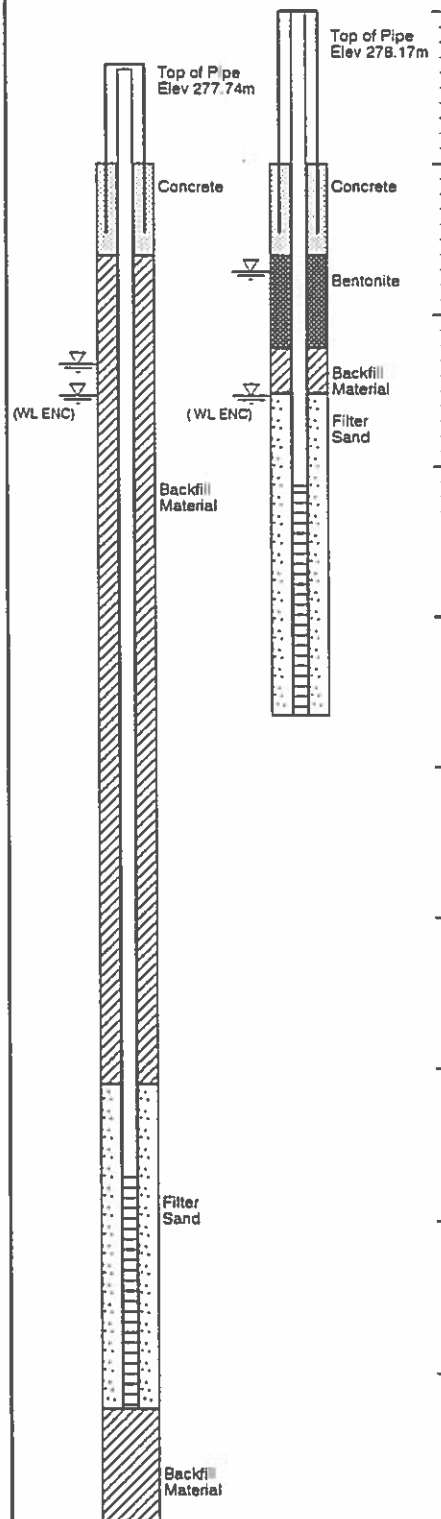
SAMPLER HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m
		GROUND SURFACE		277.12			
0	POWER AUGER (HOLLOW STEM)	Brown silty TOPSOIL, trace roots.		0.00 / 276.92			
				0.20	1	50 DO	6
1		Loose brown SILT, some sand.			2	50 DO	8
				275.60			
				1.52	3	50 DO	13
2		Stiff to very stiff grey CLAYEY SILT TILL			4	50 DO	30
3					5	50 DO	15
				273.31			
				3.81	6	50 DO	9
4		Firm to stiff grey SILTY CLAY trace sand.			7	50 DO	6
5					8	50 DO	6
				271.18			
6				5.94	9	50 DO	14
7		Stiff to hard grey, CLAYEY SILT TILL			10	50 DO	21
8					11	50 DO	80
					12	50 DO	68
9		CONTINUED ON NEXT PAGE					

WATER CONTENT PERCENT
Wp——W——Wl
10 20 30 40

ADDITIONAL LAB. TESTING

MONITORING INSTALLATIONS
GROUNDWATER AND
ENVIRONMENTAL OBSERVATIONS



DEPTH SCALE
1 : 50

Golder Associates

LOGGED: B.A.V.
CHECKED: DB

PROJECT: 971-3223

RECORD OF BOREHOLE 1

SHEET 2 OF 2

LOCATION: - REFER TO PLAN FIGURE 1 -

BORING DATE: NOV. 25, 1997

DATUM: GEODETIC

SAMPLER HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	WATER CONTENT PERCENT Wp----W----Wl (10 20 30 40) ⊕ O	ADDITIONAL LAB. TESTING	MONITORING INSTALLATIONS GROUNDWATER AND ENVIRONMENTAL OBSERVATIONS MW 1D MW 1S
9		CONTINUED FROM PREVIOUS PAGE								
	FLOWER AUGER (HOLLOW STEM)	Stiff to hard grey, CLAYEY SILT TILL		267.52	13	SS DO	75	O		
10		END OF BOREHOLE		9.60						WATER LEVEL ENCOUNTERED IN BOREHOLE AT ELEV. 275.60m DURING DRILLING NOV. 25, 1997. WATER LEVEL MEASURED IN MW 1D AT ELEV. 275.81m JAN. 19, 1998. WATER LEVEL MEASURED IN MW 1S AT ELEV. 276.42m JAN. 19, 1998
11										
12										
13										
14										
15										
16										
17										
18										
19										

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: B.A.V.

CHECKED: DB

PROJECT: 971-3223

RECORD OF BOREHOLE 2

SHEET 1 OF 1

LOCATION: - REFER TO PLAN FIGURE 1 -

BORING DATE: NOV. 25, 1997

DATUM: GEODETIC

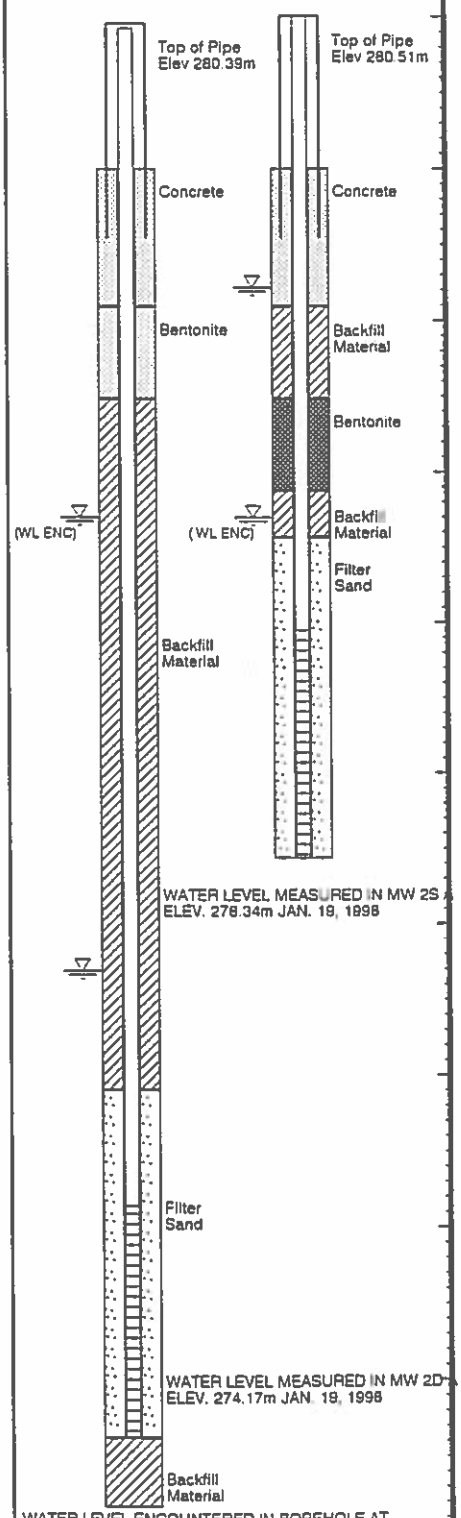
SAMPLER HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m
		GROUND SURFACE		279.47			
0	POWER AUGER (HOLLOW STEM)	Brown silty TOPSOIL, trace roots.		0.06	1	50 DO	4
1					2	50 DO	17
2					3	50 DO	30
3		Loose to very stiff, brown becoming grey at about elev. 276.42m CLAYEY SILT, trace sand, trace gravel, (TILL).			4	50 DO	15
					5	50 DO	19
4					6	50 DO	12
					7	50 DO	22
5					8	50 DO	11
6					9	50 DO	10
				272.76			
7		Stiff grey SILTY CLAY trace sand.		6.71	10	50 DO	14
					11	50 DO	10
8				271.24			
		Very stiff grey, CLAYEY SILT, trace sand, gravel, silt layers.		8.23	12	50 DO	22
9		END OF BOREHOLE		270.63 8.84			

WATER CONTENT PERCENT
Wp-----W-----Wl
10 20 30 40

ADDITIONAL LAB. TESTING

MONITORING INSTALLATIONS
GROUNDWATER AND
ENVIRONMENTAL OBSERVATIONS



WATER LEVEL ENCOUNTERED IN BOREHOLE AT ELEV. 277.18m DURING DRILLING, NOV. 25, 1997

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: B.A.V.
CHECKED: DB

PROJECT: 971-3223

RECORD OF BOREHOLE 3

SHEET 1 OF 2

LOCATION: - REFER TO PLAN FIGURE 1 -

BORING DATE: NOV. 26 1997

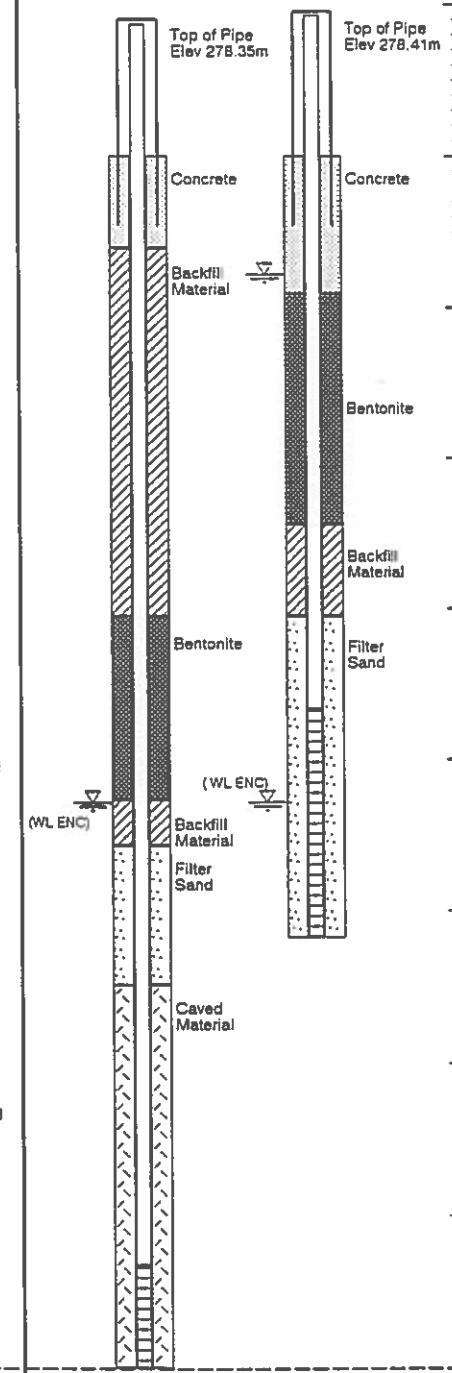
DATUM: GEODETIC

SAMPLER HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	WATER CONTENT PERCENT Wp----W----Wl (10 20 30 40)	ADDITIONAL LAB. TESTING
0	POWER AUGER (HOLLOW STEM)	GROUND SURFACE		277.48					
		Brown silty TOPSOIL, trace roots.		0.00 277.27					
				0.21	1	50 DO	6	o	
1		Loose brown SILT, some clay, trace sand.			2	50 DO	6	o	
				276.11					
				1.37	3	50 DO	37	o	
2					4	50 DO	30	o	
3		Very stiff to hard, brown becoming grey at about elev. 274.13m CLAYEY SILT, trace sand, trace gravel, (TILL).			5	50 DO	22	o	
4					6	50 DO	16	o	MH
				272.91					
				4.57	7	50 DO	20	o	
5		Compact brown SILT, trace sand, trace clay, with clayey silt layers.			8	50 DO	25	o	
6				271.38					
				6.10	9	50 DO	16	o	MH
		Compact brown SAND, trace gravel.		270.77					
		Stiff brown CLAYEY SILT, trace sand.		6.71					
7				6.86	10	50 DO	12	o o	
		Stiff grey SILTY CLAY, trace sand.							
					11	50 DO	12	o	
8		CONTINUED ON NEXT PAGE							

MONITORING INSTALLATIONS
GROUNDWATER AND
ENVIRONMENTAL OBSERVATIONS

MW 3D MW 3S



DEPTH SCALE
1 : 50

Golder Associates

LOGGED: B.A.V.
CHECKED: DB

PROJECT: 971-3223

RECORD OF BOREHOLE 3

SHEET 2 OF 2

LOCATION: - REFER TO PLAN FIGURE 1 -

BORING DATE: NOV. 26 1997

DATUM: GEODETIC

SAMPLER HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	WATER CONTENT PERCENT Wp—W—Wl (10 20 30 40) ⊕ O	ADDITIONAL LAB TESTING	MONITORING INSTALLATIONS GROUNDWATER AND ENVIRONMENTAL OBSERVATIONS MW 3D MW 3S
8	POWER AUGER (HOLLOW STEM)	CONTINUED FROM PREVIOUS PAGE								
		REFER TO PREVIOUS SHEET		269.25	11	50 DO	12			Caved Material
		Compact grey fine SAND, trace silt.		8.23	12	50 DO	24	O		
9				268.34						
		END OF BOREHOLE		9.14						
10										
11										
12										
13										
14										
15										
16										
17										
18										

WATER LEVEL ENCOUNTERED IN BOREHOLE AT ELEV. 273.21m DURING DRILLING, NOV. 26, 1997

WATER LEVEL MEASURED IN MW 3D AT ELEV. 273.20m JAN. 19, 1998

WATER LEVEL MEASURED IN MW 3S AT ELEV. 274.44m JAN. 19, 1998

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: B.A.V.

CHECKED: DB

PROJECT: 971-3223

LOCATION: - REFER TO PLAN FIGURE 1 -

RECORD OF BOREHOLE 4

BORING DATE: NOV. 26 1997

SAMPLER HAMMER, 63.5kg; DROP, 760mm

SHEET 1 OF 2

DATUM: GEODETIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	WATER CONTENT PERCENT Wp----W----Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	MONITORING INSTALLATIONS GROUNDWATER AND ENVIRONMENTAL OBSERVATIONS
0		GROUND SURFACE		278.98						
		Brown silty TOPSOIL, trace roots.		0.00 / 278.68	1	50 DO	5			
				0.30						
1	POWER AUGER (HOLLOW STEM)				2	50 DO	19			
					3	50 DO	29			
2		Very stiff to hard, brown CLAYEY SILT, trace sand, trace gravel, (TILL).			4	50 DO	38			
					5	50 DO	43			
3					6	50 DO	27			
				274.41 / 4.57						
4					7	50 DO	31			
					8	50 DO	25			
5		Compact to very dense, brown SAND, some gravel.			9	50 DO	60			
6					10	50 DO	54		MH	
7					11	50 DO	34			
8		CONTINUED ON NEXT PAGE								

MW 4D: Top of Pipe Elev 280.08m; Concrete; Backfill Material; Bentonite; Backfill Material; Filter Sand; (WL ENC)

MW 4S: Top of Pipe Elev 280.18m; Concrete; Bentonite; Backfill Material; Filter Sand

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: B.A.V.

CHECKED: DB

PROJECT: 971-3223

RECORD OF BOREHOLE 4

SHEET 2 OF 2

LOCATION: - REFER TO PLAN FIGURE 1 -

BORING DATE: NOV. 26 1997

DATUM: GEODETIC

SAMPLER HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	WATER CONTENT PERCENT Wp—W—Wl (10 20 30 40) ⊕ O	ADDITIONAL LAB. TESTING	MONITORING INSTALLATIONS GROUNDWATER AND ENVIRONMENTAL OBSERVATIONS
8		CONTINUED FROM PREVIOUS PAGE								MW 4D MW 4S
	POWER AUGER (HOLLOW STEM)	Compact to very dense, brown SAND, some gravel.			11	SS DO	34			Backfill Material
					12	SS DO	64	O		
9				269.84						
		END OF BOREHOLE		9.14						WATER LEVEL ENCOUNTERED IN BOREHOLE AT ELEV. 271.66m DURING DRILLING, NOV. 26, 1997
10										WATER LEVEL MEASURED IN MW 4D AT ELEV. 272.26m JAN. 19, 1998
										WATER LEVEL MEASURED IN MW 4S AT ELEV. 274.22m JAN. 19, 1998
11										
12										
13										
14										
15										
16										
17										
18										

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: B.A.V.

CHECKED: DR

PROJECT: 971-3223

RECORD OF BOREHOLE 5

SHEET 1 OF 1

LOCATION: - REFER TO PLAN FIGURE 1 -

BORING DATE: NOV. 26, 1997

DATUM: GEODETIC

SAMPLER HAMMER, 63.5kg; DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q ●, U ○)	HYDRAULIC CONDUCTIVITY, k, cm/s; WATER CONTENT, PERCENT (Wp, W, Wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
-1											
0	POWER AUGER (UNCASED)	GROUND SURFACE		276.86							Top of Pipe Elev 277.75m
		Brown silty TOPOSIL, some roots.		0.00 / 276.60	1	50 DO	4				Bentonite
				0.26							
1		Loose brown SILT, some clay, some sand.			2	50 DO	8				
				275.49							
				1.37							
2		Compact to dense brown SANDY SILT, trace gravel.			3	50 DO	20				(WL Enc.)
					4	50 DO	72				Backfill Material
				273.96							
3				2.90	5	50 DO	47				
		Very stiff brown becoming grey at about elev. 272.90m, CLAYEY SILT TILL.									
4					6	50 DO	18				Filter Sand
					7	50 DO	19				
5				271.83							
		END OF BOREHOLE		5.03							
6											
7											
8											
9											

WATER LEVEL ENCOUNTERED IN BOREHOLE AT ELEV. 274.88m DURING DRILLING NOV. 26, 1997

WATER LEVEL MEASURED IN PIEZOMETER AT ELEV. 273.35m JAN. 19, 1998

15 (0 / 5 / 10) PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: B.A.V.

CHECKED: DB

PROJECT: 971-3223

RECORD OF BOREHOLE 6

SHEET 1 OF 1

LOCATION: - REFER TO PLAN FIGURE 1 -

BORING DATE: NOV. 26, 1997

DATUM: GEODETIC

SAMPLER HAMMER, 63.5kg; DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH Cu, kPa (nat.V - +, rem.V - ⊕, Q - ●, U - ○)	HYDRAULIC CONDUCTIVITY, k, cm/s; WATER CONTENT, PERCENT (Wp, W, Wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
-1											Top of Pipe Elev 280.94
0		GROUND SURFACE		279.85							
	POWER AUGER (UNCASED)	Brown silty TOPOSIL, some roots.		0.00 / 279.53	1	50 DO	6				Bentonite
				0.32							
1					2	50 DO	9				Backfill Material
					3	50 DO	13				
2					4	50 DO	29				
3					5	50 DO	31				Filter Sand
		Stiff to hard brown becoming grey at about elev. 276.95m, CLAYEY SILT TILL			6	50 DO	23				
4					7	50 DO	23				
					8	50 DO	28				
5					9	50 DO	11				
6				273.30							
		END OF BOREHOLE		6.55							
7											
8											
9											

BOREHOLE DRY DURING DRILLING NOV. 26, 1997

WATER LEVEL MEASURED IN PIEZOMTER AT ELEV. 278.35m JAN. 19, 1998

15 (0 / 10) 5 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: B.A.V.

CHECKED: DL

PROJECT: 971-3223

RECORD OF BOREHOLE 7

SHEET 1 OF 1

LOCATION: - REFER TO PLAN FIGURE 1 -

BORING DATE: NOV. 26, 1997

DATUM: GEODETIC

SAMPLER HAMMER, 63.5kg; DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH Cu, kPa (nat.V. + ⊕, rem.V. - ⊖, Q - ●, U - ○)	HYDRAULIC CONDUCTIVITY, k, cm/s; WATER CONTENT, PERCENT (Wp, W, Wt)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
-1											
0		GROUND SURFACE		282.93							
	POWER AUGER (UNCASED)	Brown silty TOPOSIL, some roots.		0.06	1	50 DO	3				
1		Compact, brown SILTY SAND, some gravel, clayey silt layers below 1.37m depth.			2	50 DO	15				
					3	50 DO	20				
2				280.80							
		Very stiff brown CLAYEY SILT TILL		2.13	4	50 DO	16				
				280.19							
		END OF BOREHOLE		2.74							
3											
4											
5											
6											
7											
8											
9											

Top of Pipe Elev 283.57m

Bentonite

Filter Sand

(WL Enc.)

WATER LEVEL ENCOUNTERED IN BOREHOLE AT ELEV. 281.71m DURING DRRILLING NOV. 26, 1997

WATER LEVEL MEASURED IN PIEZOMETER AT ELEV. 282.20m JAN. 19, 1998

15 ε 5 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: B.A.V.

CHECKED: DB

PROJECT: 971-3223

RECORD OF BOREHOLE 8

SHEET 1 OF 1

LOCATION: - REFER TO PLAN FIGURE 1 -

BORING DATE: NOV. 26, 1997

DATUM: GEODETIC

SAMPLER HAMMER, 63.5kg; DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	HYDRAULIC CONDUCTIVITY, k, cm/s	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
-1								SHEAR STRENGTH Cu, kPa nat.V - + Q - ● rem.V - ⊕ U - ○	WATER CONTENT, PERCENT Wp W Wl (10 20 30 40)		
0		GROUND SURFACE		278.73							Top of Pipe Elev 278.41m
		Brown silty TOPOSIL, some roots.		0.00							Bentonite
				278.43	1	50 DO	3				Backfill Material
1	POWER AUGER (UNCASED)			0.30							Filter Sand
		Stiff brown CLAYEY SILT TILL trace sand, gravel.			2	50 DO	12				
2					3	50 DO	12				(WL Enc.)
					4	50 DO	15				
				275.99							
3		END OF BOREHOLE		2.74							
4											
5											
6											
7											
8											
9											

WATER LEVEL ENCOUNTERED IN BOREHOLE AT ELEV. 276.60m DURING DRILLING NOV. 26, 1997

WATER LEVEL MEASURED IN PIEZOMETER AT ELEV. 277.35M JAN. 19, 1998

0 15 10 5 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: B.A.V.

CHECKED:

PROJECT: 971-3223

RECORD OF BOREHOLE 9

SHEET 1 OF 1

LOCATION: - REFER TO PLAN FIGURE 1 -

BORING DATE: NOV. 26 1997

DATUM: GEODETIC

SAMPLER HAMMER, 63.5kg; DROP, 760mm

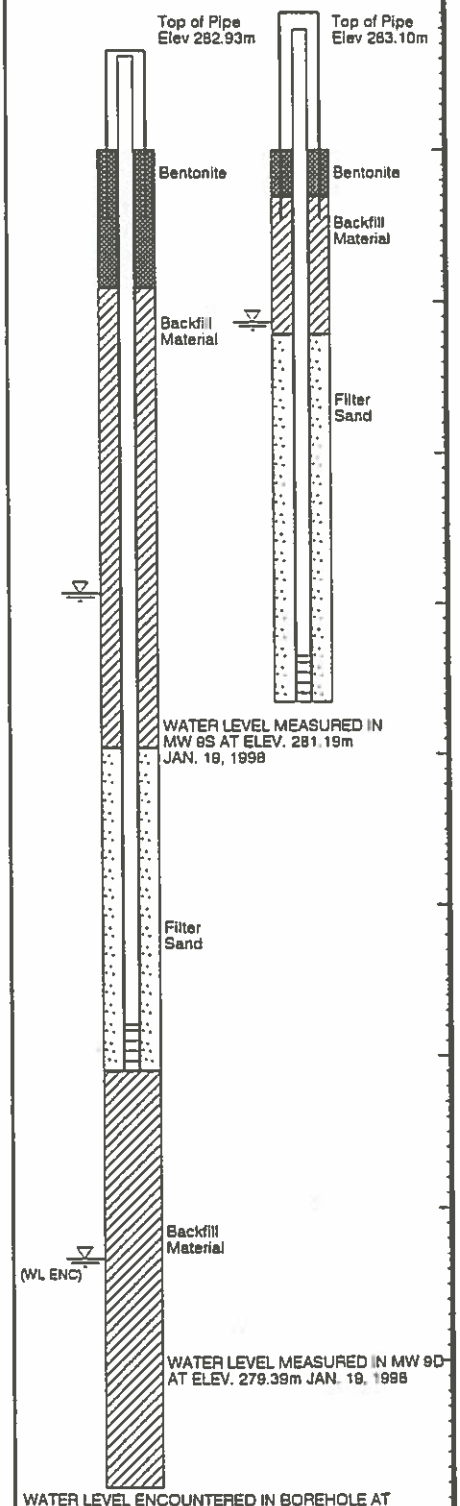
DEPTH SC. METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m
		GROUND SURFACE		282.31			
0	POWER AUGER (HOLLOW STEM)	Brown silty TOPSOIL, trace roots.		0.14	1	50 DO	5
1		Very stiff to hard, brown becoming grey at elev. 279.41m CLAYEY SILT, trace sand, trace gravel, (TILL).			2	50 DO	26
2					3	50 DO	44
3					4	50 DO	29
					5	50 DO	35
4					6	50 DO	28
5				277.13	7	50 DO	16
		Compact grey SILTY FINE SAND, with clayey silt layers.		5.18	8	50 DO	22
6				278.37			
		Stiff grey SILTY CLAY.		5.94	9	50 DO	11
7				275.60			
		Very stiff grey CLAYEY SILT, trace gravel, (TILL).		6.71	10	50 DO	25
8					11	50 DO	24
					12	50 DO	29
9		END OF BOREHOLE		273.47 8.84			

WATER CONTENT PERCENT
Wp----W----Wl
10 20 30 40

ADDITIONAL LAB. TESTING

MONITORING INSTALLATIONS
GROUNDWATER AND
ENVIRONMENTAL OBSERVATIONS

MW 9D MW 9S



WATER LEVEL ENCOUNTERED IN BOREHOLE AT ELEV. 277.13m DURING DRILLING, NOV. 26, 1997

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: B.A.V.
CHECKED: DB

PROJECT: 971-3223

RECORD OF BOREHOLE 10

SHEET 1 OF 1

LOCATION: - REFER TO PLAN FIGURE 1 -

BORING DATE: NOV. 26, 1997

DATUM: GEODETIC

SAMPLER HAMMER, 63.5kg; DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH Cu, kPa (nat.V - +, rem.V - ⊕, Q - ●, U - ○)	HYDRAULIC CONDUCTIVITY, k, cm/s; WATER CONTENT, PERCENT (Wp, W, Wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	POWER AUGER (UNCASED)	GROUND SURFACE		277.69							Top of Pipe Elev 278.13m
		Brown silty TOPOSIL, some roots.		0.11	1	50 DO	3				Bentonite
1		Very loose brown SILT, some clay.		276.17	2	50 DO	3				Backfill Material
2		Firm to stiff brown CLAYEY SILT TILL		1.52	3	50 DO	5				Filter Sand
					4	50 DO	9				
3					5	50 DO	8				
4					6	50 DO	6			MH	(WL Enc.)
		END OF BOREHOLE		273.12 4.57							
5											
6											
7											
8											
9											

WATER LEVEL ENCOUNTERED IN BOREHOLE AT ELEV. 273.73m DURING DRRILLING NOV. 26, 1997

WATER LEVEL MEASURED IN PIEZOMETER AT ELEV. 273.69m JAN. 19, 1998

15 0 5 10 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: B.A.V.

CHECKED: DB

PROJECT: 971-3223

RECORD OF BOREHOLE 11

SHEET 1 OF 1

LOCATION: - REFER TO PLAN FIGURE 1 -

BORING DATE: NOV. 26, 1997

DATUM: GEODETIC

SAMPLER HAMMER, 63.5kg; DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH Cu, kPa (nat.V - +, Q - ●, rem.V - ⊕, U - ○)	HYDRAULIC CONDUCTIVITY, k, cm/s; WATER CONTENT, PERCENT (Wp, W, Wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
-1											Top of Pipe Elev 279.40m
0		GROUND SURFACE		278.58							
		Brown silty TOPOSIL, some roots.		0.23	1	50 DO	4				Bentonite
1	POWER AUGER (UNCASED)				2	50 DO	25				Backfill Material
2		Very stiff to hard brown becoming grey at about elev. 274.92m CLAYEY SILT, trace sand, trace gravel (TILL).			3	50 DO	17				Filter Sand
3					4	50 DO	20				
					5	50 DO	31				(WL Enc.)
4					6	50 DO	21				
				274.01							
		END OF BOREHOLE		4.57							
5											WATER LEVEL ENCOUNTERED IN BOREHOLE AT ELEV. 275.23m DURING DRILLING NOV. 26, 1997
6											WATER LEVEL MEASURED IN PIEZOMETER AT ELEV. 274.01m JAN. 19, 1998
7											
8											
9											

0 15 10 5 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: B.A.V.

CHECKED: DS

PROJECT: 971-3223

RECORD OF BOREHOLE 12

SHEET 1 OF 1

LOCATION: - REFER TO PLAN FIGURE 1 -

BORING DATE: NOV. 26, 1997

DATUM: GEODETIC

SAMPLER HAMMER, 63.5kg; DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	HYDRAULIC CONDUCTIVITY, k, cm/s	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
								SHEAR STRENGTH Cu, kPa (nat.V - +, rem.V - ⊕, Q - ●, U - ○)	WATER CONTENT, PERCENT Wp, W, Wl (10, 20, 30, 40)		
0	POWER AUGER (UNCASED)	GROUND SURFACE		276.23							Top of Pipe Elev 279.10m
		Brown silty TOPOSIL, some roots.		276.04 / 0.19	1	50 DO	4				Bentonite
1		Compact brown SILTY SAND, trace gravel.		274.86 / 1.37	2	50 DO	25				Backfill Material
2		Compact brown SAND AND GRAVEL, trace to some silt.			3	50 DO	17				Filter Sand
					4	50 DO	20				
3				272.57	5	50 DO	3				(WL Enc)
4		Very stiff brown CLAYEY SILT, with sandy silt layers.		3.66 / 271.66	6	50 DO	18				
		END OF BOREHOLE		4.57							
5											
6											
7											
8											
9											

WATER LEVEL ENCOUNTERED IN BOREHOLE AT ELEV. 275.23m DURING DRRILLING NOV. 26, 1997

WATER LEVEL MEASURED IN PIEZOMETER AT ELEV. 274.26m JAN. 19, 1998

0 15 10 5 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: B.A.V.

CHECKED: DB

PROJECT: 971-3223

LOCATION: - REFER TO PLAN FIGURE 1 -

SAMPLER HAMMER, 63.5kg; DROP, 760mm

RECORD OF BOREHOLE 13

BORING DATE: NOV. 26, 1997

SHEET 1 OF 1

DATUM: GEODETIC

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m
		GROUND SURFACE		279.05			
0	POWER AUGER (UNCASED)	Brown silty TOPOSIL, some roots.		278.70	1	50 DO	2
				0.35			
1		Firm to stiff brown becoming grey at about elev. 276.92m CLAYEY SILT TILL			2	50 DO	9
2					3	50 DO	11
					4	50 DO	6
				276.31			
3		END OF BOREHOLE		2.74			

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m

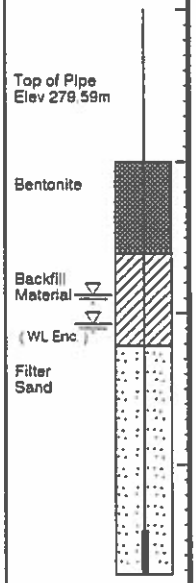
SHEAR STRENGTH Cu, kPa nat.V. + Q - ● rem.V. ⊕ U - ○

HYDRAULIC CONDUCTIVITY, k, cm/s

WATER CONTENT, PERCENT Wp W Wl (10, 20, 30, 40)

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



WATER LEVEL ENCOUNTERED IN BOREHOLE AT ELEV. 277.98m DURING DRRILLING NOV. 26, 1997

WATER LEVEL MEASURED IN PIEZOMETER AT ELEV. 278.17m JAN. 19, 1998

0 15 5 10 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: B.A.V.

CHECKED: DB

APPENDIX B

CHEMICAL ANALYTICAL RESULTS

PHILIP SERVICES

CERTIFICATE OF ANALYSIS

Attention: Mr. Dan Brown\Mr. Rick Vantfoort
Client Name: Golder Associates Ltd. (London)
Address: 500 Nottinghill Road
London, ON
N6K 3P1
Telephone: 519-471-9600
FAX: 519-471-4707

Laboratory Work Order: 39270

This Certificate of Analysis is for the following:

Sample(s) Received on: 17-Dec-97 Reported on: 23-Jan-98
Client Project No.: 971-3223
Purchase Order:
Quotation No.:

Test procedures used are performance based methods referenced from "Standard Methods for the Examination of Water and Wastewater", MOEE, EPA, NIOSH or other published references.

Water samples are discarded 4 weeks after the results have been reported. Solid samples are retained for 3 months. Storage for longer periods requires prior arrangement with the laboratory.

Reviewed by

Darlene Hoogenes or Kathie Hughes
Service Representative

Authorized by

Roger Rioux or Lorraine DaSilva
Lab Manager QA Officer

Philip Services Corporation

CERTIFICATE OF ANALYSIS

RCAp 50

Client:(1093) Golder Associates Ltd. (London), London | Reported:23-Jan-98 | Page: 1

Project Number: | Purchase Number:
Attention: Mr. Dan Brown\Mr. Rick Vantfoort | Date Received: 17-Dec-97
Work Order: 39270 Client Ref.#:971-3223 | Sample Type: Liquid

Analytical Parameter	Result	Units	MDL	Comment	MAC
97-A036477	Sample Description: 971-3223 BH#1 s				
Sodium Na	7.18	mg/L	0.1		20 G
Potassium K	2.35	mg/L	0.1		-
Calcium Ca	72.0	mg/L	0.1		-
Magnesium Mg	27.9	mg/L	0.1		-
Calculated Hardness CaCO3	295.	mg/L	0.1		-
Alkalinity CaCO3	250.	mg/L	1		30-500 G
Bicarbonate as HCO3	249.	mg/L	1		-
Carbonate CO3	1.	mg/L	1		-
Sulphate as SO4	31.	mg/L	2		500
Chloride as Cl	17.	mg/L	1		250
Silica, Reactive as SiO2	12.7	mg/L	0.5		-
Phosphorus,Diss.Orth as P	< 0.01	mg/L	0.01		-
Phosphorus as P	0.20	mg/L	0.1		-
Nitrite as N	0.06	mg/L	0.01		-
Nitrate as N	0.44	mg/L	0.05		-
Ammonia as N	0.14	mg/L	0.05		-
Colour	< 5	TCU	5		5
Turbidity	19.6	NTU	0.1		1
Conductivity	518.	us/cm	1		-
pH Value	7.64	pH units	0.1		6.5-8.5
Carbon, Diss. Org. as C	1.1	mg/L	0.5		-
Iron Fe	0.18	mg/L	0.02		0.3
Manganese Mn	0.25	mg/L	0.02		0.05
Copper Cu	< 0.02	mg/L	0.02		1.0
Zinc Zn	0.12	mg/L	0.01		5.0
Total Anions	6.16	meq/L			-
Total Cation	6.27	meq/L			-
Ion Balance	0.90	% diff.			-
Calculated T.D.S.	323.	mg/L			500 G
Saturation pH @4C	7.62	pH units			-
Saturation pH @20C	7.22	pH units			-
Langelier Index @4C	0.02				-
Langelier Index @20C	0.42				-

Note: MAC: Denotes Maximum Acceptable Concentration From Ontario Ministry of the Environment and Health and Welfare Canada (G denotes guideline).

EXPLANATION OF CODES:
MDL Method Detection Limit

Philip Analytical Services Corporation
921 Leathorne Street, London, Ontario, Canada N5Z 3M7 (519) 686-7558 1-800-268-7396 FAX (519) 686-6374

Philip Services Corporation

CERTIFICATE OF ANALYSIS

KCAp 50

Client:(1093) Golder Associates Ltd. (London). London | Reported:23-Jan-98 |

Project Number:	Purchase Number:
Attention: Mr. Dan Brown\Mr. Rick Vantfoort	Date Received: 17-Dec-97
Work Order: 39270 Client Ref.#:971-3223	Sample Type: Liquid

Analytical Parameter	Result	Units	MDL	Comment
97-A036477	Sample Description: 971-3223 BH#1 s			
Aluminum Al	< 0.05	mg/L	0.05	
Barium Ba	0.12	mg/L	0.04	
Beryllium Be	< 0.01	mg/L	0.01	
Bismuth Bi	< 0.02	mg/L	0.02	
Boron B	0.03	mg/L	0.02	
Cadmium Cd	< 0.005	mg/L	0.005	
Chromium Cr	< 0.02	mg/L	0.02	
Cobalt Co	< 0.03	mg/L	0.03	
Lead Pb	< 0.04	mg/L	0.04	
Molybdenum Mo	< 0.02	mg/L	0.02	
Nickel Ni	< 0.05	mg/L	0.05	
Silver Ag	< 0.01	mg/L	0.01	
Strontium Sr	0.62	mg/L	0.02	
Tin Sn	< 0.02	mg/L	0.02	
Titanium Ti	< 0.02	mg/L	0.02	
Vanadium V	< 0.01	mg/L	0.01	

EXPLANATION OF CODES:
MDL Method Detection Limit

Philip Analytical Services Corporation
921 Leathorne Street, London, Ontario, Canada N5Z 3M7 (519) 686-7558 1-800-268-7396 FAX (519) 686-6374

Philip Services Corporation

CERTIFICATE OF ANALYSIS

RCAp 50

Client:(1093) Golder Associates Ltd. (London). London | Reported:23-Jan-98 |

Project Number:	Purchase Number:
Attention: Mr. Dan Brown\Mr. Rick Vantfoort	Date Received: 17-Dec-97
Work Order: 39270 Client Ref.#:971-3223	Sample Type: Liquid

Analytical Parameter	Result	Units	MDL	Comment	MAC
97-A036478	Sample Description: 971-3223 BH#1 d				
Sodium Na	4.73	mg/L	0.1		20 G
Potassium K	3.42	mg/L	0.1		-
Calcium Ca	109.	mg/L	0.1		-
Magnesium Mg	19.3	mg/L	0.1		-
Calculated Hardness CaCO3	352.	mg/L	0.1		-
Alkalinity CaCO3	256.	mg/L	1		30-500 G
Bicarbonate as HCO3	255.	mg/L	1		-
Carbonate CO3	< 1	mg/L	1		-
Sulphate as SO4	45.	mg/L	2		500
Chloride as Cl	21.	mg/L	1		250
Silica, Reactive as SiO2	9.80	mg/L	0.5		-
Phosphorus,Diss.Orth as P	< 0.01	mg/L	0.01		-
Phosphorus as P	0.15	mg/L	0.1		-
Nitrite as N	0.05	mg/L	0.01		-
Nitrate as N	2.42	mg/L	0.05		-
Ammonia as N	0.08	mg/L	0.05		-
Colour	5.	TCU	5		5
Turbidity	19.4	NTU	0.1		1
Conductivity	540.	us/cm	1		-
pH Value	7.54	pH units	0.1		6.5-8.5
Carbon, Diss. Org. as C	1.2	mg/L	0.5		-
Iron Fe	0.08	mg/L	0.02		0.3
Manganese Mn	0.04	mg/L	0.02		0.05
Copper Cu	< 0.02	mg/L	0.02		1.0
Zinc Zn	< 0.01	mg/L	0.01		5.0
Total Anions	6.82	meq/L			-
Total Cation	7.33	meq/L			-
Ion Balance	3.55	% diff.			-
Calculated T.D.S.	377.	mg/L			500 G
Saturation pH @4C	7.43	pH units			-
Saturation pH @20C	7.03	pH units			-
Langelier Index @4C	0.11				-
Langelier Index @20C	0.51				-

Note: MAC Denotes Maximum Acceptable Concentration From Ontario Ministry of the Environment and Health and Welfare Canada (G denotes guideline).

EXPLANATION OF CODES:
MDL Method Detection Limit

Philip Analytical Services Corporation
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Philip Services Corporation

CERTIFICATE OF ANALYSIS

RCAp 50

Client:(1093) Golder Associates Ltd. (London), London | Reported:23-Jan-98 | Page: 4

Project Number: | Purchase Number:
Attention: Mr. Dan Brown\Mr. Rick Vantfoort | Date Received: 17-Dec-97
Work Order: 39270 | Client Ref.#:971-3223 | Sample Type: Liquid

Analytical Parameter	Result	Units	MDL	Comment
97-A036478	Sample Description: 971-3223 BH#1 d			
Aluminum Al	< 0.05	mg/L	0.05	
Barium Ba	0.13	mg/L	0.04	
Beryllium Be	< 0.01	mg/L	0.01	
Bismuth Bi	< 0.02	mg/L	0.02	
Boron B	< 0.02	mg/L	0.02	
Cadmium Cd	< 0.005	mg/L	0.005	
Chromium Cr	< 0.02	mg/L	0.02	
Cobalt Co	< 0.03	mg/L	0.03	
Lead Pb	< 0.04	mg/L	0.04	
Molybdenum Mo	< 0.02	mg/L	0.02	
Nickel Ni	< 0.05	mg/L	0.05	
Silver Ag	< 0.01	mg/L	0.01	
Strontium Sr	0.23	mg/L	0.02	
Tin Sn	< 0.02	mg/L	0.02	
Titanium Ti	< 0.02	mg/L	0.02	
Vanadium V	< 0.01	mg/L	0.01	

EXPLANATION OF CODES:
MDL Method Detection Limit

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Philip Services Corporation

CERTIFICATE OF ANALYSIS

RCAp 50

Client:(1093) Golder Associates Ltd. (London), London | Reported:23-Jan-98 |

Project Number:	Purchase Number:
Attention: Mr. Dan Brown\Mr. Rick Vantfoort	Date Received: 17-Dec-97
Work Order: 39270 Client Ref.#:971-3223	Sample Type: Liquid

Analytical Parameter	Result	Units	MDL	Comment	MAC
97-A036479	Sample Description: 971-3223 BH#3 s				
Sodium Na	3.98	mg/L	0.1		20 G
Potassium K	4.68	mg/L	0.1		-
Calcium Ca	94.6	mg/L	0.1		-
Magnesium Mg	20.0	mg/L	0.1		-
Calculated Hardness CaCO3	319.	mg/L	0.1		-
Alkalinity CaCO3	280.	mg/L	1		30-500 G
Bicarbonate as HCO3	279.	mg/L	1		-
Carbonate CO3	< 1	mg/L	1		-
Sulphate as SO4	27.	mg/L	2		500
Chloride as Cl	6.	mg/L	1		250
Silica, Reactive as SiO2	8.00	mg/L	0.5		-
Phosphorus,Diss Orth as P	< 0.01	mg/L	0.01		-
Phosphorus as P	0.12	mg/L	0.1		-
Nitrite as N	< 0.01	mg/L	0.01		-
Nitrate as N	1.50	mg/L	0.05		-
Ammonia as N	0.07	mg/L	0.05		-
Colour	5.	TCU	5		5
Turbidity	14.8	NTU	0.1		1
Conductivity	491.	us/cm	1		-
pH Value	7.50	pH units	0.1		6.5-8.5
Carbon, Diss. Org. as C	0.9	mg/L	0.5		-
Iron Fe	0.07	mg/L	0.02		0.3
Manganese Mn	0.09	mg/L	0.02		0.05
Copper Cu	< 0.02	mg/L	0.02		1.0
Zinc Zn	< 0.01	mg/L	0.01		5.0
Total Anions	6.44	meq/L			-
Total Cation	6.66	meq/L			-
Ion Balance	1.73	% diff.			-
Calculated T.D.S.	339.	mg/L			500 G
Saturation pH @4C	7.45	pH units			-
Saturation pH @20C	7.05	pH units			-
Langelier Index @4C	0.05				-
Langelier Index @20C	0.45				-

Note: MAC: Denotes Maximum Acceptable Concentration From Ontario Ministry of the Environment and Health and Welfare Canada (G denotes guideline).

EXPLANATION OF CODES:
MDL Method Detection Limit

Philip Services Corporation

CERTIFICATE OF ANALYSIS

ICAp 50

Client:(1093) Golder Associates Ltd. (London), London | Reported:23-Jan-98 | Page: 6

Project Number:
Attention: Mr. Dan Brown\Mr. Rick Vantfoort
Work Order: 39270 Client Ref.#:971-3223
Purchase Number:
Date Received: 17-Dec-97
Sample Type: Liquid

Analytical Parameter	Result	Units	MDL	Comment
97-A036479	Sample Description: 971-3223 BH#3 s			
Aluminum Al	< 0.05	mg/L	0.05	
Barium Ba	< 0.04	mg/L	0.04	
Beryllium Be	< 0.01	mg/L	0.01	
Bismuth Bi	< 0.02	mg/L	0.02	
Boron B	< 0.02	mg/L	0.02	
Cadmium Cd	< 0.005	mg/L	0.005	
Chromium Cr	< 0.02	mg/L	0.02	
Cobalt Co	< 0.03	mg/L	0.03	
Lead Pb	< 0.04	mg/L	0.04	
Molybdenum Mo	< 0.02	mg/L	0.02	
Nickel Ni	< 0.05	mg/L	0.05	
Silver Ag	< 0.01	mg/L	0.01	
Strontium Sr	0.14	mg/L	0.02	
Tin Sn	< 0.02	mg/L	0.02	
Titanium Ti	< 0.02	mg/L	0.02	
Vanadium V	< 0.01	mg/L	0.01	

EXPLANATION OF CODES:
MDL Method Detection Limit

Philip Services Corporation

CERTIFICATE OF ANALYSIS

KCAp 50

Client:(1093) Golder Associates Ltd. (London), London | Reported:23-Jan-98 |

Project Number:	Purchase Number:
Attention: Mr. Dan Brown\Mr. Rick Vantfoort	Date Received: 17-Dec-97
Work Order: 39270 Client Ref.#:971-3223	Sample Type: Liquid

Analytical Parameter	Result	Units	MDL	Comment	MAC
97-A036480	Sample Description: 971-3223 BH#4 d				
Sodium Na	14.3	mg/L	0.1		20 G
Potassium K	1.62	mg/L	0.1		-
Calcium Ca	90.4	mg/L	0.1		-
Magnesium Mg	24.6	mg/L	0.1		-
Calculated Hardness CaCO3	327.	mg/L	0.1		-
Alkalinity CaCO3	250.	mg/L	1		30-500 G
Bicarbonate as HCO3	249.	mg/L	1		-
Carbonate CO3	< 1	mg/L	1		-
Sulphate as SO4	24.	mg/L	2		500
Chloride as Cl	47.	mg/L	1		250
Silica, Reactive as SiO2	9.80	mg/L	0.5		-
Phosphorus,Diss,Orth as P	< 0.01	mg/L	0.01		-
Phosphorus as P	0.23	mg/L	0.1		-
Nitrite as N	< 0.01	mg/L	0.01		-
Nitrate as N	7.89	mg/L	0.05		-
Ammonia as N	0.06	mg/L	0.05		-
Colour	< 5	TCU	5		5
Turbidity	14.0	NTU	0.1		1
Conductivity	678.	us/cm	1		-
pH Value	7.61	pH units	0.1		6.5-8.5
Carbon, Diss, Org, as C	0.6	mg/L	0.5		-
Iron Fe	0.23	mg/L	0.02		0.3
Manganese Mn	0.02	mg/L	0.02		0.05
Copper Cu	< 0.02	mg/L	0.02		1.0
Zinc Zn	< 0.01	mg/L	0.01		5.0
Total Anions	7.39	meq/L			-
Total Cation	7.20	meq/L			-
Ion Balance	1.26	% diff.			-
Calculated T.D.S.	397.	mg/L			500 G
Saturation pH @4C	7.53	pH units			-
Saturation pH @20C	7.13	pH units			-
Langelier Index @4C	0.08				-
Langelier Index @20C	0.48				-

Note: MAC: Denotes Maximum Acceptable Concentration From Ontario Ministry of the Environment and Health and Welfare Canada (G denotes guideline).

EXPLANATION OF CODES:
MDL Method Detection Limit

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Philip Services Corporation

CERTIFICATE OF ANALYSIS

RCAp 50

Client:(1093) Golder Associates Ltd. (London). London | Reported:23-Jan-98 | Page: 8

Project Number: | Purchase Number:
Attention: Mr. Dan Brown\Mr. Rick Vantfoort | Date Received: 17-Dec-97
Work Order: 39270 | Client Ref.#:971-3223 | Sample Type: Liquid

Analytical Parameter	Result	Units	MDL	Comment
97-A036480	Sample Description: 971-3223 BH#4 d			
Aluminum Al	0.12	mg/L	0.05	
Barium Ba	0.06	mg/L	0.04	
Beryllium Be	< 0.01	mg/L	0.01	
Bismuth Bi	< 0.02	mg/L	0.02	
Boron B	0.35	mg/L	0.02	
Cadmium Cd	< 0.005	mg/L	0.005	
Chromium Cr	< 0.02	mg/L	0.02	
Cobalt Co	< 0.03	mg/L	0.03	
Lead Pb	< 0.04	mg/L	0.04	
Molybdenum Mo	< 0.02	mg/L	0.02	
Nickel Ni	< 0.05	mg/L	0.05	
Silver Ag	< 0.01	mg/L	0.01	
Strontium Sr	0.14	mg/L	0.02	
Tin Sn	< 0.02	mg/L	0.02	
Titanium Ti	< 0.02	mg/L	0.02	
Vanadium V	< 0.01	mg/L	0.01	

EXPLANATION OF CODES
MDL Method Detection Limit

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Philip Services Corporation

CERTIFICATE OF QUALITY CONTROL

Client: Golder Associates Ltd. (London)
Contact: Mr. Dan Brown\Mr. Rick Vantfoort

Date Reported: 23-Jan-98
Work Order: 39270

Matrix: Liquid

Client Reference: 971-3223

			Process Blank		Process % Recovery			Matrix Spike					Duplicate			
Parameter	MDL	Units	Result	Upper Limit	Result	Lower Limit	Upper Limit	Spike ID	Result	Target	Lower Limit	Upper Limit	Duplicate ID	Original Result	Duplicate Result	QC Flag
pH Value	0.1	pH units			99.89	97.0	102.2						97-A036319	7.86	7.86	
pH Value	0.1	pH units			100.00	97.0	102.2						97-A036259	8.00	8.00	
pH Value	0.1	pH units			99.78	97.0	102.2						97-A036274	2.84	2.84	
pH Value	0.1	pH units			99.78	97.0	102.2						97-A036289	8.21	8.21	
Ammonia as N	0.05	mg/L	0.04	0.1	96.03	79.4	119.4	97-A036477	1.89	1.82	1.30	2.41	97-A036477	0.14	0.14	
Nitrate as N	0.05	mg/L	0.00	0.1	100.60	85.0	115.0	97-A036477	2.56	2.50	2.00	3.00	97-A036477	0.44	0.45	
Nitrate as N	0.05	mg/L	0.00	0.1	95.48	85.0	115.0	97-A036515	2.69	2.35	1.88	2.82	97-A036515	< 0.05	< 0.05	
Nitrate as N	0.05	mg/L	0.00	0.1	100.30	85.0	115.0	97-A036627	2.82	2.85	2.28	3.42	97-A036627	0.18	0.15	
Nitrite as N	0.01	mg/L	0.00	0.02	90.00	85.0	115.0	97-A036477	0.31	0.35	0.28	0.42	97-A036477	0.06	0.06	
Nitrite as N	0.01	mg/L	0.00	0.02	103.33	85.0	115.0	97-A036515	0.33	0.35	0.28	0.42	97-A036515	< 0.01	< 0.01	
Nitrite as N	0.01	mg/L	0.00	0.02	103.33	85.0	115.0	97-A036627	0.33	0.35	0.28	0.42	97-A036627	0.07	0.06	
Nitrate + Nitrite as N	0.05	mg/L	0.00	0.1	100.60	85.0	115.0	97-A036477	2.50	2.50	2.00	3.00	97-A036477	0.50	0.54	
Nitrate + Nitrite as N	0.05	mg/L	0.00	0.1	95.48	85.0	115.0	97-A036515	2.69	2.35	1.88	2.82	97-A036515	< 0.05	< 0.05	
Nitrate + Nitrite as N	0.05	mg/L	0.00	0.1	100.30	85.0	115.0	97-A036627	2.75	2.85	2.28	3.42	97-A036627	0.25	0.21	
Carbon. Diss. Org. as C	0.5	mg/L	0.0	1	93.33	80.6	116.0	97-F036492	23.9	25.0	19.5	30.4	97-F036492	3.4	3.4	
Carbon. Diss. Org. as C	0.5	mg/L	0.0	1	92.12	80.6	116.0	97-A036480	25.4	25.0	19.5	30.4	97-A036480	0.6	0.5	
Phosphorus,Diss.Orth as P	0.01	mg/L	0.00	0.04	97.31	84.1	115.8	97-F036446	1.04	1.00	0.74	1.25	97-F036446	< 0.01	< 0.01	
Phosphorus,Diss.Orth as P	0.01	mg/L			99.27	84.1	115.8	97-A036480	1.04	1.00	0.74	1.25	97-A036480	< 0.01	< 0.01	
Conductivity	1	us/cm	0.9	2	101.14	81.2	112.0						97-F036446	22.8	30.0	
Conductivity	1	us/cm			99.43	81.2	112.0						97-A036693	426.	428.	
Conductivity	1	us/cm			95.45	81.2	112.0						97-A036797	1160	1160	
Sulphate as SO4	2	mg/L	< 2	4	99.21	85.0	115.0	97-A036694	21.	20.	16.	24.	97-A036694	11.	11.	
Sulphate as SO4	2	mg/L			98.82	85.0	115.0	97-A036739	213.	200.	160.	240.	97-A036739	252.	256.	
Sulphate as SO4	2	mg/L			99.61	85.0	115.0	97-A036670	99.	100.	80.	120.	97-A036670	65.	63.	

QC Flag(s) pertain to B-Process Blank, R-Process % Recovery, S-Matrix Spike and/or D-Duplicate
na Denotes Not Applicable

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Philip Services Corporation

CERTIFICATE OF QUALITY CONTROL

Client: Golder Associates Ltd. (London)
Contact: Mr. Dan Brown\Mr. Rick Vantfoort

Date Reported: 23-Jan-98
Work Order: 39270

Matrix: Liquid

Client Reference: 971-3223

			Process Blank		Process % Recovery			Matrix Spike					Duplicate			
Parameter	MDL	Units	Result	Upper Limit	Result	Lower Limit	Upper Limit	Spike ID	Result	Target	Lower Limit	Upper Limit	Duplicate ID	Original Result	Duplicate Result	QC Flag
Sulphate as SO4	2	mg/L			106.30	85.0	115.0	97-A036784	102.	100.	80.	120.	97-A036784	52.	54.	
Alkalinity CaCO3	1	mg/L	1.	2	100.61	85.0	115.0	97-A036004	24.	25.	20.	30.	97-A036004	80.	82.	
Alkalinity CaCO3	1	mg/L	1.	2	103.07	85.0	115.0	97-A036284	28.	25.	20.	30.	97-A036284	36.	30.	
Alkalinity CaCO3	1	mg/L	1.	2	105.52	85.0	115.0	97-A036516	26.	25.	20.	30.	97-A036516	212.	214.	
Alkalinity CaCO3	1	mg/L	1.	2	107.98	85.0	115.0	97-A036671	28.	25.	20.	30.	97-A036671	202.	204.	
Chloride as Cl	1	mg/L	< 1	2	101.65	85.0	115.0	97-A036515	20.	20.	16.	24.	97-A036515	42.	42.	
Colour	5	TCU	0.	10	94.80	85.0	115.0						97-A036319	20.	20.	
Silica, Reactive as SiO2	0.02	mg/L	0.00	0.04	104.70	85.0	115.0	97-A036477	4.50	5.35	4.28	6.42	97-A036477	12.7	12.6	
Silica, Reactive as SiO2	0.02	mg/L	0.00	0.04	105.16	85.0	115.0	97-A036787	5.00	5.35	4.28	6.42	97-A036787	5.80	6.30	
Silica, Reactive as SiO2	0.02	mg/L	0.00	0.04	105.63	85.0	115.0						97-A036805	16.4	16.3	
Turbidity	0.1	NTU	0.0	2	100.00	85.0	115.0						97-A036477	19.6	19.6	
Aluminum Al	0.05	mg/L	-0.06	0.1	82.93	75.1	125.0	98-A000382	20.4	20.0	14.1	25.3	98-A000382	0.35	0.36	
Barium Ba	0.04	mg/L	0.00	0.04				98-A000382	0.34	0.30	0.22	0.38	98-A000382	< 0.04	< 0.04	
Beryllium Be	0.01	mg/L	0.00	0.02				98-A000382	0.31	0.30	0.24	0.37	98-A000382	< 0.01	< 0.01	
Bismuth Bi	0.02	mg/L	0.00	0.04				97-A036477	0.09	0.10	0.06	0.14	97-A036477	< 0.02	< 0.02	
Boron B	0.02	mg/L	-0.01	0.04	106.25	80.0	129.7	98-A000382	8.47	8.00	6.14	9.58	98-A000382	0.13	0.14	
Cadmium Cd	0.005	mg/L	-0.005	0.01				98-A000382	1.99	2.00	1.59	2.48	98-A000382	< 0.005	< 0.01	
Calcium Ca	0.05	mg/L	-0.09	0.1	107.99	91.0	118.2	98-A000382	43.0	40.0	32.0	48.0	98-A000382	34.0	35.6	
Chromium Cr	0.02	mg/L	0.01	0.04	82.93	74.1	120.9	98-A000382	4.18	4.00	3.05	5.00	98-A000382	0.29	0.29	
Cobalt Co	0.03	mg/L	0.00	0.06	89.39	85.0	120.4	98-A000382	4.17	4.00	2.99	4.94	98-A000382	< 0.03	< 0.03	
Copper Cu	0.02	mg/L	-0.02	0.04	84.44	76.2	120.2	98-A000382	2.25	2.00	1.35	2.58	98-A000382	0.05	0.05	
Iron Fe	0.04	mg/L	-0.01	0.08	104.48	76.1	123.0	98-A000382	4.15	4.00	3.04	4.75	98-A000382	0.82	0.89	
Lead Pb	0.04	mg/L	0.02	0.08	101.52	77.5	125.7	98-A000382	21.1	20.0	15.1	25.4	98-A000382	0.37	0.41	
Magnesium Mg	0.05	mg/L	0.00	0.1	102.84	86.0	125.5	98-A000382	18.3	20.0	16.0	24.0	98-A000382	10.5	11.0	

QC Flag(s) pertain to B-Process Blank, R-Process % Recovery, S-Matrix Spike and/or D-Duplicate
na Denotes Not Applicable

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Philip Services Corporation

CERTIFICATE OF QUALITY CONTROL

Client: Golder Associates Ltd. (London)
Contact: Mr. Dan Brown\Mr. Rick Vantfoort

Date Reported: 23-Jan-98
Work Order: 39270

Matrix: Liquid

Client Reference: 971-3223

			Process Blank		Process % Recovery			Matrix Spike					Duplicate			
Parameter	MDL	Units	Result	Upper Limit	Result	Lower Limit	Upper Limit	Spike ID	Result	Target	Lower Limit	Upper Limit	Duplicate ID	Original Result	Duplicate Result	QC Flag
Manganese Mn	0.02	mg/L	0.00	0.04	110.00	87.0	118.1	98-A000382	0.51	0.50	0.36	0.61	98-A000382	1.88	1.95	
Molybdenum Mo	0.02	mg/L	-0.01	0.04				98-A000382	8.44	8.00	6.21	9.87	98-A000382	0.16	0.21	
Nickel Ni	0.05	mg/L	-0.01	0.1	87.72	74.6	125.5	98-A000382	4.17	4.00	3.11	5.00	98-A000382	0.70	0.73	
Phosphorus as P	0.02	mg/L	-0.01	0.04	96.25	89.4	120.8	98-A000382	18.5	20.0	15.4	26.0	98-A000382	11.1	11.0	
Potassium K	0.05	mg/L	0.00	0.1	95.92	85.7	115.0	97-A036174	1.68	2.00	1.33	2.45	97-A036174	0.36	0.36	
Potassium K	0.05	mg/L	0.00	0.1	100.97	85.7	115.0	97-F036065	2.16	2.00	1.33	2.45	97-F036064	0.90	0.90	
Potassium K	0.05	mg/L	0.00	0.1	105.82	85.7	115.0	97-A036477	2.25	2.00	1.33	2.45	97-A036477	2.35	2.35	
Potassium K	0.05	mg/L	0.00	0.1	105.82	85.7	115.0	97-A036741	2.32	2.00	1.33	2.45	97-A036741	2.41	2.40	
Potassium K	0.05	mg/L	0.00	0.1	101.94	85.7	115.0	97-A036781	2.22	2.00	1.33	2.45	97-A036781	2.63	2.64	
Potassium K	0.05	mg/L	0.05	0.1	108.74	85.7	115.0	97-A036391	1.59	2.00	1.33	2.45	97-A036391	1.98	1.98	
Potassium K	0.05	mg/L	0.05	0.1	108.74	85.7	115.0	97-A036411	50.7	40.0	26.5	49.0	97-A036411	22.6	22.6	S
Silver Ag	0.01	mg/L	-0.01	0.02									98-A000382	< 0.01	< 0.01	
Sodium Na	0.05	mg/L	0.01	0.1	98.88	75.9	122.2	97-F036064	4.64	5.00	3.24	6.63	97-F036064	4.25	4.26	
Sodium Na	0.05	mg/L	0.01	0.1	100.00	75.9	122.2	97-F036217	4.71	5.00	3.24	6.63	97-F036217	4.70	4.72	
Sodium Na	0.05	mg/L	0.01	0.1	101.68	75.9	122.2	97-A036183	5.01	5.00	3.24	6.63	97-A036183	2.27	2.27	
Sodium Na	0.05	mg/L	0.01	0.1	102.81	75.9	122.2	97-A036688	4.83	5.00	3.24	6.63	97-A036688	2.95	2.97	
Sodium Na	0.05	mg/L	0.01	0.1	101.68	75.9	122.2	97-F036446	5.01	5.00	3.24	6.63	97-F036446	0.16	0.16	
Sodium Na	0.05	mg/L	0.02	0.1	99.44	75.9	122.2	97-A036399	9.60	10.0	6.47	13.3	97-A036399	12.7	12.7	
Sodium Na	0.05	mg/L	0.00	0.1	98.31	75.9	122.2	97-A036407	9.20	10.0	6.47	13.3	97-A036407	10.5	10.5	
Sodium Na	0.05	mg/L	0.00	0.1	100.00	75.9	122.2									
Sodium Na	0.05	mg/L	0.00	0.1	100.00	75.9	122.2									
Strontium Sr	0.02	mg/L	0.00	0.04	100.00	87.9	117.2	98-A000382	0.50	0.50	0.40	0.60	98-A000382	0.21	0.22	
Tin Sn	0.02	mg/L	0.00	0.04				97-A035677	0.10	0.10	0.07	0.12	97-A035677	< 0.02	< 0.02	
Tin Sn	0.02	mg/L	0.00	0.04				97-A035951	0.09	0.10	0.07	0.12	97-A035951	0.02	< 0.02	

QC Flag(s) pertain to B-Process Blank, R-Process % Recovery, S-Matrix Spike and/or D-Duplicate
na Denotes Not Applicable

Philip Analytical Services Corporation
921 Leathorne Street, London, Ontario, Canada N5Z 3M7 (519) 686-7558 1-800-268-7396 FAX (519) 686-6374

Philip Services Corporation

CERTIFICATE OF QUALITY CONTROL

Client: Golder Associates Ltd. (London)
Contact: Mr. Dan Brown\Mr. Rick Vantfoort

Date Reported: 23-Jan-98
Work Order: 39270

Matrix: Liquid

Client Reference: 971-3223

			Process Blank		Process % Recovery			Matrix Spike					Duplicate			
Parameter	MDL	Units	Result	Upper Limit	Result	Lower Limit	Upper Limit	Spike ID	Result	Target	Lower Limit	Upper Limit	Duplicate ID	Original Result	Duplicate Result	QC Flag
Tin Sn	0.02	mg/L	0.00	0.04				97-A036477	0.07	0.10	0.07	0.12	97-A036477	< 0.02	< 0.02	
Tin Sn	0.02	mg/L	0.00	0.04				97-A036736	0.07	0.10	0.07	0.12	97-A036736	< 0.02	< 0.02	
Titanium Ti	0.02	mg/L	-0.01	0.04				98-A000382	0.57	0.50	0.40	0.60	98-A000382	0.13	0.17	
Vanadium V	0.01	mg/L	-0.02	0.02				98-A000382	2.03	2.00	1.62	2.37	98-A000382	< 0.01	< 0.01	
Zinc Zn	0.01	mg/L	0.00	0.02	100.00	88.9	122.4	98-A000382	2.06	2.00	1.48	2.55	98-A000382	1.48	1.56	

QC Flag(s) pertain to B-Process Blank, R-Process % Recovery, S-Matrix Spike and/or D-Duplicate
na Denotes Not Applicable

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Philip Services Corporation

CERTIFICATE OF ANALYSIS

HOLD TIME REPORT

Client:(1093) Golder Associates Ltd. (London). London Reported:23-Jan-98 Page: 1

Project Number:
Attention: Mr. Dan Brown\Mr. Rick Vantfoort Purchase Order:
Work Order: 39270 Client Ref.#:971-3223 Date Received: 17-Dec-97
Sample Type: Liquid

Analytical Tests	Date Analyzed	Hold Time (in days)	Actual Time (in days)	Exceeded	Regulation, Alternative
97-A036477					Date Sampled: 16-Dec-97
pH Value	17-Dec-97	4	1		MISA, EPA stat
Ammonia as N	18-Dec-97	10	2		MISA, 3 days unpreserved, EPA 28 days
Nitrate as N	18-Dec-97	2	2		EPA
Nitrite as N	18-Dec-97	2	2		EPA
Nitrate + Nitrite as N	18-Dec-97	5	2		MISA, EPA 28 days
Carbon, Diss, Org, as C	17-Dec-97	10	1		MISA, 3 days unpreserved, EPA 28 days
Phosphorus,Diss,Orth as P	17-Dec-97	2	1		EPA
Conductivity	22-Dec-97	4	6	Yes	MISA, EPA 28 days
Sulphate as SO4	23-Dec-97	30	7		MISA, EPA 28 days
Alkalinity CaCO3	19-Dec-97	14	3		EPA
Chloride as Cl	18-Dec-97	28	2		EPA
Colour	17-Dec-97	2	1		EPA
Silica, Reactive as SiO2	22-Dec-97	28	6		MISA, EPA
Turbidity	18-Dec-97	2	2		EPA
Carbonate CO3			0		Not Available
Phosphorus as P	14-Jan-98	30	29		MISA, EPA 28 days
Metal Digestion HNO3-WT	22-Dec-97	30	6		MISA, EPA 6 months

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CERTIFICATE OF ANALYSIS

HOLD TIME REPORT

Client:(1093) Golder Associates Ltd. (London), London | Reported:23-Jan-98 | Page: 2

Project Number:
Attention: Mr. Dan Brown\Mr. Rick Vantfoort
Work Order: 39270 Client Ref.#:971-3223
Purchase Order:
Date Received: 17-Dec-97
Sample Type: Liquid

Analytical Tests	Date Analyzed	Hold Time (in days)	Actual Time (in days)	Exceeded	Regulation, Alternative
97-A036478					Date Sampled: 16-Dec-97
pH Value	17-Dec-97	4	1		MISA, EPA stat
Ammonia as N	18-Dec-97	10	2		MISA, 3 days unpreserved, EPA 28 days
Nitrate as N	18-Dec-97	2	2		EPA
Nitrite as N	18-Dec-97	2	2		EPA
Nitrate + Nitrite as N	18-Dec-97	5	2		MISA, EPA 28 days
Carbon, Diss. Org. as C	17-Dec-97	10	1		MISA, 3 days unpreserved, EPA 28 days
Phosphorus,Diss.Orth as P	17-Dec-97	2	1		EPA
Conductivity	22-Dec-97	4	6	Yes	MISA, EPA 28 days
Sulphate as SO4	23-Dec-97	30	7		MISA, EPA 28 days
Alkalinity CaCO3	19-Dec-97	14	3		EPA
Chloride as Cl	18-Dec-97	28	2		EPA
Colour	17-Dec-97	2	1		EPA
Silica, Reactive as SiO2	22-Dec-97	28	6		MISA, EPA
Turbidity	18-Dec-97	2	2		EPA
Carbonate CO3			0		Not Available
Phosphorus as P	14-Jan-98	30	29		MISA, EPA 28 days
Metal Digestion HNO3-WT	22-Dec-97	30	6		MISA, EPA 6 months

CERTIFICATE OF ANALYSIS

HOLD TIME REPORT

Client:(1093) Golder Associates Ltd. (London). London | Reported:23-Jan-98 | Page: 3

Project Number: | Purchase Order:
Attention: Mr. Dan Brown\Mr. Rick Vantfoort | Date Received: 17-Dec-97
Work Order: 39270 | Client Ref.#:971-3223 | Sample Type: Liquid

Analytical Tests	Date Analyzed	Hold Time (in days)	Actual Time (in days)	Exceeded	Regulation, Alternative
97-A036479					Date Sampled: 16-Dec-97
pH Value	17-Dec-97	4	1		MISA, EPA stat
Ammonia as N	18-Dec-97	10	2		MISA, 3 days unpreserved, EPA 28 days
Nitrate as N	18-Dec-97	2	2		EPA
Nitrite as N	18-Dec-97	2	2		EPA
Nitrate + Nitrite as N	18-Dec-97	5	2		MISA, EPA 28 days
Carbon, Diss, Org, as C	17-Dec-97	10	1		MISA, 3 days unpreserved, EPA 28 days
Phosphorus,Diss,Orth as P	17-Dec-97	2	1		EPA
Conductivity	22-Dec-97	4	6	Yes	MISA, EPA 28 days
Sulphate as SO4	23-Dec-97	30	7		MISA, EPA 28 days
Alkalinity CaCO3	19-Dec-97	14	3		EPA
Chloride as Cl	18-Dec-97	28	2		EPA
Colour	17-Dec-97	2	1		EPA
Silica, Reactive as SiO2	22-Dec-97	28	6		MISA, EPA
Turbidity	18-Dec-97	2	2		EPA
Carbonate CO3			0		Not Available
Phosphorus as P	14-Jan-98	30	29		MISA, EPA 28 days
Metal Digestion HNO3-WT	22-Dec-97	30	6		MISA, EPA 6 months

CERTIFICATE OF ANALYSIS

HOLD TIME REPORT

Client:(1093) Golder Associates Ltd. (London). London | Reported:23-Jan-98 | Page: 4

Project Number:
Attention: Mr. Dan Brown\Mr. Rick Vantfoort | Purchase Order:
Work Order: 39270 | Client Ref.#:971-3223 | Date Received: 17-Dec-97 | Sample Type: Liquid

Analytical Tests	Date Analyzed	Hold Time (in days)	Actual Time (in days)	Exceeded	Regulation, Alternative
97-A036480					Date Sampled: 16-Dec-97
pH Value	17-Dec-97	4	1		MISA, EPA stat
Ammonia as N	18-Dec-97	10	2		MISA, 3 days unpreserved, EPA 28 days
Nitrate as N	19-Dec-97	2	3	Yes	EPA
Nitrite as N	19-Dec-97	2	3	Yes	EPA
Nitrate + Nitrite as N	19-Dec-97	5	3		MISA, EPA 28 days
Carbon, Diss. Org. as C	17-Dec-97	10	1		MISA, 3 days unpreserved, EPA 28 days
Phosphorus,Diss.Orth as P	17-Dec-97	2	1		EPA
Conductivity	22-Dec-97	4	6	Yes	MISA, EPA 28 days
Sulphate as SO4	23-Dec-97	30	7		MISA, EPA 28 days
Alkalinity CaCO3	19-Dec-97	14	3		EPA
Chloride as Cl	18-Dec-97	28	2		EPA
Colour	17-Dec-97	2	1		EPA
Silica, Reactive as SiO2	22-Dec-97	28	6		MISA, EPA
Turbidity	18-Dec-97	2	2		EPA
Carbonate CO3			0		Not Available
Phosphorus as P	14-Jan-98	30	29		MISA, EPA 28 days
Metal Digestion HNO3-WT	22-Dec-97	30	6		MISA, EPA 6 months

APPENDIX A

WATER WELL SURVEY SHEETS

Golder Associates Ltd.
500 Nottinghill Road
London, Ontario, Canada N6K 3P1
Telephone (519) 471-9600
Fax (519) 471-4707

WATER SUPPLY INVENTORY

REFERENCE No. 3/11

Project No: 971-3223 Project Name: Mt.Pleasant / Cemetery / London Date: November 13, 1997

GENERAL INFORMATION

Lot: _____ Concession: _____ Township: City of London County: Middlesex

Occupant: Gord Shipley Phone: 472-2888 Postal Code: N6H 5K4

Address: 2535 Hyde Park Rd.

Current Owner: same Phone: _____ Postal Code: _____

Address: _____

Former Owner(s): owner since 1978

WELL INFORMATION

Number of wells on property: 1 (if more than one, provide details of primary well below and other(s) on reverse)

M.O.E.E. Number: _____ Driller: _____ Year Constructed: _____

Location: (Sketch P.2) North of house

Type: Drilled ☑ Bored ☐ Dug ☐ Sand Point ☐ Cistern ☐ (Capacity: _____)

Casing Type: steel Casing Size: 6" Total Well Depth: 130' Depth to Water: _____

Well Deepened ☑ (When: ≈1989) Well Cleaned ☐ (When: _____)

WATER INFORMATION

Water Source: Overburden ☐ Bedrock ☑ Rainwater ☐ Lake/River ☐ Purchased ☐ Municipal ☐

Water Quality:

Analytical Results: _____

Description (Taste, Odour, Clarity, Colour, Hardness, Staining, Corrosion, Etc.):

Good Water / Iron / Hard

Water Quantity:

No. Adults: 2 No. Children: 1 No. Washrooms: 1 House Size: M

Washing Machine ☑ Dishwasher ☒ Other: _____

Livestock ☐ : Type and Number: _____

Outdoor Use ☐ : Garden ☑ Pool ☐ Watering ☑ Other: General Use (Drinking)

Partial Usage Only ☐ : Seasonal ☐ Drinking Only ☐ Livestock Only ☐ Other: _____

Water Quantity Problems ☐ : Water Level Dropped ☐ Water Shortage ☐ Well Gone Dry ☐

Describe Problem and Timing: Lots of Water

Reference No. 3/11

WELL SYSTEM

Pump ☑ Type: Hand Pump ☐ Suction ☐ Jet ☐ Submersible ☑ Size: _____ Operational ☐

Location of Pump and/or Intake: _____

Softener ☐ Other Treatment: ///

MEASUREMENTS

Well Accessible ☑ Owner will make accessible ☐ ? Well Inaccessible ☐

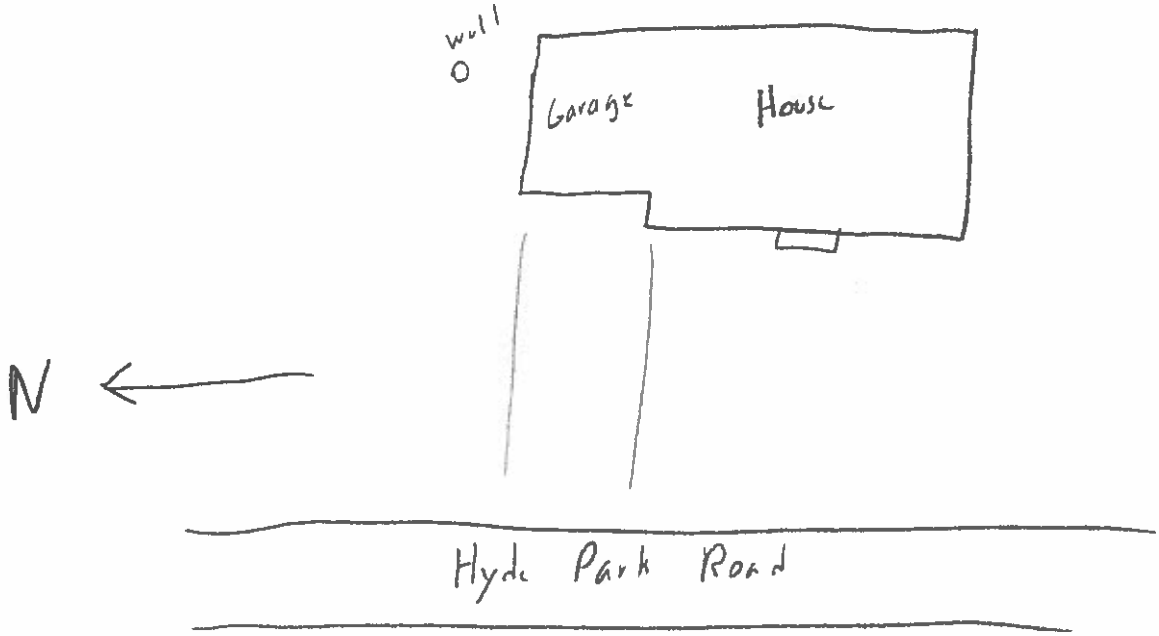
Measured from: Ground Surface ☐ Top of: Casing ☐ Pit ☐ Vent ☐ (Dist. to Ground Surface: _____)

Water Level:	Date:	Well Depth:	Measured by:
_____	_____	130'	_____
_____	_____	_____	_____
_____	_____	_____	_____

Willing to allow sampling for analysis? YES ☑ NO ☐ – did not really say yes Mr. Shipley just shrugged his shoulders

COMMENTS - Supplies Water to house #'s 2611 and 2631

Inventoried By: B A V Date Completed: Nov. 20 /97



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500 Nottinghill Road
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Fax (519) 471-4707

WATER SUPPLY INVENTORY

REFERENCE No. 4

Project No: 971-3223 Project Name: Mt.Pleasant / Cemetery / London Date: November 13, 1997

GENERAL INFORMATION

Lot: _____ Concession: _____ ~~Township~~: City of London County: Middlesex

Occupant: Dziadura / Angja Phone: 471-2055 Postal Code: N6J 5K4

Address: 2701 Hyde Park Road

Current Owner: same Phone: _____ Postal Code: _____

Address: _____

Former Owner(s): owners 17 years

WELL INFORMATION

Number of wells on property: 1 (if more than one, provide details of primary well below and other(s) on reverse)

M.O.E.E. Number: _____ Driller: _____ Year Constructed: 17 year ago

Location: (Sketch P.2)

Type: Drilled ☐ Bored ☑ Dug ☐ Sand Point ☐ Cistern ☐ (Capacity: _____)

Casing Type: concrete Casing Size: 3½' (1.07m) Total Well Depth: _____ Depth to Water: _____

Well Deepened ☐ (When: _____) Well Cleaned ☐ (When: _____)

(Lady says very deep)

WATER INFORMATION

Water Source: Overburden ☐ Bedrock ☑ Rainwater ☐ Lake/River ☐ Purchased ☐ Municipal ☐

Water Quality:

Analytical Results: _____

Description (Taste, Odour, Clarity, Colour, Hardness, Staining, Corrosion, Etc.):

Good Water (Very Good) No problems

* Used for Drinking Water

Water Quantity:

No. Adults: 2 No. Children: X No. Washrooms: 3 House Size: Large

Washing Machine ☑ Dishwasher ☑ Other: General Use

Livestock ☒ : Type and Number: _____

Outdoor Use ☐ : Garden ☑ Pool ☐ Watering ☑ Other: _____

Partial Usage Only ☐ : Seasonal ☐ Drinking Only ☐ Livestock Only ☐ Other: _____

Water Quantity Problems ☐ : Water Level Dropped ☐ Water Shortage ☐ Well Gone Dry ☐

Describe Problem and Timing: Lots of water never dry

Reference No. 4

WELL SYSTEM

Pump ☑ Type: Hand Pump ☐ Suction ☐ Jet ☐ Submersible ☐ Size: _____ Operational ☑

Location of Pump and/or Intake: basement (fruit cellar)

Softener ☐ Other Treatment: No treatment

MEASUREMENTS

Well Accessible ☑ Owner will make accessible ☑ Well Inaccessible ☐

Measured from: Ground Surface ☑ Top of: Casing ☐ Pit ☐ Vent ☐ (Dist. to Ground Surface: _____)

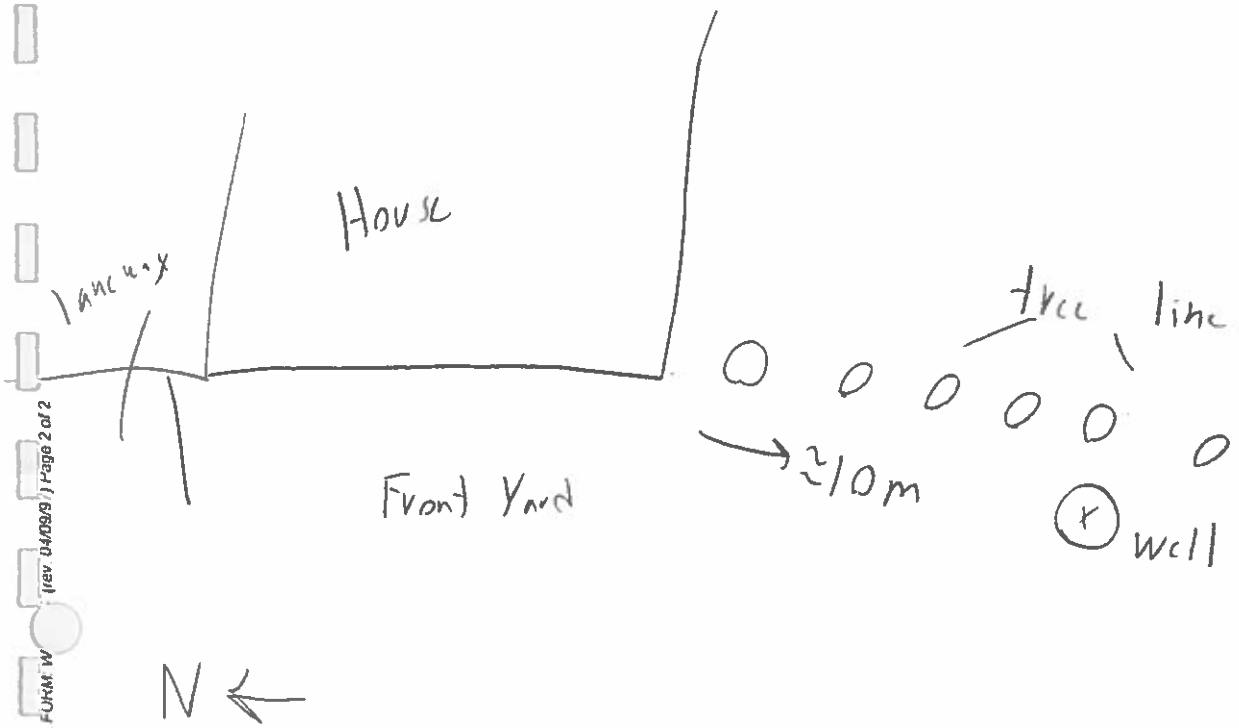
Water Level:	Date:	Well Depth:	Measured by:
9.21m	Nov. 13	42'	BAV

Willing to allow sampling for analysis? YES ☑ NO ☐

COMMENTS

Concerned about drinking water use if the water will be contaminated.

Inventoried By: B A V Date Completed: Nov. 13/96



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Fax (519) 471-4707
live house on property

WATER SUPPLY INVENTORY

REFERENCE No. 5

Project No: 971-3223 Project Name: Mt Pleasant / Cemetery / London Date: November 13, 1997

GENERAL INFORMATION

Lot: _____ Concession: _____ Township: _____ County: _____

Occupant: empty Phone: _____ Postal Code: _____

Address: 2739 Hyde Park Road

Current Owner: Ziggy Miszczak Phone: 473-2566 Postal Code: _____

Address: 134 North Timberland work 641-1711

Former Owner(s): (owner 20 years)

WELL INFORMATION

Number of wells on property: 1 (if more than one, provide details of primary well below and other(s) on reverse)

M.O.E.E. Number: _____ Driller: _____ Year Constructed: _____

Location: (Sketch P.2)

Type: Drilled ☐ Bored ☑ Dug ☐ Sand Point ☐ Cistern ☐ (Capacity: _____)

Casing Type: Concrete Casing Size: 3½' Total Well Depth: _____ Depth to Water: _____

Well Deepened ☐ (When: _____) Well Cleaned ☐ (When: _____)

WATER INFORMATION

Water Source: Overburden ☐ Bedrock ☑ Rainwater ☐ Lake/River ☐ Purchased ☐ Municipal ☐

Water Quality:

Analytical Results: _____

Description (Taste, Odour, Clarity, Colour, Hardness, Staining, Corrosion, Etc.):

Good Water

Water Quantity: Nobody lives in house

No. Adults: _____ No. Children: _____ No. Washrooms: _____ House Size: _____

Washing Machine ☑ Dishwasher ☑ Other: _____

Livestock ☐ : Type and Number: _____ Use water for everything including drinking (when lived in house)

Outdoor Use ☐ : Garden ☐ Pool ☐ Watering ☐ Other: _____

Partial Usage Only ☐ : Seasonal ☐ Drinking Only ☐ Livestock Only ☐ Other: _____

Water Quantity Problems ☐ : Water Level Dropped ☐ Water Shortage ☐ Well Gone Dry ☐

Describe Problem and Timing: Lots of water

Reference No. 5

WELL SYSTEM

Pump ☑ Type: Hand Pump ☐ Suction ☐ Jet ☐ Submersible ☐ Size: _____ Operational ☐

Location of Pump and/or Intake: basement

Softener ☐ Other Treatment: charcoal filter

MEASUREMENTS

Well Accessible ☑ Owner will make accessible ☑ Well Inaccessible ☐

Measured from: Ground Surface ☑ Top of: Casing ☐ Pit ☐ Vent ☐ (Dist. to Ground Surface: _____)

Water Level: 11.78 m Date: Nov. 13 Well Depth: 42' deep Measured by: BAL

owner says water is low this year

Willing to allow sampling for analysis? YES ☑ NO ☐

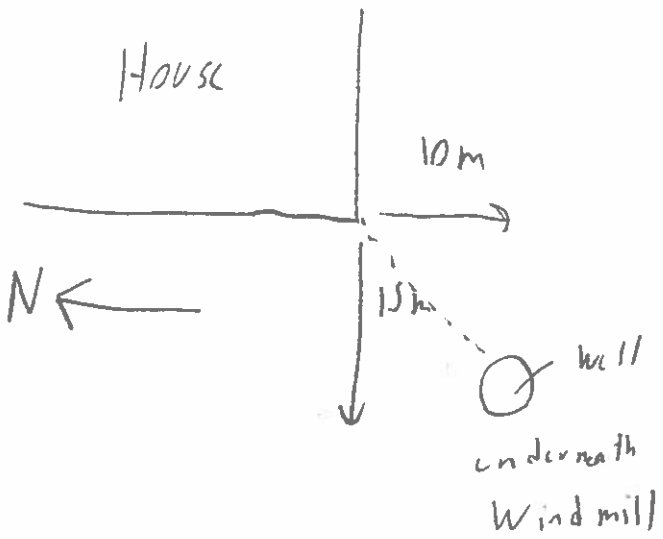
COMMENTS

Not worried about cemetery

(not worried about dead ones, only the ones alive)

Inventoried By: BAV Date Completed: Nov. 13 /97

Material	
10' feet	Clay
10' Blue	Clay
20'	Gravel
(ziggy)	



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Fax (519) 471-4707

WATER SUPPLY INVENTORY

REFERENCE No. 7

Project No: 971-3223 Project Name: Mt Pleasant / Cemetery / London Date: November 13, 1997

GENERAL INFORMATION

Lot: _____ Concession: _____ Township: City of London County: Middlesex

Occupant: Bert Verdel Phone: 471-0247 Postal Code: N6G 5B7

Address: 1535 Sunningdale Road.

Current Owner: same Phone: _____ Postal Code: _____

Address: _____

Former Owner(s): 38 years

WELL INFORMATION

Number of wells on property: 1 (if more than one, provide details of primary well below and other(s) on reverse)

M.O.E.E. Number: _____ Driller: _____ Year Constructed: 28 years old

Location: (Sketch P.2)

Type: Drilled ☑ Bored ☐ Dug ☐ Sand Point ☐ Cistern ☐ (Capacity: _____)

Casing Type: steel Casing Size: 6" Total Well Depth: 65' Depth to Water: _____

Well Deepened ☐ (When: _____) Well Cleaned ☐ (When: _____)

WATER INFORMATION

Water Source: Overburden ☐ Bedrock ☑ Rainwater ☐ Lake/River ☐ Purchased ☐ Municipal ☐

Water Quality:

Analytical Results: _____

Description (Taste, Odour, Clarity, Colour, Hardness, Staining, Corrosion, Etc.):

Good Water / excellent water / no problems

Water Quantity:

No. Adults: 2 No. Children: _____ No. Washrooms: 2 House Size: small

Washing Machine ☑ Dishwasher ☑ Other: _____

Livestock ☒ : Type and Number: _____ Use water for everything (including drinking)

Outdoor Use ☐ : Garden ☑ Pool ☑ Watering ☐ Other: _____

Partial Usage Only ☐ : Seasonal ☐ Drinking Only ☐ Livestock Only ☐ Other: _____

Water Quantity Problems ☐ : Water Level Dropped ☐ Water Shortage ☐ Well Gone Dry ☐

Describe Problem and Timing: Lots of water

Reference No. 7

WELL SYSTEM deep well pump

Pump ☑ Type: Hand Pump ☐ Suction ☐ Jet ☐ Submersible ☐ Size: _____ Operational ☐

Location of Pump and/or Intake: _____

Softener ☑ Other Treatment: Filter drinking water

MEASUREMENTS steel lid cannot open

Well Accessible ☑ Owner will make accessible ☐ Well Inaccessible ☐

Measured from: Ground Surface ☐ Top of: Casing ☐ Pit ☐ Vent ☐ (Dist. to Ground Surface: _____)

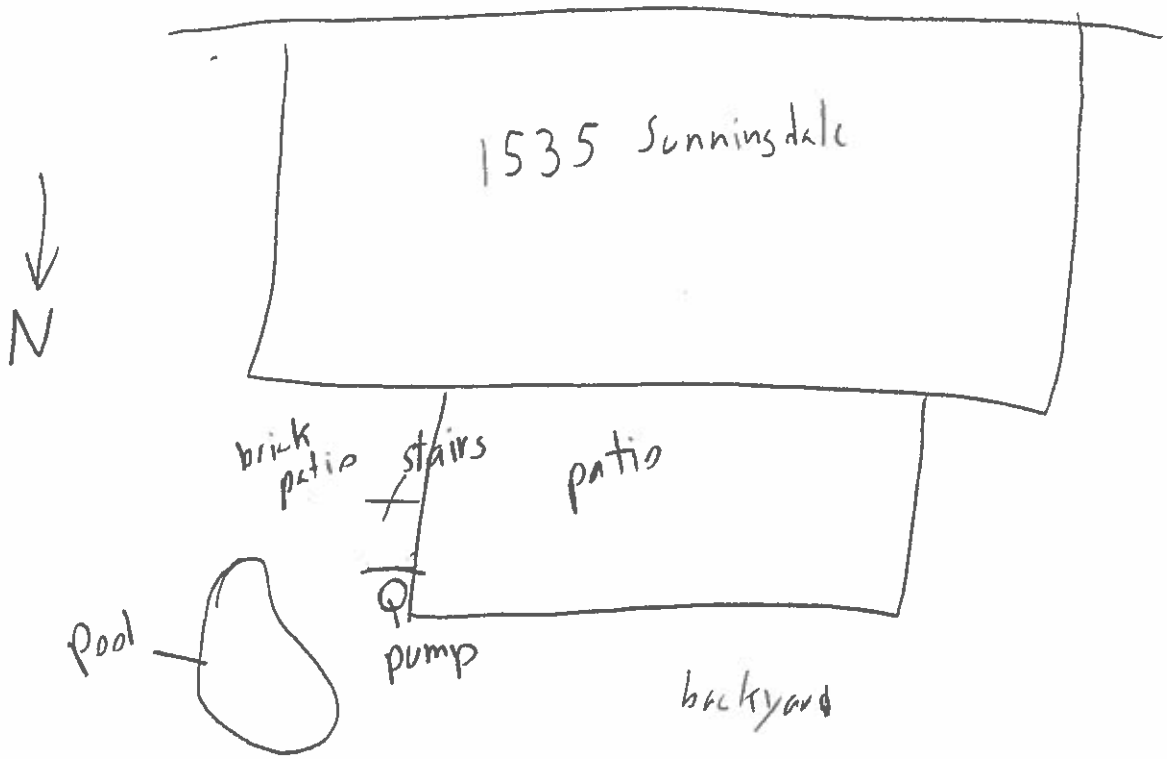
Water Level:	Date:	Well Depth:	Measured by:
_____	_____	_____	_____
_____	_____	_____	_____

Willing to allow sampling for analysis? YES ☑ NO ☐

COMMENTS

- Do not want city water
- happy with the well water

Inventoried By: B.A.V Date Completed: Nov. 13/97



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WATER SUPPLY INVENTORY

REFERENCE No. 8

Project No: 971-3223 Project Name: Mt Pleasant / Cemetery / London Date: November 13, 1997

GENERAL INFORMATION

Lot: ____ Concession: ____ Township: City of London County: Middlesex

Occupant: Rebecca Coblentz Phone: 474-2547 Postal Code: N6G 5B7

Address: 1445 Sunningdale Rd West

Current Owner: Same Phone: ____ Postal Code: ____

Address: ____

~~Former Owner~~(s): (1st year (the house is fifty years old))

WELL INFORMATION

Number of wells on property: 1 (if more than one, provide details of primary well below and other(s) on reverse)

M.O.E.E. Number: – Driller: – Year Constructed: –

Location: (Sketch P.2) West of house

Type: Drilled ☐ Bored ☑ Dug ☐ Sand Point ☐ Cistern ☐ (Capacity: ____)

Casing Type: concrete Casing Size: 4' Total Well Depth: ? Depth to Water: ____

Well Deepened ☐ (When: ____) Well Cleaned ☐ (When: ____)

WATER INFORMATION

Water Source: Overburden ☐ Bedrock ☑ Rainwater ☐ Lake/River ☐ Purchased ☐ Municipal ☐

Water Quality:

Analytical Results: ____

Description (Taste, Odour, Clarity, Colour, Hardness, Staining, Corrosion, Etc.):

Sulphur Taste and Odour / Very Hard / ↑ high iron

Water Quantity:

No. Adults: 2 No. Children: – No. Washrooms: 1 House Size: 1000 ft²

Washing Machine ☑ Dishwasher ☐ Other: ____

Livestock ☒ : Type and Number: ____

Outdoor Use ☐ : Garden ☑ Pool ☐ Watering ☑ Other: drinking

Partial Usage Only ☐ : Seasonal ☐ Drinking Only ☐ Livestock Only ☐ Other: ____

Water Quantity Problems ☐ : Water Level Dropped ☐ Water Shortage ☐ Well Gone Dry ☐

Describe Problem and Timing: lots of water

Reference No. 8

WELL SYSTEM

Pump ☑ Type: Hand Pump ☐ Suction ☐ Jet ☐ Submersible ☐ Size: _____ Operational ☐

Location of Pump and/or Intake: upstairs

Softener ☑ Other Treatment: water softener IR beam filter

MEASUREMENTS

casing 82cm high (2'8")

Well Accessible ☑ Owner will make accessible ☑ Well Inaccessible ☐

Measured from: Ground Surface ☐ Top of: Casing ☑ Pit ☐ Vent ☐ (Dist. to Ground Surface: _____)

Water Level: 1.40m Date: Nov-13/97 Well Depth: 9.10 m Measured by: BAV

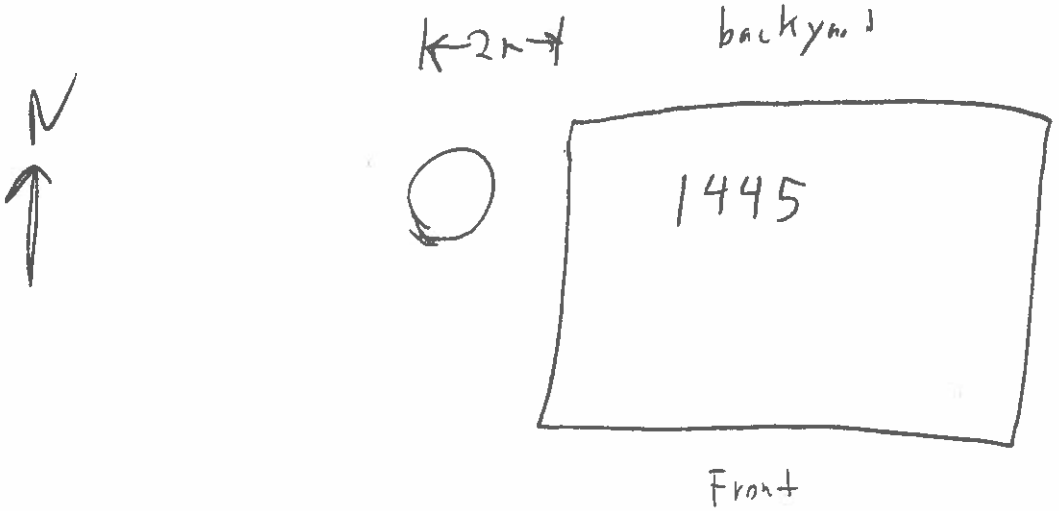
top of casing

Willing to allow sampling for analysis? YES ☑ NO ☐

COMMENTS

- Water was tested when moved in -Would like City Water
- The well was shocked twice
- The well was unsafe (high colliform bacteria counts) before moving into house

Inventoried By: BAV Date Completed: Nov. 13/97



* a drainage ditch had to be dug around property line before house could be approved for a mortgage in hope this would improve water quality

Sunnyside Road

Golder Associates Ltd.
500 Nottinghill Road
London, Ontario, Canada N6K 3P1
Telephone (519) 471-9600
Fax (519) 471-4707

WATER SUPPLY INVENTORY

REFERENCE No. 10

Project No: 971-3223 Project Name: Mt.Pleasant / Cemetery / London Date: November 13, 1997

GENERAL INFORMATION

Lot: _____ Concession: _____ Township: City of London County: Middlesex

Occupant: Alfred Thomas Phone: 472-7945 Postal Code: N6G 5B6

Address: 1550 Sunningdale Rd.

Current Owner: SUMC (12 years) Phone: _____ Postal Code: _____

Address: _____

Former Owner(s): Armstrong

WELL INFORMATION

Number of wells on property: 1 (if more than one, provide details of primary well below and other(s) on reverse)

M.O.E.E. Number: _____ Driller: _____ Year Constructed: _____

Location: (Sketch P.2) Backyard South of house

Type: Drilled ☑ Bored ☐ Dug ☐ Sand Point ☐ Cistern ☐ (Capacity: _____)

Casing Type: _____ Casing Size: _____ Total Well Depth: ≈ 50ft Depth to Water: _____

Well Deepened ☐ (When: _____) Well Cleaned ☐ (When: _____)

WATER INFORMATION

Water Source: Overburden ☐ Bedrock ☑ Rainwater ☐ Lake/River ☐ Purchased ☐ Municipal ☐

Water Quality:

Analytical Results: _____

Description (Taste, Odour, Clarity, Colour, Hardness, Staining, Corrosion, Etc.):

Good Water / No problems

Water Quantity:

No. Adults: 2 No. Children: 1 No. Washrooms: 1½ House Size: M

Washing Machine ☑ Dishwasher ☐ Other: _____

Livestock ☐ : Type and Number: _____

Outdoor Use ☐ : Garden ☑ Pool ☐ Watering ☑ Other: General Use (Drinking)

Partial Usage Only ☐ : Seasonal ☐ Drinking Only ☐ Livestock Only ☐ Other: _____

Water Quantity Problems ☐ : Water Level Dropped ☐ Water Shortage ☐ Well Gone Dry ☐

Describe Problem and Timing: Lots of water

Reference No. 10

WELL SYSTEM

Pump ☑ Type: Hand Pump ☐ Suction ☐ Jet ☐ Submersible ☐ Size: _____ Operational ☐

Location of Pump and/or Intake: basement

Softener ☑ Other Treatment: _____

MEASUREMENTS

Well Accessible ☐ Owner will make accessible ☐ Well Inaccessible ☑

Measured from: Ground Surface ☐ Top of: Casing ☐ Pit ☐ Vent ☐ (Dist. to Ground Surface: _____)

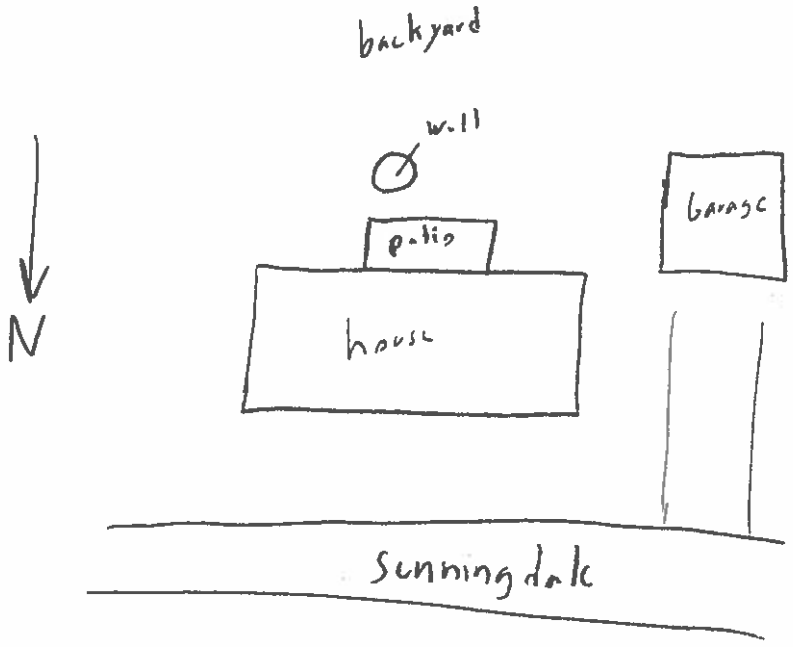
Water Level:	Date:	Well Depth:	Measured by:
_____	_____	_____	_____
_____	_____	_____	_____

Willing to allow sampling for analysis? YES ☑ NO ☐

COMMENTS

steel case well inside concrete casing, never has been able to open the well

Inventoried By: BAV Date Completed: Nov. 20/97



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London, Ontario, Canada N6K 3P1
Telephone (519) 471-9600
Fax (519) 471-4707

WATER SUPPLY INVENTORY

REFERENCE No. 12

Project No: 971-3223 Project Name: Mt Pleasant / Cemetery / London Date: November 13, 1997

* This survey was completed by Mrs. Verdi sister of Mrs. Vlasman

GENERAL INFORMATION

Lot: _____ Concession: _____ Township: City of London County: Middlesex

Occupant: Jon Vlasman Phone: 471-1407 Postal Code: N6G 5B7

Address: 1545 Sunningdale West

Current Owner: same Phone: _____ Postal Code: _____

Address: _____

Former Owner(s): 38 years

WELL INFORMATION

Number of wells on property: 1 (if more than one, provide details of primary well below and other(s) on reverse)

M.O.E.E. Number: _____ Driller: _____ Year Constructed: ≈32 years

Location: (Sketch P.2)

Type: Drilled ☑ Bored ☐ Dug ☐ Sand Point ☐ Cistern ☐ (Capacity: _____)

Casing Type: steel Casing Size: 6" Total Well Depth: ≈45' Depth to Water: _____

Well Deepened ☐ (When: _____) Well Cleaned ☐ (When: _____)

WATER INFORMATION

Water Source: Overburden ☐ Bedrock ☑ Rainwater ☐ Lake/River ☐ Purchased ☐ Municipal ☐

Water Quality:

Analytical Results: _____

Description (Taste, Odour, Clarity, Colour, Hardness, Staining, Corrosion, Etc.):

Good Water no problems

Water Quantity:

No. Adults: 2 No. Children: 3 No. Washrooms: 3 House Size: small

Washing Machine ☑ 2 Dishwasher ☑ Other: _____

Livestock ☐ : Type and Number: _____ General Use plus drinking

Outdoor Use ☐ : Garden ☑ Pool ☐ Watering ☑ Other: _____

Partial Usage Only ☐ : Seasonal ☐ Drinking Only ☐ Livestock Only ☐ Other: _____

Water Quantity Problems ☐ : Water Level Dropped ☐ Water Shortage ☐ Well Gone Dry ☐

Describe Problem and Timing: lots of water never has gone dry

GA WORK 04/05 Page 1 of

Reference No. 12

WELL SYSTEM

Pump ☑ Type: Hand Pump ☐ Suction ☐ Jet ☐ Submersible ☐ Size: _____ Operational ☑

Location of Pump and/or Intake: basement

Softener ☑ Other Treatment: _____

MEASUREMENTS

cannot open steel lid

Well Accessible ☑ Owner will make accessible ☐ Well Inaccessible ☐

Measured from: Ground Surface ☐ Top of: Casing ☐ Pit ☐ Vent ☐ (Dist. to Ground Surface: _____)

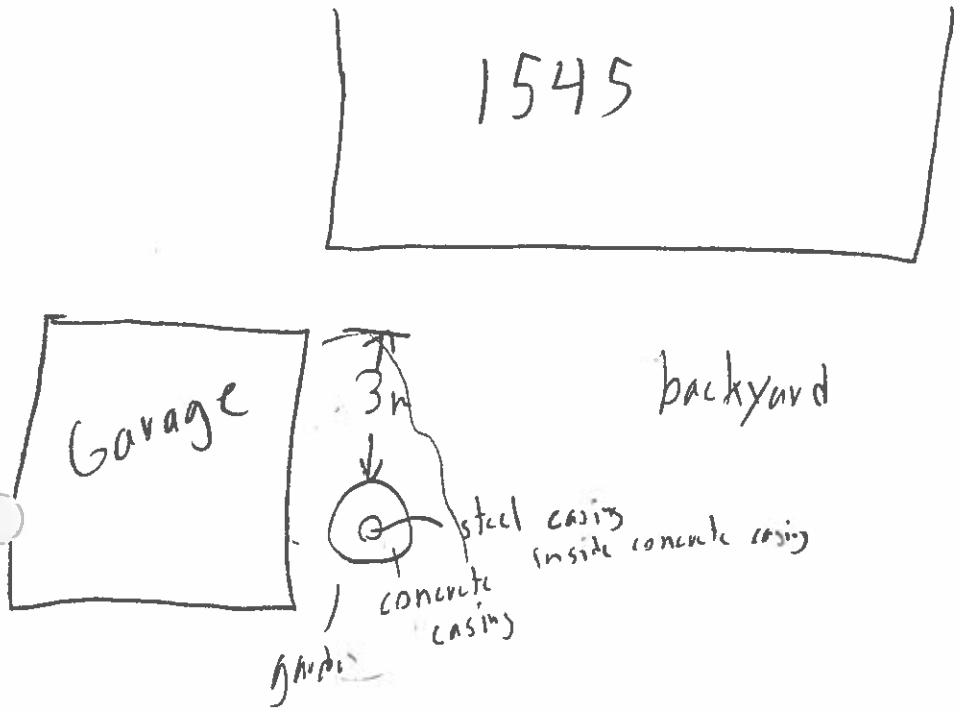
Water Level:	Date:	Well Depth:	Measured by:
_____	_____	_____	_____
_____	_____	_____	_____

Willing to allow sampling for analysis? YES ☑ NO ☐

COMMENTS

Inventoried By: BAV

Date Completed: Nov. 10



Golder Associates Ltd.
500 Nottinghill Road
London, Ontario, Canada N6K 3P1
Telephone (519) 471-9600
Fax (519) 471-4707

No record

WATER SUPPLY INVENTORY

REFERENCE No. 13

Project No: 971-3223 Project Name: Mt.Pleasant / Cemetery / London Date: November 13, 1997

GENERAL INFORMATION

Lot: _____ Concession: _____ ~~Township~~: City of London County: Middlesex

Occupant: Way Brian Phone: 473-4573 Postal Code: N6H 5K4

Address: 2545 Hyde Park Rd.

Current Owner: same (7 years) Phone: _____ Postal Code: _____

Address: _____

Former Owner(s): //

WELL INFORMATION

Number of wells on property: 1 (if more than one, provide details of primary well below and other(s) on reverse)

M.O.E.E. Number: _____ Driller: _____ Year Constructed: 20 years old

Location: (Sketch #2) North of House

Type: Drilled ☑ Bored ☐ Dug ☐ Sand Point ☐ Cistern ☐ (Capacity: _____)

Casing Type: Steel Casing Size: 6" dia Total Well Depth: dug well Depth to Water: _____

Well Deepened ☐ (When: _____) Well Cleaned ☐ (When: _____)

WATER INFORMATION

Water Source: Overburden ☐ Bedrock ☑ Rainwater ☐ Lake/River ☐ Purchased ☐ Municipal ☐

Water Quality:

Analytical Results: _____

Description (Taste, Odour, Clarity, Colour, Hardness, Staining, Corrosion, Etc.):

Good Water / However the water is Hard

Water Quantity:

No. Adults: 2 No. Children: / No. Washrooms: 3 House Size: M

Washing Machine ☑ Dishwasher ☑ Other: _____

Livestock ☐ : Type and Number: _____

Outdoor Use ☑ : Garden ☑ Pool ☐ Watering ☑ Other: General Use

Partial Usage Only ☐ : Seasonal ☐ Drinking Only ☐ Livestock Only ☐ Other: _____

Water Quantity Problems ☐ : Water Level Dropped ☐ Water Shortage ☐ Well Gone Dry ☐

Describe Problem and Timing: Lots of Water

Reference No. 13

WELL SYSTEM

Pump ☑ Type: Hand Pump ☐ Suction ☐ Jet ☐ Submersible ☐ Size: _____ Operational ☐

Location of Pump and/or Intake: _____

Softener ☑ Other Treatment: Iron Filter

MEASUREMENTS

Well Accessible ☑ Owner will make accessible ☑ Well Inaccessible ☐

Measured from: Ground Surface ☐ Top of: Casing ☐ Pit ☐ Vent ☐ (Dist. to Ground Surface: _____)

Water Level: _____ Date: _____ Well Depth: _____ Measured by: _____

_____ _____ _____ _____

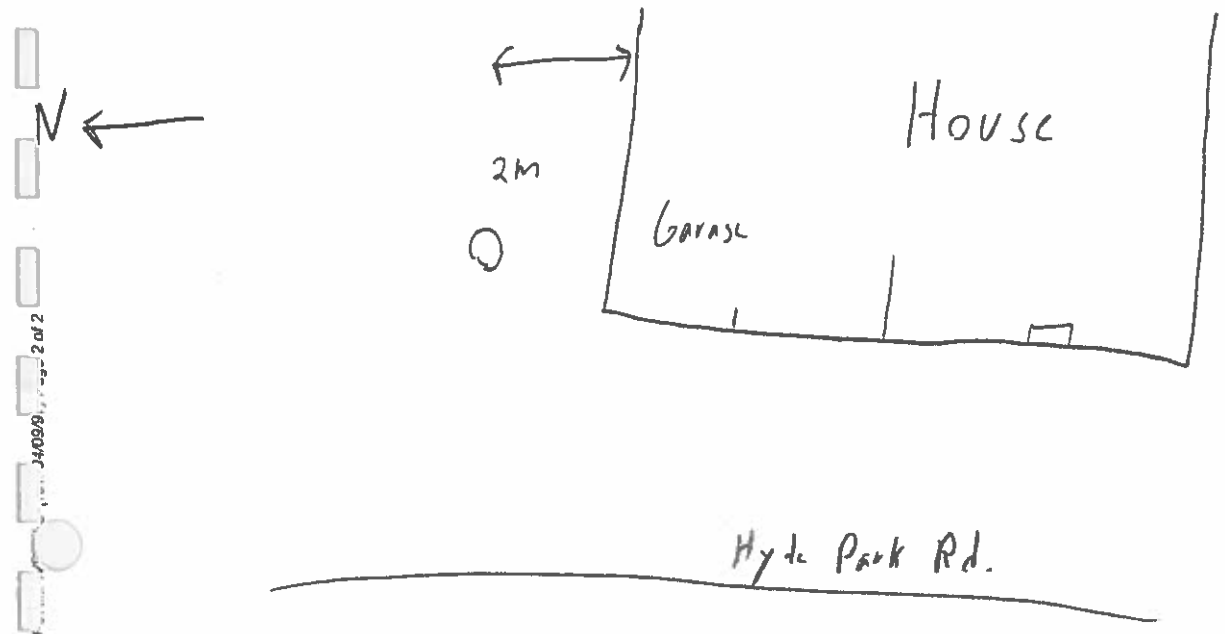
_____ _____ _____ _____

Willing to allow sampling for analysis? YES ☑ NO ☐

COMMENTS

- Concerned that the well may become contaminated
- Do not want the water quality to change

Inventoried By: B A V Date Completed: Nov. 15/96



Golder Associates Ltd.
500 Nottinghill Road
London, Ontario, Canada N6K 3P1
Telephone (519) 471-9600
Fax (519) 471-4707

No record
No well

WATER SUPPLY INVENTORY

REFERENCE No.

Project No: 971-3223 Project Name: Mt.Pleasant / Cemetery / London Date: November 13, 1997

GENERAL INFORMATION

2611 Hyde Park Rd.

Lot: _____ Concession: _____ Township: City of London County: Middlesex

Occupant: Barb Borrowman Phone: 471-2887 Postal Code: N6H 5K4

Address: 2611 Hyde Park

Current Owner: Same Phone: _____ Postal Code: _____

Address: _____

Former Owner(s): 25 years

WELL INFORMATION

Number of wells on property: 0 (if more than one, provide details of primary well below and other(s) on reverse)

M.O.E.E. Number: _____ Driller: _____ Year Constructed: _____

Location: (Sketch P.2) _____

Type: Drilled ☐ Bored ☐ Dug ☐ Sand Point ☐ Cistern ☐ (Capacity: _____)

Casing Type: _____ Casing Size: _____ Total Well Depth: _____ Depth to Water: _____

Well Deepened ☐ (When: _____) Well Cleaned ☐ (When: _____)

WATER INFORMATION

Water Source: Overburden ☐ Bedrock ☐ Rainwater ☐ Lake/River ☐ Purchased ☐ Municipal ☐

Water Quality: Water comes from a well at 2535 Hyde Park (piped)

Analytical Results: _____

Description (Taste, Odour, Clarity, Colour, Hardness, Staining, Corrosion, Etc.):

Sulphur Water / Rusty / Very Hard

Water Quantity:

No. Adults: 2 No. Children: 1 No. Washrooms: 1 House Size: Medium

Washing Machine ☑ Dishwasher ☒ Other: _____

Livestock ☒ : Type and Number: _____

Outdoor Use ☑ : Garden ☑ Pool ☐ Watering ☐ Other: General / Drinking

Partial Usage Only ☐ : Seasonal ☐ Drinking Only ☐ Livestock Only ☐ Other: _____

Water Quantity Problems ☐ : Water Level Dropped ☐ Water Shortage ☐ Well Gone Dry ☐

Describe Problem and Timing: always have plenty of water

Reference No. _____

WELL SYSTEM

Pump ☐ Type: Hand Pump ☐ Suction ☐ Jet ☐ Submersible ☐ Size: _____ Operational ☐

Location of Pump and/or Intake: _____

Softener ☐ Other Treatment: _____

MEASUREMENTS no well

Well Accessible ☐ Owner will make accessible ☐ Well Inaccessible ☐

Measured from: Ground Surface ☐ Top of: Casing ☐ Pit ☐ Vent ☐ (Dist. to Ground Surface: _____)

Water Level:	Date:	Well Depth:	Measured by:
_____	_____	_____	_____
_____	_____	_____	_____

Willing to allow sampling for analysis? YES ☑ NO ☐

COMMENTS

- Concerned about drinking contaminated water
- Will the cemetery affect the well water

* would like piped water

Inventoried By: Brian Vandergulik Date Completed: _____

(Jim)

* Mr. Borrowman – is familiar with the surface ground water flow (Walks and trains his dogs through the fields)

Golder Associates Ltd.
500 Nottinghill Road
London, Ontario, Canada N6K 3P1
Telephone (519) 471-9600
Fax (519) 471-4707

No water
No well

WATER SUPPLY INVENTORY

REFERENCE No.

Project No: 971-3223 Project Name: Mt.Pleasant / Cemetery / London Date: November 13, 1997

GENERAL INFORMATION

2631 Hyde Park Rd.

Lot: ____ Concession: ____ Township: City of London County: Middlesex

Occupant: None Phone: ____ Postal Code: N6H 5K4

Address: 2631 Hyde Park

Current Owner: Mt. Pleasant Cem Phone: ____ Postal Code: ____

Address: ____

Former Owner(s): ____

WELL INFORMATION

Number of wells on property: 0 (if more than one, provide details of primary well below and other(s) on reverse)

M.O.E.E. Number: ____ Driller: ____ Year Constructed: ____

Location: (Sketch P.2)

Type: Drilled ☐ Bored ☐ Dug ☐ Sand Point ☐ Cistern ☐ (Capacity: ____)

Casing Type: ____ Casing Size: ____ Total Well Depth: ____ Depth to Water: ____

Well Deepened ☐ (When: ____) Well Cleaned ☐ (When: ____)

WATER INFORMATION

Water Source: Overburden ☐ Bedrock ☐ Rainwater ☐ Lake/River ☐ Purchased ☐ Municipal ☐

Water Quality: Water comes from a well at 2535 Hyde Park (piped)

Analytical Results: ____

Description (Taste, Odour, Clarity, Colour, Hardness, Staining, Corrosion, Etc.):

Water Quantity:

No. Adults: ____ No. Children: ____ No. Washrooms: 1 House Size: Medium

Washing Machine Dishwasher Other: ____

Livestock : Type and Number: ____

Outdoor Use : Garden Pool ☐ Watering ☐ Other: ____

Partial Usage Only ☐ : Seasonal ☐ Drinking Only ☐ Livestock Only ☐ Other: ____

Water Quantity Problems ☐ : Water Level Dropped ☐ Water Shortage ☐ Well Gone Dry ☐

Describe Problem and Timing: ____

:LL SYSTEM

Pump ☐ Type: Hand Pump ☐ Suction ☐ Jet ☐ Submersible ☐ Size: _____ Operational ☐

Location of Pump and/or Intake: _____

Softener ☐ Other Treatment: _____

MEASUREMENTS no well

Well Accessible ☐ Owner will make accessible ☐ Well Inaccessible ☐

Measured from: Ground Surface ☐ Top of: Casing ☐ Pit ☐ Vent ☐ (Dist. to Ground Surface: _____)

Water Level:	Date:	Well Depth:	Measured by:
_____	_____	_____	_____
_____	_____	_____	_____

Willing to allow sampling for analysis? YES ☑ NO ☐

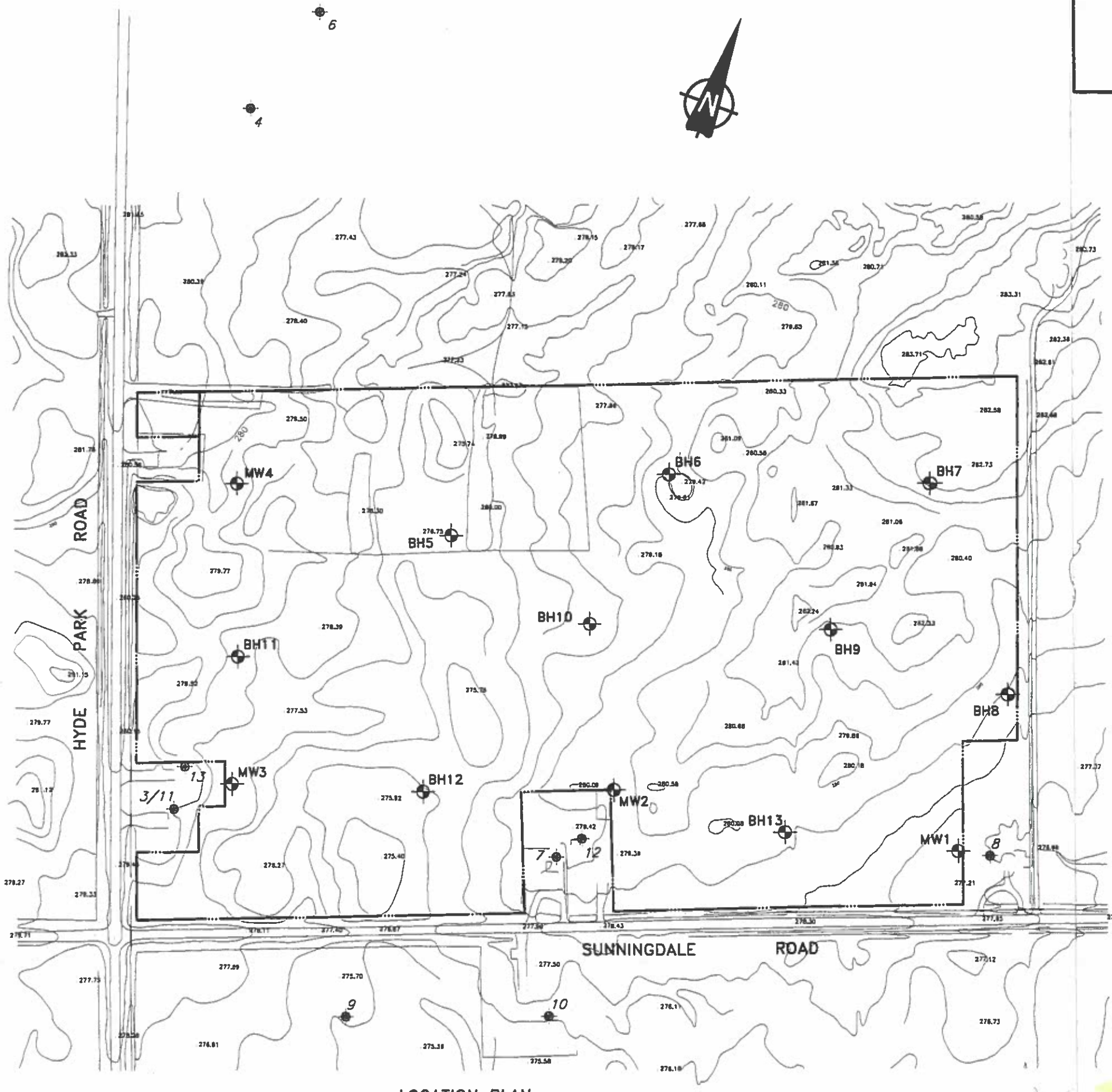
COMMENTS

Inventoried By: Brian Vandervalk Date Completed: _____

LOCATION PLAN

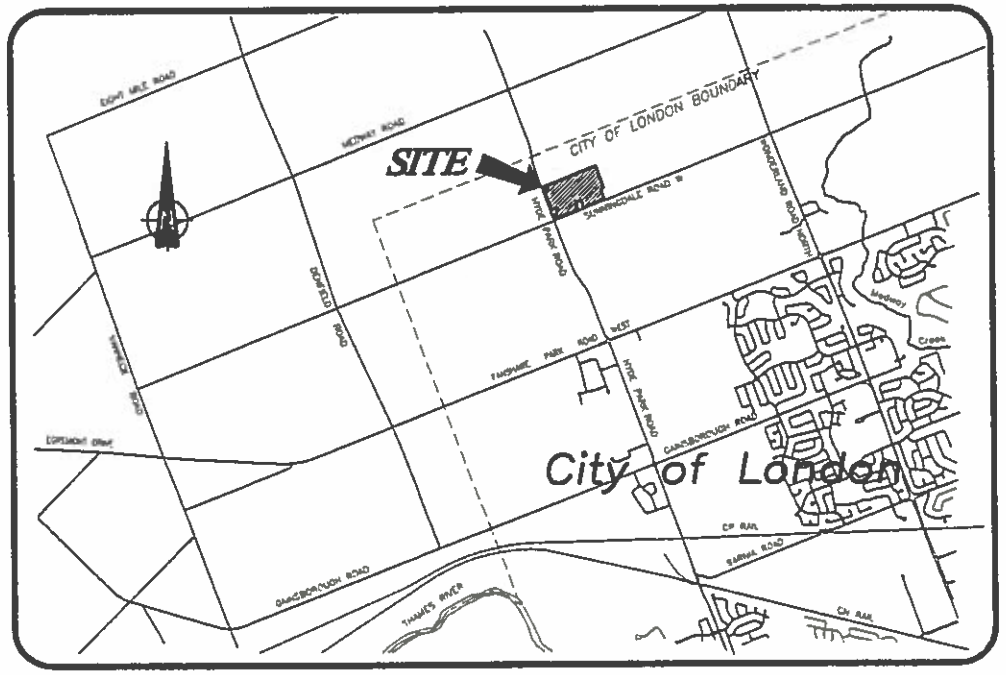
MT. PLEASANT CEMETERY, LONDON ONTARIO

FIGURE 1



LOCATION PLAN

SCALE: 1:3000



KEY PLAN

LEGEND

MW1 — BOREHOLE AND OR MONITORING WELL LOCATION

8 — DOMESTIC WATER WELL LOCATION & IDENTIFICATION
(Approximate Locations Only)

REFERENCE

PLAN SUPPLIED BY: CITY OF LONDON
ENTITLED: TOPOGRAPHICAL MAPPING

Date JUNE 24, 1998
Project 971-3223

Golder Associates
LONDON, ONTARIO, CANADA

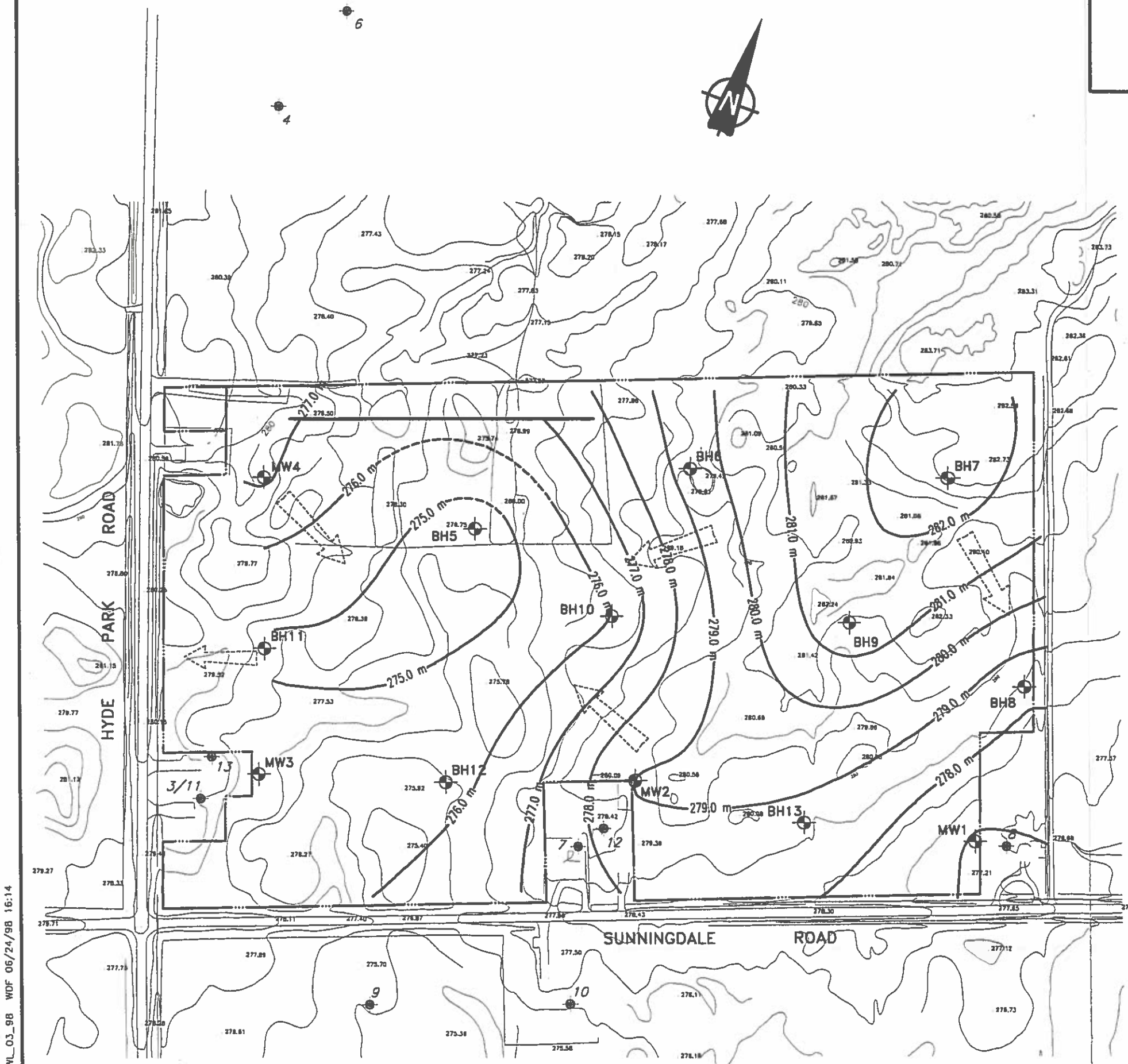
Drawn BG/WF
Chkd

D:\971-3223\SITE_PLN WDF 06/24/98 16:10

PIEZOMETRIC CONTOURS
MARCH 1998

MT. PLEASANT CEMETERY, LONDON ONTARIO

FIGURE 2



LOCATION PLAN

SCALE: 1:3000

LEGEND

MW1 – BOREHOLE AND OR MONITORING WELL LOCATION

281.0 m – INFERRED GROUNDWATER CONTOURS IN METRES (MAR. 30, 1998)

INFERRED GROUNDWATER FLOW DIRECTION

8 – DOMESTIC WATER WELL LOCATION & IDENTIFICATION
(Approximate Locations Only)

REFERENCE

PLAN SUPPLIED BY: CITY OF LONDON
ENTITLED: TOPOGRAPHICAL MAPPING

NOTE

THIS DRAWING IS APPROXIMATE ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT.

Date JUNE 24, 1998
Project 971-3223

Golder Associates
LONDON, ONTARIO, CANADA

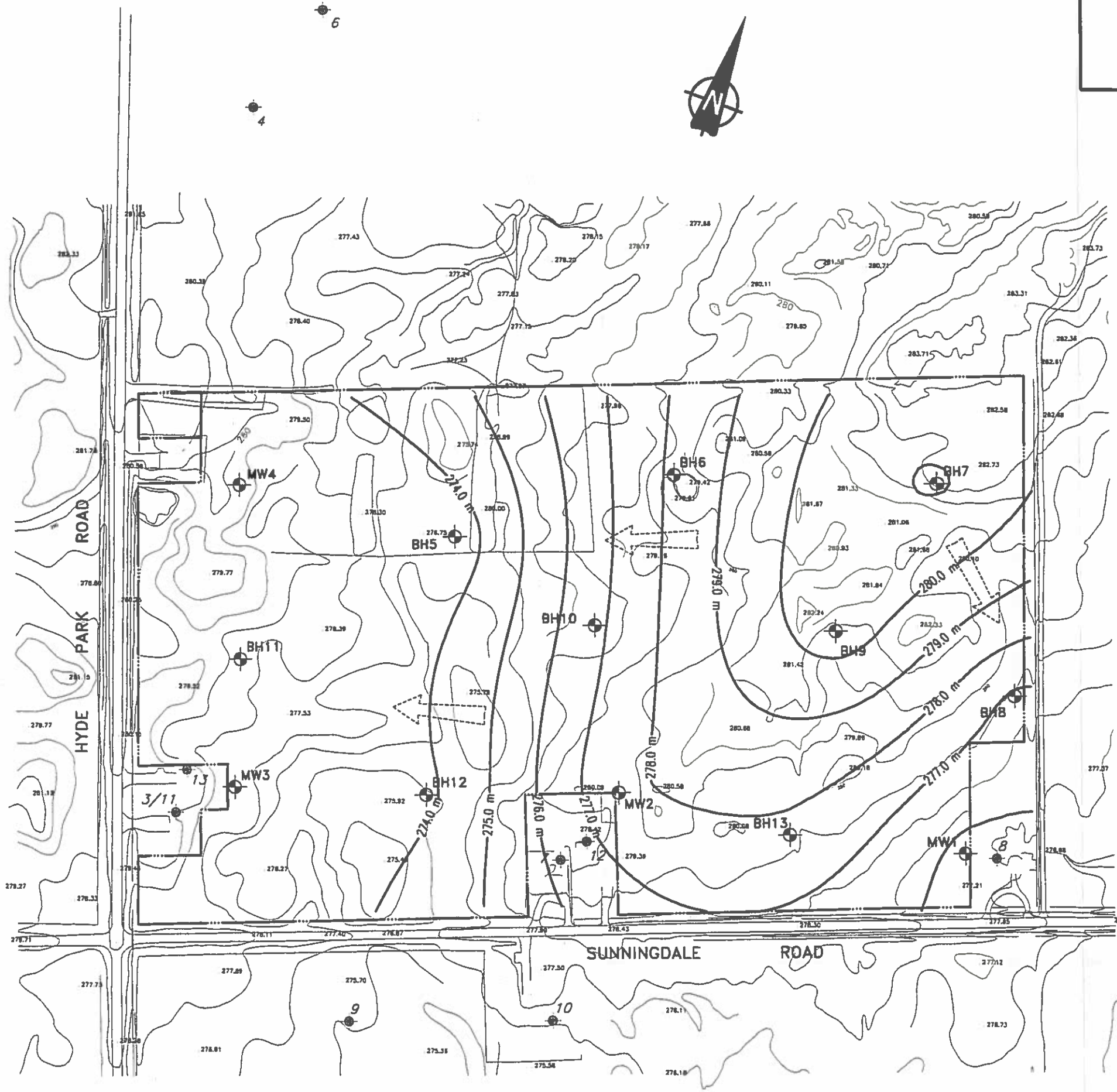
Drawn BG/WF
Chkd DB

D:\971-3223\WL_03_98 WDF 06/24/98 16:14

PIEZOMETRIC CONTOURS
JUNE 1998

MT. PLEASANT CEMETERY, LONDON ONTARIO

FIGURE 3



LOCATION PLAN

SCALE: 1:3000

LEGEND

MW1 — BOREHOLE AND OR MONITORING WELL LOCATION

281.0 m — INFERRED GROUNDWATER CONTOURS IN METRES (JUNE 13, 1998)

INFERRED GROUNDWATER FLOW DIRECTION

8 — DOMESTIC WATER WELL LOCATION & IDENTIFICATION
(Approximate Locations Only)

REFERENCE

PLAN SUPPLIED BY: CITY OF LONDON
ENTITLED: TOPOGRAPHICAL MAPPING

NOTE

THIS DRAWING IS APPROXIMATE ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT.

Date JUNE 24, 1998
Project 971-3223

Golder Associates
LONDON, ONTARIO, CANADA

Drawn BG/WF
Chkd

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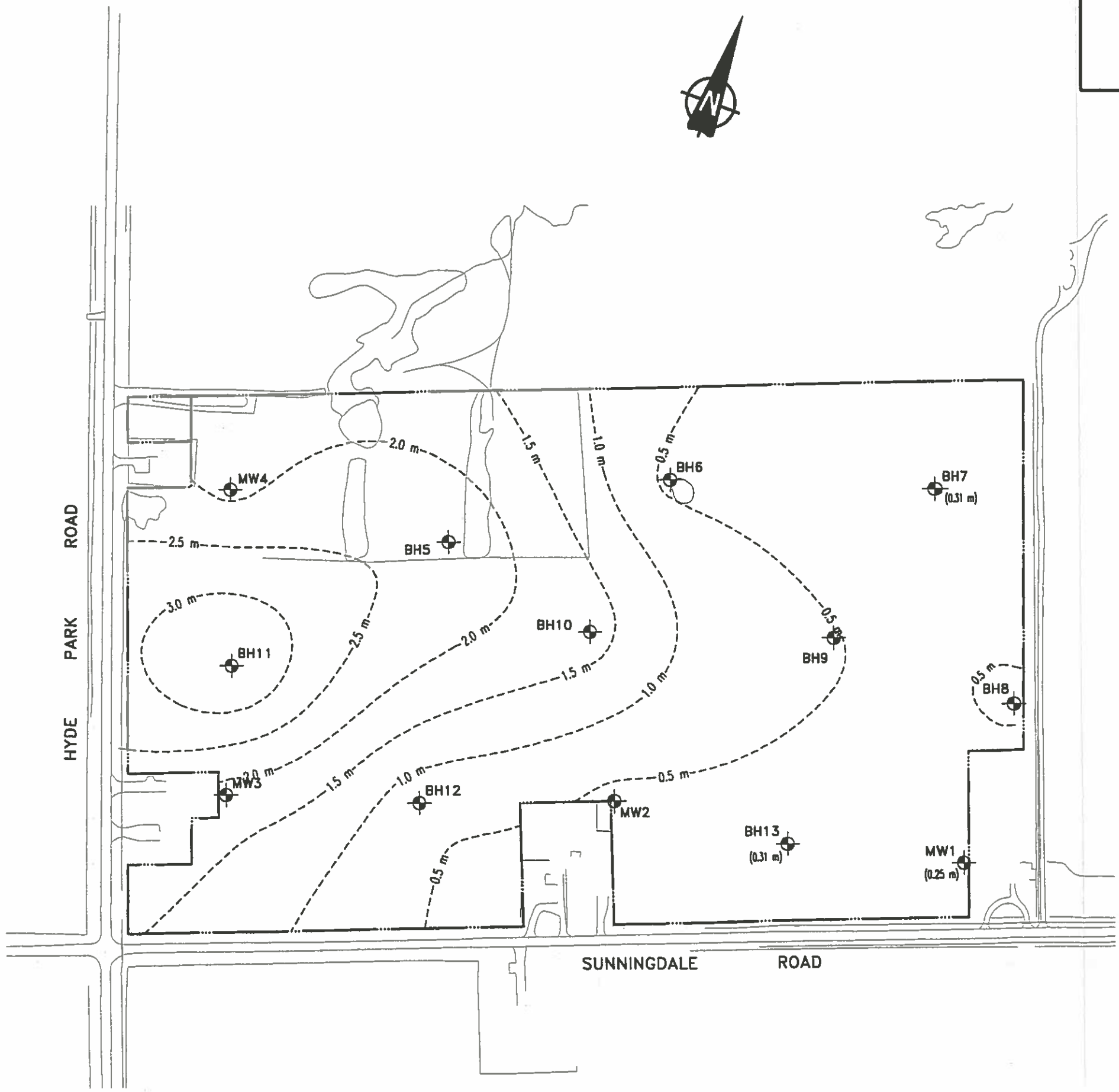
UNSATURATED SOIL DEPTH

MT. PLEASANT CEMETERY, LONDON ONTARIO

FIGURE 4



LEGEND

MW1 — BOREHOLE AND OR MONITORING WELL LOCATION

281.0 m — INFERRED UNSATURATED SOIL DEPTH CONTOUR (METRES – BASED ON MAR. 30, 1998 DATA)

REFERENCE

PLAN SUPPLIED BY: CITY OF LONDON
ENTITLED: TOPOGRAPHICAL MAPPING

NOTE

THIS DRAWING IS APPROXIMATE ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT.

LOCATION PLAN

SCALE: 1:3000

Date JUNE 25, 1998
Project 971-3223

Golder Associates
LONDON, ONTARIO, CANADA

Drawn BG/WF
Chkd DG

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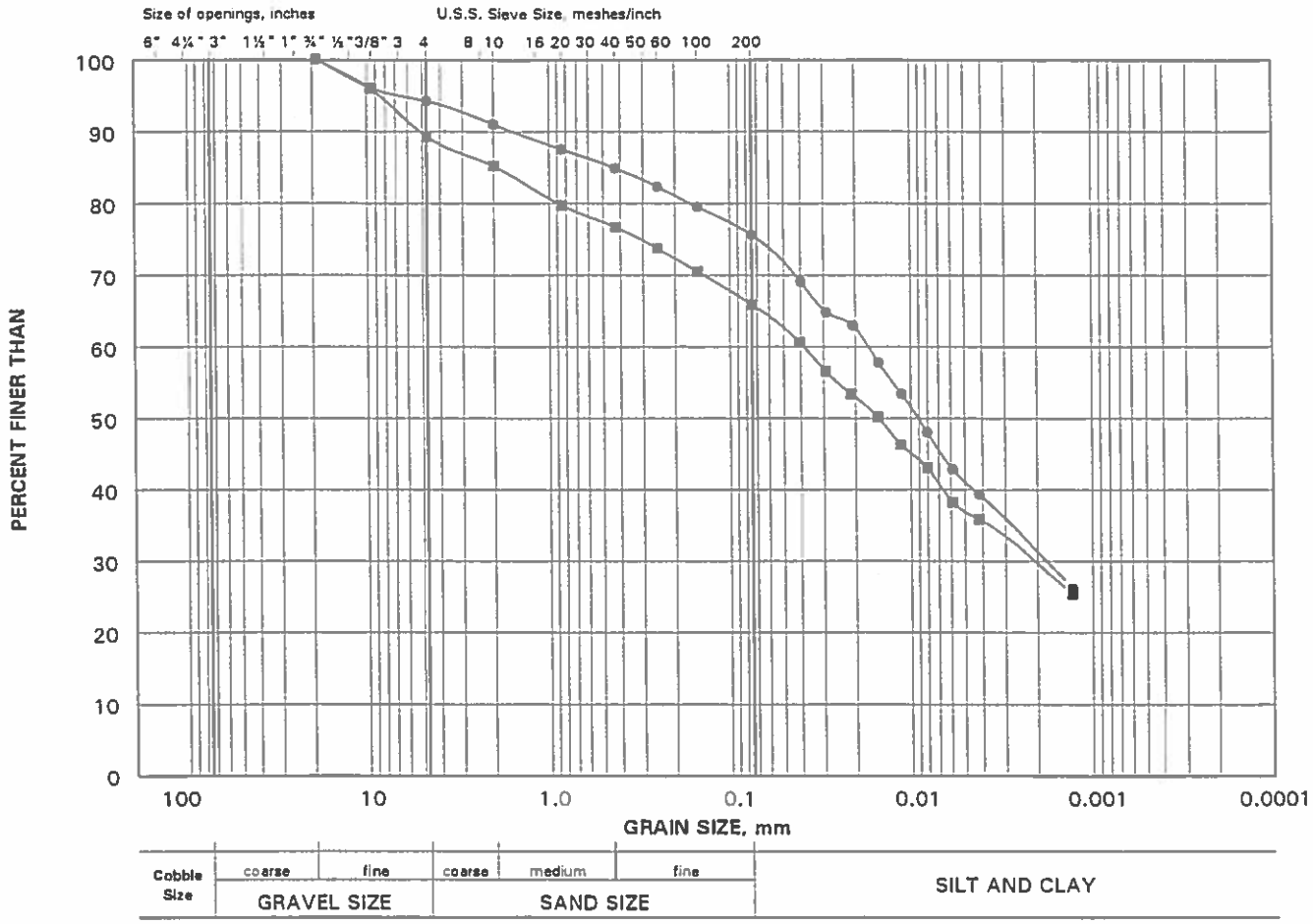
GRAIN SIZE DISTRIBUTION

FIGURE 5

CLAYEY SILT TILL



LEGEND				
SYMBOL	BOREHOLE	SAMPLE	ELEV.	(m)
●	3	6	273.67	
■	10	6	273.88	

ProGrain ver. 2.01

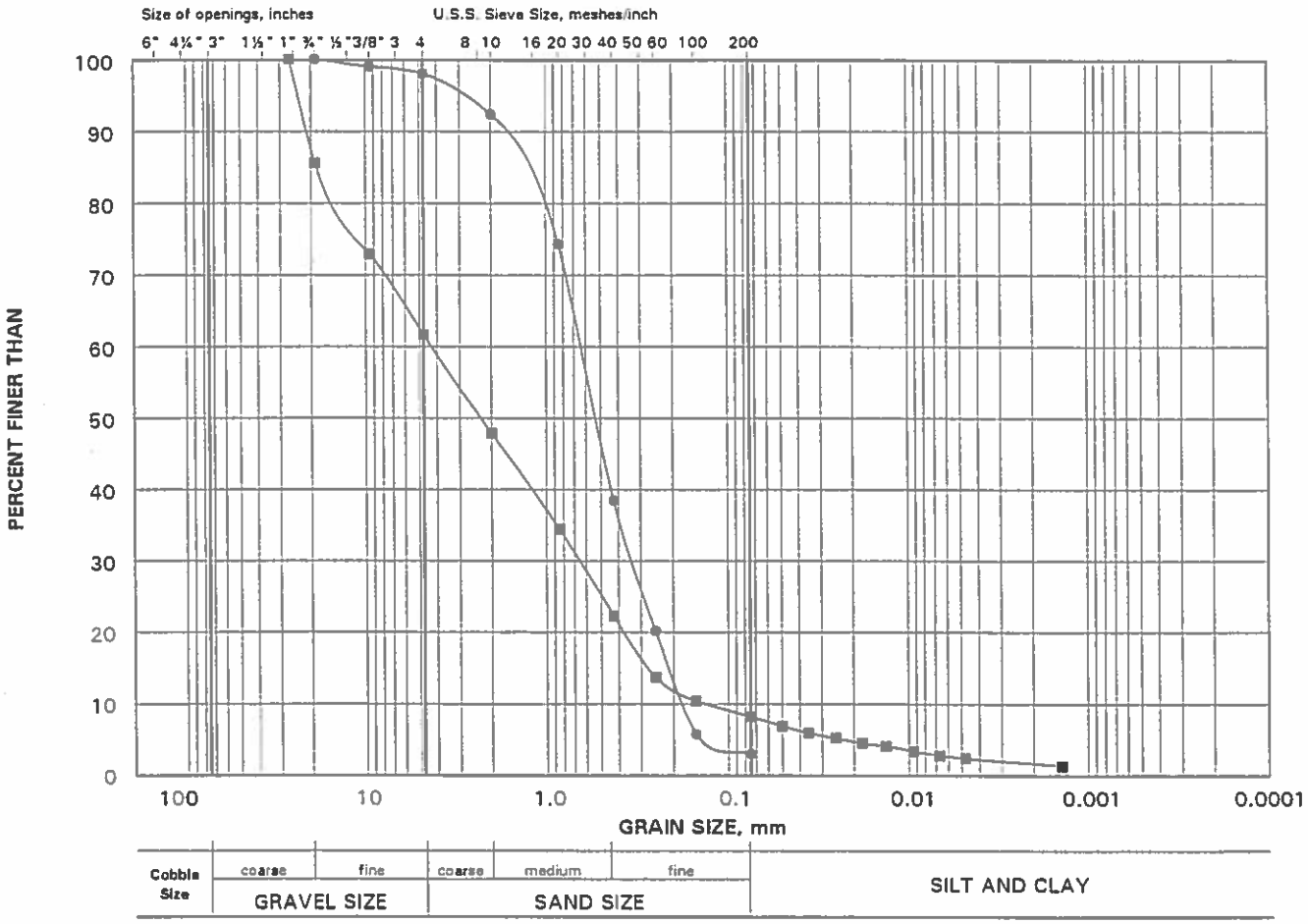
Project 971-3223

Golder Associates

GRAIN SIZE DISTRIBUTION

FIGURE 6

SAND & GRAVEL



LEGEND				
SYMBOL	BOREHOLE	SAMPLE	ELEV.	(m)
●	3	9	271.38	
■	4	10	272.12	

ProGrain ver. 2.01

Project 971-3223

Golder Associates

Hydrogeological Assessment

FINAL REPORT

Auburn Developments Inc.

Project Name:
Mount Pleasant Lands
2631 Hyde Park Road & 1521 Sunningdale Road West
London, Ontario

Project Number:
LON-00017696-HG

Prepared By:
EXP Services Inc.
15701 Robin's Hill Road
London, Ontario, N5V 0A5
t: +1.519.963.3000
f: +1.519.963.1152

Date Submitted:
October 22, 2021

Hydrogeological Assessment

Auburn Developments Inc.

Type of Document:

Final Report

Project Name:

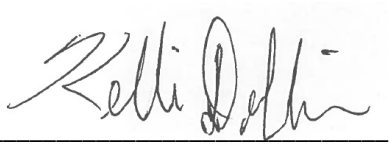
Mount Pleasant Lands
2361 Hyde Park Road & 1521 Sunningdale Road West
London, Ontario

Project Number:

LON-00017696-HG

Prepared and Reviewed By:

EXP Services Inc.
15701 Robins Hill Road
London, ON, N5V 0A5
Canada
t: +1.519.963.3000
f: +1.519.963.1152



Kelli Dobbin, B.Sc., G.I.T.
Earth and Environment

Heather Jaggard, M.Sc., P.Geo.
Hydrogeologist, Earth and Environment

Date Submitted:

October 22, 2021

Executive Summary

EXP Services Inc. (EXP) was retained by **Auburn Developments Inc.** to conduct a hydrogeological assessment of the proposed residential development to be located at 2631 Hyde Park Road and 1521 Sunningdale Road West in London, Ontario, hereinafter referred to as the 'Site'.

The objective of the hydrogeological assessment was to examine the hydrogeological characteristics of the Site by reviewing the Ministry of the Environment, Conservation and Parks (MECP) Water Well Records (WWR), reviewing the soils and groundwater information provided from a series of sampled boreholes and monitoring wells at the Site, compiling a site wide water balance, collecting multiple months of groundwater elevations to identify any seasonal variations, and assess the natural heritage features on the property. It is understood that the hydrogeological assessment will be submitted for review and approval by the City of London and the Upper Thames River Conservation Authority (UTRCA).

Based on the results of the hydrogeological assessment, the following findings are presented:

- A subwatershed divide is present across the north portion of the Site. The north part of the Site is within the Oxbow Creek subwatershed and the south part is within the Medway Creek subwatershed;

- An Unevaluated Wetland (UW) is present along the north edge of the Site and primarily located on the adjacent property to the north, as classified by the City of London in Natural Heritage Map 5. Another UW is located immediately north of the northeast corner of the Site. An area encompassing both the UWs is considered regulated lands of the UTRCA;

- The Site is largely covered with a low-permeability clayey silt till with silty sand/sandy silt/silt present at surface in some areas. Underlying the till in some areas is sand/sand and gravel at varying depths and thicknesses;

- Through review of UTRCA online mapping software, the Site is not within a wellhead protection area. A small portion of the Site along the east edge is mapped as being within a significant groundwater recharge area (SGRA) and a highly vulnerable aquifer (HVA), however the coarse-textured deposits that are mapped to be present on this area were not identified during the detailed borehole drilling and infiltration testing programs in this area. Therefore, we have concluded that the Site is **not** within a SGRA or HVA;

- A total of nineteen (19) domestic groundwater supply wells are located within a 500 m radius of the Site. These wells were generally installed into intermediate and deep sand/sand and gravel overburden or into bedrock, with depths ranging from 8.5 to 66 mbgs. The one (1) well installed to a depth of <10 mbgs is installed in clay and not expected to be impacted by Site development;

- Two (2) grain size analyses were carried out on samples of the sand and sandy silt. The estimated hydraulic conductivity of the sand was 3.1 x 10^{-5} m/s and of the sandy silt was 7.2 x 10^{-7} m/s based on the test results;

- Infiltration testing was completed in the surficial clayey silt till at four (4) locations across the Site and resulted in an average hydraulic conductivity of 1.26 x 10^{-7} m/s. Factored infiltration rates were found to range from 1.6 to 2.6 mm/hour;

- Surface drainage follows Site topography and is divided between north and south, following the subwatershed divide. The Unevaluated Wetlands are part of the Oxbow subwatershed and are identified to drain to the north;

- A wetland risk assessment has been completed for the UW and indicates that it has a low magnitude of potential hydrologic change;

- The monitoring wells on Site have been maintained for ongoing study past the completion of this report. When the wells are no longer required, they should be decommissioned in accordance with O. Reg. 903;

- Groundwater is found with 1 to 5 meters below ground surface across most of the Site. In particular, shallower conditions are found in the southern portion of the Site

- During construction, short term dewatering of the shallow groundwater may be necessary, where excavations crossing the shallow groundwater require construction dewatering, particularly near the south edge of the Site where groundwater is found closest to surface. Based on the low hydraulic conductivity of the native till soils, it is not anticipated that a dewatering permit will be required;

- Water balance calculations are provided, however as the development plan for the Site has not been finalized, the water balance calculations only represent a preliminary evaluation of the runoff and infiltration conditions expected under post development conditions. Once the development plan has been finalized, it is recommended that the water balance be re-evaluated and considered to assist with storm water management and the requirement for secondary infiltration and Low Impact Design (LID) techniques.

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Appendices

Tables (in text)

Drawings (Appendix A)

1. Introduction and Background

1.1 Background

EXP Services Inc. (EXP) was retained by **Auburn Developments Inc.** to conduct a hydrogeological study and water balance assessment relating to the proposed residential subdivision development to be located at 2631 Hyde Park Road and 1521 Sunningdale Road West in London, Ontario, hereinafter referred to as the 'Site' (**Appendix A, Drawing 1**). The draft plan for the Site is currently proposed to include a combination of low/medium density and multi-family residential buildings, as well as a park space and a school. The current draft plan is included in **Appendix B**. The subdivision will have complete municipal servicing and will be accessed with paved neighbourhood streets.

The objective of the hydrogeological study was to examine the hydrogeological characteristics of the Site by reviewing the Ministry of the Environment, Conservation and Parks (MECP) Water Well Records (WWR), reviewing the soil and groundwater information provided from a series of sampled boreholes and monitoring wells at the Site, compiling a Site wide water balance, collecting multiple months of groundwater elevations to identify any seasonal variations; and assess the natural heritage features on the property. The assessment provides comments pertaining to potential impacts on hydrogeological conditions at the Site and provides recommendations and design/construction measures, where applicable, to mitigate this potential for impact.

It is understood that the hydrogeological study and water balance assessment will be submitted for review and approval by the City of London and the Upper Thames River Conservation Authority (UTRCA) as part of the Draft Plan Approval for the proposed development. The study design and report have been compiled in accordance with the City of London Design Specification & Requirements Manual (2019) as well as the Conservation Authority Guidelines for Hydrogeological Assessments (2013). A pre-consultation meeting was held between The City of London and UTRCA staff on January 21, 2021 where the scope of this study was discussed and confirmed.

Two Unevaluated Wetlands (UW) are located along the north edge of the Site and primarily reside on the adjacent property to the north, as shown on **Drawing 2**. The eastern UW is entirely on the property to the north, just touching the Site boundary, and the western UW extends onto the Site in the northwest. These natural features have been assessed based on their impact to, and dependence on, groundwater resources on the Site.

The UTRCA administers a regulation made under Section 28 of the Conservation Authorities Act, known as Development, Interference with Wetlands and Alterations to Shorelines and Watercourses (O.Reg. 157/06). The regulation was approved by the Minister of Natural Resources and Forestry on May 4, 2006. This regulation allows the UTRCA to ensure that proposed development and other activities have regard for natural hazard features. The UTRCA implements the regulation by issuing Section 28 permits for works in or near watercourses, valleys, wetlands, or shorelines, when required.

Property owners must obtain permission and/or a letter of clearance from the local Conservation Authority before beginning any development, site alteration, construction, or placement of fill within the regulated area. Permits are also required for any wetland interference, or for altering, straightening, diverting or interfering in any way with the existing channel of a creek, stream or river. It is EXP's understanding that the Site is subject to this regulation, and required a Section 28 permit, as the Site contains wetland features.

1.2 Terms of Reference and Scope of Work

The hydrogeological assessment was generally completed in accordance with the scope of work outlined through email correspondence. Authorization to proceed with this investigation was received from Mr. Stephen Stapleton of **Auburn Developments Inc**. A scoping meeting was held with the UTRCA and the City of London on January 21, 2021. An updated scope of work was sent to Mr. Stephen Stapleton by email on February 2, 2021.

The purpose of the 2021 assessment was to further examine the natural heritage features on the Site by installing a new piezometer and staff gauge in the unevaluated wetland (**Drawing 2**) and to continue monitoring groundwater and surface water conditions on the Site. Subsoil and groundwater information from the Preliminary Geotechnical and Hydrogeological Investigation prepared by EXP in February 2020 was used to assist in the preparation of this report.

The scope of work for the 2021 Hydrogeological Assessment consisted of the following tasks:

1. Desktop Study: This task consisted of a review of existing information including Site plans, previous reports, geological maps, geological cross sections, groundwater level information, borehole logs, and MECP water well records (WWR).

   EXP completed a review of the previous EXP Hydrogeological Investigation (EXP, 2019) and the Preliminary Geotechnical and Hydrogeological Investigation completed at the Site in 2020 (EXP, 2020). A previous hydrogeological investigation was also completed by Golder Associates (Golder, 1998) for the Site. Relevant details from these investigations are provided in this report, where applicable.

2. Field Program: As part of the Preliminary Geotechnical and Hydrogeological Investigation completed in 2020 (EXP, 2020), a total of six (6) boreholes were advanced with monitoring wells installed in four (4) of the boreholes (BH102/MW, BH103/MW, BH104/MW and BH105/MW). These monitoring wells were used as part of this 2021 monitoring program. Water levels were collected from the monitoring wells for six (6) months in 2020 (January to June 2020) and from February to September 2021 to identify seasonal fluctuations in the groundwater elevations and the hydroperiod of the wetland.

   In addition, a piezometer (P-101) was installed in the wetland feature in the northwest portion of the Site during the 2020 investigation. This piezometer was monitored for six (6) months from January to June 2020. For the 2021 investigation, this piezometer was re-installed into the wetland feature along with a staff gauge to monitor surface water elevations from February to September 2021.

   As part of the 2021 field study, infiltration testing was also completed in select areas across the Site. Water levels were measured, groundwater and surface water samples were collected, and dataloggers were installed in select wells for the purposes of characterizing the hydrogeological conditions at the Site.

3. Data Evaluation: Evaluation of the available field and laboratory data, assessment of the dewatering requirements and potential dewatering effects on the surrounding environment, as applicable.

4. Water Balance: Preparation of a water balance assessment of the subject Site evaluating pre- and post-development conditions based on the current development plan.

5. Reporting: This task consisted of preparing this hydrogeological assessment report. In preparing this report, EXP has considered the guidance material available in the Conservation Ontario Guidelines for Hydrogeological Assessments (Conservation Ontario, 2013) and City of London Design Specification & Requirements Manual (2019).

Reference is made to **Appendix J** of this report, which contains further information necessary for the proper interpretation and use of this report.

1.3 Previous Studies

A Hydrogeological Investigation was completed in 1998 by Golder Associates (Golder, 1998) for the property at 1521 Sunningdale Road West in London, Ontario. A brief overview of the work completed, and the findings is provided here.

- Eighteen (18) groundwater monitoring wells and piezometers installed across the Site including nested wells in five (5) locations - none in the Unevaluated Wetland (UW);
- Groundwater monitoring from November 1997 to June 1998;
- Groundwater samples collected from four (4) wells – no surface water samples collected from the UW;
- Groundwater exceedances for hardness and turbidity in all sampled wells, manganese in shallow sampled wells, and aluminum in MW4-D;
- Door-to-door well survey for residences immediately adjacent to the Site;
- Groundwater found to be high in the east end of the Site and deepens to the west;
- Groundwater elevations increased from January to March 1998 and decreased from March to June 1998;
- Consistent downward vertical hydraulic gradient at nested wells;
- Shallow groundwater flow generally mirrors topography with a major westerly component;
- Deep groundwater flow is consistently northwest;
- Estimated hydraulic conductivity for shallow soils is 10^{-5} cm/s and for deeper aquifers is 10^{-2} cm/s; and,
- Majority of the Site has low permeable surface soils such as clay and silt with a few isolated areas of more permeable silty sand.

A preliminary Geotechnical and Hydrogeological Investigation was completed by EXP for the Site (EXP, 2020). A brief overview of the work completed, and the findings is provided here.

- Six (6) boreholes advanced with monitoring wells installed in four (4) boreholes;
- One (1) piezometer manually installed in the unevaluated wetland (UW) located on the Site;
- Grain size analysis of two (2) samples collected during drilling;
- Groundwater monitoring in EXP wells and remaining three (3) nested well sets from Golder investigation indicated groundwater flow is generally to the west but highly influenced by localized topographic variation;
- Groundwater measured between 0.40 and 7.22 m below ground surface (mbgs) and between 271.66 and 277.73 m above sea level (mASL);
- Review of MECP well records within a 500m radius of the Site was completed;
- One (1) shallow domestic well identified within 500 m of the Site. Well record indicates clay from surface and it is believed to have been decommissioned;
- No anticipated impact on nearby wells due to their depth;
- Overburden soils noted in well records are generally clay with intermediate and deep sand/sand and gravel layers;

- Significant groundwater infiltration may be anticipated for excavations extending below elevations of 271.66 to 277.73 mASL and dewatering may be required;
- Hydraulic conductivity estimated to be 3.0×10^{-2} cm/s for sand and gravel, 3.1×10^{-3} cm/s for sand, 7.2×10^{-5} cm/s for sandy silt, and 9.0×10^{-8} cm/s for clayey silt till;
- Near surface soils in some test hole locations have potential for use in LID stormwater management design;
- Eastern edge of Site is mapped within a Significant Groundwater Recharge Area (SGRA) and Highly Vulnerable Aquifer (HVA) however Site investigations did not identify coarse-textured deposits in this area; and,
- UW in northwest of Site does not appear to be sourced from groundwater;

Information from these investigations has been utilized throughout this report where applicable.

2. Methodology

A drilling program was completed by EXP in January 2020 as part of the preliminary Geotechnical and Hydrogeological Investigation for the Site (EXP, 2020). The drilling program included completion of six (6) boreholes across the Site with installation of monitoring wells in four (4) boreholes (BH102/MW, BH103/MW, BH104/MW, and BH105/MW). Borehole drilling and monitoring well installation was completed from January 21st to 23rd, 2020 under the technical supervision of EXP. Boreholes were advanced to depths ranging from 3.7 to 8.5 m below grade.

The boreholes were completed using a track-mounted drill rig and standard 21 cm (8") OD continuous flight solid and hollow stem auger drilling techniques with split spoon sampling. During the drilling, the stratigraphy in the boreholes was examined and logged in the field by EXP technical personnel. Representative samples of the soils found in the boreholes were submitted for laboratory testing that included moisture content and gradation. Copies of the field borehole logs are provided in **Appendix C**. Copies of the soil gradation analyses are included in **Appendix D**.

Four (4) groundwater monitoring wells were installed within the clayey silt till or the underlying sandy material. All wells were constructed from 5.1 cm (2") diameter, schedule 40, polyvinyl chloride (PVC), flush-threaded casing. The appropriate number of risers were coupled with screen sections via threaded joints to construct the well. The well screens consisted of PVC pipe with 0.010-inch factory-generated slots. A summary of the well installation details is provided in **Table 1**, with the well locations shown in **Drawing 2**.

A primary filter pack consisting of Silica Sand was placed around the well screen in the borehole and extended above the top of the well screen. Hole Plug, a swelling Bentonite clay that forms an effective barrier to the vertical movement of fluids when installed in a borehole, was used as a seal above the filter pack.

A previous study was carried out at the Site by Golder Associates Ltd. (Golder) in 1997 to 1998 and included the advancement of thirteen (13) boreholes with nested well sets installed in five (5) of the locations. The remaining locations had piezometers installed upon completion. During EXP's Site visit on January 6, 2020, it was noted that nested wells MW1, MW3 and MW4 were still functional. All other wells and piezometers were either missing or destroyed. The remaining functioning Golder 1998 wells have been included in **Table 1**.

Table 1 – Monitoring Well Construction Details

Well ID	Ground Surface Elevation (m AMSL)	Completion Depth (m bgs)	Screen Length (m)	Screened Strata
BH102/MW	282.88	7.62	1.52	Clayey Silt Till
BH103/MW	276.50	6.10	1.52	Sand; Clayey Silt Till
BH104/MW	278.37	7.62	1.52	Clayey Silt Till
BH105/MW	276.96	6.10	1.52	Sandy Silt; Sand and Gravel
MW1S (Golder)	277.12	3.7	1.52	Clayey Silt Till
MW1D (Golder)	277.12	8.2	1.52	Clayey Silt Till
MW3S (Golder)	277.48	5.2	1.52	Silt; Clayey Silt
MW3D (Golder)	277.48	8.2	1.52	Silty Clay
MW4S (Golder)	278.98	4.9	1.52	Clayey Silt; Sand
MW4D (Golder)	278.98	8.5	1.52	Sand

Notes: 1. m AMSL denotes metres above mean sea level.
2. m bgs denotes metres below ground surface.

2.1 Piezometer and Staff Gauge Installation

One (1) shallow groundwater piezometer was installed on January 31, 2020 in the Unevaluated Wetland (UW) in the northwest area of the Site (P-101). This piezometer was used for monitoring until June 2020, and was then removed.

Following consultation with the Upper Thames River Conservation Authority (UTRCA) in January 2021, the piezometer P-101 was re-installed in the UW, and a staff gauge was also installed adjacent to the piezometer (SG1) to capture monthly surface water elevations. The locations are shown on **Drawing 2**. The following **Table 2** outlines the piezometer construction details.

The piezometer was installed with a 6-inch Solinst drive point end (6-inch screen length). The Solinst drive point piezometer end has a stainless steel, 50 mesh cylindrical filter screen, within a ¾" (20mm) stainless steel drive-point body.

Table 2 – Surface Water Station Details

Station ID	Piezometer ID	Ground Surface Elevation (m AMSL)	Top of Piezometer Elevation (m AMSL)	Completion Depth (m bgs)	Screen Length (m)	Staff Gauge Installed
Station 1	**P-101**	275.91	277.43	0.82	0.15	Yes (SG1) in February 2021

Notes: 1. m AMSL denotes metres above mean sea level.
2. m bgs denotes metres below ground surface.

2.2 Well Development and Groundwater Sampling

Monitoring wells were developed after installation. The wells were developed to:

- remove fine soil particles adjacent to the well screen that may otherwise interfere with water quality analyses;
- restore the groundwater properties that may have been disturbed during the drilling process;
- improve the hydraulic communication between the well and the geologic materials; and,
- remove water, if any, added during the drilling process.

Wells were generally developed by removing a minimum of ten times the volume of water contained in the well casing (casing volume) where possible using rigid high-density polyethylene (HDPE) tubing fitted with Waterra™ inertial pumps.

Groundwater samples were collected for analysis of groundwater quality. Samples were collected from select monitoring wells on March 24, 2021 to establish baseline water quality.

Prior to collecting groundwater samples for chemical analysis during each sampling event, the stagnant water in the well was purged to allow groundwater representative of the aquifer to enter the well. A minimum of three casing volumes of water was removed ("purged") from each well immediately prior to sampling.

Monitoring wells were purged using either a peristaltic pump or rigid high-density polyethylene (HDPE) tubing fitted with Waterra™ inertial pumps that are dedicated to each monitoring well. Water samples were collected by direct transfer of groundwater from the Waterra™ pumping system to appropriate pre-labelled containers, with filtering and preservation as appropriate, before submission to Bureau Veritas Laboratories in London, ON for chemical analysis. The samples were submitted for laboratory analysis of dissolved metals, cations and anions, nitrogen species (nitrate, nitrite, and ammonia), phosphate and chloride.

2.3 Surface Water Sampling

Surface water sampling was completed at Station 1 within the UW in order to establish baseline surface water quality. The surface water sample was collected on March 24th, 2021. The sample was submitted for laboratory analysis of

total and dissolved metals, cations and anions, nitrogen species (nitrate, nitrite, and ammonia), phosphate and chloride.

2.4 Long-Term Groundwater Elevation Monitoring

Water level monitoring in all initial wells was completed monthly by Golder from November 1997 to June 1998. Water level monitoring in all remaining Golder wells and new EXP monitoring wells and piezometer installed on Site was completed monthly from January 2020 to June 2020 and again from February 2021 to September 2021. Monitoring well BH102/MW was found to be damaged in February 2021 and has not been replaced. Measurements were manually collected using a battery-signal water level tape.

Water level dataloggers were installed in monitoring wells MW3-S, MW4, BH103/MW and BH104/MW, as well as in piezometer P-101 to assist in the evaluation of groundwater elevations and influence of precipitation on groundwater levels. The water level dataloggers were installed on February 26, 2021 and remained in place for continued monitoring until September 2021. Water level measurements were automatically collected every 24 hours from the dataloggers.

2.5 Hydraulic Conductivity Testing

Hydraulic conductivity estimates for the soils were determined using a calculated estimation of hydraulic conductivity based on soil sample particle size analysis using the Beyer method.

A total of two (2) soil samples were selected for grain size distribution analysis testing. Due to the nature of the Site soils, estimated hydraulic conductivity (K) values were determined using the methodologies derived by Beyer et al. The Beyer method of correlating the grain size distribution analysis to the soil hydraulic conductivity is based on the following relationship:

$$K\ (cm/s) = 0.45 \times \log\left(500 \times \frac{D10}{D60}\right) D10^{2}$$

Additional hydraulic conductivity estimates were obtained from the infiltration testing which is discussed in more detail in **Section 2.6**.

2.6 Infiltration Testing

An in-situ infiltration testing program was completed in July 2021 to identify the potential infiltration rates of the shallow soils on site, and for potential design and implementation of Low Impact Development (LID) features. Infiltration testing was completed in four (4) locations in July 2021 using a Guelph Permeameter. The infiltration testing locations are shown on **Drawing 2**.

Infiltration Rates were then calculated using methods referenced from the “Low Impact Development Stormwater Management Planning and Design Guide, Appendix C”, published by the Toronto and Region Conservation Authority (TRCA) and Credit Valley Conservation Authority (CVC).

3. Site Description and Geologic Setting

3.1 Site Location and Description

The Site is located at the northeast corner of Hyde Park Road and Sunningdale Road West. The municipal address is 2631 Hyde Park Road and 1521 Sunningdale Road West in London Ontario. The Site is irregular in shape and approximately 20.63 ha in size (**Drawing 1**). The Site is generally bounded by agricultural fields to the north and east, Hyde Park Road to the west, and Sunningdale Road West to the south.

An Unevaluated Wetland (UW) is located along the northern edge of the Site (**Drawing 2**) and extends into the property to the north. A second UW is located immediately north of the Site in the northeast corner within the adjacent property, as shown on **Drawing 2**.

The development plan for the Site includes a combination of low/medium density and multi family residential structures with associated roadways and is to be serviced with municipal water and sewer services set at conventional depths. Also included in the development plan is a park area surrounding the UW in the northwest and a school block in the southeast. The proposed development plan is included in **Appendix B**.

3.2 Topography and Drainage

The Site ground surface elevations range from approximately 275 to 283 metres above sea level (masl). Drainage from the Site is primarily through surface infiltration and overland flow. Surface drainage is influenced by the limited presence of near-surface silty sand soils and is highly dependent on Site topography. Groundwater infiltration is limited to weathered zones and pockets which have higher sand content, resulting in discontinuous pockets of shallow groundwater, perched within the predominately silt and clay soil. The Ministry of Agriculture, Food and Rural Affairs (OMAFRA) mapping used in **Drawing 3** does not have drainage information for the Site but suggests the agricultural fields of surrounding properties to be randomly tile drained with an area of systematic tile drainage to the west.

A subwatershed divide crosses the northern portion of the Site, as shown on **Drawing 2**. The northern portion of the Site is within the Oxbow Creek subwatershed and the southern portion is within the Medway Creek subwatershed. The majority of the north edge of the Site surrounding the UWs is regulated by the Upper Thames River Conservation Authority (UTRCA) as shown on **Drawing 4**.

3.3 Natural Heritage Features

A detailed Ecological Land Classification (ELC) map was provided my MTE. The ELC map is included in **Appendix B**. The Unevaluated Wetland (UW) in the northern portion of the Site is mapped as an Ephemeral Pond (0.02 ha).The land surrounding this pond is classified as Mineral Cultural Woodland (0.2 ha) and Thicket (0.03 ha).

The surficial soils in the vicinity of the UW consist of 4.5 m of very stiff clayey silt till overlying a sand aquifer. The nested monitoring well set MW4-S and MW4-D are installed adjacent to the Ephemeral Pond area. MW4-S has been dry since installation and the groundwater elevation in MW4-D has been consistently deeper than 6.8 mbgs, suggesting the UW is not sourced from groundwater. A shallow piezometer was installed in the UW in January 2020 and has had groundwater present since installation, except for September 2021 when it was dry. A staff gauge was installed into the UW in February 2021 and has shown ponded water to be present from February to June, and was dry for July, August, and September.

3.4 Site Geology

3.4.1 Bedrock Geology

The Site is underlain by limestone, dolostone and shale of the Dundee Formation (OGS, 2011). This formation consists of 60 to 160 feet (18 to 49 m) of light brown, medium-grained with some minor chert (Hewitt, 1972), and is part of the Algonquin Arch, which forms a ridge along the southwestern Ontario peninsula between the Michigan Basin (to the northwest) and the Appalachian Basin (to the southwest). Bedrock is generally not exposed in the area.

Review of bedrock topography mapping (**Drawing 5**; OGS, 1978) indicates the bedrock surface at an elevation in the range of 213 mASL (700 feetASL) at the Site. The bedrock surface generally slopes to the southwest in this area. Review of MECP Water Well Records (WWR) for the area (**Appendix F**) indicates one (1) well within 500 m of the Site intersects bedrock at a depth of approximately 66 mbgs. Based on ground surface elevations detailed in the MECP WWR, this equates to a bedrock elevation of about 215 m, which is generally consistent with the bedrock topography mapping. Bedrock was not encountered during the drilling program completed as part of this investigation.

3.4.2 Overburden Geology

The physiography of Southwestern Ontario was altered significantly by the glacial and interglacial periods that took place throughout the Quaternary period. The overburden deposits which are present in the study area were formed by numerous glacial events during the late Wisconsinan glacial stage approximately 10,000 to 23,000 years before present. There were two distinct glacial lobes present in Southwestern Ontario during this period. The Huron Lobe advanced from Lake Huron southwards, and the Erie Lobe advanced from the northeast, receding to the east. The physiography of the Site was influenced by the Huron Lobe.

During the advancement of the glacial ice sheets, bedrock and unconsolidated sediments were eroded. During the recession of the glaciers, the eroded materials were deposited in lakes, rivers and along spillways, contributing to the present configuration of moraines, abandoned spillways, drumlins, eskers, abandoned shorelines, and various still-water sediment deposits.

Deposits in the area can be contributed to the Port Bruce Stadial period. In the London area, a series of east-west recessional and end moraines were formed, along with the Port Stanley Till Plain. Deposition of the basal portion of the Port Stanley Till was formed during the initial advance of the Erie Lobe. Overlying till was deposited during subsequent cycles of advance and retreat, resulting in silt and sand layering within the till plain.

The surficial deposits were mapped and categorized into a number of physiographic regions by Chapman and Putnam (1984). The Site is part of the physiographic region known as the Stratford Till Plain (**Drawing 6**). The Site is located on an undrumlinized till plain, immediately to the south of the Arva Moraine (**Drawing 7**).

Quaternary mapping completed by Barnett et. al. (1981) indicates that the Site is located in an area characterized by Tavistock Till (**Drawing 8**), which is generally a silt to sandy silt matrix.

Surficial geology has also been described by Ontario Geological Survey MRD128 (OGS, 2010) as being predominately sandy silt to silty sand-textured till deposits, with the exception of a small area along the east edge which consists of coars-textures glaciolacustrine deposits containing sand, gravel, minor silt and clay (**Drawing 9**).

3.4.3 Site Specific Surficial Geology

As part of the Preliminary Geotechnical and Hydrogeological Investigation for the Site (EXP, 2020), six (6) boreholes were completed by EXP, with installation of monitoring wells in four (4) boreholes. A series of boreholes and monitoring wells were also completed by Golder (Golder, 1998) and borehole logs were provided to assist with this assessment. The locations of the boreholes are provided in **Drawing 2**. The boreholes were terminated at a maximum depth of between 2.8 and 9.8 m below existing grade. Borehole logs are provided in **Appendix C**.

Generalized stratigraphic cross sections through the Site, as shown in **Drawing 10**, are provided as **Drawings 11** and **12**. The cross sections generally show the dominant soil type on site to be the low permeability clayey silt/silty clay till. Sand was found at surface in some small areas across the Site, in particular around boreholes BH12, BH10 and BH7 (**Drawing 11**). Coarser grained sand is encountered at depth in some areas of the Site but is typically not continuous.

Generally, the site was overlain by a layer of topsoil ranging in thickness from 60 mm to 350 mm. Beneath the topsoil and extending to depths between 1.4 and 2.9 mbgs in boreholes MW1, MW3, BH5, BH7, BH10, and BH12 was a layer of silty sand/sandy silt/silt. A deeper layer ranging in depth and thickness was observed in Boreholes MW3, MW9 and BH105/MW. In general, the layer was described as brown with trace to some clay, trace to some gravel and very loose to very dense.

The predominant soil encountered in the boreholes was a glacial till. Each borehole, with the exception of Boreholes MW3, MW4, BH101 and BH105/MW, was terminated in the till. The till generally comprised clayey silt, with silty clay layers noted in some of the Golder boreholes, and was brown becoming grey with depth. The till was described as weathered in the upper layers, contained trace to some sand, trace to some gravel, and was firm to hard in consistency.

A total of two (2) grain size analyses were completed by EXP during the 2020 drilling and four (4) were completed by Golder in 1997 from samples collected during drilling at various locations across the Site. The grain size results are discussed in Section 4.5 *Hydraulic Conductivity*. Laboratory results and graphs are provided in **Appendix D**.

4. Hydrogeologic Setting

In addition to the groundwater information collected from the monitoring wells installed at the Site, the following documents were reviewed to gain an understanding of the hydrogeological conditions in the area:

- Dillon Consulting Limited and Golder Associates Ltd. Middlesex-Elgin Groundwater Study, Final Report, submitted to Middlesex and Elgin Counties, dated July 2004, henceforth referred to as the Middlesex-Elgin Groundwater Study;
- Goff, K and D.R. Brown, 1981. Ground-Water Resources – Summary. Thames River Basin Water Management Study Technical Report. Ontario Ministry of the Environment, Water Resources Report 14;
- Thames-Sydenham and Region Source Protection Committee. 2011. Upper Thames River Source Protection Area, Approved Updated Assessment Report. 12 August; and,
- MECP Water Well Records (WWR) within 500 m of the perimeter of the Site.

4.1 Regional Aquifer

Goff and Brown (1981) described the potential for four regional aquifers in the study area; shallow unconfined overburden aquifer, intermediate and deep confined aquifers and a bedrock aquifer.

4.1.1 Overburden Aquifers

The uppermost shallow and unconfined overburden aquifer was described as consisting of lacustrine or glacio-fluvial sands that may, in some locations, be overlain by lower permeability silts and clays. Regionally, the shallow aquifer is generally associated with the Caradoc Sand Plain and glacial deposits and are typically less than 15 m in thickness. Shallow overburden aquifers are discontinuous in nature and are expected to be linked more directly to precipitation and recharge compared to the intermediate and deep overburden aquifers.

Intermediate depth (15 to 30 m below ground surface (bgs)) and deep overburden (>30 m bgs) aquifers generally consist of saturated sand and gravel deposits in the overburden and are very discontinuous in nature due to the heterogeneous nature of glacial deposits. Sand and gravel layers are present in the Port Stanley and Catfish Creek glacial till sheets. The intermediate depth and deep overburden aquifers are generally confined by overlying silt, clay and glacial till deposits which limit vertical migration of shallow groundwater.

Locally, shallow groundwater flow is expected to follow the local topography, and generally drain towards Oxbow Creek, to the west of the Site. On a regional scale, the deep overburden aquifer flow direction is reported to be towards the south-southwest (Dillon and Golder, 2004).

Based on the well record information reviewed for this investigation (discussed below), the occurrence of shallow overburden water supply wells in the immediate vicinity of the Site is low.

4.1.2 Bedrock Aquifer

The bedrock aquifer is contained within limestone of the Dundee Formation. The water quality is generally good with elevated levels of iron, sodium and chloride in some wells. As with the intermediate and deep overburden aquifers, the bedrock aquifer is confined by the overlying till material, which generally ranges in thickness up to 17 m in the vicinity of the Site. Wells extending into the shallow fractured bedrock (up to about 3 m) are typically considered to be hydraulically connected to the overlying sand and gravel deposits that are present at the bedrock-overburden interface.

Flow direction in the deeper confined aquifer(s) and regional groundwater system has not been assessed as part of this investigation. However, as part of the Middlesex-Elgin Groundwater Study (Dillon and Golder, 2004), groundwater flow within the deeper aquifer is generally in a south-southwest direction towards Lake Erie.

4.2 MECP Water Well Records

A search of the Ontario Ministry of Environment, Conservation and Parks (MECP) Water Well Records (WWR) database resulted in the identification of twenty-five (25) records for an area within approximately 500 m of the Site boundary.

Water uses in the area include the following:

- domestic water supply (19 wells);
- monitoring or test holes (4 wells); and
- 2 abandoned wells.

The approximate locations of identified wells are shown on **Drawing 13**, with the MECP WWR Summary provided in **Appendix F**.

Domestic water supply in the local area wells is drawing from the intermediate and deep sand/sand and gravel aquifers or bedrock at depths ranging from 8.5 to 66 mbgs. The one (1) domestic water supply well listed as being less than 10 mbgs (Well ID 410251) is installed in clay. Overburden soils noted in the MECP WWR are generally described as clay with intermediate and deep sand/sand and gravel layers.

The monitoring/test holes range in depth between 6.1 m and 13.7 m and typically are terminated in the surficial sand or sand and gravel.

4.3 Well Survey

A door-to-door well survey was completed for the properties immediately adjacent to the Site as part of the Golder investigation (Golder, 1998). The survey identified eight (8) bedrock wells in the area and no overburden wells. Bedrock wells will not be impacted by Site development. A well survey was not completed by EXP for other properties within 500 m of the Site due to the low permeable surficial soils and low potential for shallow water wells.

4.4 Site Specific Groundwater Elevations and Flow

Manual water levels in the monitoring wells were collected monthly from January 2020 to June 2020 and from February to September 2021. Details of the monthly water levels are summarized in **Appendix G**.

Dataloggers were installed in four (4) select monitoring wells in February 2021 (monitoring wells MW3-S, MW4-D, BH103/MW and BH104/MW) and in piezometer P-101 to provide continuous groundwater elevation monitoring. Results are presented in **Appendix G**. Manual measurements generally correlate well with datalogger results.

The overall water level trends observed from monitoring wells MW3-S and BH103/MW are similar through the beginning portion of the year, as both wells are screened in the underlying sand/silt, at elevations of approximately 270-273 masl. The hydrographs from wells MW3-S and BH103/MW, which are both located in the southwest corner of the Site, appear to show a response to the large precipitation event on March 26, 2021. However, groundwater sampling at the Site was completed on March 24, 2021, which can be seen on these hydrographs by a decrease in groundwater elevations on that day. It is likely that the increase in groundwater elevations was not a result of the March 26 rainfall and was simply the groundwater returning to static levels following sampling. Groundwater elevations in both wells increased to their peak on March 11, 2021 at which point they began to decrease. This decreasing trend continued in monitoring well MW3-S, except for an increase in April 2021. Both MW3-S and BH103/MW show this increase on April 19, 2021. The groundwater elevations in MW3-S has remained low since May 2021, indicating dry conditions. The groundwater elevations in BH103/MW fluctuated throughout the year and did show a response to the large precipitation event on August 26, 2021.

Monitoring well MW4-D is a deep well installed into the underlying sand, located near the UW in the northwest portion of the Site. Although this well looks to be installed in the same unit as wells MW3-S and BH103/MW, it shows a very different overall trend. Groundwater elevations in monitoring well MW4-D generally showed an increasing trend since the datalogger was installed in February 2021 until April 2021, at which point they began to decline. No notable impact from precipitation is seen in this well. The total range of water levels in this well is less than 1 m.

Monitoring well BH104/MW is in the southeast corner of the Site and is installed in the clayey silt till. Groundwater elevations in this well have shown a range of less than 1 m throughout the monitoring period, with the highest levels seen in early April 2021. A general increasing trend is seen from February to early April 2021, and then a decreasing trend until June 2021. Water levels began increasing following a precipitation event on June 25th, 2021 and continued to increase until mid August 2021.

Also included in **Appendix G** is a hydrograph showing all monitoring wells with dataloggers installed. Monitoring well MW4-D is shown to have a much lower groundwater elevation than the other monitoring wells but follows a similar trend to BH104/MW. Monitoring wells MW3-S and BH103/MW have a very similar trend until June 2021, when MW3-S remained dry for the summer months.

A datalogger was also installed in piezometer P-101 located in the UW. This hydrograph shows that shallow groundwater elevations increased from February 2021 until May 2021, at which point they stabilized. Shallow groundwater elevations began decreasing in late July 2021 and continued decreasing to dry conditions at the end of August 2021.

Groundwater flow across the Site is affected by hydraulic conductivity, topography, drainage, and geology. A groundwater elevation map was created based on groundwater measurements collected from monitoring wells on

March 17, 2020. The Groundwater flow map was completed is shown in **Drawings 14**. Overall groundwater flow is to the southwest.

Table 3 – Hydraulic Gradients

	Completion Depth (m ASL)	Groundwater Elevation (m AMSL)											
		Jan 31, 20	Mar 17, 20	Apr 28, 20	May 25, 20	Jun 4, 20	Feb 26, 21	Mar 24, 21	Apr 19, 21	Jun 28, 21	Jul 30, 21	Aug 27, 21	Sep 15, 21
MW1-D (Deep)	268.92	276.55	276.63	276.19	275.69	275.99	275.93	275.99	276.04	276.02	275.99	275.95	275.83
MW1-S (Shallow)	273.42	276.72	276.81	276.34	276.18	276.12	276.52	276.47	276.24	276.19	276.14	276.13	276.00
Hydraulic Gradient		Down	Down	Down	Down	Down	Down	Down	Down	Down	Down	Down	Down
MW3-D (Deep)	269.28	272.32	272.63	272.29	272.31	272.17	272.21	272.54	273.00	-	-	-	272.08
MW3-S (Shallow)	272.28	275.30	274.64	273.95	274.00	273.63	272.86	273.22	273.59	-	-	-	272.35
Hydraulic Gradient		Down	Down	Down	Down	Down	Down	Down	Down	-	-	-	Down

Notes: 1. m ASL denotes metres above sea level.

The groundwater elevations collected in the nested well sets indicate that the hydraulic gradient is consistently downwards during each of the monitoring events, due to the shallow well having higher groundwater elevations than the deeper well. This is consistent with the findings in the 1998 hydrogeological investigation (Golder, 1998).

4.5 Hydraulic Conductivity

Grain size analyses were carried out on select soil samples collected from the boreholes, with results summarized in **Table 4**, and shown graphically in **Appendix D**.

A total of two (2) soil samples from Site were selected for grain size distribution analysis testing. Due to the nature of the Site soils, estimated hydraulic conductivity (K) values were determined using the methodology derived by Beyer et al. The Beyer method of correlating the grain size distribution analysis to the soil hydraulic conductivity is based on the following relationship:

$$K\ (cm/s) = 0.45 \times \log\left(500 \times \frac{D10}{D60}\right) D10^{2}$$

Based on the grain size analyses, the hydraulic conductivity for the sand is 3.1 x 10^{-5} m/s and for the sandy silt is 7.2 x 10^{-7} m/s. The results of all hydraulic conductivity testing are compiled in the table below.

Table 4 – Hydraulic Conductivity Results

Sample ID	Lithology	Hydraulic Conductivity (m/s)
Grain Size Analyses		
BH103/MW		
BH105/MW	Sandy Silt, trace Clay	7.2 x 10^{-7}
Infiltration Testing		
GP INF 1		
GP INF 2	Clayey Silt Till	2.38 x 10^{-7}
GP INF 3		
GP INF 4	Clayey Silt Till	1.52 x 10^{-7}

4.6 Infiltration Testing

An infiltration testing program was completed at four (4) location across the Site in July 2021. The locations are shown on **Drawing 2**. The hydraulic conductivity values from the infiltration tests are included above in **Table 4** and range from 1.52 x 10^{-7} to 7.01 x 10^{-8} m/s.

The infiltration calculation methods were referenced from the "Low Impact Development Stormwater Management Planning and Design Guide, Appendix C", published by the Toronto and Region Conservation Authority (TRCA) and Credit Valley Conservation Authority (CVC, 2010).

The soil infiltration rates are estimated based on the relationship between hydraulic conductivity and infiltration rate. In terms of the method presented in the "Low Impact Development Stormwater Management Planning and Design Guide, Appendix C", the soil infiltration rates were converted according to the estimated hydraulic conductivity values.

Based on the recommendations made by the TRCA, the infiltration rates used to design an infiltration facility must incorporate a safety correction factor that compensates for potential reductions in soil permeability due to compaction or smearing during construction, gradual accumulation of fine sediments over the lifespan of the facility, and uncertainty in measured values. The safety correction factor calculations are included in **Appendix E**. The safety correction factor for calculating design infiltration rates is 3.5, as outlined in the TRCA and CVC 2010 document.

The estimated hydraulic conductivity and infiltration rates are presented in **Table 5**.

Table 5 – Infiltration Rates for Design Purposes

Location	Soil Sample Depth (mbgs)	Lithology	Estimated Hydraulic Conductivity (m/s)	Unfactored Infiltration Rate (mm/hour)	Factored Infiltration Rate (mm/hour)
Infiltration Testing					
GP INF1	0.5	Sandy Silt	4.21×10^{-8}	6	1.7
GP INF2	0.35	Clayey Silt Till	2.38×10^{-7}	9	2.6
GP INF3	0.35	Clayey Silt Till	7.01×10^{-8}	7	1.9
GP INF4	0.45	Clayey Silt Till	1.52×10^{-7}	8	2.3

The surficial soils on Site are shown to be largely clayey silt till. Based on the infiltration tests, the clayey silt till in the upper 1 m zone ranges in hydraulic conductivity from 1.52×10^{-7} to 7.01×10^{-8} m/s. The factored infiltration rate for the clayey silt till ranges from 1.7 to 2.6 mm/hour.

4.7 Groundwater and Surface Water Quality

Groundwater samples were collected from four (4) select monitoring wells (MW3-D, MW4-D, BH103/MW, and BH104/MW) on March 24th, 2021 to establish baseline water quality. A surface water sample was also collected from Station 1 (**Drawing 2**) on March 24th, 2021 to establish baseline water quality of the Unevaluated Wetland (UW) prior to development. The Bureau Veritas laboratory results and chain of custodies are included in **Appendix H**.

Groundwater quality was compared to the Ontario Drinking Water Standards, Objectives and Guidelines (ODWQS) (O.Reg. 169/03) maximum allowable concentrations (MAC). Although the groundwater on site is not planned for use as drinking water, the MAC guidelines are used for comparisons sake only. In comparison to these guidelines, groundwater was found to meet all of the ODWQS. The groundwater results are tabulated in **Appendix H**.

Surface water quality was compared to Ontario Provincial Water Quality Objectives (PWQO). Surface water quality was found to exceed the PWQO guidelines for aluminum (PWQO 75 ug/L) and iron (PWQO 300 ug/L), with concentrations of 79 ug/L and 320 ug/L, respectively.

The water quality results were plotted on a Piper Diagram and Schoeller Diagrams and are presented in **Drawings 15 and 16,** respectively. The Piper Diagram shows that MW3-D, MW4-D, BH104/MW and the surface water sampled are magnesium bicarbonate type waters. The largest difference is seen in BH103/MW, which is sodium chloride type. BH103/MW is a shallow well located near the southwest corner of the Site and is likely impacted by road salt coming off Sunningdale Road and Hyde Park Road.

Two Schoeller Diagrams have been created, one for major ions and one for minor ions. The major ions Schoeller diagram also shows road salt impact in BH103/MW, with sodium and chloride being higher in this well than the others. The surface water sample has similar concentrations of calcium, magnesium, and sodium to the monitoring wells, but has higher chloride and sulphate concentrations. The Schoeller Diagram for minor ions shows a similar

composition of all samples, with BH104/MW having slightly higher concentrations of barium, strontium and boron. Nitrate + nitrite was highest in monitoring wells MW4-D and BH103/MW.

5. Sourcewater Protection Considerations

5.1 Significant Groundwater Recharge Areas (SGRA)

Groundwater recharge is largely controlled by soil conditions, and typically occurs in upland areas. The groundwater flow direction has been previously identified as flowing in a southeastern direction.

As defined in the Clean Water Act (2006), an area is a significant groundwater recharge area if,

1. the area annually recharges water to the underlying aquifer at a rate that is greater than the rate of recharge across the whole of the related groundwater recharge area by a factor of 1.15 or more; or

2. the area annually recharges a volume of water to the underlying aquifer that is 55% or more of the volume determined by subtracting the annual evapotranspiration for the whole of the related groundwater recharge area from the annual precipitation for the whole of the related groundwater recharge area.

An assessment report for the Upper Thames River Source Protection Area was completed by the Thames-Sydenham and Region Source Protection Committee. As defined by the Clean Water Act (2006) and identified by the Thames-Sydenham and Region Source Protection Committee, the eastern edge of the Site and the northwestern corner are mapped as being a SGRA (**Drawing 17**). The eastern edge of the Site is identified by the surficial geology mapping as having coarse-textured glaciolacustrine deposits of sand, gravel, minor silt, and clay. The detailed borehole investigation and infiltration testing in this area revealed no evidence of the deposit, therefore it is determined that the Site is **not** within a SGRA.

5.2 Highly Vulnerable Aquifers (HVA)

The susceptibility of an aquifer to contamination is a function of the susceptibility of its recharge area to the infiltration of contaminants. As defined in the *Clean Water Act (2006)*, the vulnerability of groundwater within a source protection area shall be assessed using one or more of the following groundwater vulnerability assessment methods:

1. Intrinsic susceptibility index (ISI).
2. Aquifer vulnerability index (AVI).
3. Surface to aquifer advection time (SAAT).
4. Surface to well advection time (SWAT).

In the Thames-Sydenham and Region, HVAs were mapped using the ISI method. The ISI method is an indexing approach using existing provincial Water Well Information System (WWIS) database. The ISI method is described in detail in the MECP's Technical Terms of Reference (2001). However, in short, the ISI method is a scoring system that takes into consideration the unique hydrogeologic conditions at a particular location. The scores are determined using a combination of the saturated thickness of each unit and an index number related to the soil type, and as such, the scores reflect the susceptibility of the aquifer to contamination.

As defined in the MECP's 2001 Technical Rules,

- an area having an ISI score of less than 30 is considered to be an area of high vulnerability;
- an area having an ISI score greater than or equal to 30, but less than or equal to 80, is considered to be an area of medium vulnerability; and,
- an area having an ISI score of greater than 80 is considered to be an area of low vulnerability.

The Thames-Sydenham and Region Source Protection Committee has determined, using the ISI method, that the eastern edge of the Site is located within a HVA area (**Drawing 18**). However, similar to the SGRA, we have determined that the Site is not within an HVA as no evidence of the coarse-textured deposits was found in this area during the detailed borehole investigation and infiltration testing.

6. Water Balance Assessment

6.1 Background Information

The water balance assessment for the Site was completed in accordance with the recommendations indicated in the guidance document "Hydrogeological Assessment Submissions: Conservation Authority Guidelines to Support Development Applications" (Conservation Ontario, 2013), and using appropriate site condition values obtained from Table 3.1 of the MOE Stormwater Management Planning and Design Manual (MOE, 2003).

The water balance is based on estimates for a typical annual period, as an expression of the mean annual precipitation, change in groundwater storage, evapotranspiration, surficial run-off and infiltration. The relationship in these factors can be balanced, as shown in the following equation:

Mean Annual Precipitation - Change in Groundwater Storage - Evapotranspiration = Runoff + Infiltration

where:

- Mean Annual precipitation (1011.5 mm/yr) is based on data provided by Environment Canada, based on the 30-year average data for climate normals, using local weather station information (London, ON).

- Long term changes in groundwater storage are assumed to be negligible (i.e. no significant groundwater pumping or withdrawal from the aquifer). Seasonal changes are expected to balance out over the course of a full year.

- Evapotranspiration combines evaporation and transpiration and refers to the water lost to the atmosphere. The rate of evapotranspiration is a function of the water holding capacity of the soil and varies with soil and vegetation type and amount of impermeable surface cover. The evapotranspiration values are obtained using the method described by Thornthwaite and Mather (1957) but are sourced from Environment Canada Data using values for water holding capacity derived from Table 3.1 of the MOE Stormwater Management Planning and Design Manual (MOE, 2003).

The difference between the annual precipitation and the annual evapotranspiration represents the surplus water which is available for infiltration and surface run-off. Distribution of the surplus water to infiltration is based on an infiltration factor based on site conditions for topography, cover vegetation and soil.

6.2 Pre-development and Post-development Calculations

Pre-development and Post-development monthly water balance calculations have been carried out and are based on preliminary and available design data. The development consists of low/medium and multi family residential development, a park and a school, as well as associated roadways, as presented in **Appendix B**. As no surface water management plans have been finalized, the drainage patterns between pre and post development have been assumed to be similar.

In general, the Site comprises a land area of 20.63 hectares and is currently vacant. Post-development will consist of residential buildings with non-impervious areas consisting of a vegetative cover classification of urban lawns and landscaping.

Regional mapping completed by the Ministry of Agriculture, Food and Rural Affairs indicates that the majority of the Site is Hydrological Soil Group (HSG) "B", which is described as soils having a moderate infiltration rate when thoroughly wet and consist of well drained soils with a moderately fine to moderately coarse texture. However, detailed Site investigations completed by both EXP and Golder did not identify these soils at surface across most of the Site and found clayey silt till present at surface. Based on these findings the Site has been categorized as HSG "C-D" type soils, which are described as soils of fine texture and clays.

The soil water holding capacities were determined using values presented in Table 3.1 of the MOE Stormwater Management Planning and Design Manual (MOE, 2003) based on the vegetative cover and the hydrologic soil group, as listed above. The values based on the Site conditions are presented in the calculation sheets provided in **Appendix I**.

Evapotranspiration values were determined using the method described by Thornthwaite and Mather (1957). It is common practice and an accepted method by most Conservation Authorities to provide estimates of surplus using the Thornthwaite and Mather approach, where surplus is estimated based on precipitation minus evapotranspiration (Steenhuis and Van Der Molen, 1986). The distribution of runoff and infiltration from the surplus water is determined from the infiltration factor for the site. An infiltration factor of 0.5 was used for the Site based on topography (0.2), soil (0.2) and cover (0.1). For pre-development conditions, the Site was considered to be free of impermeable surfaces. Post-development conditions assumed 45% impermeable surfaces across the Site and pervious surfaces consisting of landscaped areas.

Table 6 provides a summary of the pre and post development water balance calculations. Calculation worksheets are provided in **Appendix I**.

Table 6: Summary of Water Balance Estimates

Location	Pre Development (m^3/year)	Post Development (m^3/year)	Post Development with Mitigation(m^3/year)	Percentage of Pre Development (%)	Percentage of Pre Development (with Mitigation) (%)
	118,233	83,313	86,181	70%	73%
Estimated Runoff	69,931	113,599	96,559	162%	138%
Estimated Infiltration	31,732	17,453	25,973	55%	82%

Conservation Ontario Guidelines (Conservation Ontario, 2013) suggest a target of 80% of the pre-development infiltration being maintained in the post-development conditions. Calculations for the Site are indicative of the post-development infiltration reaching approximately 82% of the pre-development infiltration volumes with mitigation measures being implemented. Reduction in infiltration volumes is expected as the Site will be largely developed with impervious surfaces. Opportunities to capture run-off and provide secondary infiltration in greenspace areas will be required to increase post-development infiltration. With mitigation measures the post-development infiltration is estimated can be raised to over 80% of the pre-development infiltration for the Site.

As evidenced by the water balance calculations, the use of Low Impact Development (LID) strategies will need to be constructed on the Site to reduce the variation between pre- and post-development conditions. Based on the water balance calculations a 15% runoff reduction would achieve post-development infiltration of 82% of pre-development infiltration. Options for possible LIDs which could be established are discussed further in **Section 8.5**.

7. Wetland Risk Assessment

The intention of completing a wetland risk assessment is to evaluate the potential risks to the Unevaluated Wetland (UW) located in the northwest of the Site based on the proposed site development. The following risk assessment was completed as outlined in the Wetland Water Balance Risk Evaluation, Toronto and Region Conservation Authority document (TRCA, 2017).

The following **Table 7** outlines the magnitude of hydrologic change to the woodlot, as outlined in TRCA, 2017.

Table 7: Magnitude of Hydrologic Change

No.	Criteria	EXP Responses
1	Impervious cover Score (S) within catchment is calculated as: $S = \frac{IC \times C_{dev}}{C}$ Where, IC = proportion of impervious cover proposed within the area of the UW catchment that is within the proponent's holdings (as a percentage between 0 and 100); C_{dev} = total development area of the catchment; C = size of the woodlot catchment in ha	Unevaluated Wetland Feature: Area of UW catchment existing = 15.62 ha Area of impervious cover in post-dev within UW catchment = 1.34 ha Therefore, IC = 24 Impervious cover Score (S) is: S = (24 × 3.35 ha) ÷ 15.62 ha = 5.15 The UW Feature has an Impervious Cover Score (S) of less than 10, therefore this feature is considered to have a **low magnitude** of hydrologic change.
2	Increase or decrease in catchment size	The UW Feature is determined as **low magnitude** (< 10 %) based on the decrease in catchment size (increased impervious cover). Calculations as follows: UW Feature: Total impervious cover = 1.34 ha Total Catchment = 15.62 ha (1.34 ha ÷ 15.62 ha) x 100 = 8.6**%**
3	Water taking or discharge	The water taking or discharge requirements for development construction have yet to be determined as detailed design drawings are not yet compiled.

No.	Criteria	EXP Responses
		However, preliminary calculations suggest that dewatering rates of over 400,000 L/day may be required in areas of high groundwater elevations. These preliminary calculations are based on the following assumptions: - the average hydraulic conductivity of the overlying clayey silt till material across the site is approximately 2.61 x 10^{-5} m/s; - municipal servicing construction trench lengths would be no longer than 100m in length and 5m in width; - dewatering would be for 24 hours a day Dewatering volumes exceeding 400,000 L/day would be localized and primarily required in the south part of the Site where groundwater elevations are closer to surface. These volumes are not anticipated to extend across the entire site for the duration of construction (i.e <6 months anticipated), as groundwater elevations vary across the site based on current monitoring data. Therefore, the water taking or discharge at the site is considered **medium magnitude**.
4	Impact to recharge areas	There are no locally significant groundwater recharge areas within the catchment to the woodlot, therefore, there is a **low magnitude** of hydrologic change.

Overall, the UW has been found to have a **low magnitude** of potential hydrological change based on the proposed development of its catchment area. No information on the sensitivity of the UW in terms of vegetation communities, flora and fauna is currently available. As such, the sensitivity of the wetland to hydrological change has not been assessed as part of this risk assessment. However, even if the sensitivity of the wetland is considered Medium or High Risk, the overall Risk Assignment for the wetland feature would still remain as an overall **Low Risk Assignment.**

8. Impact Assessment

8.1 Water Well Users

Potable wells in the area are typically sourced from deep sand and gravel aquifers which are generally confined below low permeability silty clay overburden or from bedrock. Domestic water supply in the local area wells is sourced from the deep aquifers, which consist of confined sand and gravel that underlies the clay overburden and extend to depths between 8.5 and 61 mbgs. The one well which is shallower than 10 mbgs is installed within the clay and is not expected to be impacted by Site development.

Wells set at depths greater than 10 m are not expected to be impacted by the construction of site services or typical excavations associated with the residential development of the site. The silty clay strata noted in the boreholes will limit both the vertical and horizontal zone of influence impacting the wells due to the lower permeability of the founding soils. No significant long-term impact is anticipated on the deep wells, either quantitatively or qualitatively since the inverts of the sewers are not expected to be deep enough to penetrate into the underlying aquifers. Any temporary dewatering operations which may be required to deal with groundwater seepage from the overburden soils are not expected to cause any long-term impacts to the intermediate and deep overburden and bedrock aquifers supplying the water supply wells near the Site.

Monitoring wells have been installed at the Site as part of the Site investigations to document stabilized groundwater conditions. Prior to the Site grading work, and when the monitoring wells are determined to be no longer required, the wells should be properly decommissioned in accordance with Ontario Regulation 903. Decommissioning a well which is no longer in use helps to ensure the safety of those in the vicinity of the well, prevents surface water infiltration into an aquifer via the well, prevents the vertical movement of water within a well, conserves aquifer yield and hydraulic head and can potentially remove a physical hazard.

8.2 Surface Water Features

8.2.1 Unevaluated Wetlands (UW)

Two (2) unevaluated wetlands (UW) are documented in the City of London's Natural Heritage Map 5 and are depicted in **Drawing 2**. The eastern UW is located immediately north of the Site and has not been studied as part of this investigation. The western UW is primarily located on the adjacent property to the north but does extend onto the Site in the northwest. A piezometer (P-101) and staff gauge (SG1) were installed within this UW for further investigation. This UW has had surface water present for the majority of the monitoring period thus far. Further discussion of seasonal trends will be provided at the completion of the monitoring period in the final report. As discussed in Section 6.2.1, the near surface soils generally consist of low permeability silty clay soils.

8.2.2 General Comments

The UWs are considered as being vulnerable to contamination from surface sources. During construction, short term impacts to the surface water may be anticipated, particularly where vegetation on nearby land is stripped and area grading works are underway.

The following comments are provided with recommendations to help minimize impact to surface water features observed at the site:

- During the site grading work, suitable sedimentation controls will be required to help control and reduce the turbidity of run-off water which may flow towards the surface water features;
- A Best Management Practice (BMP) and spill contingency plan (including a spill action response plan) should be in place for fuel handling, storage and onsite equipment maintenance activities to minimize the risk of contaminant releases as a result of the proposed construction activities;
- Re-establishing vegetative cover in disturbed areas following the completion of the construction work;
- Limit the use of commercial fertilizers in landscaped areas which border a habitat feature; and,

Limit the use of salts or other additives for ice and snow control on the roadways and parking areas.

8.3 Water Quality Monitoring Considerations

A monitoring program to assess the characteristics of the shallow groundwater collected in the monitoring wells and the surface water at the Site has been carried out. Baseline water quality testing was carried out on samples of the shallow groundwater collected from select monitoring wells, and the surface water in the UW in the northwest of the Site.

In comparison with ODWQS and the PWQO, which is considered appropriate for assessing potential impacts of groundwater discharge to surface or nearby surface water features (which may occur during construction dewatering activities associated with site servicing), the test results for the water samples do not indicate a high potential for adverse effects for aquatic receptors which may be present in nearby surface water features.

There are a number of items which can be considered during construction and for the future residential development which can assist in maintaining groundwater and surface water quality. The following comments are provided for consideration, but are not intended as an exhaustive list in this regard:

- In the event that imported materials are required to restore onsite excavations, or to raise grades in portions of the Site, analytical testing of the imported material may be considered to ensure that any material brought to the Site meets the applicable standards under Ontario Regulation 153 for residential lands.
- Contractors working at the Site should ensure that construction equipment is in good working order. Equipment operators should have spill-prevention kits, where appropriate.
- Chemical application in landscaped and grassed areas should be limited. Consideration may be given to using grass varieties which are heartier and require less extensive watering or fertilizers.

Consideration may be given to carrying out additional water quality testing during construction, where construction activities are in close proximity to surface water features, where a concern for potential impact is identified.

Monitoring stations to assess post-development changes to water quality may be considered; however, the specific purpose and long-term responsibility for servicing and maintenance of the monitoring stations would need to be established.

8.4 Construction Dewatering Considerations

The water supply wells recorded in the MECP Well Database are set into deep depth aquifers. As mentioned in Section 4.2, the stratigraphy encountered in the wells set into deep aquifers consist of confined sand/sand and gravel soils that underlie thick layers of clay overburden. In this regard, no impact to the groundwater quality or quantity is anticipated as a result of any construction dewatering that may be required at the Site.

Based on the soil conditions and groundwater observations reported in the borehole logs for the Site and surrounding areas, groundwater infiltration may be anticipated within excavations in certain areas of the Site, particularly in the southeast where groundwater was found to be less than 2 mbgs throughout the monitoring period.

Any collected water from service trenches and temporary excavations should be discharged a sufficient distance away from the excavated area to prevent the discharge water from returning to the excavation. Sediment control measures should be provided at the discharge point of the dewatering system.

Although not anticipated, it should be noted that for construction projects requiring groundwater control with a removal rate in excess of 50,000 litres per day, an Environmental Activity and Sector Registry (EASR) or a Permit to Take Water (PTTW) will be required. EASR's are required for dewatering volumes up to 400,000 litres per day. For volumes of 400,000 litres or more per day, Category 3 PTTW applications will need to be approved by the MECP according to Sections 34 and 98 of the Ontario Water Resources Act R.S.O. 1990 and the Water Taking and Transfer Regulation O. Reg. 387/04.

During construction, short term impacts to the near surface and shallow groundwater quantity may be anticipated as a result of construction dewatering where wet sand soils are present in open excavations. The length of time where this impact would occur would be limited to the time when active pumping of the groundwater is being carried out. Once construction activities are complete, the shallow groundwater levels would be expected to stabilize.

8.5 Secondary Infiltration Opportunities

Due to the increased impermeable surfaces (such as roof-tops, roadways, sidewalks), the proposed development is expected to result in a reduction in the post-development infiltration level, and a corresponding increase in the estimated run-off. The use of secondary infiltration opportunities is recommended to reduce the variation between pre-development and post-development conditions, although due to the nature of the dominant soil type, there is typically significantly more runoff than infiltration.

Mitigative measures that could be considered may include reducing the amount of impervious surface areas, which is not always practical to implement on an effective scale. Although the shallow clayey silt soils observed in the study area are not conducive to shallow groundwater recharge by infiltrated surface water, some opportunity is available in the silt and silty sand soils encountered in some of the boreholes. Because of the nature of the predominant silty clay till soils which are encountered near surface, there may be limited effectiveness in incorporating at-source infiltration structures such as dry-wells, infiltration galleries or using pervious pipe subsurface systems. Similarly, the use of permeable pavements in parking areas, patios, and sidewalks are also not expected to yield a significant increase in the post-development infiltration.

More productive measures may include secondary infiltration by directing and capturing run-off water from impervious surfaces into landscaped areas where existing infiltration capacity can be utilized. More specifically, considerations may include the following:

- Increased topsoil depth throughout green space areas to reduce runoff. In general, a run-off reduction up to 25% may be possible in areas where increased topsoil thicknesses are utilized (depending on final topsoil thickness, storm duration and intensity); and,

- Collection of roof-top run-off into swales and/or vegetative filter strips to promote infiltration.

9. Qualifications of Assessors

EXP Services Inc. provides a full range of environmental services through a full-time Earth and Environmental Services Group. EXP's Environmental Services Group has developed a strong working relationship with clients in both the private and public sectors and has developed a positive relationship with the Ontario Ministry of the Environment, Conservation and Parks (MECP). Personnel in the numerous branch offices form part of a large network of full-time dedicated environmental professionals in the EXP organization.

This report was authored by Ms. Kelli Dobbin, G.I.T. Ms. Dobbin works in the Earth and Environment Discipline and has been thoroughly trained in conducting hydrogeological assessments. She obtained a Bachelor of Science Degree from the University of Waterloo and has been working in the geo-science field for over 6 years. She has authored and reviewed reports for numerous projects including residential and commercial developments that require hydrogeological input, groundwater impact assessments and calculated groundwater removal quantities for short- and long-term construction.

This report was reviewed by Ms. Heather Jaggard, M.Sc., P.Geo. Ms. Jaggard is a hydrogeologist and environmental geoscientist with more than 9 years in the environmental field and is a licensed Professional Geoscientist (P.Geo.) in Ontario. She obtained a Master's of Science (M.Sc.) in 2012 from Queen's University in Kingston, and is a Qualified Person (QP) registered with the Ontario Ministry of Environment, Conservation and Parks (MECP). She has worked in the Hydrogeological and Environmental fields since that time. In her professional career for the past few years, Ms. Jaggard has completed numerous hydrogeological assessments and modelling works for land development sites. Environmental site assessments and preparation of submissions for Permit to Take Water (PTTW) have been part of her routine assignments.

10. References

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11. General Limitations

The information presented in this report is based on a limited investigation designed to provide information to support an assessment of the current environmental conditions within the subject property. The conclusions and recommendations presented in this report reflect Site conditions existing at the time of the investigation. Consequently, during the future development of the property, conditions not observed during this investigation may become apparent. Should this occur, EXP Services Inc. should be contacted to assess the situation, and the need for additional testing and reporting. EXP has qualified personnel to provide assistance in regards to any future geotechnical and environmental issues related to this property.

Our undertaking at EXP, therefore, is to perform our work within limits prescribed by our clients, with the usual thoroughness and competence of the engineering profession. It is intended that the outcome of this investigation assist in reducing the client's risk associated with environmental impairment. Our work should not be considered 'risk mitigation'. No other warranty or representation, either expressed or implied, is included or intended in this report.

The comments given in this report are intended only for the guidance of design engineers. The number of test holes required to determine the localized underground conditions between test holes affecting construction costs, techniques, sequencing, equipment, scheduling, etc. would be much greater than has been carried out for design purposes. Contractors bidding on or undertaking the works should in this light, decide on their own investigations, as well as their own interpretations of the factual borehole results, so that they may draw their own conclusions as to how the subsurface conditions may affect them.

EXP Services Inc. should be retained for a general review of the final design and specifications to verify that this report has been properly interpreted and implemented. If not afforded the privilege of making this review, EXP Services Inc. will assume no responsibility for interpretation of the recommendations in this report.

This report was prepared for the exclusive use of **Auburn Developments Inc.** and may not be reproduced in whole or in part, without the prior written consent of EXP, or used or relied upon in whole or in part by other parties for any purposes whatsoever. Any use which a third party makes of this report, or any part thereof, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. EXP Services Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

We trust this report is satisfactory for your purposes. Should you have any questions, please do not hesitate to contact this office.

Appendix A - Drawings

15701 Robin's Hill Road | London, Ontario | Canada
t: +1.519.963.3000 | f: +1.519.963.1152 | exp.com

-LEGEND-

Approximate Site Boundary

Image Source: Google Earth Pro (July 2018)

Hydrogeological Assessment

Mount Pleasant Lands

2631 Hyde Park Rd & 1521 Sunningdale Rd W
London, Ontario

CLIENT	Auburn Developments Inc.
TITLE	Site Location Plan
Prepared By: K.D.	Reviewed By: H.J.

EXP Services Inc.
15701 Robin's Hill Road, London, ON, N5V 0A5

DATE	APPROXIMATE SCALE	PROJECT NO.	DWG.
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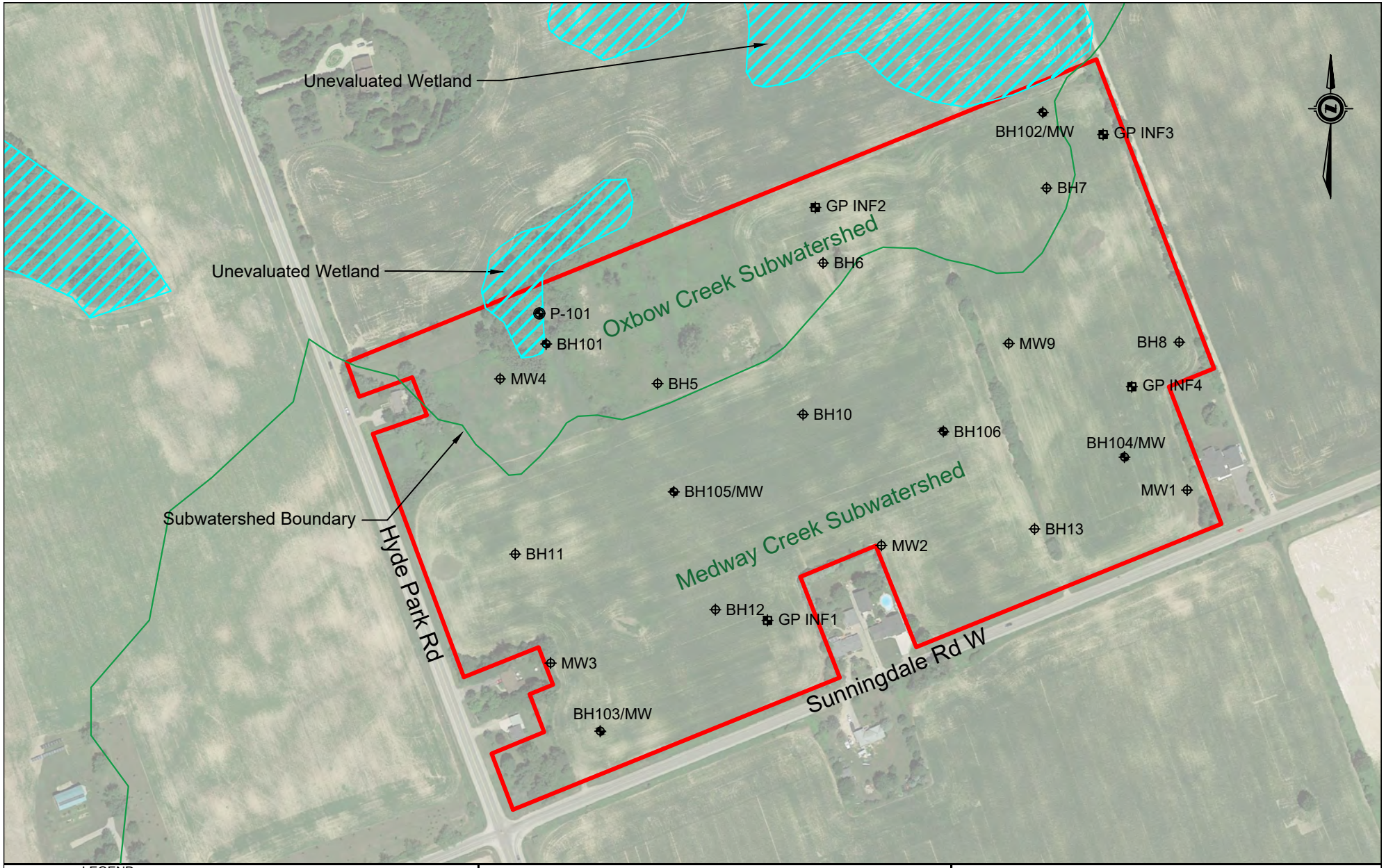

-LEGEND-

BH101/MW	Approximate Borehole Location (EXP, 2020)
MW1	Approximate Borehole Location (Golder,1997)
P-101	Approximate Piezometer Location (EXP, 2020)
GP INF4	In-Situ testing by Guelph Permeameter (July 2021)
	Approximate Site Boundary
	Subwatershed Boundary
	Unevaluated Wetland

Image Source: Google Earth Pro (July 2018)
Note: Natural Heritage Feature boundaries obtained from City of London's Natural Heritage Map 5.

Hydrogeological Assessment

Mount Pleasant Lands

2631 Hyde Park Rd & 1521 Sunningdale Rd W
London, Ontario

CLIENT: Auburn Developments Inc.

TITLE: Borehole Location Plan and Natural Heritage Features

Prepared By: K.D.

Reviewed By: H.J.

EXP Services Inc.
15701 Robin's Hill Road, London, ON, N5V 0A5

DATE	APPROXIMATE SCALE	PROJECT NO.	DWG.
MAY 2021	1:4000	LON-00017696-GE	2

-LEGEND-

- Approximate Site Boundary
- Open Drain
- Closed/Tiled Drain
- Random Tile Drainage
- Systematic Tile Drainage

Image Source: OMAFRA Mapping; www.gisapplication.lrc.gov.on.ca

Hydrogeological Assessment

Mount Pleasant Lands

2631 Hyde Park Rd & 1521 Sunningdale Rd W
London, Ontario

CLIENT	Auburn Developments Inc.
TITLE	Site Area Drainage
Prepared By: K.D.	Reviewed By: H.J.

EXP Services Inc.
15701 Robin's Hill Road, London, ON, N5V 0A5

DATE	APPROXIMATE SCALE	PROJECT NO.	DWG.
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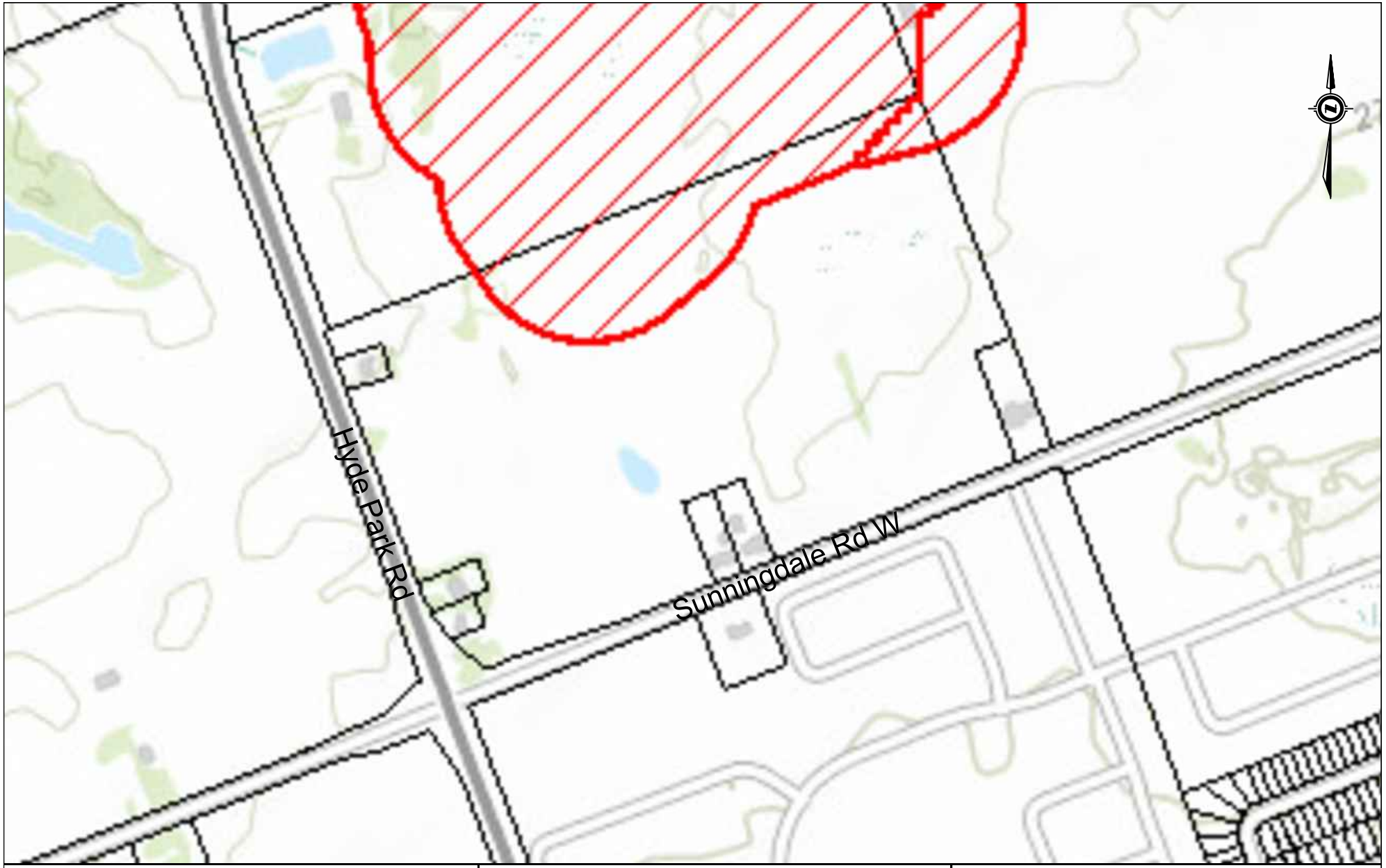

-LEGEND-

Approximate Site Boundary

Regulated Lands of the Upper Thames River Conservation Authority

Image Source: UTRCA mapping software, Regulated Area Screening Map; www.maps.thamesriver.on.ca

Hydrogeological Assessment

Mount Pleasant Lands

2631 Hyde Park Rd & 1521 Sunningdale Rd W
London, Ontario

CLIENT	Auburn Developments Inc.
TITLE	Regulated Lands of the UTRCA
Prepared By: K.D.	Reviewed By: H.J.

EXP Services Inc.
15701 Robin's Hill Road, London, ON, N5V 0A5

DATE	APPROXIMATE SCALE	PROJECT NO.	DWG.
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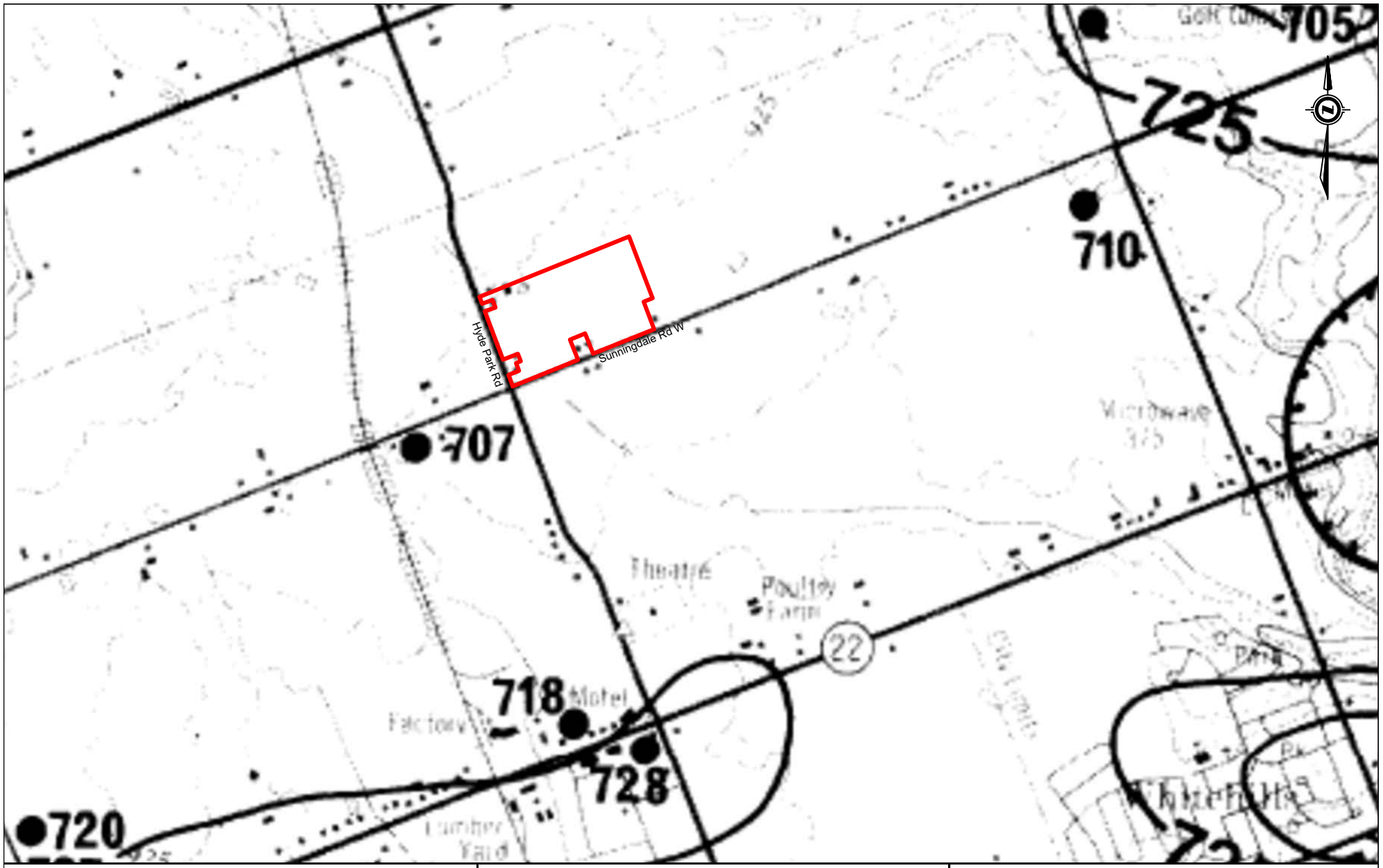

-LEGEND-

- Approximate Site Boundary
- 707 — Bedrock Surface Elevation (feet) in a Well or Test Hole
- 725 — Contours on Bedrock Surface (feet)

Image Source: Ontario Geological Survey. 1980. Bedrock Topography Series, Lucan Sheet, Southern Ontario, Preliminary Map P.291

Hydrogeological Assessment

Mount Pleasant Lands

2631 Hyde Park Rd & 1521 Sunningdale Rd W
London, Ontario

CLIENT	Auburn Developments Inc.
TITLE	Bedrock Topography
Prepared By: K.D.	Reviewed By: H.J.

EXP Services Inc.
15701 Robin's Hill Road, London, ON, N5V 0A5

DATE	APPROXIMATE SCALE	PROJECT NO.	DWG.
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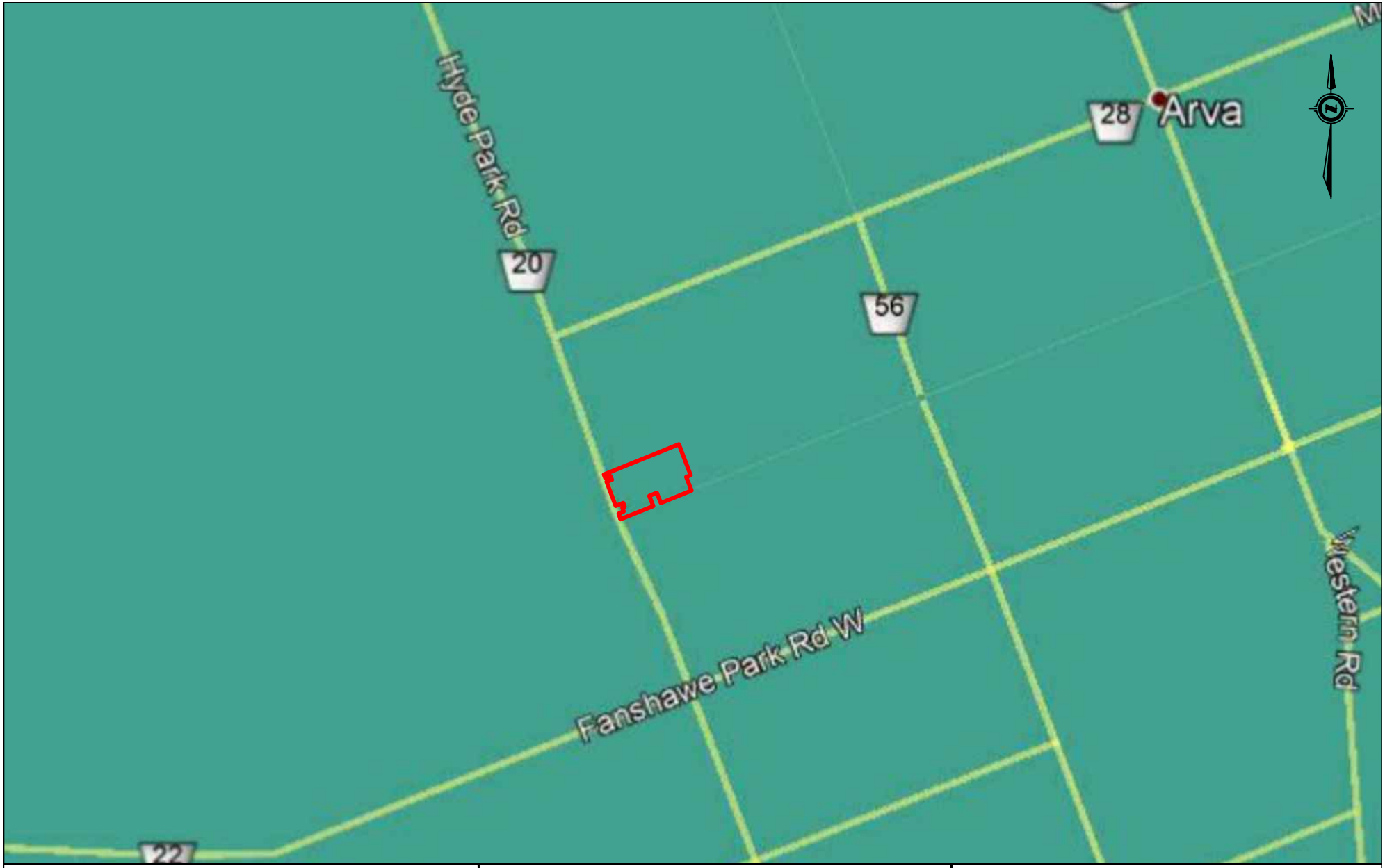

-LEGEND-

Approximate Site Boundary

Stratford Till Plain

Image Source: Chapman, L.J. and Putnam, D.F. 2007. The Physiography of Southern Ontario; Ontario Geological Survey, Miscellaneous Release---Data228.

Hydrogeological Assessment

Mount Pleasant Lands

2631 Hyde Park Rd & 1521 Sunningdale Rd W
London, Ontario

CLIENT	Auburn Developments Inc.
TITLE	Physiographic Regions
Prepared By: K.D.	Reviewed By: H.J.

EXP Services Inc.
15701 Robin's Hill Road, London, ON, N5V 0A5

DATE	APPROXIMATE SCALE	PROJECT NO.	DWG.
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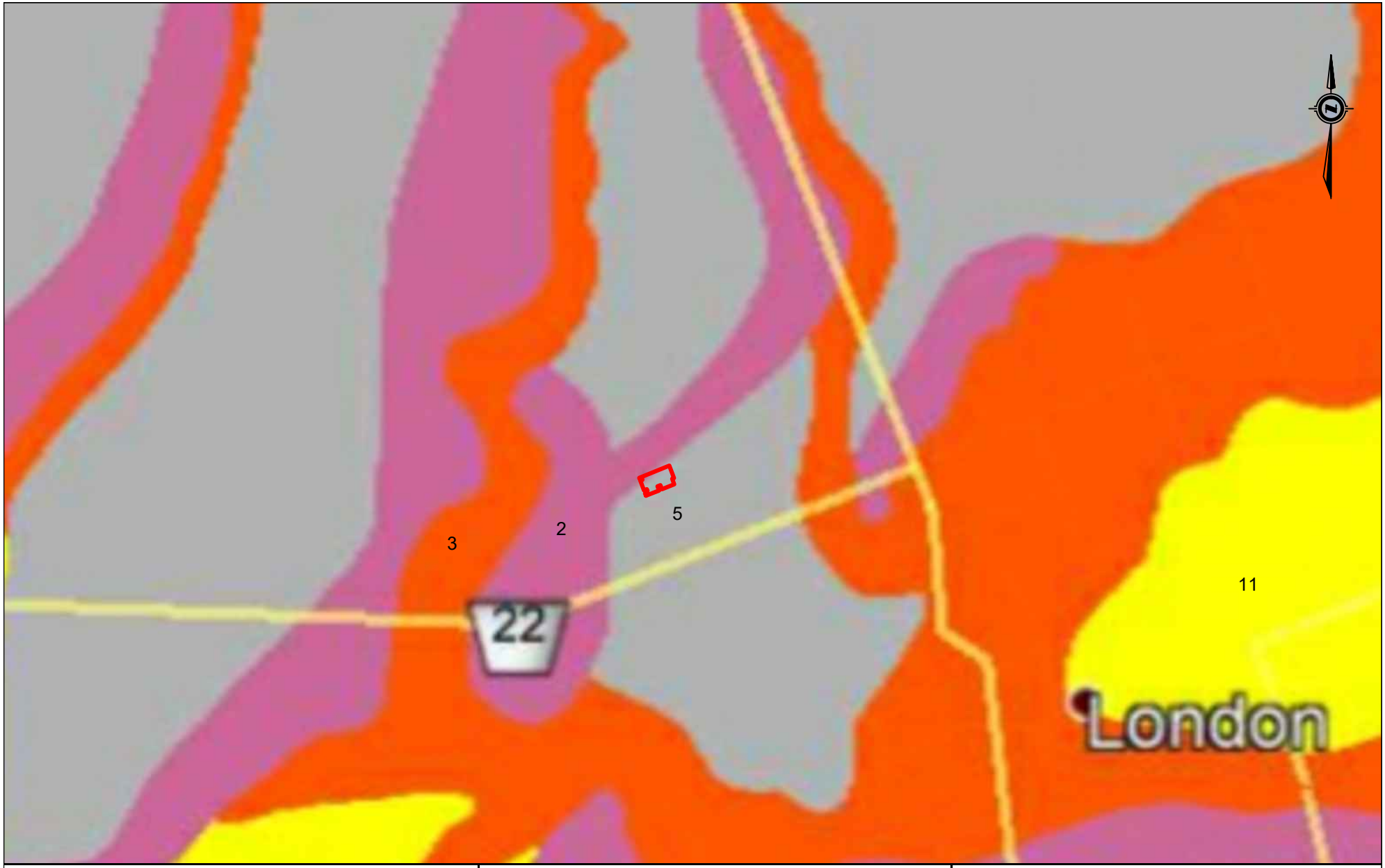

-LEGEND-

- Approximate Site Boundary
- 2 Till Moraines
- 3 Spillways
- 5 Till Plains (Undrumlinized)
- 11 Sand Plains

Image Source: Chapman, L.J. and Putnam, D.F. 2007. The Physiography of Southern Ontario; Ontario Geological Survey, Miscellaneous Release---Data228.

Hydrogeological Assessment

Mount Pleasant Lands

2631 Hyde Park Rd & 1521 Sunningdale Rd W
London, Ontario

CLIENT	Auburn Developments Inc.
TITLE	Physiographic Landforms
Prepared By: K.D.	Reviewed By: H.J.

EXP Services Inc.
15701 Robin's Hill Road, London, ON, N5V 0A5

DATE	APPROXIMATE SCALE	PROJECT NO.	DWG.
SEPTEMBER 2021	1:100,000	LON-00017696-GE	7

-LEGEND-

- Approximate Site Boundary
- 5 Tavistock Till
- 11 Rannoch Till
- 24 Glaciolacustrine deposits - silt and clay

Image Source: Barnett, P.J., Cowan, W.R. and Henry, A.P. 1991. Quaternary geology of Ontario, southern sheet; Ontario Geological Survey, Map 2556.

Hydrogeological Assessment

Mount Pleasant Lands

2631 Hyde Park Rd & 1521 Sunningdale Rd W
London, Ontario

CLIENT	Auburn Developments Inc.
TITLE	Quaternary Geology
Prepared By: K.D.	Reviewed By: H.J.

EXP Services Inc.
15701 Robin's Hill Road, London, ON, N5V 0A5

DATE	APPROXIMATE SCALE	PROJECT NO.	DWG.
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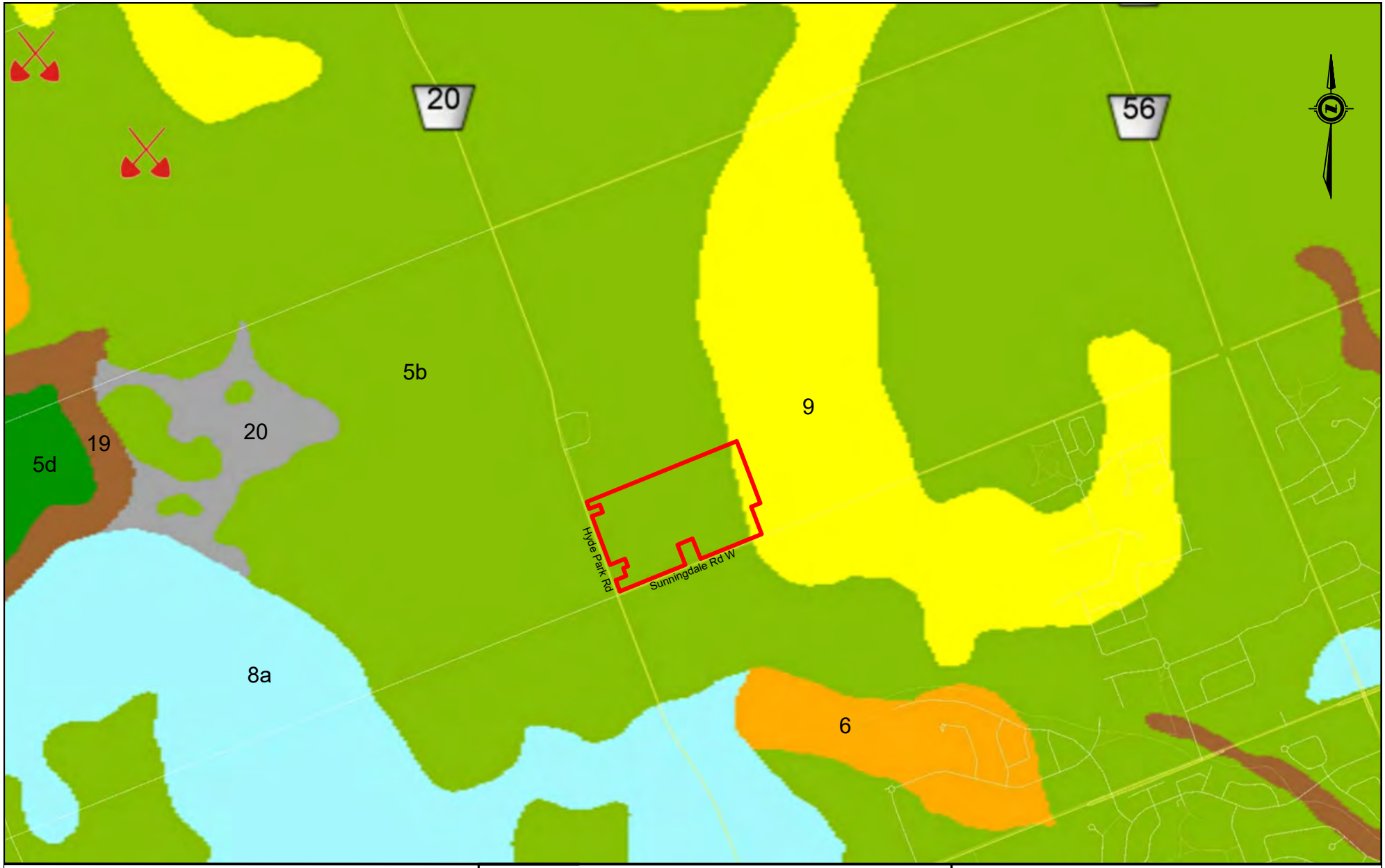


-LEGEND-

- Approximate Site Boundary
- 5b Till: sandy silt to silty sand
- 5d Till: clay to silt
- 6 Ice contact stratified deposits
- 8a Fine-textured glaciolacustrine deposits
- 9 Coarse-textured glaciolacustrine deposits
- 19 Modern alluvial deposits
- 20 Organic deposits

Image Source: Barnett, P.J., Cowan, W.R. and Henry, A.P. 1991. Quaternary geology of Ontario, southern sheet; Ontario Geological Survey, Map 2556.

Hydrogeological Assessment

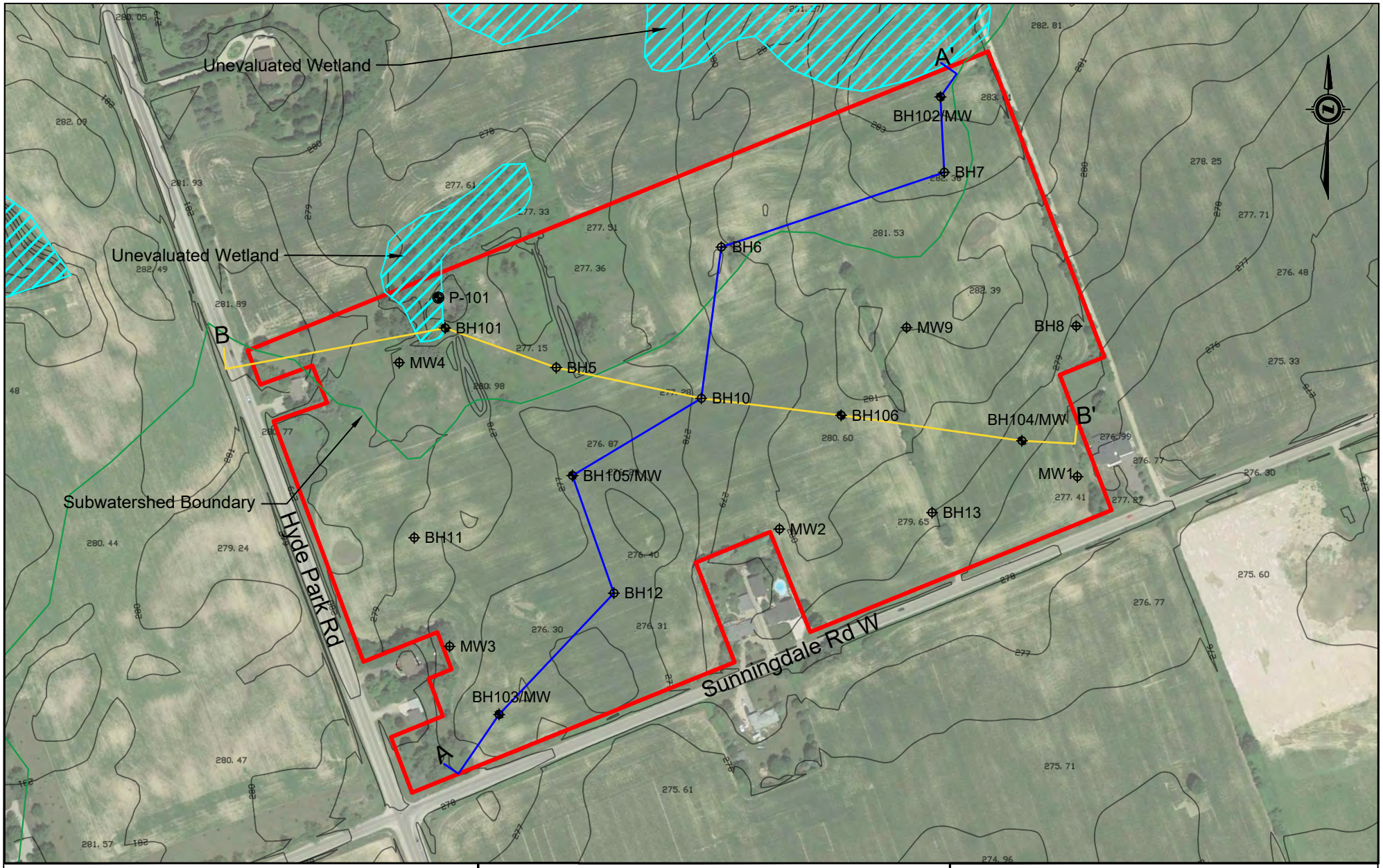
Mount Pleasant Lands

2631 Hyde Park Rd & 1521 Sunningdale Rd W
London, Ontario

CLIENT	Auburn Developments Inc.
TITLE	Surficial Geology
Prepared By: K.D.	Reviewed By: H.J.

EXP Services Inc.
15701 Robin's Hill Road, London, ON, N5V 0A5

DATE	APPROXIMATE SCALE	PROJECT NO.	DWG.
SEPTEMBER 2021	1:20,000	LON-00017696-GE	9



A—A'	Cross Sections
BH101/MW	Approximate Borehole Location (EXP, 2020)
MW1	Approximate Borehole Location (Golder,1997)
P-101	Approximate Piezometer Location (EXP, 2020)
INF4	Approximate Infiltration Test Location
	Approximate Site Boundary
	Subwatershed Boundary
	Unevaluated Wetland

Image Source: Google Earth Pro (July 2018)
Note: Natural Heritage Feature boundaries obtained from City of London's Natural Heritage Map 5.

Hydrogeological Assessment

Mount Pleasant Lands

2631 Hyde Park Rd & 1521 Sunningdale Rd W
London, Ontario

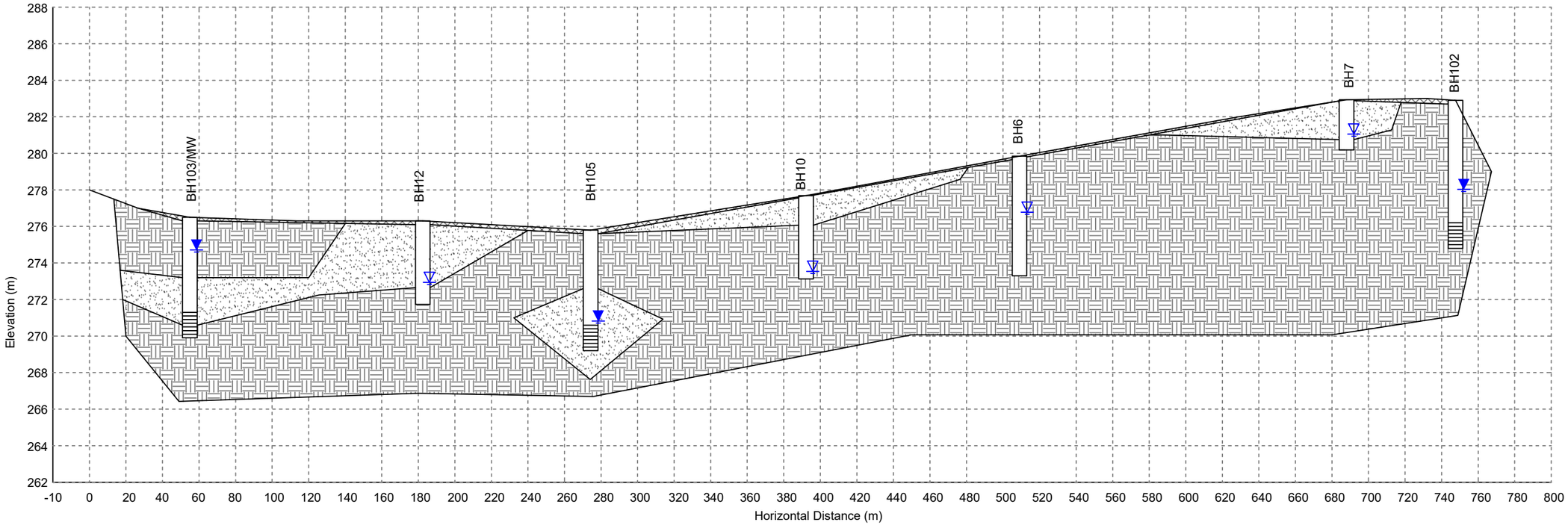
CLIENT	Auburn Developments Inc.
TITLE	Cross Sections A-A' and B-B'
Prepared By: J.M.	Reviewed By: H.J.

EXP Services Inc.
15701 Robin's Hill Road, London, ON, N5V 0A5

DATE	APPROXIMATE SCALE	PROJECT NO.	DWG.
MAY 2021	1:4000	LON-00017696-GE	10

Cross Section A - A'

SW NE



-LEGEND-

- Groundwater Measurement, Januray 31, 2021 (EXP)
- Groundwater Measurement, Januray 19, 1998 (Golder)
- Top Soil
- Sand and Gravel
- Clayey Silt Till

-NOTES-

1. The cross section should be read in conjunction with EXP Hydrogeological Assessment LON-00017696-GE.
2. Refer to Drawing 10 for cross section location.

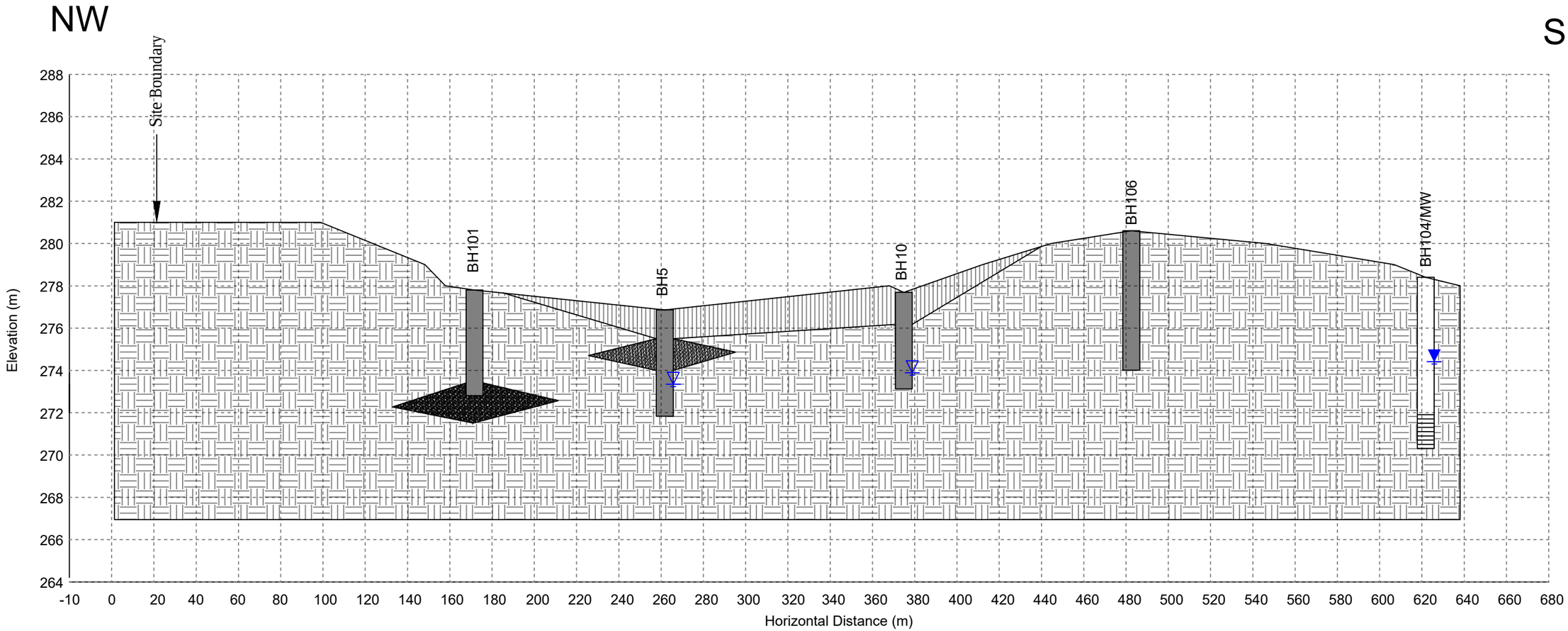
Hydrogeological Assessment

Mount Pleasant Lands

2631 Hyde Park Rd & 1521 Sunningdale Rd W
London, Ontario

CLIENT	Auburn Developments Inc.
TITLE	Cross Section A - A'
DRAWN BY: J.M. / REVIEWED BY: H.J. / DATE: MAY 2021	
	EXP Services Inc. 15701 Robin's Hill Road London, ON, N5V 0A5
SCALE: H=1:1000, V=1:200 (11x17) / PROJECT NO.: LON-00017696-GE / DWG.: 11	

Cross Section B - B'



-LEGEND-

- Groundwater Measurement, Januray 31, 2021 (EXP)
- Groundwater Measurement, Januray 19, 1998 (Golder)
- Silt
- Sandy Silt
- Sand and Gravel
- Clayey Silt Till

-NOTES-

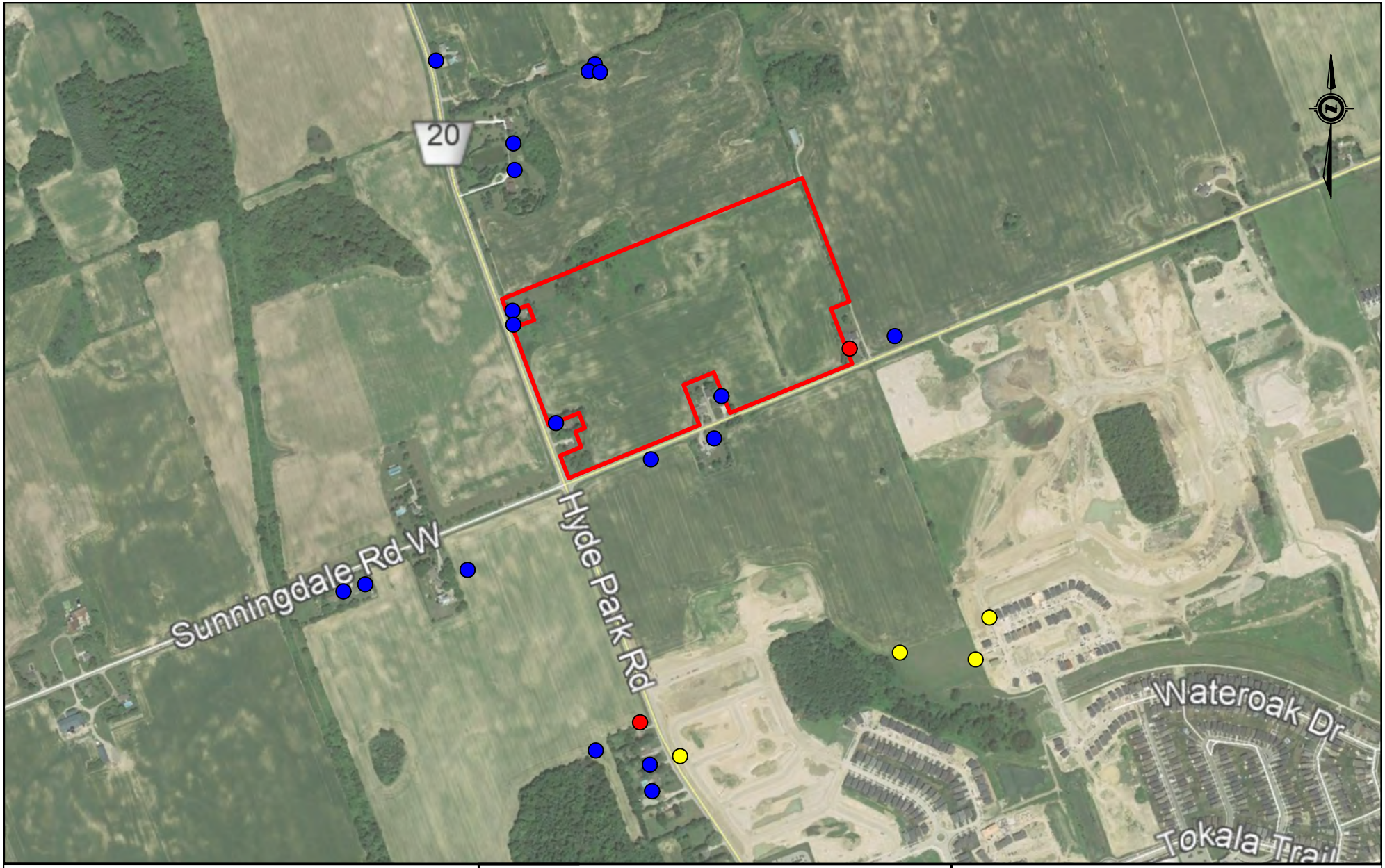
1. The cross section should be read in conjunction with EXP Hydrogeological Assessment LON-00017696-GE.
2. Refer to Drawing 10 for cross section location.

Hydrogeological Assessment

Mount Pleasant Lands

2631 Hyde Park Rd & 1521 Sunningdale Rd W
London, Ontario

CLIENT	Auburn Developments Inc.
TITLE	Cross Section B - B'
DRAWN BY: J.M. / REVIEWED BY: H.J. / DATE: MAY 2021	
	EXP Services Inc. 15701 Robin's Hill Road London, ON, N5V 0A5
SCALE: H=1:1000, V=1:200 (11x17) / PROJECT NO.: LON-00017696-GE / DWG.: 12	



-LEGEND-

- Approximate Site Boundary
- Water Supply - Domestic
- Monitoring/Test Hole
- Abandoned

Image Source: Google Earth Pro (July 2018)

Hydrogeological Assessment

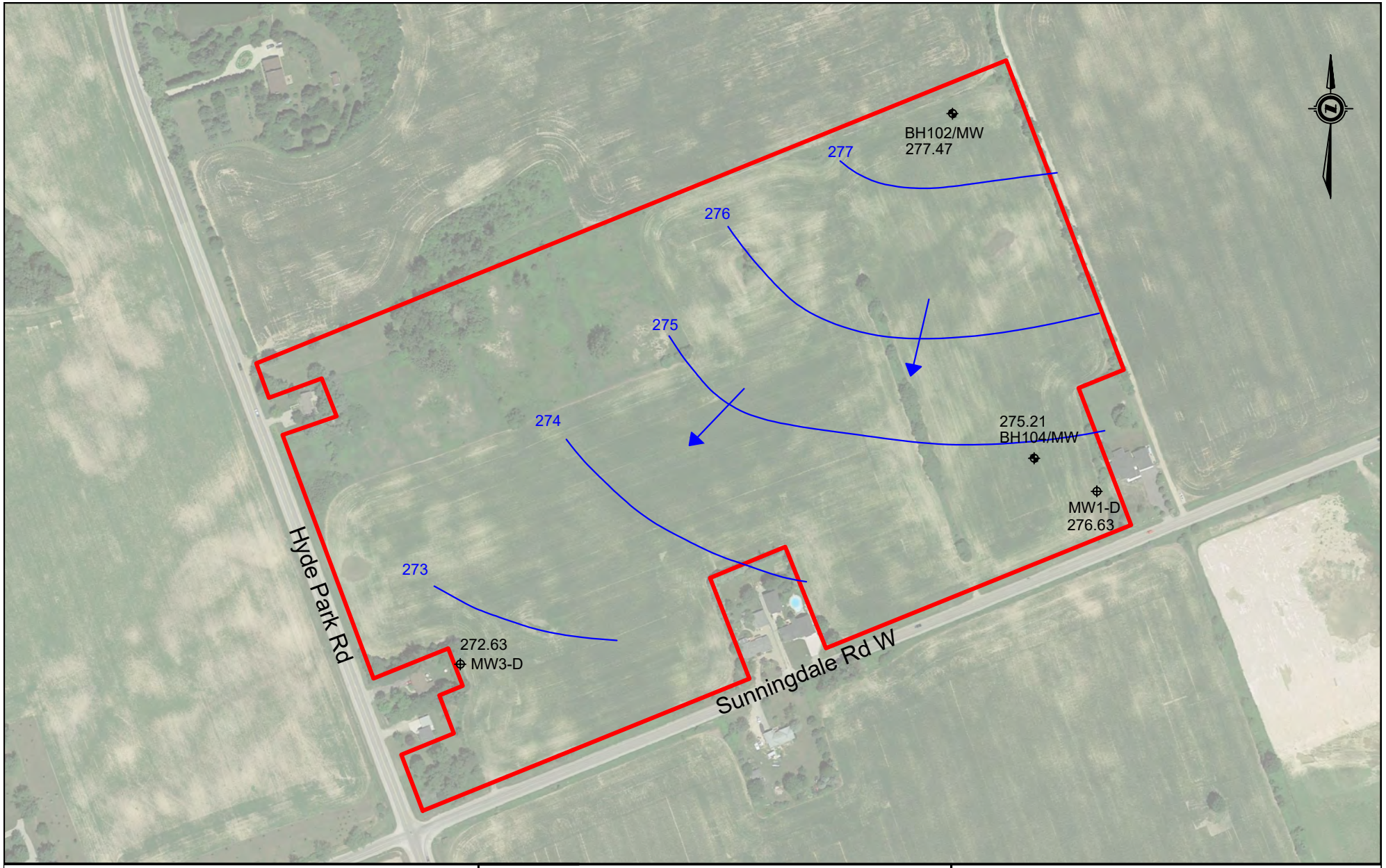
Mount Pleasant Lands

2631 Hyde Park Rd & 1521 Sunningdale Rd W
London, Ontario

CLIENT	Auburn Developments Inc.
TITLE	Approximate Location of MECP Registered Wells
Prepared By: K.D.	Reviewed By: H.J.

EXP Services Inc.
15701 Robin's Hill Road, London, ON, N5V 0A5

DATE	APPROXIMATE SCALE	PROJECT NO.	DWG.
MAY 2021	1:10,000	LON-00017696-GE	13



-LEGEND-

- Approximate Site Boundary
- BH101/MW — Approximate Borehole Location (EXP, 2020)
- MW1 — Approximate Borehole Location (Golder,1997)
- 274.19 — Groundwater Measurement (March 17, 2020)
- Groundwater Equipotential Line
- Groundwater Flow Direction

Image Source: Google Earth Pro (July 2018)

Hydrogeological Assessment

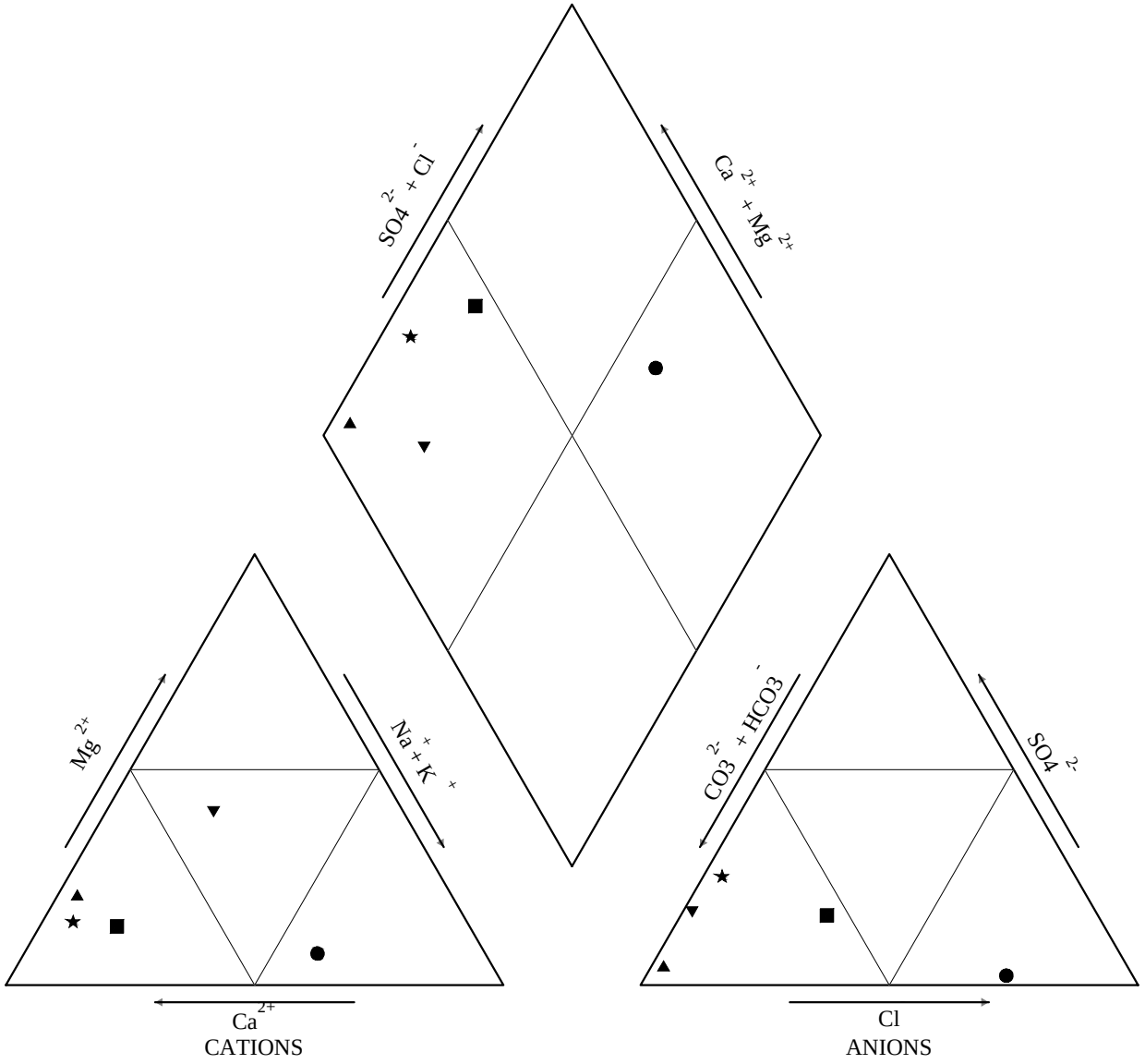
Mount Pleasant Lands

2631 Hyde Park Rd & 1521 Sunningdale Rd W
London, Ontario

CLIENT	Auburn Developments Inc.
TITLE	Groundwater Flow Direction
Prepared By: K.D.	Reviewed By: H.J.

EXP Services Inc.
15701 Robin's Hill Road, London, ON, N5V 0A5

DATE	APPROXIMATE SCALE	PROJECT NO.	DWG.
MAY 2021	1:4,000	LON-00017696-GE	14



-LEGEND-

- MW3-D
- MW4-D
- BH103/MW
- BH104/MW
- SW1

Hydrogeological Assessment

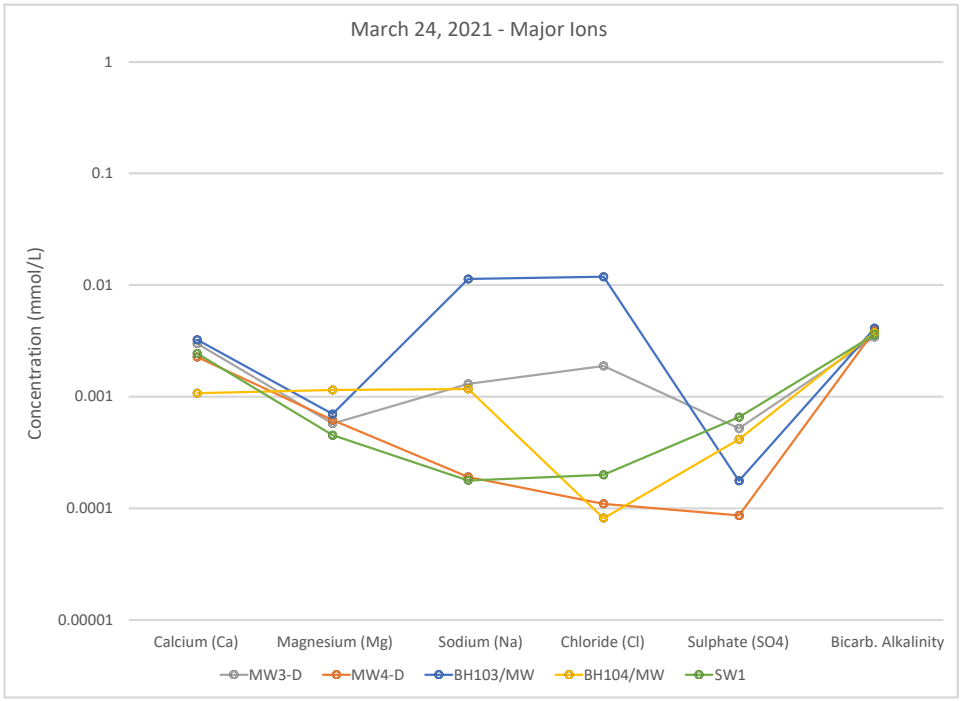
Mount Pleasant Lands

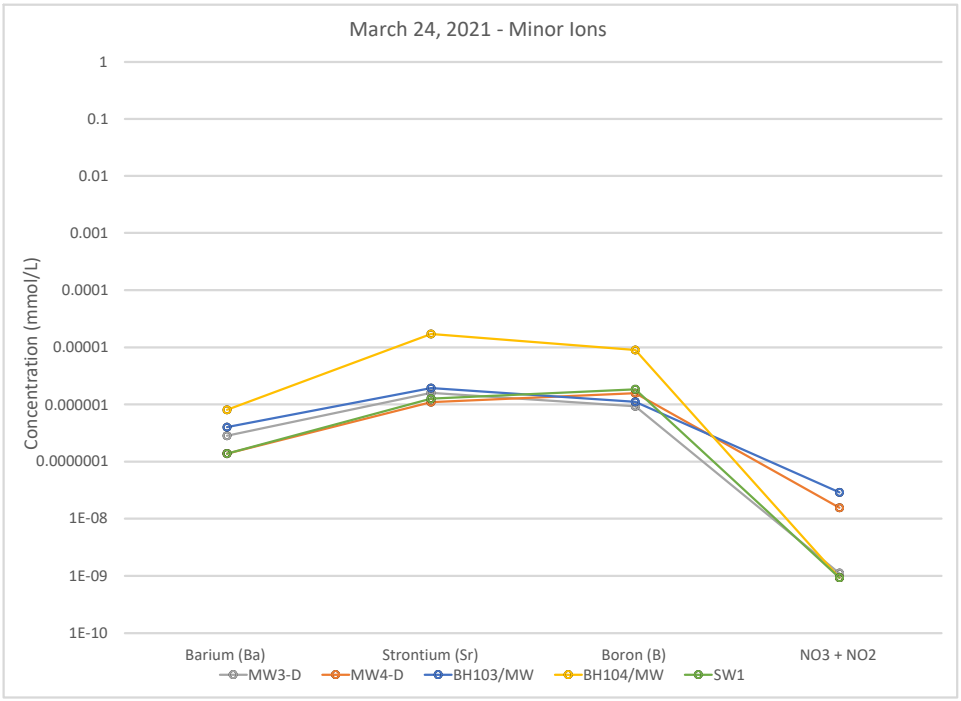
2631 Hyde Park Rd & 1521 Sunningdale Rd W
London, Ontario

CLIENT	Auburn Developments Inc.
TITLE	Piper Diagram
Prepared By: K.D.	Reviewed By: H.J.

EXP Services Inc.
15701 Robin's Hill Road, London, ON, N5V 0A5

DATE	APPROXIMATE SCALE	PROJECT NO.	DWG.
MAY 2021	NA	LON-00017696-GE	15





Hydrogeological Assessment

Mount Pleasant Lands

2631 Hyde Park Rd & 1521 Sunningdale Rd W
London, Ontario

CLIENT: Auburn Developments Inc.

TITLE: Schoeller Diagrams for Water Quality

Prepared By: K.D.

Reviewed By: H.J.

EXP Services Inc.
15701 Robin's Hill Road, London, ON, N5V 0A5

D-TE	-PPROXIM-TE SC-LE	PROJECT NO.	DWG.
MAY 2021	NA	LON-00017696-GE	16

-LEGEND-

Approximate Site Boundary

Significant Groundwater Recharge Area - Approved

Image Source: UTRCA online mapping software: maps.thamesriver.on.ca

Hydrogeological Assessment

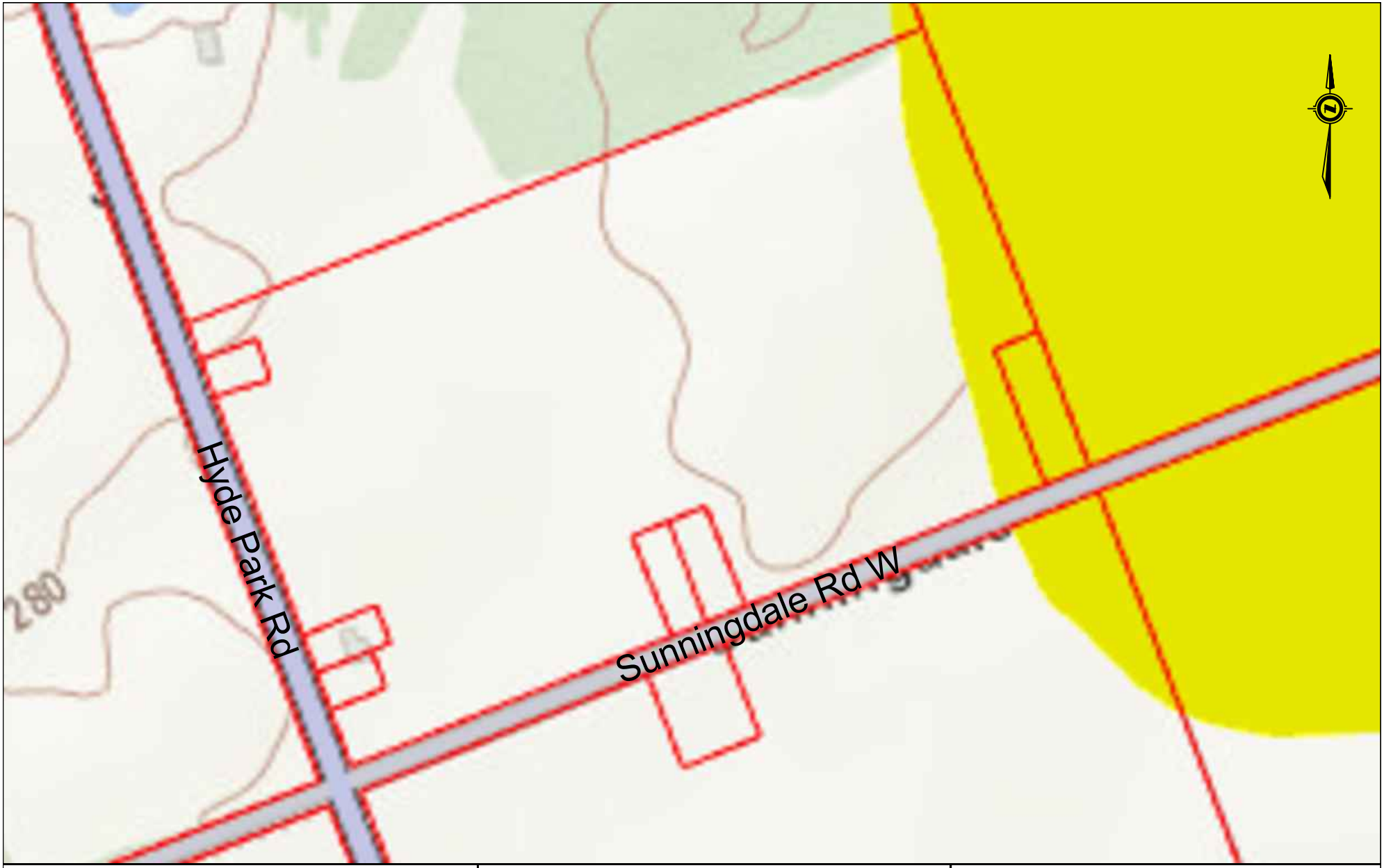
Mount Pleasant Lands

2631 Hyde Park Rd & 1521 Sunningdale Rd W
London, Ontario

CLIENT	Auburn Developments Inc.
TITLE	Significant Groundwater Recharge Areas
Prepared By: K.D.	Reviewed By: H.J.

EXP Services Inc.
15701 Robin's Hill Road, London, ON, N5V 0A5

DATE	APPROXIMATE SCALE	PROJECT NO.	DWG.
MAY 2021	1:4,000	LON-00017696-GE	17



-LEGEND-

Approximate Site Boundary

Highly Vulnerable Aquifer - Approved

Image Source: UTRCA online mapping software: maps.thamesriver.on.ca

Hydrogeological Assessment

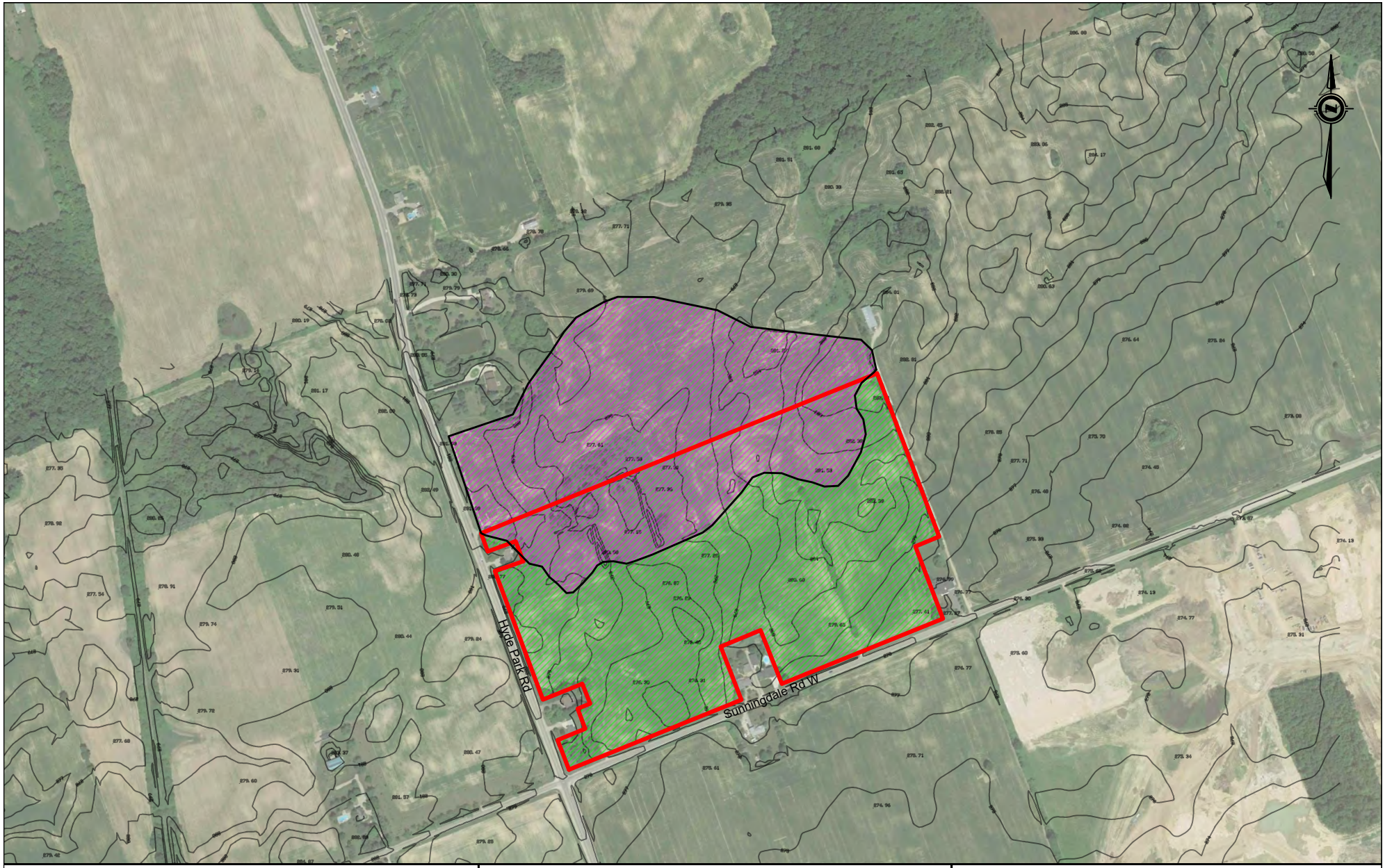
Mount Pleasant Lands

2631 Hyde Park Rd & 1521 Sunningdale Rd W
London, Ontario

CLIENT	Auburn Developments Inc.
TITLE	Highly Vulnerable Aquifers
Prepared By: K.D.	Reviewed By: H.J.

EXP Services Inc.
15701 Robin's Hill Road, London, ON, N5V 0A5

DATE	APPROX. SCALE	PROJECT NO.	DWG.
MAY 2021	1:4,000	LON-00017696-GE	18



-LEGEND-

- Approximate Site Boundary
- Area 1 - Drains to Unevaluated Wetland
- Area 2 - Drains to Southwest

Image Source: Google Earth Pro (July 2018); City of London Digital Mapping (2017)

Hydrogeological Assessment

Mount Pleasant Lands

2631 Hyde Park Rd & 1521 Sunningdale Rd W
London, Ontario

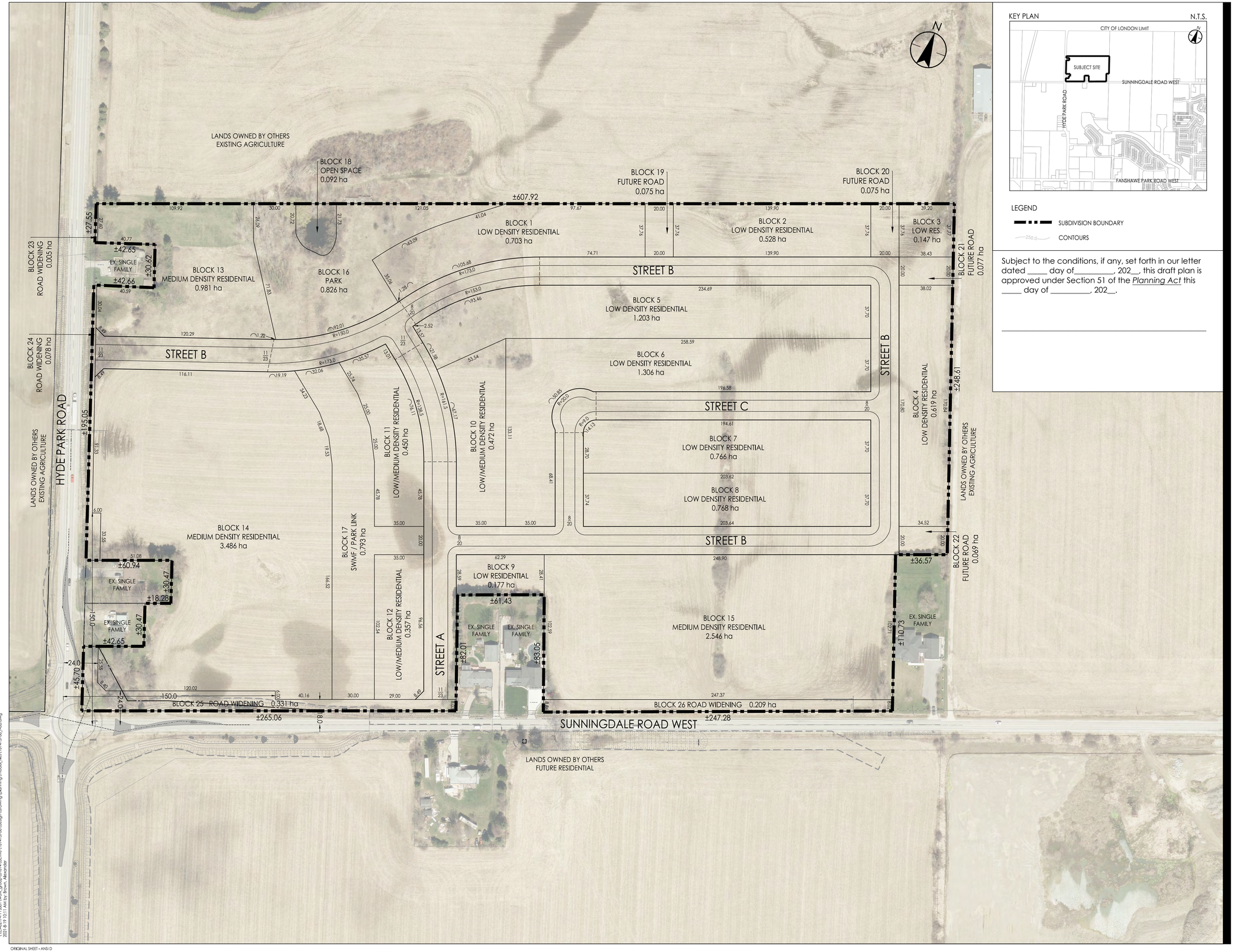
CLIENT	Auburn Developments Inc.
TITLE	Pre-Development Drainage Areas
Prepared By: E.B.	Reviewed By: K.D.

EXP Services Inc.
15701 Robin's Hill Road, London, ON, N5V 0A5

DATE	APPROXIMATE SCALE	PROJECT NO.	DWG.
MAY 2021	1:7,500	LON-00017696-GE	19

Appendix B – Draft Plan and Ecological Land Classification

15701 Robin's Hill Road | London, Ontario | Canada
t: +1.519.963.3000 | f: +1.519.963.1152 | exp.com



KEY PLAN N.T.S.

LEGEND

SUBDIVISION BOUNDARY

250.0 CONTOURS

Subject to the conditions, if any, set forth in our letter dated _____ day of_____, 202__, this draft plan is approved under Section 51 of the *Planning Act* this _____ day of _____, 202__.

_____

Stantec

Stantec
600-171 Queens Avenue
London ON N6A 5J7
Tel. 519-645-2007
www.stantec.com

Liability Note

The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing - any errors or omissions shall be reported to Stantec without delay.

DRAFT PLAN OF SUBDIVISION MOUNT PLEASANT LANDS

PART OF
LOT 24
CONCESSION 6
IN THE
CITY OF LONDON
COUNTY OF MIDDLESEX

INFORMATION REQUIRED UNDER SECTION 51(17) OF THE PLANNING ACT

A: AS SHOWN ON DRAFT PLAN
B: AS SHOWN ON DRAFT AND KEY PLAN
C: AS SHOWN ON DRAFT AND KEY PLAN
D: ACCORDING TO LAND USE SCHEDULE
E: RESIDENTIAL, AGRICULTURAL
F: AS SHOWN ON DRAFT PLAN
G: AS SHOWN ON DRAFT AND KEY PLAN
H: MUNICIPAL PIPED WATER TO BE INSTALLED
I : T.B.D.
J: AS SHOWN ON DRAFT PLAN
K: MUNICIPAL SANITARY AND STORM SEWERS TO BE INSTALLED
L: AS SHOWN ON PLAN

SCHEDULE OF LAND USE

LOW DENSITY RESIDENTIAL	- BLOCKS 1 - 9	6.217 ha
LOW/MEDIUM DENSITY RESIDENTIAL	- BLOCKS 10 - 12	1.279 ha
MEDIUM DENSITY RESIDENTIAL	- BLOCKS 13 - 15	7.013 ha
PARK	- BLOCKS 16	0.826 ha
SWMF / PARK LINK	- BLOCK 17	0.793 ha
OPEN SPACE	- BLOCK 18	0.092 ha
FUTURE ROAD	- BLOCK 19 - 22	0.296 ha
ROAD WIDENING	- BLOCK 23 - 26	0.623 ha
ROADS		3.404 ha
	TOTAL	20.543 ha

OWNER'S AUTHORIZATION

THE UNDERSIGNED AUTHORIZES THE PREPARATION AND SUBMISSION OF THIS DRAFT PLAN OF SUBDIVISION.

JAMIE CRICH, PRESIDENT
AUBURN DEVELOPMENTS INC.
AUTHORIZING AGENT — DATE

SURVEYOR'S CERTIFICATE

I HEREBY CERTIFY THAT THE BOUNDARIES OF THE LAND TO BE SUBDIVIDED, AS SHOWN ON THIS PLAN, AND THEIR RELATIONSHIP TO ADJACENT LANDS ARE ACCURATELY AND CORRECTLY SHOWN.

JEREMY C.E. MATTHEWS O.L.S.
STANTEC GEOMATICS — DATE

File Name: 161413708_r-db	RT	BB	RT	21.07.30
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Client/Project

AUBURN DEVELOPMENTS INC.

1521 SUNNINGDALE ROAD WEST

London, ON Canada

Title

DRAFT PLAN OF SUBDIVISION
AUGUST 19, 2021

Project No.	Scale	Drawing No.	Sheet	Revision
161413708	HORZ – 1 : 1250 (12.5 0 25m)	1	1 of 1	

\\CAD01.FPPS01\work_group\161413708\active\161413708\design\drawing\modal\files\161413708_r-db.dwg
2021-8-19 10:11 AM by: Brown, Alexander

ORIGINAL SHEET - ANSI D

Appendix C – Borehole Logs

15701 Robin's Hill Road | London, Ontario | Canada
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BOREHOLE LOG

BH101
Sheet 1 of 1

CLIENT **Auburn Developments Inc.** PROJECT NO. **LON-00017696-GE**

PROJECT **Mount Pleasant Lands - London, Ontario** DATUM **Geodetic**

LOCATION **2631 Hyde Park Rd & 1521 Sunningdale Rd W** DATES: Boring **January 22, 2020** Water Level

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (%)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	277.8								
	277.5	**TOPSOIL** - 300 mm							
1		**CLAYEY SILT TILL** - brown, weathered in upper levels, trace sand, trace gravel, stiff to very stiff, moist			SS	S1	100	9	15
2					SS	S2	100	12	14
3					SS	S3	100	23	14
					SS	S4	100	22	12
4					AS	S5			11
	273.4								
		SAND AND GRAVEL - brown, trace silt, compact, moist			SS	S6	60	14	7
5	272.8	**End of Borehole at 5.0 m bgs.**							
6									
7									
8									
9									

SHEAR STRENGTH
S Field Vane Test (#=Sensitivity)
Penetrometer Torvane
100 200 kPa

Atterberg Limits and Moisture
W_P W W_L

SPT N Value × Dynamic Cone
10 20 30 40

NOTES

1) Borehole Log interpretation requires assistance by EXP before use by others. Borehole Logs must be read in conjunction with EXP Report LON-00017696-GE.
2) bgs denotes below ground surface.
3) Borehole open to 4.6 m bgs and dry upon completion of drilling.
4) No significant methane gas concentration was detected upon completion of drilling.

SAMPLE LEGEND
AS Auger Sample SS Split Spoon ST Shelby Tube
Rock Core (eg. BQ, NQ, etc.) VN Vane Sample

OTHER TESTS

G Specific Gravity	C Consolidation
H Hydrometer	CD Consolidated Drained Triaxial
S Sieve Analysis	CU Consolidated Undrained Triaxial
γ Unit Weight	UU Unconsolidated Undrained Triaxial
P Field Permeability	UC Unconfined Compression
K Lab Permeability	DS Direct Shear

WATER LEVELS
Apparent Measured Artesian (see Notes)

BOREHOLE LOG

BH102/MW
Sheet 1 of 1

CLIENT **Auburn Developments Inc.** PROJECT NO. **LON-00017696-GE**

PROJECT **Mount Pleasant Lands - London, Ontario** DATUM **Geodetic**

LOCATION **2631 Hyde Park Rd & 1521 Sunningdale Rd W** DATES: Boring **January 22, 2020** Water Level **Feb 7/20**

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (%)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	282.9								
	282.7	**TOPSOIL** - 200 mm							
		CLAYEY SILT TILL - brown, weathered in upper levels, trace sand, trace gravel, firm to very stiff, moist							
1					SS	S1	100	6	18
2					SS	S2	100	14	13
					SS	S3	20	27	14
3					SS	S4	100	18	13
		- becoming grey near 3.7 m bgs							
4					SS	S5	100	14	13
					SS	S6	100	13	12
5									
		- becoming very moist to wet below 5.6 m bgs							
6									
		- dilatant silt layering encountered near 6.1 m bgs			SS	S7	20	20	19
7									
8	274.8	- 150 mm thick wet sand and gravel lens encountered near 7.8 m bgs			SS	S8	100	26	15
		End of Borehole at 8.1 m bgs.							
9									

SHEAR STRENGTH
S Field Vane Test (#=Sensitivity)
Penetrometer Torvane
100 200 kPa

Atterberg Limits and Moisture
W_P W W_L
SPT N Value Dynamic Cone
10 20 30 40

NOTES

1) Borehole Log interpretation requires assistance by EXP before use by others. Borehole Logs must be read in conjunction with EXP Report LON-00017696-GE.
2) bgs denotes below ground surface.
3) No significant methane gas concentration was detected upon completion of drilling.
4) Water Level Readings:
January 31, 2020 - 5.23 m bgs, Elevation 277.65 m
February 7, 2020 - 5.15 m bgs, Elevation 277.73 m

SAMPLE LEGEND
AS Auger Sample SS Split Spoon ST Shelby Tube
Rock Core (eg. BQ, NQ, etc.) VN Vane Sample

OTHER TESTS

G Specific Gravity	C Consolidation
H Hydrometer	CD Consolidated Drained Triaxial
S Sieve Analysis	CU Consolidated Undrained Triaxial
γ Unit Weight	UU Unconsolidated Undrained Triaxial
P Field Permeability	UC Unconfined Compression
K Lab Permeability	DS Direct Shear

WATER LEVELS
Apparent Measured Artesian (see Notes)

BOREHOLE LOG

BH103/MW
Sheet 1 of 1

CLIENT **Auburn Developments Inc.** PROJECT NO. **LON-00017696-GE**

PROJECT **Mount Pleasant Lands - London, Ontario** DATUM **Geodetic**

LOCATION **2631 Hyde Park Rd & 1521 Sunningdale Rd W** DATES: Boring **January 23, 2020** Water Level **Feb 7/20**

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (%)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	276.5								
	276.3	**TOPSOIL** - 200 mm							
		CLAYEY SILT TILL - brown, weathered in upper levels, trace sand, trace gravel, very stiff, moist							
1					SS	S1	100	16	14
2					SS	S2	100	22	12
					SS	S3	30	27	14
3	273.2				SS	S4	100	18	14
		SAND - brown, fine to medium grained, some silt, trace gravel, compact to loose, wet							
4					SS	S5	100	14	24
		- clayey silt layering encountered near 4.0 m bgs							
5					SS	S6	100	8	17
	270.6								
6		**CLAYEY SILT TILL** - grey, trace sand, trace gravel, very stiff, very moist							
	270.0				SS	S7	80	15	16
		End of Borehole at 6.6 m bgs.							
7									
8									
9									

SHEAR STRENGTH
S Field Vane Test (#=Sensitivity)
Penetrometer Torvane
100 200 kPa

Atterberg Limits and Moisture
W_P W W_L
SPT N Value × Dynamic Cone
10 20 30 40

NOTES

1) Borehole Log interpretation requires assistance by EXP before use by others. Borehole Logs must be read in conjunction with EXP Report LON-00017696-GE.
2) bgs denotes below ground surface.
3) No significant methane gas concentration was detected upon completion of drilling.
4) Water Level Readings:
January 31, 2020 - 1.67 m bgs, Elevation 274.83 m
February 7, 2020 - 2.11 m bgs, Elevation 274.39 m

SAMPLE LEGEND
AS Auger Sample SS Split Spoon ST Shelby Tube
Rock Core (eg. BQ, NQ, etc.) VN Vane Sample

OTHER TESTS

G Specific Gravity	C Consolidation
H Hydrometer	CD Consolidated Drained Triaxial
S Sieve Analysis	CU Consolidated Undrained Triaxial
γ Unit Weight	UU Unconsolidated Undrained Triaxial
P Field Permeability	UC Unconfined Compression
K Lab Permeability	DS Direct Shear

WATER LEVELS
Apparent Measured Artesian (see Notes)

BOREHOLE LOG

BH104/MW
Sheet 1 of 1

CLIENT **Auburn Developments Inc.** PROJECT NO. **LON-00017696-GE**
PROJECT **Mount Pleasant Lands - London, Ontario** DATUM **Geodetic**
LOCATION **2631 Hyde Park Rd & 1521 Sunningdale Rd W** DATES: Boring **January 21, 2020** Water Level **Feb 7/20**

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (%)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
	278.4						
0	278.2	**TOPSOIL** - 150 mm					
		CLAYEY SILT TILL - brown, weathered in upper levels, trace sand, trace gravel, stiff to very stiff, moist					
1			SS	S1	100	14	17
2			SS	S2	100	15	11
			SS	S3	100	16	13
3		- possible cobble encountered near 2.7 m bgs - becoming grey near 2.9 m bgs	SS	S4	100	13	15
4			SS	S5	100	9	17
5			SS	S6	100	10	19
6		- dilatant silt layering encountered near 6.1 m bgs	SS	S7	100	8	22
7							
8	270.3		SS	S8	100	21	12
		End of Borehole at 8.1 m bgs.					
9							

SHEAR STRENGTH
S Field Vane Test (#=Sensitivity)
Penetrometer Torvane
100 200 kPa

Atterberg Limits and Moisture
W_P W W_L
SPT N Value Dynamic Cone
10 20 30 40

NOTES

1) Borehole Log interpretation requires assistance by EXP before use by others. Borehole Logs must be read in conjunction with EXP Report LON-00017696-GE.
2) bgs denotes below ground surface.
3) No significant methane gas concentration was detected upon completion of drilling.
4) Water Level Readings:
January 31, 2020 - 3.12 m bgs, Elevation 275.25 m
February 7, 2020 - 3.09 m bgs, Elevation 275.28 m

SAMPLE LEGEND
AS Auger Sample SS Split Spoon ST Shelby Tube
Rock Core (eg. BQ, NQ, etc.) VN Vane Sample

OTHER TESTS

G Specific Gravity	C Consolidation
H Hydrometer	CD Consolidated Drained Triaxial
S Sieve Analysis	CU Consolidated Undrained Triaxial
γ Unit Weight	UU Unconsolidated Undrained Triaxial
P Field Permeability	UC Unconfined Compression
K Lab Permeability	DS Direct Shear

WATER LEVELS
Apparent Measured Artesian (see Notes)

BOREHOLE LOG

BH105/MW
Sheet 1 of 1

CLIENT **Auburn Developments Inc.** PROJECT NO. **LON-00017696-GE**
PROJECT **Mount Pleasant Lands - London, Ontario** DATUM **Geodetic**
LOCATION **2631 Hyde Park Rd & 1521 Sunningdale Rd W** DATES: Boring **January 22, 2020** Water Level **Feb 7/20**

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (%)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	277.0								
	276.8	**TOPSOIL** - 200 mm							
1		**CLAYEY SILT TILL** - brown, weathered in upper levels, trace sand, trace gravel, stiff to very stiff, moist			SS	S1	100	14	18
2					SS	S2	100	27	13
		- dilatant silt layer encountered near 2.3 m bgs			SS	S3	100	17	15
3	273.8								
		SANDY SILT - brown, trace clay, compact to dense, very moist - wet sand layer encountered near 3.2 m bgs			SS	S4	80	13	21
4					AS	S5			18
					SS	S6	80	30	18
5		- wet sand layer encountered near 4.9 m bgs							
	271.4								
6		**SAND AND GRAVEL** - brown, trace silt, compact, wet							
	270.4				SS	S7	60	18	17
		End of Borehole at 6.6 m bgs.							
7									
8									
9									

SHEAR STRENGTH
S Field Vane Test (#=Sensitivity)
Penetrometer Torvane
100 200 kPa

Atterberg Limits and Moisture
W_P W W_L
SPT N Value × Dynamic Cone
10 20 30 40

NOTES

1) Borehole Log interpretation requires assistance by EXP before use by others. Borehole Logs must be read in conjunction with EXP Report LON-00017696-GE.
2) bgs denotes below ground surface.
3) No significant methane gas concentration was detected upon completion of drilling.
4) Water Level Readings:
January 31, 2020 - 5.18 m bgs, Elevation 271.78 m
February 7, 2020 - 5.09 m bgs, Elevation 271.87 m

SAMPLE LEGEND
AS Auger Sample SS Split Spoon ST Shelby Tube
Rock Core (eg. BQ, NQ, etc.) VN Vane Sample

OTHER TESTS

G Specific Gravity	C Consolidation
H Hydrometer	CD Consolidated Drained Triaxial
S Sieve Analysis	CU Consolidated Undrained Triaxial
γ Unit Weight	UU Unconsolidated Undrained Triaxial
P Field Permeability	UC Unconfined Compression
K Lab Permeability	DS Direct Shear

WATER LEVELS
Apparent Measured Artesian (see Notes)

BOREHOLE LOG

BH106
Sheet 1 of 1

CLIENT **Auburn Developments Inc.** PROJECT NO. **LON-00017696-GE**

PROJECT **Mount Pleasant Lands - London, Ontario** DATUM **Geodetic**

LOCATION **2631 Hyde Park Rd & 1521 Sunningdale Rd W** DATES: Boring **January 23, 2020** Water Level

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (%)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	280.6								
	280.5	**TOPSOIL** - 150 mm							
		CLAYEY SILT TILL - brown, weathered in upper levels, trace to some sand, trace to some gravel, stiff to very stiff, moist							
1					SS	S1	100	24	10
		- possible cobble encountered near 1.5 m bgs			AS	S2			10
2					SS	S3	100	25	12
3		- becoming grey near 2.9 m bgs			SS	S4	100	27	13
4					AS	S5			15
					SS	S6	100	11	15
5									
6					SS	S7	100	12	19
	274.1								
		End of Borehole at 6.6 m bgs.							
7									
8									
9									

SHEAR STRENGTH
✤ S Field Vane Test (#=Sensitivity)
▲ Penetrometer ■ Torvane
100 200 kPa

Atterberg Limits and Moisture
W_P W W_L
● SPT N Value × Dynamic Cone
10 20 30 40

NOTES

1) Borehole Log interpretation requires assistance by EXP before use by others. Borehole Logs must be read in conjunction with EXP Report LON-00017696-GE.
2) bgs denotes below ground surface.
3) Borehole open to 5.8 m bgs and dry upon completion of drilling.
4) No significant methane gas concentration was detected upon completion of drilling.

SAMPLE LEGEND
☒ AS Auger Sample ▨ SS Split Spoon ■ ST Shelby Tube
▯ Rock Core (eg. BQ, NQ, etc.) ▯ VN Vane Sample

OTHER TESTS

G Specific Gravity	C Consolidation
H Hydrometer	CD Consolidated Drained Triaxial
S Sieve Analysis	CU Consolidated Undrained Triaxial
γ Unit Weight	UU Unconsolidated Undrained Triaxial
P Field Permeability	UC Unconfined Compression
K Lab Permeability	DS Direct Shear

WATER LEVELS
▽ Apparent ▼ Measured ▲ Artesian (see Notes)

PROJECT: 971-3223

RECORD OF BOREHOLE 1

SHEET 1 OF 2

LOCATION: - REFER TO PLAN FIGURE 1 -

BORING DATE: NOV. 25, 1997

DATUM: GEODETIC

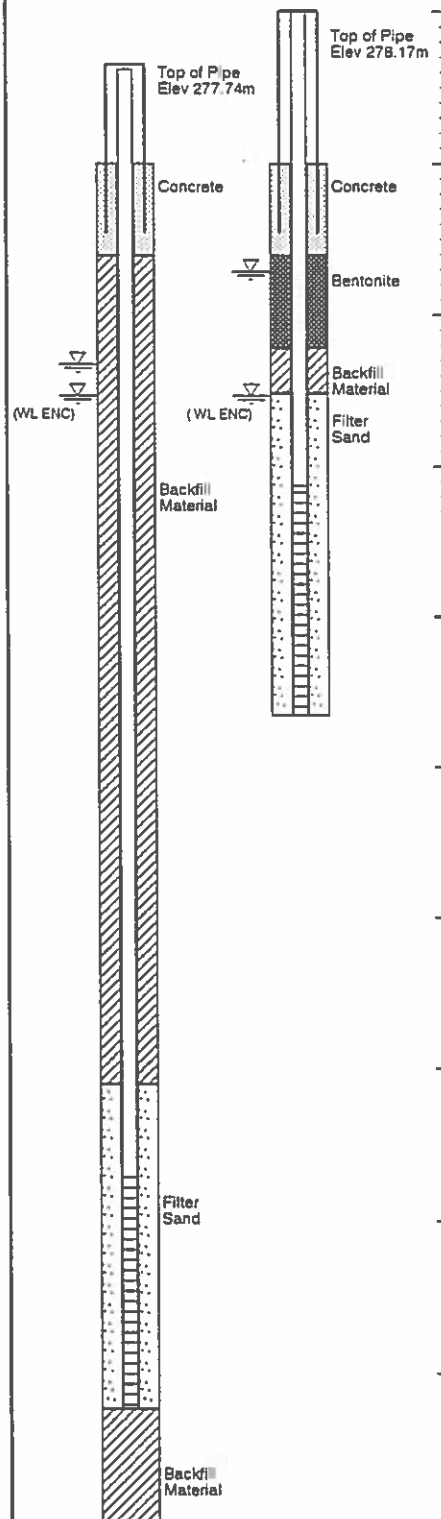
SAMPLER HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m
		GROUND SURFACE		277.12			
0	POWER AUGER (HOLLOW STEM)	Brown silty TOPSOIL, trace roots.		0.00 / 276.92			
				0.20	1	50 DO	6
1		Loose brown SILT, some sand.			2	50 DO	8
				275.60			
				1.52	3	50 DO	13
2		Stiff to very stiff grey CLAYEY SILT TILL			4	50 DO	30
3					5	50 DO	15
				273.31			
				3.81	6	50 DO	9
4		Firm to stiff grey SILTY CLAY trace sand.			7	50 DO	6
5					8	50 DO	6
				271.18			
6				5.94	9	50 DO	14
7		Stiff to hard grey, CLAYEY SILT TILL			10	50 DO	21
8					11	50 DO	80
					12	50 DO	68
9		CONTINUED ON NEXT PAGE					

WATER CONTENT PERCENT
Wp——W——Wl
10 20 30 40

ADDITIONAL LAB. TESTING

MONITORING INSTALLATIONS
GROUNDWATER AND
ENVIRONMENTAL OBSERVATIONS



DEPTH SCALE
1 : 50

Golder Associates

LOGGED: B.A.V.
CHECKED: DB

PROJECT: 971-3223

RECORD OF BOREHOLE 1

SHEET 2 OF 2

LOCATION: - REFER TO PLAN FIGURE 1 -

BORING DATE: NOV. 25, 1997

DATUM: GEODETIC

SAMPLER HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	WATER CONTENT PERCENT Wp----W----Wl (10 20 30 40) ⊕ O	ADDITIONAL LAB. TESTING	MONITORING INSTALLATIONS GROUNDWATER AND ENVIRONMENTAL OBSERVATIONS MW 1D MW 1S
9		CONTINUED FROM PREVIOUS PAGE								
	FLOWER AUGER (HOLLOW STEM)	Stiff to hard grey, CLAYEY SILT TILL		267.52	13	SS DO	75	O		
10		END OF BOREHOLE		9.60						WATER LEVEL ENCOUNTERED IN BOREHOLE AT ELEV. 275.60m DURING DRILLING NOV. 25, 1997. WATER LEVEL MEASURED IN MW 1D AT ELEV. 275.81m JAN. 19, 1998. WATER LEVEL MEASURED IN MW 1S AT ELEV. 276.42m JAN. 19, 1998
11										
12										
13										
14										
15										
16										
17										
18										
19										

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: B.A.V.

CHECKED: DB

PROJECT: 971-3223

RECORD OF BOREHOLE 2

SHEET 1 OF 1

LOCATION: - REFER TO PLAN FIGURE 1 -

BORING DATE: NOV. 25, 1997

DATUM: GEODETIC

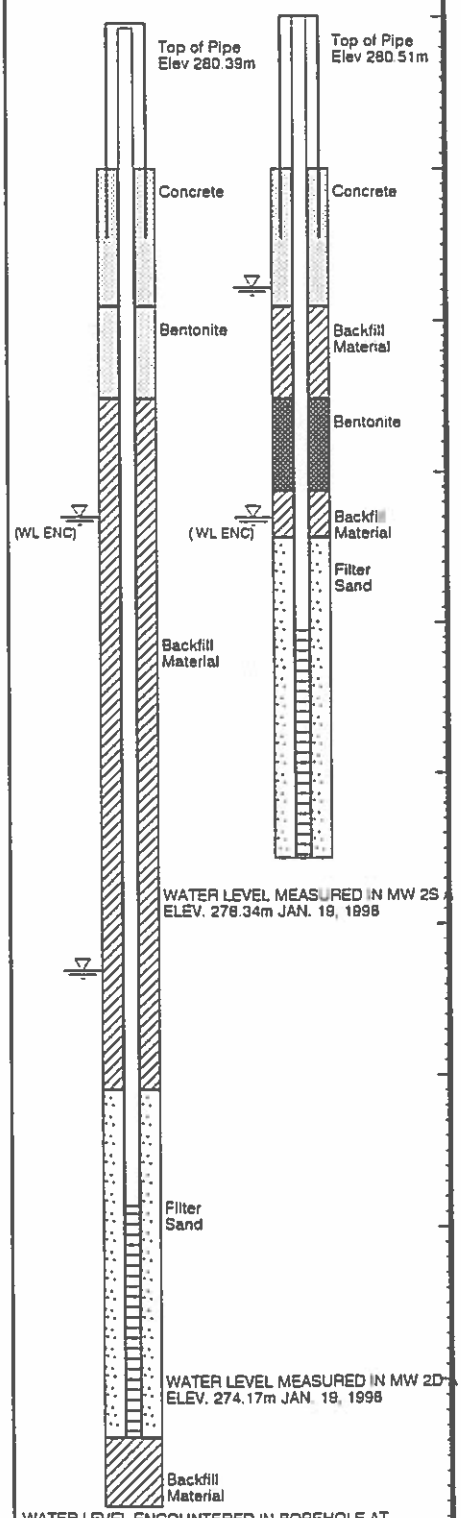
SAMPLER HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m
		GROUND SURFACE		279.47			
0	POWER AUGER (HOLLOW STEM)	Brown silty TOPSOIL, trace roots.		0.06	1	50 DO	4
1					2	50 DO	17
2					3	50 DO	30
3		Loose to very stiff, brown becoming grey at about elev. 276.42m CLAYEY SILT, trace sand, trace gravel, (TILL).			4	50 DO	15
					5	50 DO	19
4					6	50 DO	12
					7	50 DO	22
5					8	50 DO	11
6					9	50 DO	10
				272.76			
7		Stiff grey SILTY CLAY trace sand.		6.71	10	50 DO	14
					11	50 DO	10
8				271.24			
		Very stiff grey, CLAYEY SILT, trace sand, gravel, silt layers.		8.23	12	50 DO	22
9		END OF BOREHOLE		270.63 8.84			

WATER CONTENT PERCENT
Wp-----W-----Wl
10 20 30 40

ADDITIONAL LAB. TESTING

MONITORING INSTALLATIONS
GROUNDWATER AND
ENVIRONMENTAL OBSERVATIONS



WATER LEVEL ENCOUNTERED IN BOREHOLE AT ELEV. 277.18m DURING DRILLING, NOV. 25, 1997

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: B.A.V.
CHECKED: DB

PROJECT: 971-3223

RECORD OF BOREHOLE 3

SHEET 1 OF 2

LOCATION: - REFER TO PLAN FIGURE 1 -

BORING DATE: NOV. 26 1997

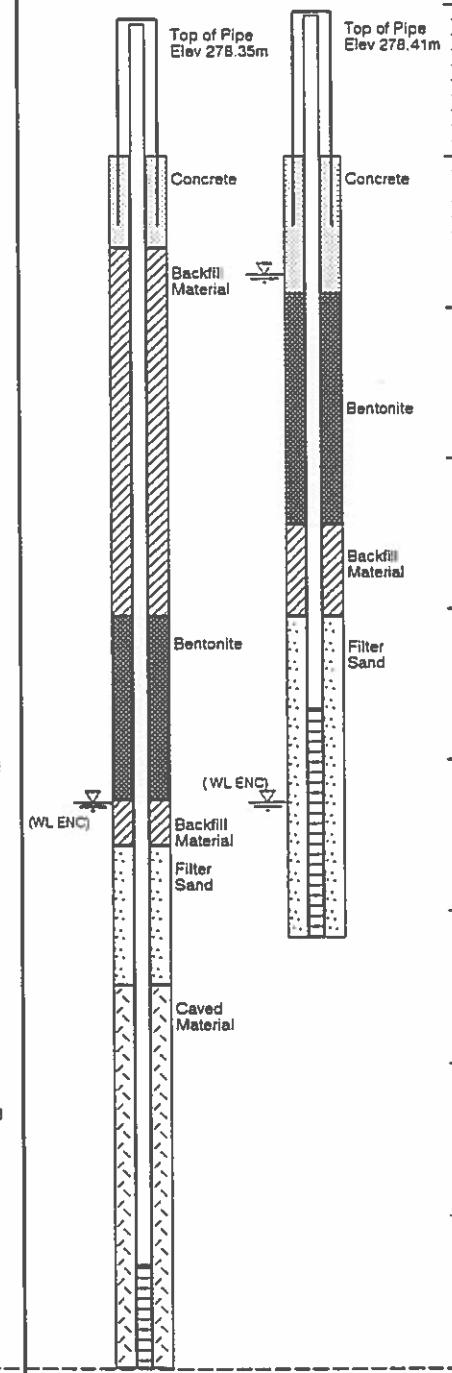
DATUM: GEODETIC

SAMPLER HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	WATER CONTENT PERCENT Wp----W----Wl (10 20 30 40)	ADDITIONAL LAB. TESTING
0	POWER AUGER (HOLLOW STEM)	GROUND SURFACE		277.48					
		Brown silty TOPSOIL, trace roots.		0.00 277.27					
				0.21	1	50 DO	6	o	
1		Loose brown SILT, some clay, trace sand.			2	50 DO	6	o	
				276.11					
				1.37	3	50 DO	37	o	
2					4	50 DO	30	o	
3		Very stiff to hard, brown becoming grey at about elev. 274.13m CLAYEY SILT, trace sand, trace gravel, (TILL).			5	50 DO	22	o	
4					6	50 DO	16	o	MH
				272.91					
				4.57	7	50 DO	20	o	
5		Compact brown SILT, trace sand, trace clay, with clayey silt layers.			8	50 DO	25	o	
6				271.38					
				6.10	9	50 DO	16	o	MH
		Compact brown SAND, trace gravel.		270.77					
		Stiff brown CLAYEY SILT, trace sand.		6.71					
7				6.86	10	50 DO	12	o o	
		Stiff grey SILTY CLAY, trace sand.							
					11	50 DO	12	o	
8		CONTINUED ON NEXT PAGE							

MONITORING INSTALLATIONS
GROUNDWATER AND
ENVIRONMENTAL OBSERVATIONS

MW 3D MW 3S



DEPTH SCALE
1 : 50

Golder Associates

LOGGED: B.A.V.
CHECKED: DB

PROJECT: 971-3223

RECORD OF BOREHOLE 3

SHEET 2 OF 2

LOCATION: - REFER TO PLAN FIGURE 1 -

BORING DATE: NOV. 26 1997

DATUM: GEODETIC

SAMPLER HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	WATER CONTENT PERCENT Wp—W—Wl (10 20 30 40) ⊕ O	ADDITIONAL LAB TESTING	MONITORING INSTALLATIONS GROUNDWATER AND ENVIRONMENTAL OBSERVATIONS MW 3D MW 3S
8	POWER AUGER (HOLLOW STEM)	CONTINUED FROM PREVIOUS PAGE								
		REFER TO PREVIOUS SHEET		269.25	11	50 DO	12			Caved Material
		Compact grey fine SAND, trace silt.		8.23	12	50 DO	24	O		
9				268.34						
		END OF BOREHOLE		9.14						
10										
11										
12										
13										
14										
15										
16										
17										
18										

WATER LEVEL ENCOUNTERED IN BOREHOLE AT ELEV. 273.21m DURING DRILLING, NOV. 26, 1997

WATER LEVEL MEASURED IN MW 3D AT ELEV. 273.20m JAN. 19, 1998

WATER LEVEL MEASURED IN MW 3S AT ELEV. 274.44m JAN. 19, 1998

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: B.A.V.

CHECKED: DB

PROJECT: 971-3223

LOCATION: - REFER TO PLAN FIGURE 1 -

RECORD OF BOREHOLE 4

BORING DATE: NOV. 26 1997

SAMPLER HAMMER, 63.5kg; DROP, 760mm

SHEET 1 OF 2

DATUM: GEODETIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	WATER CONTENT PERCENT Wp----W----Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	MONITORING INSTALLATIONS GROUNDWATER AND ENVIRONMENTAL OBSERVATIONS
0		GROUND SURFACE		278.98						
		Brown silty TOPSOIL, trace roots.		0.00 / 278.68	1	50 DO	5			
				0.30						
1	POWER AUGER (HOLLOW STEM)				2	50 DO	19			
					3	50 DO	29			
2		Very stiff to hard, brown CLAYEY SILT, trace sand, trace gravel, (TILL).			4	50 DO	38			
					5	50 DO	43			
3					6	50 DO	27			
				274.41 / 4.57						
4					7	50 DO	31			
					8	50 DO	25			
5		Compact to very dense, brown SAND, some gravel.			9	50 DO	60			
6					10	50 DO	54		MH	
7					11	50 DO	34			
8		CONTINUED ON NEXT PAGE								

MW 4D: Top of Pipe Elev 280.08m; Concrete; Backfill Material; Bentonite; Backfill Material; Filter Sand; (WL ENC)

MW 4S: Top of Pipe Elev 280.18m; Concrete; Bentonite; Backfill Material; Filter Sand

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: B.A.V.

CHECKED: DB

PROJECT: 971-3223

RECORD OF BOREHOLE 4

SHEET 2 OF 2

LOCATION: - REFER TO PLAN FIGURE 1 -

BORING DATE: NOV. 26 1997

DATUM: GEODETIC

SAMPLER HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	WATER CONTENT PERCENT Wp—W—Wl (10 20 30 40) ⊕ O	ADDITIONAL LAB. TESTING	MONITORING INSTALLATIONS GROUNDWATER AND ENVIRONMENTAL OBSERVATIONS
8		CONTINUED FROM PREVIOUS PAGE								MW 4D MW 4S
	POWER AUGER (HOLLOW STEM)	Compact to very dense, brown SAND, some gravel.			11	SS DO	34			Backfill Material
					12	SS DO	64	O		
9				269.84						
		END OF BOREHOLE		9.14						WATER LEVEL ENCOUNTERED IN BOREHOLE AT ELEV. 271.66m DURING DRILLING, NOV. 26, 1997
10										WATER LEVEL MEASURED IN MW 4D AT ELEV. 272.26m JAN. 19, 1998
										WATER LEVEL MEASURED IN MW 4S AT ELEV. 274.22m JAN. 19, 1998
11										
12										
13										
14										
15										
16										
17										
18										

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: B.A.V.

CHECKED: DR

PROJECT: 971-3223

RECORD OF BOREHOLE 5

SHEET 1 OF 1

LOCATION: - REFER TO PLAN FIGURE 1 -

BORING DATE: NOV. 26, 1997

DATUM: GEODETIC

SAMPLER HAMMER, 63.5kg; DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q ●, U ○)	HYDRAULIC CONDUCTIVITY, k, cm/s; WATER CONTENT, PERCENT (Wp, W, Wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
-1											
0	POWER AUGER (UNCASED)	GROUND SURFACE		276.86							Top of Pipe Elev 277.75m
		Brown silty TOPOSIL, some roots.		0.00 / 276.60	1	50 DO	4				Bentonite
				0.26							
1		Loose brown SILT, some clay, some sand.			2	50 DO	8				
				275.49							
				1.37							
2		Compact to dense brown SANDY SILT, trace gravel.			3	50 DO	20				(WL Enc.)
					4	50 DO	72				Backfill Material
				273.96							
3				2.90	5	50 DO	47				
		Very stiff brown becoming grey at about elev. 272.90m, CLAYEY SILT TILL.									
4					6	50 DO	18				Filter Sand
					7	50 DO	19				
5				271.83							
		END OF BOREHOLE		5.03							
6											
7											
8											
9											

WATER LEVEL ENCOUNTERED IN BOREHOLE AT ELEV. 274.88m DURING DRILLING NOV. 26, 1997

WATER LEVEL MEASURED IN PIEZOMETER AT ELEV. 273.35m JAN. 19, 1998

15 (0 / 5 / 10) PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: B.A.V.

CHECKED: DB

PROJECT: 971-3223

RECORD OF BOREHOLE 6

SHEET 1 OF 1

LOCATION: - REFER TO PLAN FIGURE 1 -

BORING DATE: NOV. 26, 1997

DATUM: GEODETIC

SAMPLER HAMMER, 63.5kg; DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH Cu, kPa (nat.V - +, rem.V - ⊕, Q - ●, U - ○)	HYDRAULIC CONDUCTIVITY, k, cm/s; WATER CONTENT, PERCENT (Wp, W, Wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
-1											Top of Pipe Elev 280.94
0		GROUND SURFACE		279.85							
	POWER AUGER (UNCASED)	Brown silty TOPOSIL, some roots.		0.00 / 279.53	1	50 DO	6				Bentonite
				0.32							
1					2	50 DO	9				Backfill Material
					3	50 DO	13				
2					4	50 DO	29				
3					5	50 DO	31				Filter Sand
		Stiff to hard brown becoming grey at about elev. 276.95m, CLAYEY SILT TILL			6	50 DO	23				
4					7	50 DO	23				
					8	50 DO	28				
5					9	50 DO	11				
6				273.30							
		END OF BOREHOLE		6.55							
7											
8											
9											

BOREHOLE DRY DURING DRILLING NOV. 26, 1997

WATER LEVEL MEASURED IN PIEZOMTER AT ELEV. 278.35m JAN. 19, 1998

15 (0 / 10) 5 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: B.A.V.

CHECKED: DL

PROJECT: 971-3223

RECORD OF BOREHOLE 7

SHEET 1 OF 1

LOCATION: - REFER TO PLAN FIGURE 1 -

BORING DATE: NOV. 26, 1997

DATUM: GEODETIC

SAMPLER HAMMER, 63.5kg; DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH Cu, kPa (nat.V. + ⊕, rem.V. - ⊖, Q - ●, U - ○)	HYDRAULIC CONDUCTIVITY, k, cm/s; WATER CONTENT, PERCENT (Wp, W, Wt)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
-1											
0		GROUND SURFACE		282.93							
	POWER AUGER (UNCASED)	Brown silty TOPOSIL, some roots.		0.06	1	50 DO	3				
1		Compact, brown SILTY SAND, some gravel, clayey silt layers below 1.37m depth.			2	50 DO	15				
					3	50 DO	20				
2				280.80							
		Very stiff brown CLAYEY SILT TILL		2.13	4	50 DO	16				
				280.19							
		END OF BOREHOLE		2.74							
3											
4											
5											
6											
7											
8											
9											

Top of Pipe Elev 283.57m

Bentonite

Filter Sand

(WL Enc.)

WATER LEVEL ENCOUNTERED IN BOREHOLE AT ELEV. 281.71m DURING DRRILLING NOV. 26, 1997

WATER LEVEL MEASURED IN PIEZOMETER AT ELEV. 282.20m JAN. 19, 1998

15 ε 5 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: B.A.V.

CHECKED: DB

PROJECT: 971-3223

RECORD OF BOREHOLE 8

SHEET 1 OF 1

LOCATION: - REFER TO PLAN FIGURE 1 -

BORING DATE: NOV. 26, 1997

DATUM: GEODETIC

SAMPLER HAMMER, 63.5kg; DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	HYDRAULIC CONDUCTIVITY, k, cm/s	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
-1								SHEAR STRENGTH Cu, kPa nat.V - + Q - ● rem.V - ⊕ U - ○	WATER CONTENT, PERCENT Wp W Wl (10 20 30 40)		
0		GROUND SURFACE		278.73							Top of Pipe Elev 278.41m
		Brown silty TOPOSIL, some roots.		0.00							Bentonite
				278.43	1	50 DO	3				Backfill Material
1	POWER AUGER (UNCASED)			0.30							Filter Sand
		Stiff brown CLAYEY SILT TILL trace sand, gravel.			2	50 DO	12				
2					3	50 DO	12				(WL Enc.)
					4	50 DO	15				
				275.99							
3		END OF BOREHOLE		2.74							
4											
5											
6											
7											
8											
9											

WATER LEVEL ENCOUNTERED IN BOREHOLE AT ELEV. 276.60m DURING DRILLING NOV. 26, 1997

WATER LEVEL MEASURED IN PIEZOMETER AT ELEV. 277.35M JAN. 19, 1998

0 15 10 5 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: B.A.V.

CHECKED:

PROJECT: 971-3223

RECORD OF BOREHOLE 9

SHEET 1 OF 1

LOCATION: - REFER TO PLAN FIGURE 1 -

BORING DATE: NOV. 26 1997

DATUM: GEODETIC

SAMPLER HAMMER, 63.5kg; DROP, 760mm

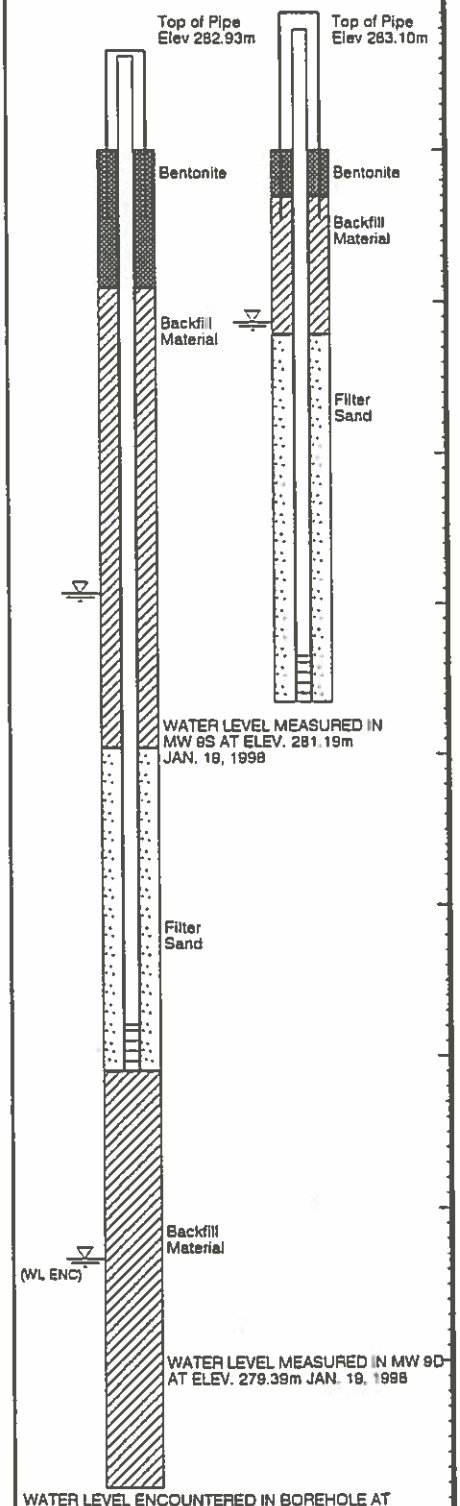
DEPTH SC. METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m
		GROUND SURFACE		282.31			
0	POWER AUGER (HOLLOW STEM)	Brown silty TOPSOIL, trace roots.		0.14	1	50 DO	5
1		Very stiff to hard, brown becoming grey at elev. 279.41m CLAYEY SILT, trace sand, trace gravel, (TILL).			2	50 DO	26
2					3	50 DO	44
3					4	50 DO	29
					5	50 DO	35
4					6	50 DO	28
5				277.13	7	50 DO	16
		Compact grey SILTY FINE SAND, with clayey silt layers.		5.18	8	50 DO	22
6				278.37			
		Stiff grey SILTY CLAY.		5.94	9	50 DO	11
7				275.60			
		Very stiff grey CLAYEY SILT, trace gravel, (TILL).		6.71	10	50 DO	25
8					11	50 DO	24
					12	50 DO	29
9		END OF BOREHOLE		273.47 8.84			

WATER CONTENT PERCENT
Wp----W----Wl
10 20 30 40

ADDITIONAL LAB. TESTING

MONITORING INSTALLATIONS
GROUNDWATER AND
ENVIRONMENTAL OBSERVATIONS

MW 9D MW 9S



WATER LEVEL ENCOUNTERED IN BOREHOLE AT ELEV. 277.13m DURING DRILLING, NOV. 26, 1997

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: B.A.V.
CHECKED: DB

PROJECT: 971-3223

RECORD OF BOREHOLE 10

SHEET 1 OF 1

LOCATION: - REFER TO PLAN FIGURE 1 -

BORING DATE: NOV. 26, 1997

DATUM: GEODETIC

SAMPLER HAMMER, 63.5kg; DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH Cu, kPa (nat.V - +, rem.V - ⊕, Q - ●, U - ○)	HYDRAULIC CONDUCTIVITY, k, cm/s; WATER CONTENT, PERCENT (Wp, W, Wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	POWER AUGER (UNCASED)	GROUND SURFACE		277.69							Top of Pipe Elev 278.13m
		Brown silty TOPOSIL, some roots.		0.11	1	50 DO	3				Bentonite
1		Very loose brown SILT, some clay.		276.17	2	50 DO	3				Backfill Material
2		Firm to stiff brown CLAYEY SILT TILL		1.52	3	50 DO	5				Filter Sand
					4	50 DO	9				
3					5	50 DO	8				
4					6	50 DO	6			MH	(WL Enc.)
		END OF BOREHOLE		273.12 4.57							
5											
6											
7											
8											
9											

WATER LEVEL ENCOUNTERED IN BOREHOLE AT ELEV. 273.73m DURING DRRILLING NOV. 26, 1997

WATER LEVEL MEASURED IN PIEZOMETER AT ELEV. 273.69m JAN. 19, 1998

15 0 5 10 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: B.A.V.

CHECKED: DB

PROJECT: 971-3223

RECORD OF BOREHOLE 11

SHEET 1 OF 1

LOCATION: - REFER TO PLAN FIGURE 1 -

BORING DATE: NOV. 26, 1997

DATUM: GEODETIC

SAMPLER HAMMER, 63.5kg; DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH Cu, kPa (nat.V - +, Q - ●, rem.V - ⊕, U - ○)	HYDRAULIC CONDUCTIVITY, k, cm/s; WATER CONTENT, PERCENT (Wp, W, Wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
-1											Top of Pipe Elev 279.40m
0		GROUND SURFACE		278.58							
		Brown silty TOPOSIL, some roots.		0.23	1	50 DO	4				Bentonite
1	POWER AUGER (UNCASED)				2	50 DO	25				Backfill Material
2		Very stiff to hard brown becoming grey at about elev. 274.92m CLAYEY SILT, trace sand, trace gravel (TILL).			3	50 DO	17				Filter Sand
3					4	50 DO	20				
					5	50 DO	31				(WL Enc.)
4					6	50 DO	21				
				274.01							
		END OF BOREHOLE		4.57							
5											WATER LEVEL ENCOUNTERED IN BOREHOLE AT ELEV. 275.23m DURING DRILLING NOV. 26, 1997
6											WATER LEVEL MEASURED IN PIEZOMETER AT ELEV. 274.01m JAN. 19, 1998
7											
8											
9											

0 15 10 5 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: B.A.V.

CHECKED: DS

PROJECT: 971-3223

RECORD OF BOREHOLE 12

SHEET 1 OF 1

LOCATION: - REFER TO PLAN FIGURE 1 -

BORING DATE: NOV. 26, 1997

DATUM: GEODETIC

SAMPLER HAMMER, 63.5kg; DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	HYDRAULIC CONDUCTIVITY, k, cm/s	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
								SHEAR STRENGTH Cu, kPa (nat.V - +, rem.V - ⊕, Q - ●, U - ○)	WATER CONTENT, PERCENT Wp, W, Wl (10, 20, 30, 40)		
0	POWER AUGER (UNCASED)	GROUND SURFACE		276.23							Top of Pipe Elev 279.10m
		Brown silty TOPOSIL, some roots.		276.04 / 0.19	1	50 DO	4				Bentonite
1		Compact brown SILTY SAND, trace gravel.		274.86 / 1.37	2	50 DO	25				Backfill Material
2		Compact brown SAND AND GRAVEL, trace to some silt.			3	50 DO	17				Filter Sand
					4	50 DO	20				
3				272.57	5	50 DO	3				(WL Enc)
4		Very stiff brown CLAYEY SILT, with sandy silt layers.		3.66 / 271.66	6	50 DO	18				
		END OF BOREHOLE		4.57							
5											
6											
7											
8											
9											

WATER LEVEL ENCOUNTERED IN BOREHOLE AT ELEV. 275.23m DURING DRRILLING NOV. 26, 1997

WATER LEVEL MEASURED IN PIEZOMETER AT ELEV. 274.26m JAN. 19, 1998

0 15 10 5 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: B.A.V.

CHECKED: DB

PROJECT: 971-3223

LOCATION: - REFER TO PLAN FIGURE 1 -

SAMPLER HAMMER, 63.5kg; DROP, 760mm

RECORD OF BOREHOLE 13

BORING DATE: NOV. 26, 1997

SHEET 1 OF 1

DATUM: GEODETIC

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m
		GROUND SURFACE		279.05			
0	POWER AUGER (UNCASED)	Brown silty TOPOSIL, some roots.		278.70	1	50 DO	2
				0.35			
1		Firm to stiff brown becoming grey at about elev. 276.92m CLAYEY SILT TILL			2	50 DO	9
2					3	50 DO	11
					4	50 DO	6
				276.31			
3		END OF BOREHOLE		2.74			

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m

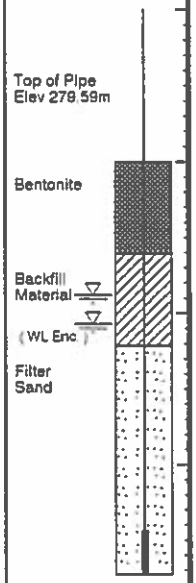
SHEAR STRENGTH Cu, kPa nat.V. + Q - ● rem.V. ⊕ U - ○

HYDRAULIC CONDUCTIVITY, k, cm/s

WATER CONTENT, PERCENT Wp W Wl (10, 20, 30, 40)

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



WATER LEVEL ENCOUNTERED IN BOREHOLE AT ELEV. 277.98m DURING DRRILLING NOV. 26, 1997

WATER LEVEL MEASURED IN PIEZOMETER AT ELEV. 278.17m JAN. 19, 1998

0 15 5 10 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: B.A.V.

CHECKED: DB

Appendix D – Grain Size Analyses

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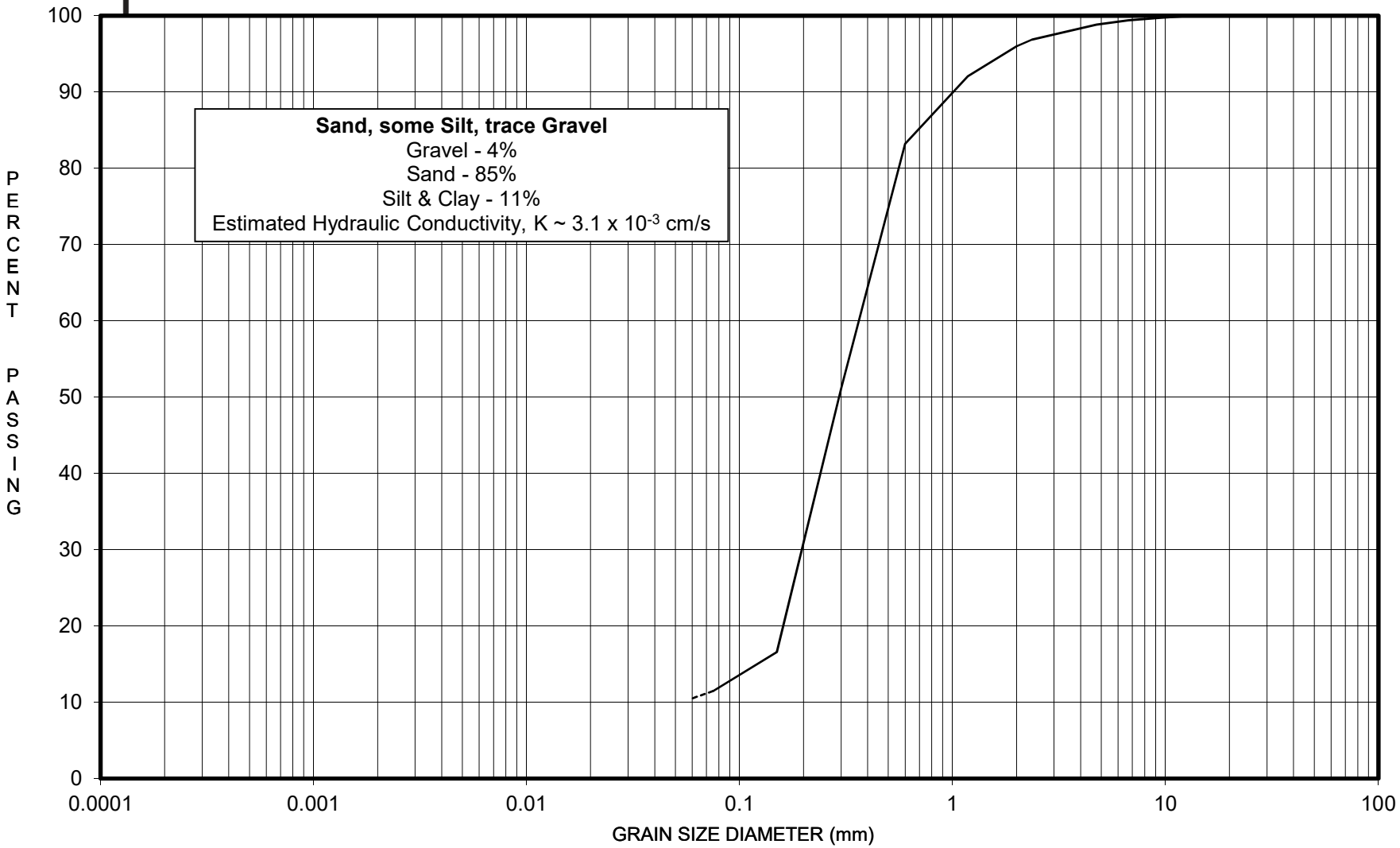
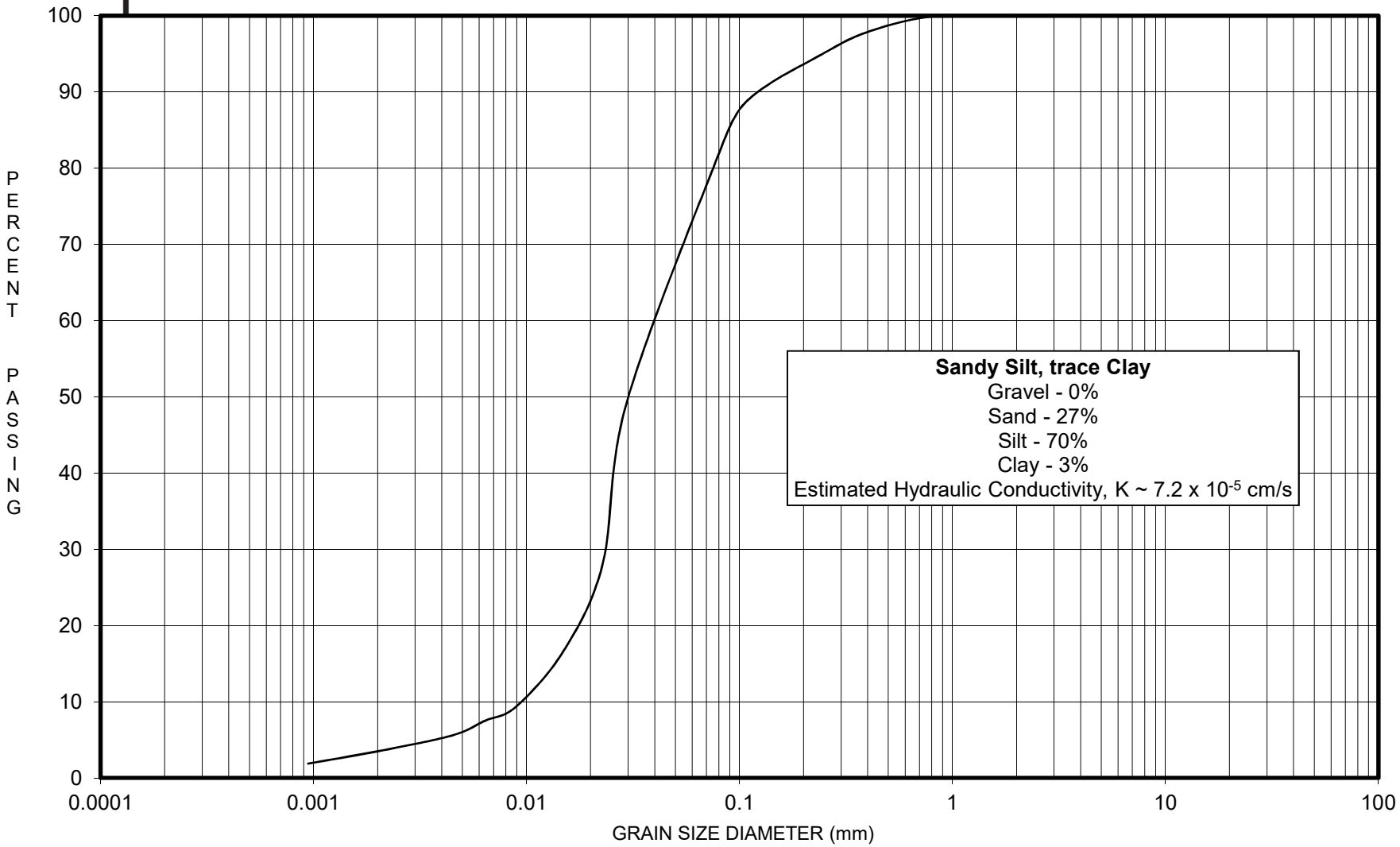
MECHANICAL GRAIN SIZE ANALYSIS



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	
	SILT			SAND			GRAVEL			
MODIFIED M.I.T. CLASSIFICATION	**Sample Description:** **Sand (BH103 S6, 4.6 - 5.0 m bgs)**						**Project: LON-00017696-GE** **Mount Pleasant Lands**			**Figure 1**

MECHANICAL GRAIN SIZE ANALYSIS



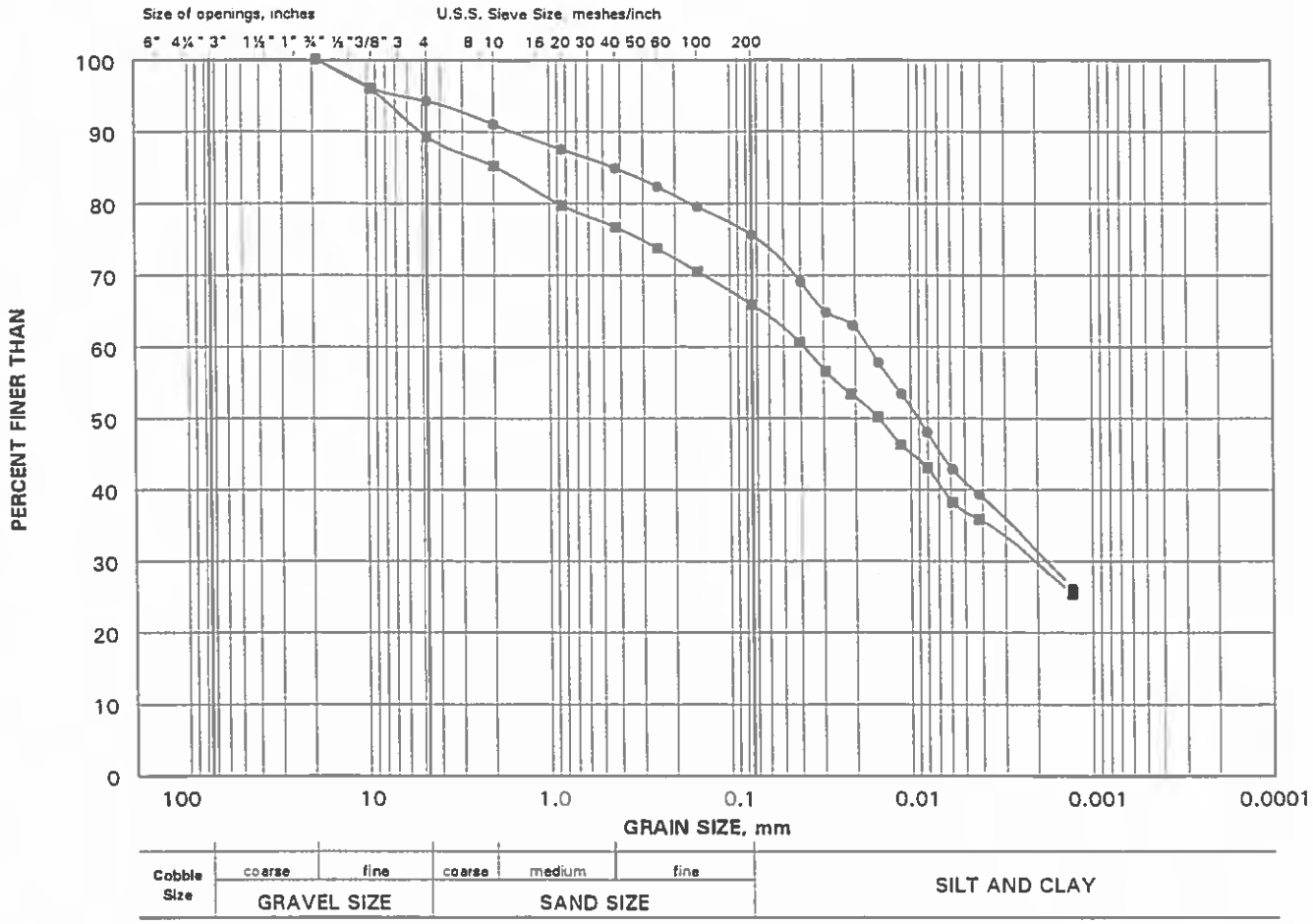
CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	
	SILT			SAND			GRAVEL			

MODIFIED M.I.T. CLASSIFICATION	**Sample Description:** **Sandy Silt (BH105 S6, 4.6 - 5.0 m bgs)**	**Project: LON-00017696-GE** **Mount Pleasant Lands**	**Figure 2**

GRAIN SIZE DISTRIBUTION

FIGURE 3

CLAYEY SILT TILL



LEGEND				
SYMBOL	BOREHOLE	SAMPLE	ELEV.	(m)
●	3	6	273.67	
■	10	6	273.88	

ProGrain ver. 2.01

Project 971-3223

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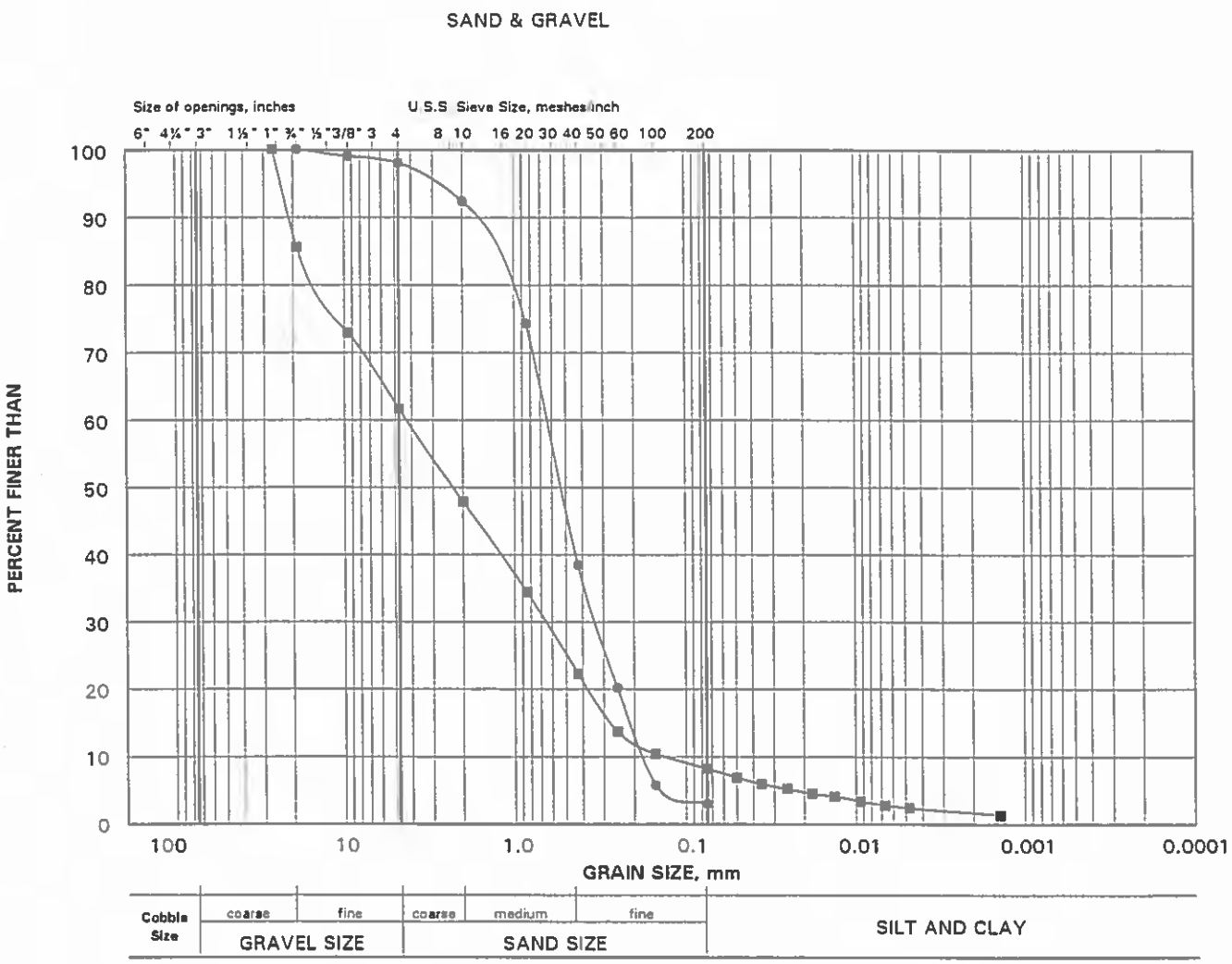
GRAIN SIZE DISTRIBUTION

FIGURE 4



LEGEND				
SYMBOL	BOREHOLE	SAMPLE	ELEV.	(m)
●	3	9	271.38	
■	4	10	272.12	

ProGrain ver 2.01

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Appendix E – Infiltration Testing

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Summary of Infiltration Rate Calculation[1]

Test Number	Depth (m)	Soil Type	Estimated permeability (K_{fs})[2] (cm/s)	Calculated Infiltration Rate (I)[2] (mm/hr)	Ratio of Mean Measured Infiltration Rates[3]	Safety Factor (C)
INF1	0.60	Clayey Silt Till	4.74E-03	130		
INF2	0.60	Clayey Silt Till	4.13E-03	125		
INF3	0.60	Clayey Silt Till	1.57E-03	97		
INF4	0.60	Clayey Silt Till	1.50E-03	96		
Geometric Mean				**111**		
					1.2	**3.5**
Design Infiltration Rate[4]			**Maximum**	**37**		
			Minimum	**27**		
			Geometric Mean	**32**		

Safety Correction Factors for Calculating Design Infiltration Rates	
Ratio of Mean Measured Infiltration Rates[3]	Safety Factor (C)
<1	2.5
1.1 to 4.0	3.5
4.1 to 8.0	4.5
8.1 to 16.0	6.5
16.1 or greater	8.5

Notes:

[1]Inconclusive/negative/zero infiltration results are excluded from the summary of infiltration calculations

[2]The relationship between infiltration rate and hydraulic conductivity is taken as $K_{fs} = 6E\text{-}11(I^{3.7363})$, as described in the "Stormwater Management Criteria" from the Toronto and Region Conservation Authority, dated August 2012

[3]Ratio is determined by dividing the geometric mean measured infiltration rate at the proposed bottom elevation by the geometric mean measured infiltration rate of the least permeable soil horizon within 1.5 meters below the proposed bottom elevation.

***Design Infiltration Rate is calculated by dividing the geometric mean measured infiltration rate at the proposed bottom elevation by the safety correction factor

Project number: 17696-HG
Site Location: Mount Pleasant Lands
Test Location:

Prepared by: K.Dobbin
Date: 06-May-21

Appendix F – MECP Water Well Record Summary

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TABLE F1

Well ID	Well Type	Date Completed	Depth (m)	Water Use	Water Status	Screened Lithology	Water Found at Depth (m)	Static Water Level (m)
4102043	Overburden	06-Jan-61	22.3	Domestic	Water Supply	Gravel	20.7	10.7
4102150	Overburden	01-May-62	31.4	Domestic	Water Supply	Gravel	31.4	10.7
4102151	Overburden	20-Aug-63	8.5	Domestic	Water Supply	Clay	4.6	1.2
4104570	Overburden	24-Jul-68	14.9	Domestic	Water Supply	Sand	11.6	4.6
4104571	Overburden	17-Jun-68	14.9	Domestic	Water Supply	Sand	11.6	4.6
4105314	Bedrock	23-Jul-70	65.8	Domestic	Water Supply	Bedrock	65.5	21.3
4105652	Overburden	15-Nov-71	19.8	Domestic	Water Supply	Sand	18.3	8.2
4106241	Overburden	27-Mar-73	16.8	Domestic	Water Supply	Sand	14.0	5.8
4106856	Overburden	31-Jul-74	14.6	Domestic	Water Supply	Sand	14.0	4.9
4106897	Overburden	25-Jul-74	53.9	Abandoned-Other	---	Sand	53.6	18.3
4106992	Overburden	24-Sep-74	14.9	Domestic	Water Supply	Sand	12.5	11.6
4108452	Overburden	20-Jun-78	12.2	Domestic	Water Supply	Gravel	11.6	9.1
4108453	Overburden	20-Jun-78	11.6	Domestic	Water Supply	Gravel	6.1	6.1
4108619	Overburden	06-Sep-78	14.6	Domestic	Water Supply	Sand	14.0	7.6
4109161	Overburden	10-Oct-79	40.8	Domestic	Water Supply	Sand	36.0	10.4
4110387	Overburden	02-Sep-85	28.7	Domestic	Water Supply	Sand	24.4	9.1
4113399	Overburden	16-May-95	11.3	Domestic	Water Supply	Sand	9.8	5.9
4114099	Overburden	03-Aug-98	25.3	Domestic	Water Supply	Sand & Gravel	22.3	9.1
4114261	Overburden	12-May-99	12.2	Domestic	Water Supply	Gravel	8.5	3.7
7157210	Overburden	04-Nov-10	6.1	Monitoring	Test Hole	Sand	---	---
7157217	Overburden	23-Sep-10	13.7	Monitoring	Test Hole	Silty Sand	11.3	11.3
7157218	Overburden	21-Sep-10	9.1	Monitoring	Test Hole	Sand & Gravel	0.9	0.9
7234309	Overburden	29-Sep-14	21.3	Domestic	Water Supply	Sand & Gravel	9.1	9.8
7251789	Overburden	30-Sep-15	6.1	Monitoring	Test Hole	Sand & Gravel	3.0	
7273094	Overburden	30-Sep-16	8.5	Abandoned-Other	---	---	---	---

Appendix G – Water Levels and Hydrographs

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Mount Pleasant Lands

2631 Hyde Park Road & 1521 Sunningdale Road West

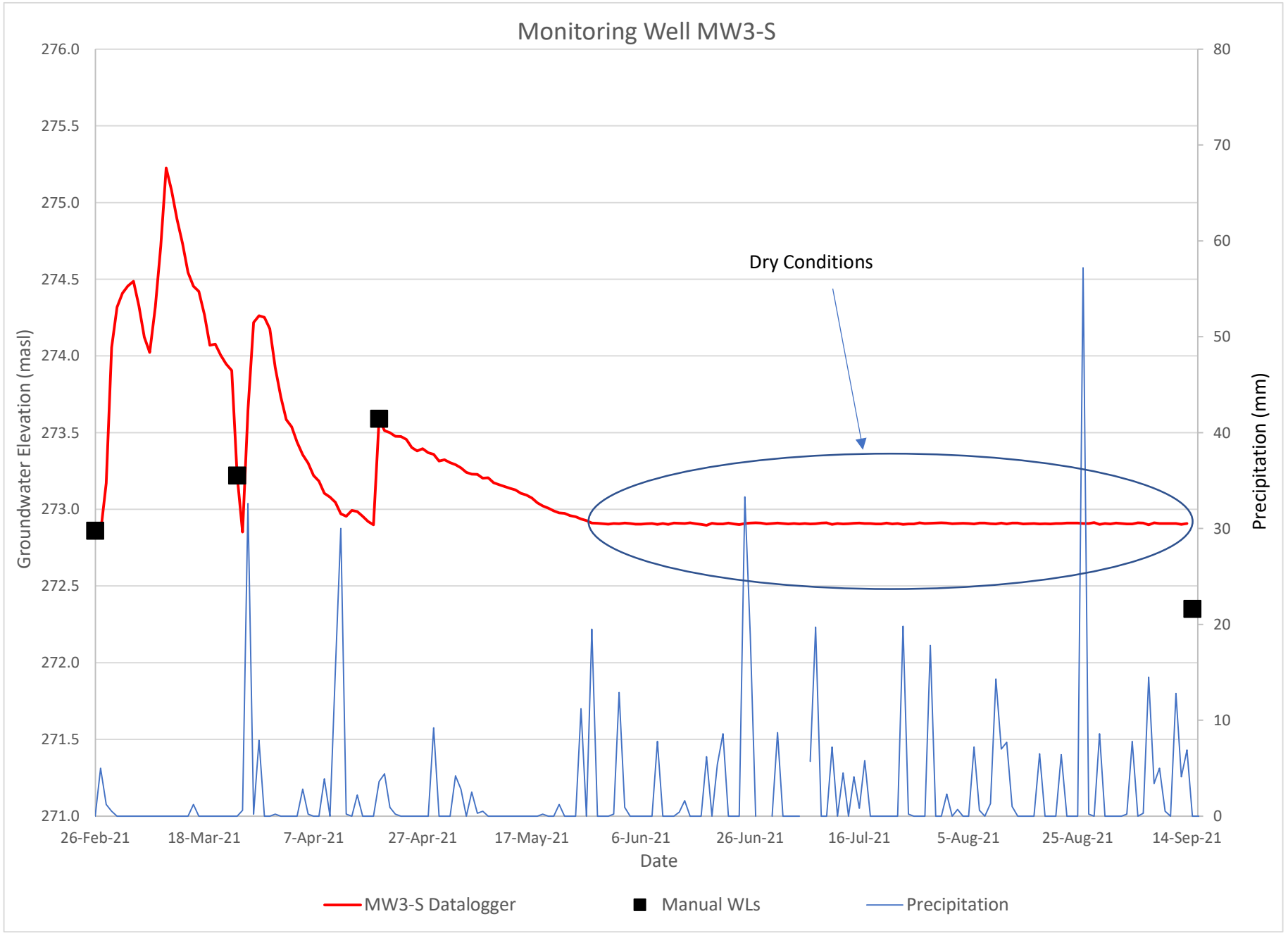
Groundwater and Surface Water Level Monitoring - Meters Above Sea Level (mASL)

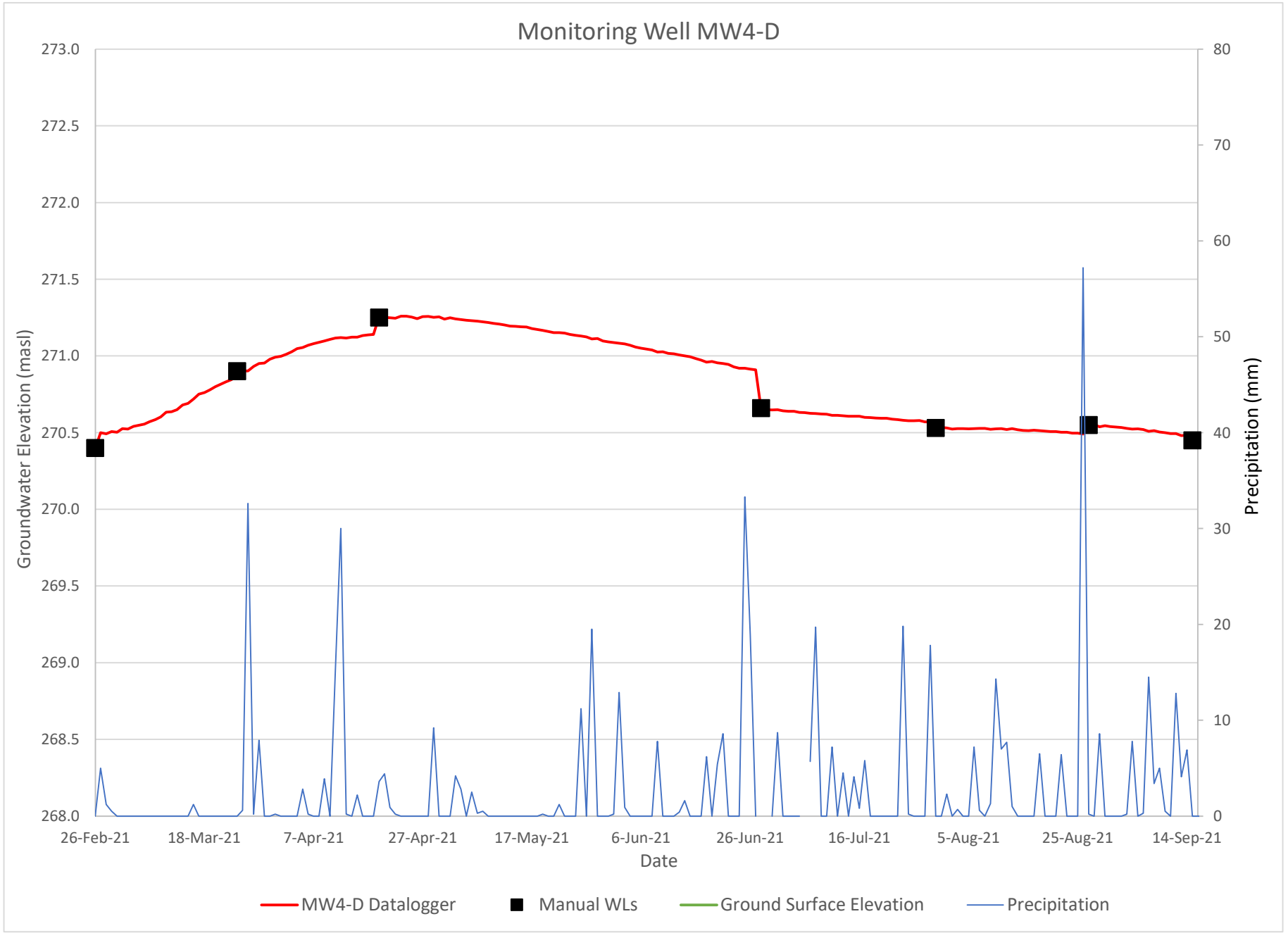
Station ID	BH102/MW	BH103/MW	BH104/MW	BH105/MW	MW1-S	MW1-D	MW3-S	MW3-D	MW4-S	MW4-D	P-101 Inside	P-101 Outside	SG1
Elevation	282.88	276.50	278.37	276.96	277.12	277.12	277.48	277.48	278.98	278.98	275.83	275.83	275.72
Top of Pipe Elevation	283.79	277.23	279.24	277.73	277.99	277.50	278.34	278.31	280.03	279.98	277.12	-	-
Water Elevation (mASL)													
31-Jan-20	277.65	274.83	275.25	271.78	276.72	276.55	275.30	272.32	Dry	271.66	275.96	Frozen	-
7-Feb-20	277.73	274.39	275.28	271.87	-	-	-	-	-	-	Frozen	Frozen	-
17-Mar-20	277.47	274.19	275.21	271.93	276.81	276.63	274.64	272.63	Dry	271.92	-	-	-
28-Apr-20	277.48	273.75	275.12	272.05	276.34	276.19	273.95	272.29	Dry	272.12	276.39	276.39	-
25-May-20	277.05	273.81	275.10	271.88	276.18	275.69	274.00	272.31	Dry	271.99	277.43	277.43	-
4-Jun-20	277.10	273.48	274.98	271.83	276.12	275.99	273.63	272.17	Dry	271.95	276.18	276.16	-
28-Feb-21	Damaged	272.59	274.75	Dry	276.52	275.93	272.86	272.21	Dry	270.40	Dry	Dry	275.83
24-Mar-21	Damaged	273.11	274.79	270.98	276.47	275.99	273.22	272.54	Dry	270.90	275.59	276.06	276.10
19-Apr-21	Damaged	273.34	274.83	271.02	276.24	276.04	273.59	273.00	Dry	271.25	275.71	276.12	276.16
4-May-21	Damaged	-	-	-	-	-	-	-	-	-	275.75	276.05	276.10
28-Jun-21	Damaged	272.57	274.51	Dry	276.19	276.02	-	-	Dry	270.66	275.78	Dry	275.81
30-Jul-21	Damaged	271.77	-	Dry	276.14	275.99	-	-	Dry	270.53	275.76	Dry	Dry
27-Aug-21	Damaged	271.71	274.36	Dry	276.13	275.95	-	-	Dry	270.55	275.74	Dry	Dry
15-Sep-21	Damaged	272.27	274.57	Dry	276.00	275.83	272.35	272.08	Dry	270.45	Dry	Dry	Dry

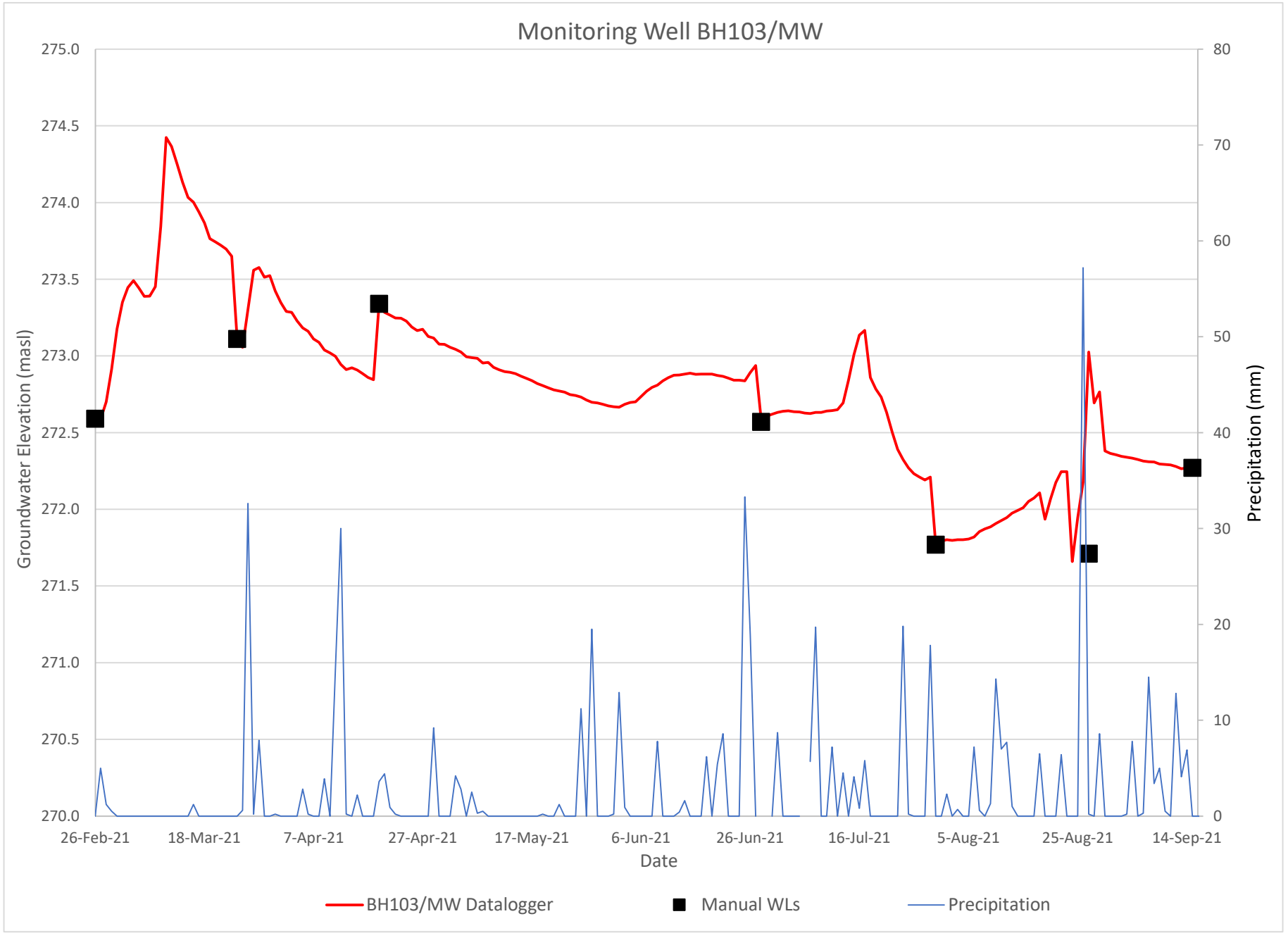
Groundwater and Surface Water Level Monitoring - Meters Below Ground Surface (mbgs)

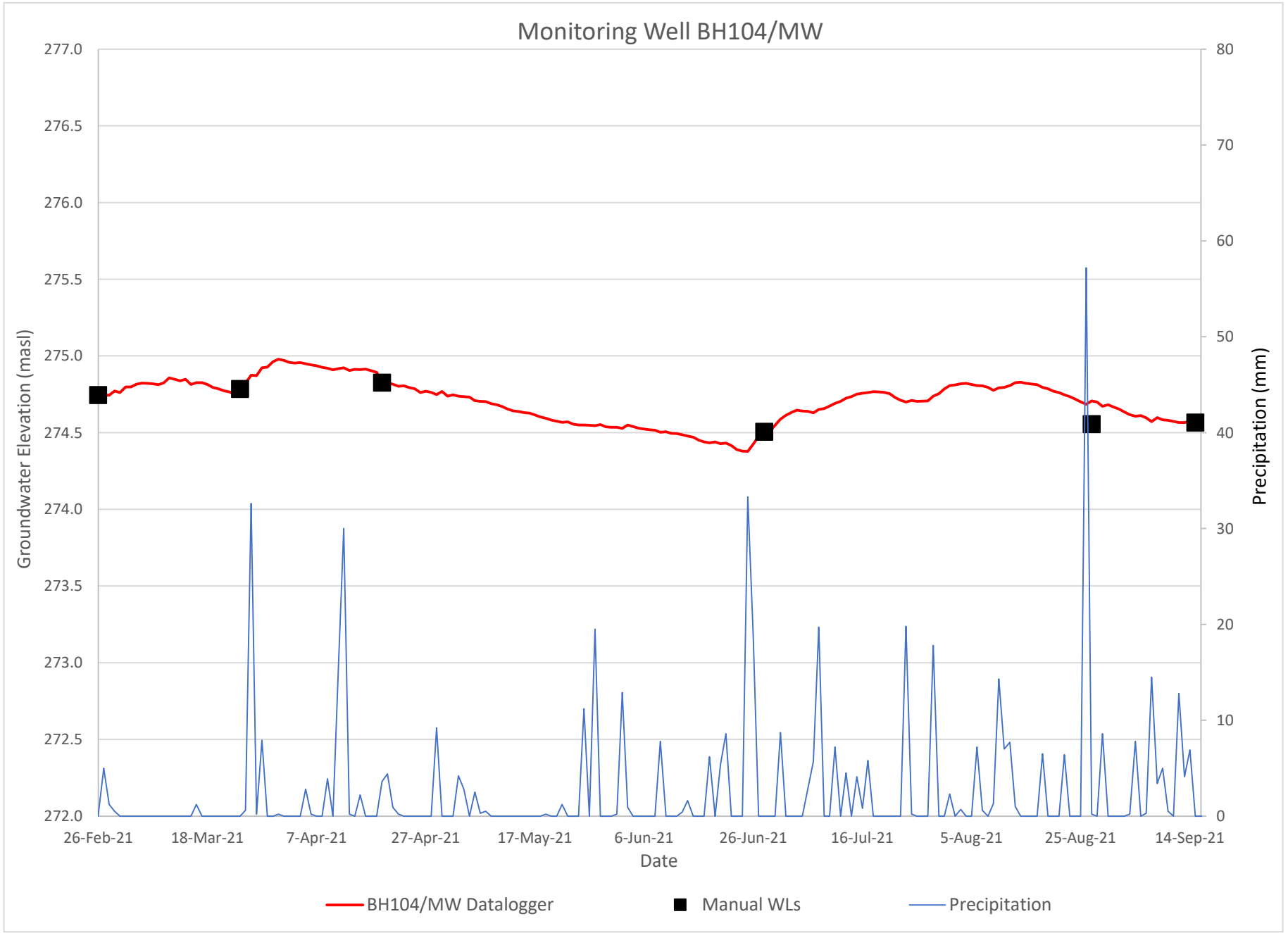
Station ID	BH102/MW	BH103/MW	BH104/MW	BH105/MW	MW1-S	MW1-D	MW3-S	MW3-D	MW4-S	MW4-D	P-101 Inside	P-101 Outside	SG1
Elevation	282.88	276.50	278.37	276.96	277.12	277.12	277.48	277.48	278.98	278.98	275.91	275.91	275.91
Top of Pipe Elevation	283.79	277.23	279.24	277.73	277.99	277.50	278.34	278.31	280.03	279.98	277.43	-	-
Depth Below Ground Surface (mbgs)													
31-Jan-20	5.23	1.67	3.12	5.18	0.40	0.57	2.18	5.16	Dry	7.32	0.18	Frozen	-
7-Feb-20	5.15	2.11	3.09	5.09	-	-	-	-	-	-	Frozen	Frozen	-
17-Mar-20	5.41	2.31	3.16	5.03	0.31	0.49	2.84	4.85	Dry	7.06	-	-	-
28-Apr-20	5.40	2.75	3.25	4.92	0.78	0.93	3.53	5.19	Dry	6.86	-0.25	-0.25	-
25-May-20	5.83	2.69	3.27	5.08	0.94	1.43	3.48	5.17	Dry	6.99	-1.29	-1.29	-
4-Jun-20	5.78	3.02	3.39	5.13	1.00	1.13	3.85	5.31	Dry	7.03	-0.04	-0.02	-
28-Feb-21	Damaged	3.91	3.62	Dry	0.60	1.19	4.62	5.27	Dry	8.58	Dry	Dry	-0.11
24-Mar-21	Damaged	3.39	3.58	5.98	0.65	1.13	4.26	4.94	Dry	8.08	0.24	-0.23	-0.39
19-Apr-21	Damaged	3.16	3.54	5.94	0.88	1.08	3.89	4.48	Dry	7.73	0.12	-0.29	-0.44
4-May-21	Damaged	-	-	-	-	-	-	-	-	-	0.08	-0.22	-0.39
28-Jun-21	Damaged	3.93	3.86	Dry	0.93	1.10	-	-	Dry	8.32	0.05	Dry	-0.09
30-Jul-21	Damaged	4.73	-	Dry	0.98	1.13	-	-	Dry	8.45	0.07	Dry	Dry
27-Aug-21	Damaged	4.79	4.01	Dry	0.99	1.17	-	-	Dry	8.43	0.09	Dry	Dry
15-Sep-21	Damaged	4.23	3.80	Dry	1.12	1.29	5.13	5.40	Dry	8.53	Dry	Dry	Dry

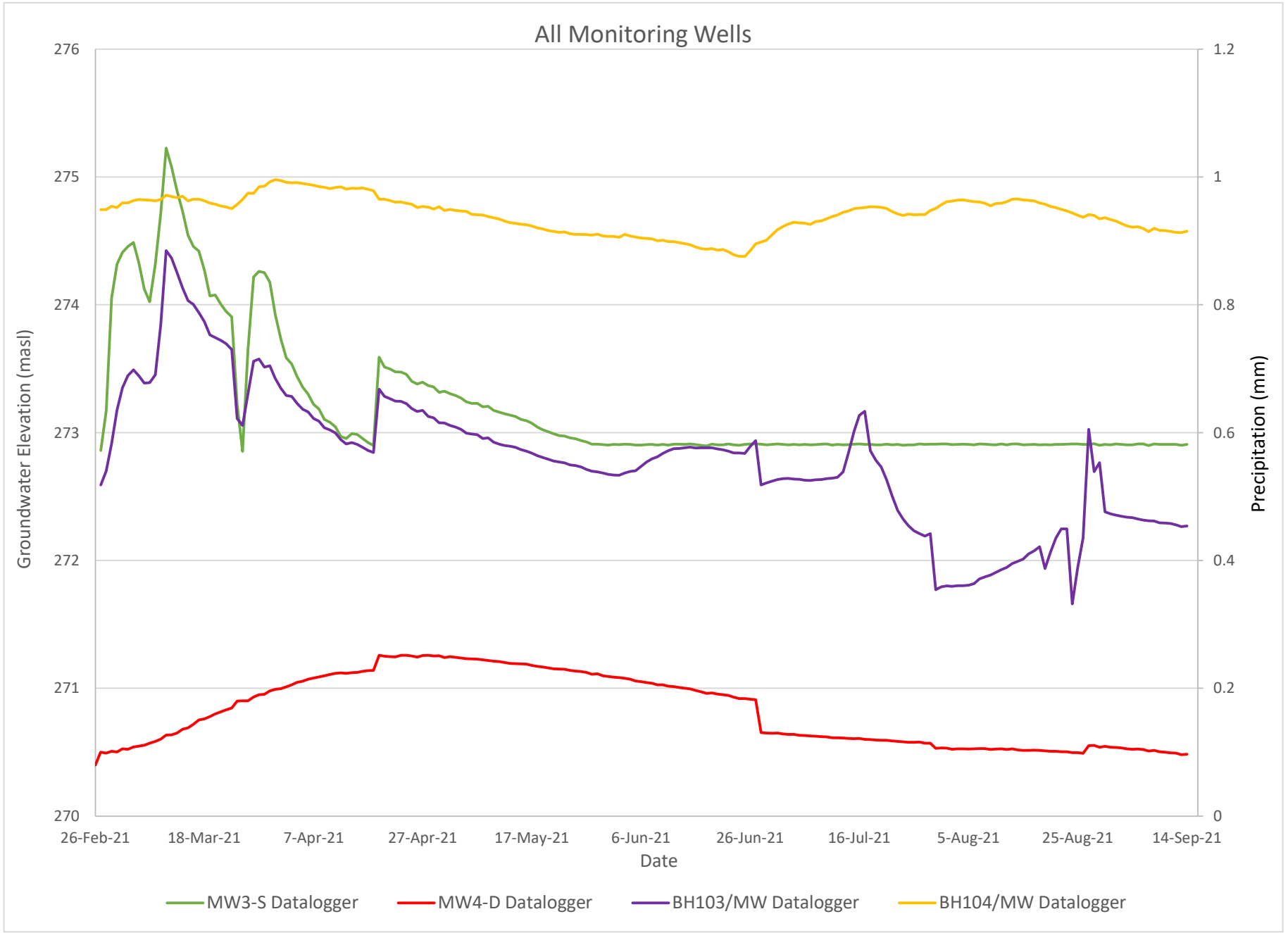
Notes:
- indicates not measured

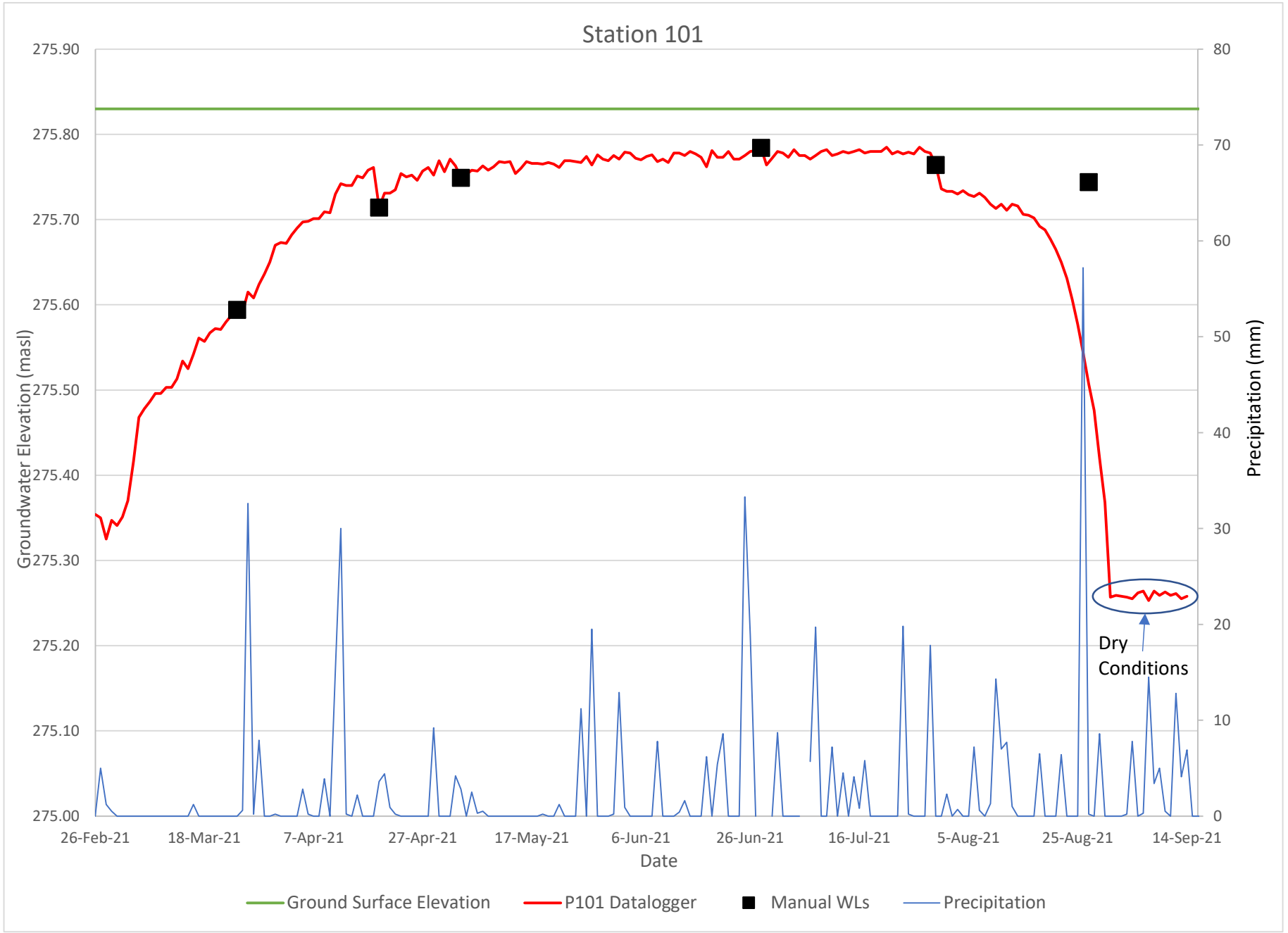

Monitoring Well MW3-S
Groundwater Elevation (masl)
Precipitation (mm)
Dry Conditions
Date
276.0
275.5
275.0
274.5
274.0
273.5
273.0
272.5
272.0
271.5
271.0
80
70
60
50
40
30
20
10
0
26-Feb-21
18-Mar-21
7-Apr-21
27-Apr-21
17-May-21
6-Jun-21
26-Jun-21
16-Jul-21
5-Aug-21
25-Aug-21
14-Sep-21
MW3-S Datalogger
Manual WLs
Precipitation


Monitoring Well MW4-D
Groundwater Elevation (masl)
Precipitation (mm)
273.0
272.5
272.0
271.5
271.0
270.5
270.0
269.5
269.0
268.5
268.0
80
70
60
50
40
30
20
10
0
26-Feb-21
18-Mar-21
7-Apr-21
27-Apr-21
17-May-21
6-Jun-21
26-Jun-21
16-Jul-21
5-Aug-21
25-Aug-21
14-Sep-21
Date
MW4-D Datalogger
Manual WLs
Ground Surface Elevation
Precipitation


Monitoring Well BH103/MW
Groundwater Elevation (masl)
Precipitation (mm)
275.0
274.5
274.0
273.5
273.0
272.5
272.0
271.5
271.0
270.5
270.0
80
70
60
50
40
30
20
10
0
26-Feb-21
18-Mar-21
7-Apr-21
27-Apr-21
17-May-21
6-Jun-21
26-Jun-21
16-Jul-21
5-Aug-21
25-Aug-21
14-Sep-21
Date
BH103/MW Datalogger
Manual WLs
Precipitation


Monitoring Well BH104/MW
Groundwater Elevation (masl)
Precipitation (mm)
277.0
276.5
276.0
275.5
275.0
274.5
274.0
273.5
273.0
272.5
272.0
80
70
60
50
40
30
20
10
0
26-Feb-21
18-Mar-21
7-Apr-21
27-Apr-21
17-May-21
6-Jun-21
26-Jun-21
16-Jul-21
5-Aug-21
25-Aug-21
14-Sep-21
Date
BH104/MW Datalogger
Manual WLs
Precipitation


All Monitoring Wells
Groundwater Elevation (masl)
Precipitation (mm)
276
275
274
273
272
271
270
1.2
1
0.8
0.6
0.4
0.2
0
26-Feb-21
18-Mar-21
7-Apr-21
27-Apr-21
17-May-21
6-Jun-21
26-Jun-21
16-Jul-21
5-Aug-21
25-Aug-21
14-Sep-21
Date
MW3-S Datalogger
MW4-D Datalogger
BH103/MW Datalogger
BH104/MW Datalogger


Station 101
Groundwater Elevation (masl)
Precipitation (mm)
275.90
275.80
275.70
275.60
275.50
275.40
275.30
275.20
275.10
275.00
80
70
60
50
40
30
20
10
0
26-Feb-21
18-Mar-21
7-Apr-21
27-Apr-21
17-May-21
6-Jun-21
26-Jun-21
16-Jul-21
5-Aug-21
25-Aug-21
14-Sep-21
Date
Dry Conditions
Ground Surface Elevation
P101 Datalogger
Manual WLs
Precipitation

Appendix H – Water Quality Data

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Groundwater Quality Results
1521 Sunningdael Road West, London, ON
Project No. 17696

CRITERIA	ODWQS	Units	24-Mar-21 MW103	24-Mar-21 MW3D	24-Mar-21 MW4D	24-Mar-21 MW104
Calculated Parameters						
Anion Sum	NV	me/L	17.5	7.21	5.15	5.57
Bicarb. Alkalinity (calc. as CaCO3)	NV	mg/L	250	210	240	230
Calculated TDS	NV	mg/L	1000	420	280	300
Carb. Alkalinity (calc. as CaCO3)	NV	mg/L	1.8	2	1.7	3.1
Cation Sum	NV	me/L	19.2	8.62	6.02	5.65
Hardness (CaCO3)	NV	mg/L	400	360	290	220
Ion Balance (% Difference)	NV	%	4.58	8.91	7.82	0.75
Langelier Index (@ 20C)	NV	N/A	0.85	0.96	0.811	0.738
Langelier Index (@ 4C)	NV	N/A	0.604	0.712	0.562	0.489
Saturation pH (@ 20C)	NV	N/A	7.03	7.03	7.08	7.42
Saturation pH (@4C)	NV	N/A	7.28	7.28	7.33	7.67
Inorganics						
Total Ammonia-N	NV	mg/L	<0.050	<0.050	<0.050	<0.050
Conductivity	NV	umho/cm	2000	810	550	520
Dissolved Organic Carbon (DOC)	NV	mg/L	0.77	2.4	1.1	0.66
Orthophosphate (P)	NV	mg/L	<0.010	<0.010	<0.010	0.012
pH	NV	pH	7.88	7.99	7.89	8.16
Dissolved Sulphate (SO4)	NV	mg/L	17	50	8.3	40
Alkalinity (Total as CaCO3)	NV	mg/L	250	210	240	230
Dissolved Chloride (Cl-)	NV	mg/L	420	67	3.9	2.9
Nitrite (N)	1	mg/L	<0.010	<0.010	<0.010	<0.010
Nitrate (N)	10	mg/L	3.12	0.12	1.68	0.1
Nitrate + Nitrite (N)	NV	mg/L	3.12	0.12	1.68	0.1
Metals						
Dissolved Aluminum (Al)	NV	ug/L	<4.9	<4.9	<4.9	6.9
Dissolved Antimony (Sb)	6	ug/L	<0.50	<0.50	<0.50	<0.50
Dissolved Arsenic (As)	25	ug/L	<1.0	<1.0	<1.0	1.5
Dissolved Barium (Ba)	1000	ug/L	55	39	19	110
Dissolved Beryllium (Be)	NV	ug/L	<0.40	<0.40	<0.40	<0.40
Dissolved Boron (B)	5000	ug/L	12	<10	17	97
Dissolved Cadmium (Cd)	5	ug/L	<0.090	<0.090	<0.090	<0.090
Dissolved Calcium (Ca)	NV	ug/L	130000	120000	91000	43000
Dissolved Chromium (Cr)	50	ug/L	<5.0	<5.0	<5.0	<5.0
Dissolved Cobalt (Co)	NV	ug/L	<0.50	<0.50	<0.50	<0.50
Dissolved Copper (Cu)	NV	ug/L	0.96	1.6	1.4	<0.90
Dissolved Iron (Fe)	NV	ug/L	<100	<100	<100	<100
Dissolved Lead (Pb)	10	ug/L	<0.50	<0.50	<0.50	<0.50
Dissolved Magnesium (Mg)	NV	ug/L	17000	14000	15000	28000
Dissolved Manganese (Mn)	NV	ug/L	<2.0	<2.0	<2.0	31
Dissolved Molybdenum (Mo)	NV	ug/L	<0.50	<0.50	17	17
Dissolved Nickel (Ni)	NV	ug/L	<1.0	<1.0	<1.0	<1.0
Dissolved Phosphorous (P)	NV	ug/L	<100	<100	<100	<100
Dissolved Potassium (K)	NV	ug/L	1500	360	2100	1600
Dissolved Selenium (Se)	10	ug/L	<2.0	<2.0	<2.0	<2.0
Dissolved Silicon (Si)	NV	ug/L	3800	2200	3800	7100
Dissolved Silver (Ag)	NV	ug/L	<0.090	<0.090	<0.090	<0.090
Dissolved Sodium (Na)	NV	ug/L	260000	30000	4400	27000
Dissolved Strontium (Sr)	NV	ug/L	170	140	96	1500
Dissolved Thallium (Tl)	NV	ug/L	<0.050	<0.050	<0.050	<0.050
Dissolved Titanium (Ti)	NV	ug/L	<5.0	<5.0	<5.0	<5.0
Dissolved Uranium (U)	20	ug/L	0.55	1.4	0.52	2.6
Dissolved Vanadium (V)	NV	ug/L	<0.50	<0.50	<0.50	0.71
Dissolved Zinc (Zn)	NV	ug/L	<5.0	<5.0	<5.0	<5.0

Notes:
Results compared to Ontario Drinking Water Quality Standards
NV indicates 'No value'
N/A indicates 'Not Applicable'
Exceeds ODWQS

Surface Water Quality Results
1521 Sunningdale Road West, London, ON
Project No. 17696

CRITERIA	PWQO	Units	24-Mar-21
			SW1 P101
Calculated Parameters			
Bicarb. Alkalinity (calc. as CaCO3)	NV	mg/L	220
Calculated TDS	NV	mg/L	340
Carb. Alkalinity (calc. as CaCO3)	NV	mg/L	2.8
Hardness (CaCO3)	NV	mg/L	300
Langelier Index (@ 20C)	NV	N/A	1.06
Langelier Index (@ 4C)	NV	N/A	0.806
Saturation pH (@ 20C)	NV	N/A	7.07
Saturation pH (@4C)	NV	N/A	7.32
Inorganics			
Total Ammonia-N	NV	mg/L	<0.050
Conductivity	NV	umho/cm	570
Total Organic Carbon (TOC)	NV	mg/L	10
Orthophosphate (P)	NV	mg/L	0.069
pH	6.5 - 8.5	pH	8.12
Total Phosphorus	NV	mg/L	0.15
Dissolved Sulphate (SO4)	NV	mg/L	63
Turbidity	NV	NTU	1.4
Alkalinity (Total as CaCO3)	NV	mg/L	230
Dissolved Chloride (Cl-)	NV	mg/L	7.1
Nitrite (N)	NV	mg/L	<0.010
Nitrate (N)	NV	mg/L	<0.10
Metals			
Dissolved Calcium (Ca)	NV	mg/L	100
Dissolved Magnesium (Mg)	NV	mg/L	11
Dissolved Potassium (K)	NV	mg/L	8
Dissolved Sodium (Na)	NV	mg/L	4.3
Total Aluminum (Al)	75	ug/L	**79**
Total Antimony (Sb)	20	ug/L	<0.50
Total Arsenic (As)	100	ug/L	1
Total Barium (Ba)	NV	ug/L	21
Total Beryllium (Be)	11	ug/L	<0.40
Total Boron (B)	200	ug/L	21
Total Cadmium (Cd)	0.1	ug/L	<0.090
Total Calcium (Ca)	NV	ug/L	100000
Total Chromium (Cr)	8.9	ug/L	<5.0
Total Cobalt (Co)	0.9	ug/L	<0.50
Total Copper (Cu)	5	ug/L	2.7
Total Iron (Fe)	300	ug/L	**320**
Total Lead (Pb)	5	ug/L	<0.50
Total Magnesium (Mg)	NV	ug/L	11000
Total Manganese (Mn)	NV	ug/L	42
Total Molybdenum (Mo)	40	ug/L	1.7
Total Nickel (Ni)	25	ug/L	<1.0
Total Potassium (K)	NV	ug/L	7900
Total Selenium (Se)	100	ug/L	<2.0
Total Silicon (Si)	NV	ug/L	5500
Total Silver (Ag)	0.1	ug/L	<0.090
Total Sodium (Na)	NV	ug/L	4100
Total Strontium (Sr)	NV	ug/L	120
Total Thallium (Tl)	0.3	ug/L	<0.050
Total Titanium (Ti)	NV	ug/L	<5.0
Total Vanadium (V)	6	ug/L	0.78
Total Zinc (Zn)	20	ug/L	8.2
Dissolved Aluminum (Al)	NV	ug/L	<4.9
Dissolved Antimony (Sb)	NV	ug/L	<0.50
Dissolved Arsenic (As)	NV	ug/L	<1.0
Dissolved Barium (Ba)	NV	ug/L	19
Dissolved Beryllium (Be)	NV	ug/L	<0.40
Dissolved Bismuth (Bi)	NV	ug/L	<1.0
Dissolved Boron (B)	NV	ug/L	20
Dissolved Cadmium (Cd)	NV	ug/L	<0.090
Dissolved Calcium (Ca)	NV	ug/L	98000
Dissolved Chromium (Cr)	NV	ug/L	<5.0
Dissolved Cobalt (Co)	NV	ug/L	<0.50
Dissolved Copper (Cu)	NV	ug/L	3.9
Dissolved Iron (Fe)	NV	ug/L	<100
Dissolved Lead (Pb)	NV	ug/L	<0.50
Dissolved Lithium (Li)	NV	ug/L	<5.0
Dissolved Magnesium (Mg)	NV	ug/L	11000
Dissolved Manganese (Mn)	NV	ug/L	16
Dissolved Molybdenum (Mo)	NV	ug/L	1.6
Dissolved Nickel (Ni)	NV	ug/L	<1.0
Dissolved Phosphorous (P)	NV	ug/L	100
Dissolved Potassium (K)	NV	ug/L	7900
Dissolved Selenium (Se)	NV	ug/L	<2.0
Dissolved Silicon (Si)	NV	ug/L	5200
Dissolved Silver (Ag)	NV	ug/L	<0.090
Dissolved Sodium (Na)	NV	ug/L	4100
Dissolved Strontium (Sr)	NV	ug/L	110
Dissolved Tellurium (Te)	NV	ug/L	<1.0
Dissolved Thallium (Tl)	NV	ug/L	<0.050
Dissolved Tin (Sn)	NV	ug/L	<1.0
Dissolved Titanium (Ti)	NV	ug/L	<5.0
Dissolved Tungsten (W)	NV	ug/L	<1.0
Dissolved Uranium (U)	NV	ug/L	1.2
Dissolved Vanadium (V)	NV	ug/L	<0.50
Dissolved Zinc (Zn)	NV	ug/L	6.3
Dissolved Zirconium (Zr)	NV	ug/L	<1.0

Notes:
Results compared to Ontario Provincial Water Quality Objectives (PWQO)
NV indicates 'No value'
N/A indicates ' Not Applicabale'
Exceeds PWQO

Your Project #: LON-00017696-GE
Site Location: Mount Pleasant Lands
Your C.O.C. #: 817254-01-01

Attention: Eric Buchanan

exp Services Inc
London Branch
15701 Robin's Hill Rd
Unit 2
London, ON
CANADA N5V 0A5

Report Date: 2021/03/31
Report #: R6577096
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C178913
Received: 2021/03/24, 15:47

Sample Matrix: Water
Samples Received: 5

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity	5	N/A	2021/03/30	CAM SOP-00448	SM 23 2320 B m
Carbonate, Bicarbonate and Hydroxide	5	N/A	2021/03/30	CAM SOP-00102	APHA 4500-CO2 D
Chloride by Automated Colourimetry	5	N/A	2021/03/29	CAM SOP-00463	SM 23 4500-Cl E m
Conductivity	5	N/A	2021/03/30	CAM SOP-00414	SM 23 2510 m
Dissolved Organic Carbon (DOC) (1)	4	N/A	2021/03/26	CAM SOP-00446	SM 23 5310 B m
Hardness (calculated as CaCO3)	4	N/A	2021/03/30	CAM SOP 00102/00408/00447	SM 2340 B
Hardness (calculated as CaCO3)	1	N/A	2021/03/31	CAM SOP 00102/00408/00447	SM 2340 B
Lab Filtered Metals Analysis by ICP	1	2021/03/27	2021/03/29	CAM SOP-00408	EPA 6010D m
Lab Filtered Metals by ICPMS	4	2021/03/27	2021/03/30	CAM SOP-00447	EPA 6020B m
Lab Filtered Metals by ICPMS	1	2021/03/30	2021/03/31	CAM SOP-00447	EPA 6020B m
Total Metals Analysis by ICPMS	1	N/A	2021/03/30	CAM SOP-00447	EPA 6020B m
Ion Balance (% Difference)	4	N/A	2021/03/31		
Anion and Cation Sum	3	N/A	2021/03/30		
Anion and Cation Sum	1	N/A	2021/03/31		
Total Ammonia-N	1	N/A	2021/03/29	CAM SOP-00441	USGS I-2522-90 m
Total Ammonia-N	4	N/A	2021/03/30	CAM SOP-00441	USGS I-2522-90 m
Nitrate (NO3) and Nitrite (NO2) in Water (2)	5	N/A	2021/03/30	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH	5	2021/03/26	2021/03/30	CAM SOP-00413	SM 4500H+ B m
Orthophosphate	5	N/A	2021/03/29	CAM SOP-00461	EPA 365.1 m
Sat. pH and Langelier Index (@ 20C)	5	N/A	2021/03/31		Auto Calc
Sat. pH and Langelier Index (@ 4C)	5	N/A	2021/03/31		Auto Calc
Sulphate by Automated Colourimetry	5	N/A	2021/03/29	CAM SOP-00464	EPA 375.4 m
Total Dissolved Solids (TDS calc)	5	N/A	2021/03/31		Auto Calc
Total Organic Carbon (TOC) (3)	1	N/A	2021/03/26	CAM SOP-00446	SM 23 5310B m
Total Phosphorus (Colourimetric)	1	2021/03/26	2021/03/26	CAM SOP-00407	SM 23 4500 P B H m
Turbidity	1	N/A	2021/03/29	CAM SOP-00417	SM 23 2130 B m

Remarks:

Your Project #: LON-00017696-GE
Site Location: Mount Pleasant Lands
Your C.O.C. #: 817254-01-01

Attention: Eric Buchanan

exp Services Inc
London Branch
15701 Robin's Hill Rd
Unit 2
London, ON
CANADA N5V 0A5

Report Date: 2021/03/31
Report #: R6577096
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C178913
Received: 2021/03/24, 15:47

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
(2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.
(3) Total Organic Carbon (TOC) present in the sample should be considered as non-purgeable TOC.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Christine Gripton, Senior Project Manager
Email: Christine.Gripton@bureauveritas.com
Phone# (519)652-9444
==========
This report has been generated and distributed using a secure automated process.
BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

BV Labs Job #: C178913
Report Date: 2021/03/31

exp Services Inc
Client Project #: LON-00017696-GE
Site Location: Mount Pleasant Lands
Sampler Initials: M.B

RCAP - COMPREHENSIVE (LAB FILTERED)

BV Labs ID		PDW394		PDW395	PDW396		PDW397		
Sampling Date		2021/03/24		2021/03/24	2021/03/24		2021/03/24		
COC Number		817254-01-01		817254-01-01	817254-01-01		817254-01-01		
	UNITS	MW103	RDL	MW3D	MW4D	QC Batch	MW104	RDL	QC Batch
Calculated Parameters									
Anion Sum	me/L	17.5	N/A	7.21	5.15	7266563	5.57	N/A	7266563
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	250	1.0	210	240	7266523	230	1.0	7266523
Calculated TDS	mg/L	1000	1.0	420	280	7266568	300	1.0	7266568
Carb. Alkalinity (calc. as CaCO3)	mg/L	1.8	1.0	2.0	1.7	7266523	3.1	1.0	7266523
Cation Sum	me/L	19.2	N/A	8.62	6.02	7266563	5.65	N/A	7266563
Hardness (CaCO3)	mg/L	400	1.0	360	290	7266294	220	1.0	7266294
Ion Balance (% Difference)	%	4.58	N/A	8.91	7.82	7266316	0.750	N/A	7266316
Langelier Index (@ 20C)	N/A	0.850		0.960	0.811	7266564	0.738		7266564
Langelier Index (@ 4C)	N/A	0.604		0.712	0.562	7266565	0.489		7266565
Saturation pH (@ 20C)	N/A	7.03		7.03	7.08	7266564	7.42		7266564
Saturation pH (@ 4C)	N/A	7.28		7.28	7.33	7266565	7.67		7266565
Inorganics									
Total Ammonia-N	mg/L	<0.050	0.050	<0.050	<0.050	7269357	<0.050	0.050	7269357
Conductivity	umho/cm	2000	1.0	810	550	7269628	520	1.0	7269628
Dissolved Organic Carbon	mg/L	0.77	0.40	2.4	1.1	7269491	0.66	0.40	7269491
Orthophosphate (P)	mg/L	<0.010	0.010	<0.010	<0.010	7269591	0.012	0.010	7269591
pH	pH	7.88		7.99	7.89	7269629	8.16		7269629
Dissolved Sulphate (SO4)	mg/L	17	1.0	50	8.3	7269590	40	1.0	7269590
Alkalinity (Total as CaCO3)	mg/L	250	1.0	210	240	7269603	230	1.0	7269603
Dissolved Chloride (Cl-)	mg/L	420	5.0	67	3.9	7269566	2.9	1.0	7269566
Nitrite (N)	mg/L	<0.010	0.010	<0.010	<0.010	7269484	<0.010	0.010	7269484
Nitrate (N)	mg/L	3.12	0.10	0.12	1.68	7269484	0.10	0.10	7269484
Nitrate + Nitrite (N)	mg/L	3.12	0.10	0.12	1.68	7269484	0.10	0.10	7269484
Metals									
Dissolved Aluminum (Al)	ug/L	<4.9	4.9	<4.9	<4.9	7270416	6.9	4.9	7274526
Dissolved Antimony (Sb)	ug/L	<0.50	0.50	<0.50	<0.50	7270416	<0.50	0.50	7274526
Dissolved Arsenic (As)	ug/L	<1.0	1.0	<1.0	<1.0	7270416	1.5	1.0	7274526
Dissolved Barium (Ba)	ug/L	55	2.0	39	19	7270416	110	2.0	7274526
Dissolved Beryllium (Be)	ug/L	<0.40	0.40	<0.40	<0.40	7270416	<0.40	0.40	7274526
Dissolved Boron (B)	ug/L	12	10	<10	17	7270416	97	10	7274526
Dissolved Cadmium (Cd)	ug/L	<0.090	0.090	<0.090	<0.090	7270416	<0.090	0.090	7274526

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

BV Labs Job #: C178913
Report Date: 2021/03/31

exp Services Inc
Client Project #: LON-00017696-GE
Site Location: Mount Pleasant Lands
Sampler Initials: M.B

RCAP - COMPREHENSIVE (LAB FILTERED)

BV Labs ID		PDW394		PDW395	PDW396		PDW397		
Sampling Date		2021/03/24		2021/03/24	2021/03/24		2021/03/24		
COC Number		817254-01-01		817254-01-01	817254-01-01		817254-01-01		
	UNITS	MW103	RDL	MW3D	MW4D	QC Batch	MW104	RDL	QC Batch
Dissolved Calcium (Ca)	ug/L	130000	200	120000	91000	7270416	43000	200	7274526
Dissolved Chromium (Cr)	ug/L	<5.0	5.0	<5.0	<5.0	7270416	<5.0	5.0	7274526
Dissolved Cobalt (Co)	ug/L	<0.50	0.50	<0.50	<0.50	7270416	<0.50	0.50	7274526
Dissolved Copper (Cu)	ug/L	0.96	0.90	1.6	1.4	7270416	<0.90	0.90	7274526
Dissolved Iron (Fe)	ug/L	<100	100	<100	<100	7270416	<100	100	7274526
Dissolved Lead (Pb)	ug/L	<0.50	0.50	<0.50	<0.50	7270416	<0.50	0.50	7274526
Dissolved Magnesium (Mg)	ug/L	17000	50	14000	15000	7270416	28000	50	7274526
Dissolved Manganese (Mn)	ug/L	<2.0	2.0	<2.0	<2.0	7270416	31	2.0	7274526
Dissolved Molybdenum (Mo)	ug/L	<0.50	0.50	<0.50	17	7270416	17	0.50	7274526
Dissolved Nickel (Ni)	ug/L	<1.0	1.0	<1.0	<1.0	7270416	<1.0	1.0	7274526
Dissolved Phosphorus (P)	ug/L	<100	100	<100	<100	7270416	<100	100	7274526
Dissolved Potassium (K)	ug/L	1500	200	360	2100	7270416	1600	200	7274526
Dissolved Selenium (Se)	ug/L	<2.0	2.0	<2.0	<2.0	7270416	<2.0	2.0	7274526
Dissolved Silicon (Si)	ug/L	3800	50	2200	3800	7270416	7100	50	7274526
Dissolved Silver (Ag)	ug/L	<0.090	0.090	<0.090	<0.090	7270416	<0.090	0.090	7274526
Dissolved Sodium (Na)	ug/L	260000	100	30000	4400	7270416	27000	100	7274526
Dissolved Strontium (Sr)	ug/L	170	1.0	140	96	7270416	1500	1.0	7274526
Dissolved Thallium (Tl)	ug/L	<0.050	0.050	<0.050	<0.050	7270416	<0.050	0.050	7274526
Dissolved Titanium (Ti)	ug/L	<5.0	5.0	<5.0	<5.0	7270416	<5.0	5.0	7274526
Dissolved Uranium (U)	ug/L	0.55	0.10	1.4	0.52	7270416	2.6	0.10	7274526
Dissolved Vanadium (V)	ug/L	<0.50	0.50	<0.50	<0.50	7270416	0.71	0.50	7274526
Dissolved Zinc (Zn)	ug/L	<5.0	5.0	<5.0	<5.0	7270416	<5.0	5.0	7274526

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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BV Labs Job #: C178913
Report Date: 2021/03/31

exp Services Inc
Client Project #: LON-00017696-GE
Site Location: Mount Pleasant Lands
Sampler Initials: M.B

RCAP - SURFACE WATER (WATER)

BV Labs ID		PDW398		
Sampling Date		2021/03/24		
COC Number		817254-01-01		
	UNITS	SW#1 P101	RDL	QC Batch
Calculated Parameters				
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	220	1.0	7266523
Calculated TDS	mg/L	340	1.0	7266568
Carb. Alkalinity (calc. as CaCO3)	mg/L	2.8	1.0	7266523
Hardness (CaCO3)	mg/L	300	1.0	7266294
Langelier Index (@ 20C)	N/A	1.06		7266564
Langelier Index (@ 4C)	N/A	0.806		7266565
Saturation pH (@ 20C)	N/A	7.07		7266564
Saturation pH (@ 4C)	N/A	7.32		7266565
Inorganics				
Total Ammonia-N	mg/L	<0.050	0.050	7268438
Conductivity	umho/cm	570	1.0	7269628
Total Organic Carbon (TOC)	mg/L	10	0.40	7268461
Orthophosphate (P)	mg/L	0.069	0.010	7269591
pH	pH	8.12		7269629
Total Phosphorus	mg/L	0.15	0.02	7268243
Dissolved Sulphate (SO4)	mg/L	63	1.0	7269590
Turbidity	NTU	1.4	0.1	7269453
Alkalinity (Total as CaCO3)	mg/L	230	1.0	7269603
Dissolved Chloride (Cl-)	mg/L	7.1	1.0	7269566
Nitrite (N)	mg/L	<0.010	0.010	7269484
Nitrate (N)	mg/L	<0.10	0.10	7269484
Metals				
Dissolved Calcium (Ca)	mg/L	100	0.05	7270366
Dissolved Magnesium (Mg)	mg/L	11	0.05	7270366
Dissolved Potassium (K)	mg/L	8	1	7270366
Dissolved Sodium (Na)	mg/L	4.3	0.5	7270366
Total Aluminum (Al)	ug/L	79	4.9	7272467
Total Antimony (Sb)	ug/L	<0.50	0.50	7272467
Total Arsenic (As)	ug/L	1.0	1.0	7272467
Total Barium (Ba)	ug/L	21	2.0	7272467
Total Beryllium (Be)	ug/L	<0.40	0.40	7272467
Total Boron (B)	ug/L	21	10	7272467

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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BV Labs Job #: C178913
Report Date: 2021/03/31

exp Services Inc
Client Project #: LON-00017696-GE
Site Location: Mount Pleasant Lands
Sampler Initials: M.B

RCAP - SURFACE WATER (WATER)

BV Labs ID		PDW398		
Sampling Date		2021/03/24		
COC Number		817254-01-01		
	UNITS	SW#1 P101	RDL	QC Batch
Total Cadmium (Cd)	ug/L	<0.090	0.090	7272467
Total Calcium (Ca)	ug/L	100000	200	7272467
Total Chromium (Cr)	ug/L	<5.0	5.0	7272467
Total Cobalt (Co)	ug/L	<0.50	0.50	7272467
Total Copper (Cu)	ug/L	2.7	0.90	7272467
Total Iron (Fe)	ug/L	320	100	7272467
Total Lead (Pb)	ug/L	<0.50	0.50	7272467
Total Magnesium (Mg)	ug/L	11000	50	7272467
Total Manganese (Mn)	ug/L	42	2.0	7272467
Total Molybdenum (Mo)	ug/L	1.7	0.50	7272467
Total Nickel (Ni)	ug/L	<1.0	1.0	7272467
Total Potassium (K)	ug/L	7900	200	7272467
Total Selenium (Se)	ug/L	<2.0	2.0	7272467
Total Silicon (Si)	ug/L	5500	50	7272467
Total Silver (Ag)	ug/L	<0.090	0.090	7272467
Total Sodium (Na)	ug/L	4100	100	7272467
Total Strontium (Sr)	ug/L	120	1.0	7272467
Total Thallium (Tl)	ug/L	<0.050	0.050	7272467
Total Titanium (Ti)	ug/L	<5.0	5.0	7272467
Total Vanadium (V)	ug/L	0.78	0.50	7272467
Total Zinc (Zn)	ug/L	8.2	5.0	7272467

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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BV Labs Job #: C178913
Report Date: 2021/03/31

exp Services Inc
Client Project #: LON-00017696-GE
Site Location: Mount Pleasant Lands
Sampler Initials: M.B

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		PDW398		
Sampling Date		2021/03/24		
COC Number		817254-01-01		
	UNITS	SW#1 P101	RDL	QC Batch
Metals				
Dissolved Aluminum (Al)	ug/L	<4.9	4.9	7270416
Dissolved Antimony (Sb)	ug/L	<0.50	0.50	7270416
Dissolved Arsenic (As)	ug/L	<1.0	1.0	7270416
Dissolved Barium (Ba)	ug/L	19	2.0	7270416
Dissolved Beryllium (Be)	ug/L	<0.40	0.40	7270416
Dissolved Bismuth (Bi)	ug/L	<1.0	1.0	7270416
Dissolved Boron (B)	ug/L	20	10	7270416
Dissolved Cadmium (Cd)	ug/L	<0.090	0.090	7270416
Dissolved Calcium (Ca)	ug/L	98000	200	7270416
Dissolved Chromium (Cr)	ug/L	<5.0	5.0	7270416
Dissolved Cobalt (Co)	ug/L	<0.50	0.50	7270416
Dissolved Copper (Cu)	ug/L	3.9	0.90	7270416
Dissolved Iron (Fe)	ug/L	<100	100	7270416
Dissolved Lead (Pb)	ug/L	<0.50	0.50	7270416
Dissolved Lithium (Li)	ug/L	<5.0	5.0	7270416
Dissolved Magnesium (Mg)	ug/L	11000	50	7270416
Dissolved Manganese (Mn)	ug/L	16	2.0	7270416
Dissolved Molybdenum (Mo)	ug/L	1.6	0.50	7270416
Dissolved Nickel (Ni)	ug/L	<1.0	1.0	7270416
Dissolved Phosphorus (P)	ug/L	100	100	7270416
Dissolved Potassium (K)	ug/L	7900	200	7270416
Dissolved Selenium (Se)	ug/L	<2.0	2.0	7270416
Dissolved Silicon (Si)	ug/L	5200	50	7270416
Dissolved Silver (Ag)	ug/L	<0.090	0.090	7270416
Dissolved Sodium (Na)	ug/L	4100	100	7270416
Dissolved Strontium (Sr)	ug/L	110	1.0	7270416
Dissolved Tellurium (Te)	ug/L	<1.0	1.0	7270416
Dissolved Thallium (Tl)	ug/L	<0.050	0.050	7270416
Dissolved Tin (Sn)	ug/L	<1.0	1.0	7270416
Dissolved Titanium (Ti)	ug/L	<5.0	5.0	7270416
Dissolved Tungsten (W)	ug/L	<1.0	1.0	7270416
Dissolved Uranium (U)	ug/L	1.2	0.10	7270416

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

BV Labs Job #: C178913
Report Date: 2021/03/31

exp Services Inc
Client Project #: LON-00017696-GE
Site Location: Mount Pleasant Lands
Sampler Initials: M.B

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		PDW398		
Sampling Date		2021/03/24		
COC Number		817254-01-01		
	UNITS	SW#1 P101	RDL	QC Batch
Dissolved Vanadium (V)	ug/L	<0.50	0.50	7270416
Dissolved Zinc (Zn)	ug/L	6.3	5.0	7270416
Dissolved Zirconium (Zr)	ug/L	<1.0	1.0	7270416

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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BV Labs Job #: C178913
Report Date: 2021/03/31

exp Services Inc
Client Project #: LON-00017696-GE
Site Location: Mount Pleasant Lands
Sampler Initials: M.B

TEST SUMMARY

BV Labs ID: PDW394
Sample ID: MW103
Matrix: Water

Collected: 2021/03/24
Shipped:
Received: 2021/03/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7269603	N/A	2021/03/30	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	7266523	N/A	2021/03/30	Automated Statchk
Chloride by Automated Colourimetry	KONE	7269566	N/A	2021/03/29	Deonarine Ramnarine
Conductivity	AT	7269628	N/A	2021/03/30	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	7269491	N/A	2021/03/26	Nimarta Singh
Hardness (calculated as CaCO3)		7266294	N/A	2021/03/30	Automated Statchk
Lab Filtered Metals by ICPMS	ICP/MS	7270416	2021/03/27	2021/03/30	Arefa Dabhad
Ion Balance (% Difference)	CALC	7266316	N/A	2021/03/31	Automated Statchk
Anion and Cation Sum	CALC	7266563	N/A	2021/03/30	Automated Statchk
Total Ammonia-N	LACH/NH4	7269357	N/A	2021/03/30	Alina Dobreanu
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	7269484	N/A	2021/03/30	Chandra Nandlal
pH	AT	7269629	2021/03/26	2021/03/30	Surinder Rai
Orthophosphate	KONE	7269591	N/A	2021/03/29	Avneet Kour Sudan
Sat. pH and Langelier Index (@ 20C)	CALC	7266564	N/A	2021/03/31	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	7266565	N/A	2021/03/31	Automated Statchk
Sulphate by Automated Colourimetry	KONE	7269590	N/A	2021/03/29	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	7266568	N/A	2021/03/31	Automated Statchk

BV Labs ID: PDW395
Sample ID: MW3D
Matrix: Water

Collected: 2021/03/24
Shipped:
Received: 2021/03/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7269603	N/A	2021/03/30	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	7266523	N/A	2021/03/30	Automated Statchk
Chloride by Automated Colourimetry	KONE	7269566	N/A	2021/03/29	Deonarine Ramnarine
Conductivity	AT	7269628	N/A	2021/03/30	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	7269491	N/A	2021/03/26	Nimarta Singh
Hardness (calculated as CaCO3)		7266294	N/A	2021/03/30	Automated Statchk
Lab Filtered Metals by ICPMS	ICP/MS	7270416	2021/03/27	2021/03/30	Arefa Dabhad
Ion Balance (% Difference)	CALC	7266316	N/A	2021/03/31	Automated Statchk
Anion and Cation Sum	CALC	7266563	N/A	2021/03/30	Automated Statchk
Total Ammonia-N	LACH/NH4	7269357	N/A	2021/03/30	Alina Dobreanu
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	7269484	N/A	2021/03/30	Chandra Nandlal
pH	AT	7269629	2021/03/26	2021/03/30	Surinder Rai
Orthophosphate	KONE	7269591	N/A	2021/03/29	Avneet Kour Sudan
Sat. pH and Langelier Index (@ 20C)	CALC	7266564	N/A	2021/03/31	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	7266565	N/A	2021/03/31	Automated Statchk
Sulphate by Automated Colourimetry	KONE	7269590	N/A	2021/03/29	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	7266568	N/A	2021/03/31	Automated Statchk

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BV Labs Job #: C178913
Report Date: 2021/03/31

exp Services Inc
Client Project #: LON-00017696-GE
Site Location: Mount Pleasant Lands
Sampler Initials: M.B

TEST SUMMARY

BV Labs ID: PDW396
Sample ID: MW4D
Matrix: Water

Collected: 2021/03/24
Shipped:
Received: 2021/03/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7269603	N/A	2021/03/30	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	7266523	N/A	2021/03/30	Automated Statchk
Chloride by Automated Colourimetry	KONE	7269566	N/A	2021/03/29	Deonarine Ramnarine
Conductivity	AT	7269628	N/A	2021/03/30	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	7269491	N/A	2021/03/26	Nimarta Singh
Hardness (calculated as CaCO3)		7266294	N/A	2021/03/30	Automated Statchk
Lab Filtered Metals by ICPMS	ICP/MS	7270416	2021/03/27	2021/03/30	Arefa Dabhad
Ion Balance (% Difference)	CALC	7266316	N/A	2021/03/31	Automated Statchk
Anion and Cation Sum	CALC	7266563	N/A	2021/03/30	Automated Statchk
Total Ammonia-N	LACH/NH4	7269357	N/A	2021/03/30	Alina Dobreanu
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	7269484	N/A	2021/03/30	Chandra Nandlal
pH	AT	7269629	2021/03/26	2021/03/30	Surinder Rai
Orthophosphate	KONE	7269591	N/A	2021/03/29	Avneet Kour Sudan
Sat. pH and Langelier Index (@ 20C)	CALC	7266564	N/A	2021/03/31	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	7266565	N/A	2021/03/31	Automated Statchk
Sulphate by Automated Colourimetry	KONE	7269590	N/A	2021/03/29	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	7266568	N/A	2021/03/31	Automated Statchk

BV Labs ID: PDW397
Sample ID: MW104
Matrix: Water

Collected: 2021/03/24
Shipped:
Received: 2021/03/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7269603	N/A	2021/03/30	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	7266523	N/A	2021/03/30	Automated Statchk
Chloride by Automated Colourimetry	KONE	7269566	N/A	2021/03/29	Deonarine Ramnarine
Conductivity	AT	7269628	N/A	2021/03/30	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	7269491	N/A	2021/03/26	Nimarta Singh
Hardness (calculated as CaCO3)		7266294	N/A	2021/03/31	Automated Statchk
Lab Filtered Metals by ICPMS	ICP/MS	7274526	2021/03/30	2021/03/31	Arefa Dabhad
Ion Balance (% Difference)	CALC	7266316	N/A	2021/03/31	Automated Statchk
Anion and Cation Sum	CALC	7266563	N/A	2021/03/31	Automated Statchk
Total Ammonia-N	LACH/NH4	7269357	N/A	2021/03/30	Alina Dobreanu
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	7269484	N/A	2021/03/30	Chandra Nandlal
pH	AT	7269629	2021/03/26	2021/03/30	Surinder Rai
Orthophosphate	KONE	7269591	N/A	2021/03/29	Avneet Kour Sudan
Sat. pH and Langelier Index (@ 20C)	CALC	7266564	N/A	2021/03/31	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	7266565	N/A	2021/03/31	Automated Statchk
Sulphate by Automated Colourimetry	KONE	7269590	N/A	2021/03/29	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	7266568	N/A	2021/03/31	Automated Statchk

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BV Labs Job #: C178913
Report Date: 2021/03/31

exp Services Inc
Client Project #: LON-00017696-GE
Site Location: Mount Pleasant Lands
Sampler Initials: M.B

TEST SUMMARY

BV Labs ID: PDW398
Sample ID: SW#1 P101
Matrix: Water

Collected: 2021/03/24
Shipped:
Received: 2021/03/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7269603	N/A	2021/03/30	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	7266523	N/A	2021/03/30	Automated Statchk
Chloride by Automated Colourimetry	KONE	7269566	N/A	2021/03/29	Deonarine Ramnarine
Conductivity	AT	7269628	N/A	2021/03/30	Surinder Rai
Hardness (calculated as CaCO3)		7266294	N/A	2021/03/30	Automated Statchk
Lab Filtered Metals Analysis by ICP	ICP	7270366	2021/03/27	2021/03/29	Suban Kanapathippllai
Lab Filtered Metals by ICPMS	ICP/MS	7270416	2021/03/27	2021/03/30	Arefa Dabhad
Total Metals Analysis by ICPMS	ICP/MS	7272467	N/A	2021/03/30	Arefa Dabhad
Total Ammonia-N	LACH/NH4	7268438	N/A	2021/03/29	Alina Dobreanu
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	7269484	N/A	2021/03/30	Chandra Nandlal
pH	AT	7269629	2021/03/26	2021/03/30	Surinder Rai
Orthophosphate	KONE	7269591	N/A	2021/03/29	Avneet Kour Sudan
Sat. pH and Langelier Index (@ 20C)	CALC	7266564	N/A	2021/03/31	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	7266565	N/A	2021/03/31	Automated Statchk
Sulphate by Automated Colourimetry	KONE	7269590	N/A	2021/03/29	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	7266568	N/A	2021/03/31	Automated Statchk
Total Organic Carbon (TOC)	TOCV/NDIR	7268461	N/A	2021/03/26	Nimarta Singh
Total Phosphorus (Colourimetric)	LACH/P	7268243	2021/03/26	2021/03/26	Shivani Shivani
Turbidity	AT	7269453	N/A	2021/03/29	Tarunpreet Kaur

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exp Services Inc
Client Project #: LON-00017696-GE
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GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	10.7°C

Results relate only to the items tested.

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BV Labs Job #: C178913
Report Date: 2021/03/31

QUALITY ASSURANCE REPORT

exp Services Inc
Client Project #: LON-00017696-GE
Site Location: Mount Pleasant Lands
Sampler Initials: M.B

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7268243	Total Phosphorus	2021/03/26	103	80 - 120	98	80 - 120	<0.004	mg/L	0.53	20	95	80 - 120
7268438	Total Ammonia-N	2021/03/29	100	75 - 125	101	80 - 120	<0.050	mg/L	1.3	20		
7268461	Total Organic Carbon (TOC)	2021/03/26	95	80 - 120	95	80 - 120	<0.40	mg/L	3.6	20		
7269357	Total Ammonia-N	2021/03/30	99	75 - 125	100	80 - 120	<0.050	mg/L	2.7	20		
7269453	Turbidity	2021/03/29			100	85 - 115	<0.1	NTU	2.8	20		
7269484	Nitrate (N)	2021/03/30	100	80 - 120	99	80 - 120	<0.10	mg/L	0.19	20		
7269484	Nitrite (N)	2021/03/30	106	80 - 120	107	80 - 120	<0.010	mg/L	NC	20		
7269491	Dissolved Organic Carbon	2021/03/26	92	80 - 120	95	80 - 120	<0.40	mg/L	0.21	20		
7269566	Dissolved Chloride (Cl-)	2021/03/29	118	80 - 120	99	80 - 120	<1.0	mg/L	1.6	20		
7269590	Dissolved Sulphate (SO4)	2021/03/29	118	75 - 125	104	80 - 120	<1.0	mg/L	0.22	20		
7269591	Orthophosphate (P)	2021/03/29	108	75 - 125	99	80 - 120	<0.010	mg/L	NC	25		
7269603	Alkalinity (Total as CaCO3)	2021/03/30			96	85 - 115	<1.0	mg/L	2.7	20		
7269628	Conductivity	2021/03/30			101	85 - 115	<1.0	umho/cm	0.12	25		
7269629	pH	2021/03/30			102	98 - 103			0.026	N/A		
7270366	Dissolved Calcium (Ca)	2021/03/29	94	80 - 120	100	80 - 120	<0.05	mg/L	2.0	25		
7270366	Dissolved Magnesium (Mg)	2021/03/29	99	80 - 120	96	80 - 120	<0.05	mg/L	1.2	25		
7270366	Dissolved Potassium (K)	2021/03/29	101	80 - 120	99	80 - 120	<1	mg/L	NC	25		
7270366	Dissolved Sodium (Na)	2021/03/29	101	80 - 120	99	80 - 120	<0.5	mg/L	3.1	25		
7270416	Dissolved Aluminum (Al)	2021/03/30	103	80 - 120	104	80 - 120	11, RDL=4.9	ug/L				
7270416	Dissolved Antimony (Sb)	2021/03/30	104	80 - 120	102	80 - 120	<0.50	ug/L				
7270416	Dissolved Arsenic (As)	2021/03/30	100	80 - 120	101	80 - 120	<1.0	ug/L				
7270416	Dissolved Barium (Ba)	2021/03/30	99	80 - 120	102	80 - 120	<2.0	ug/L				
7270416	Dissolved Beryllium (Be)	2021/03/30	100	80 - 120	98	80 - 120	<0.40	ug/L				
7270416	Dissolved Bismuth (Bi)	2021/03/30	101	80 - 120	104	80 - 120	<1.0	ug/L				
7270416	Dissolved Boron (B)	2021/03/30	101	80 - 120	97	80 - 120	<10	ug/L				
7270416	Dissolved Cadmium (Cd)	2021/03/30	103	80 - 120	103	80 - 120	<0.090	ug/L				
7270416	Dissolved Calcium (Ca)	2021/03/30	91	80 - 120	102	80 - 120	<200	ug/L				
7270416	Dissolved Chromium (Cr)	2021/03/30	99	80 - 120	100	80 - 120	<5.0	ug/L				
7270416	Dissolved Cobalt (Co)	2021/03/30	98	80 - 120	100	80 - 120	<0.50	ug/L				
7270416	Dissolved Copper (Cu)	2021/03/30	99	80 - 120	101	80 - 120	<0.90	ug/L				

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7270416	Dissolved Iron (Fe)	2021/03/30	97	80 - 120	99	80 - 120	<100	ug/L				
7270416	Dissolved Lead (Pb)	2021/03/30	98	80 - 120	97	80 - 120	<0.50	ug/L				
7270416	Dissolved Lithium (Li)	2021/03/30	104	80 - 120	101	80 - 120	<5.0	ug/L				
7270416	Dissolved Magnesium (Mg)	2021/03/30	88	80 - 120	100	80 - 120	<50	ug/L				
7270416	Dissolved Manganese (Mn)	2021/03/30	99	80 - 120	101	80 - 120	<2.0	ug/L				
7270416	Dissolved Molybdenum (Mo)	2021/03/30	102	80 - 120	100	80 - 120	<0.50	ug/L				
7270416	Dissolved Nickel (Ni)	2021/03/30	97	80 - 120	101	80 - 120	<1.0	ug/L				
7270416	Dissolved Phosphorus (P)	2021/03/30	105	80 - 120	105	80 - 120	<100	ug/L				
7270416	Dissolved Potassium (K)	2021/03/30	103	80 - 120	102	80 - 120	<200	ug/L				
7270416	Dissolved Selenium (Se)	2021/03/30	103	80 - 120	103	80 - 120	<2.0	ug/L				
7270416	Dissolved Silicon (Si)	2021/03/30	104	80 - 120	104	80 - 120	<50	ug/L				
7270416	Dissolved Silver (Ag)	2021/03/30	99	80 - 120	99	80 - 120	<0.090	ug/L				
7270416	Dissolved Sodium (Na)	2021/03/30	91	80 - 120	102	80 - 120	<100	ug/L				
7270416	Dissolved Strontium (Sr)	2021/03/30	95	80 - 120	101	80 - 120	<1.0	ug/L				
7270416	Dissolved Tellurium (Te)	2021/03/30	102	80 - 120	101	80 - 120	<1.0	ug/L				
7270416	Dissolved Thallium (Tl)	2021/03/30	101	80 - 120	101	80 - 120	<0.050	ug/L				
7270416	Dissolved Tin (Sn)	2021/03/30	104	80 - 120	101	80 - 120	<1.0	ug/L				
7270416	Dissolved Titanium (Ti)	2021/03/30	102	80 - 120	98	80 - 120	<5.0	ug/L				
7270416	Dissolved Tungsten (W)	2021/03/30	101	80 - 120	102	80 - 120	<1.0	ug/L				
7270416	Dissolved Uranium (U)	2021/03/30	99	80 - 120	99	80 - 120	<0.10	ug/L				
7270416	Dissolved Vanadium (V)	2021/03/30	100	80 - 120	101	80 - 120	<0.50	ug/L				
7270416	Dissolved Zinc (Zn)	2021/03/30	98	80 - 120	111	80 - 120	<5.0	ug/L				
7270416	Dissolved Zirconium (Zr)	2021/03/30	107	80 - 120	105	80 - 120	<1.0	ug/L				
7272467	Total Aluminum (Al)	2021/03/31	152 (1)	80 - 120	103	80 - 120	<4.9	ug/L	0.41	20		
7272467	Total Antimony (Sb)	2021/03/30	99	80 - 120	101	80 - 120	<0.50	ug/L				
7272467	Total Arsenic (As)	2021/03/30	103	80 - 120	104	80 - 120	<1.0	ug/L				
7272467	Total Barium (Ba)	2021/03/30	99	80 - 120	99	80 - 120	<2.0	ug/L				
7272467	Total Beryllium (Be)	2021/03/30	103	80 - 120	99	80 - 120	<0.40	ug/L				
7272467	Total Boron (B)	2021/03/30	108	80 - 120	99	80 - 120	<10	ug/L				
7272467	Total Cadmium (Cd)	2021/03/31	102	80 - 120	103	80 - 120	<0.090	ug/L	17	20		
7272467	Total Calcium (Ca)	2021/03/30	96	80 - 120	102	80 - 120	<200	ug/L				

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7272467	Total Chromium (Cr)	2021/03/31	99	80 - 120	101	80 - 120	<5.0	ug/L	8.3	20		
7272467	Total Cobalt (Co)	2021/03/30	104	80 - 120	105	80 - 120	<0.50	ug/L				
7272467	Total Copper (Cu)	2021/03/31	105	80 - 120	99	80 - 120	<0.90	ug/L	15	20		
7272467	Total Iron (Fe)	2021/03/31	99	80 - 120	101	80 - 120	<100	ug/L	20	20		
7272467	Total Lead (Pb)	2021/03/31	98	80 - 120	101	80 - 120	<0.50	ug/L	2.6	20		
7272467	Total Magnesium (Mg)	2021/03/30	98	80 - 120	102	80 - 120	<50	ug/L				
7272467	Total Manganese (Mn)	2021/03/30	99	80 - 120	102	80 - 120	<2.0	ug/L				
7272467	Total Molybdenum (Mo)	2021/03/30	98	80 - 120	100	80 - 120	<0.50	ug/L				
7272467	Total Nickel (Ni)	2021/03/31	101	80 - 120	102	80 - 120	<1.0	ug/L	1.5	20		
7272467	Total Potassium (K)	2021/03/30	91	80 - 120	100	80 - 120	<200	ug/L				
7272467	Total Selenium (Se)	2021/03/30	107	80 - 120	109	80 - 120	<2.0	ug/L				
7272467	Total Silicon (Si)	2021/03/30	100	80 - 120	99	80 - 120	<50	ug/L				
7272467	Total Silver (Ag)	2021/03/30	98	80 - 120	101	80 - 120	<0.090	ug/L				
7272467	Total Sodium (Na)	2021/03/30	91	80 - 120	104	80 - 120	<100	ug/L				
7272467	Total Strontium (Sr)	2021/03/30	100	80 - 120	100	80 - 120	<1.0	ug/L				
7272467	Total Thallium (Tl)	2021/03/30	99	80 - 120	103	80 - 120	<0.050	ug/L				
7272467	Total Titanium (Ti)	2021/03/30	98	80 - 120	100	80 - 120	<5.0	ug/L				
7272467	Total Vanadium (V)	2021/03/30	101	80 - 120	102	80 - 120	<0.50	ug/L				
7272467	Total Zinc (Zn)	2021/03/31	103	80 - 120	105	80 - 120	<5.0	ug/L	9.4	20		
7274526	Dissolved Aluminum (Al)	2021/03/31	99	80 - 120	101	80 - 120	<4.9	ug/L	NC	20		
7274526	Dissolved Antimony (Sb)	2021/03/31	102	80 - 120	102	80 - 120	<0.50	ug/L	NC	20		
7274526	Dissolved Arsenic (As)	2021/03/31	101	80 - 120	101	80 - 120	<1.0	ug/L	NC	20		
7274526	Dissolved Barium (Ba)	2021/03/31	98	80 - 120	99	80 - 120	<2.0	ug/L	0.70	20		
7274526	Dissolved Beryllium (Be)	2021/03/31	96	80 - 120	96	80 - 120	<0.40	ug/L	NC	20		
7274526	Dissolved Boron (B)	2021/03/31	92	80 - 120	91	80 - 120	<10	ug/L	2.9	20		
7274526	Dissolved Cadmium (Cd)	2021/03/31	100	80 - 120	101	80 - 120	<0.090	ug/L	NC	20		
7274526	Dissolved Calcium (Ca)	2021/03/31	97	80 - 120	100	80 - 120	<200	ug/L	2.1	20		
7274526	Dissolved Chromium (Cr)	2021/03/31	93	80 - 120	95	80 - 120	<5.0	ug/L	NC	20		
7274526	Dissolved Cobalt (Co)	2021/03/31	96	80 - 120	97	80 - 120	<0.50	ug/L	NC	20		
7274526	Dissolved Copper (Cu)	2021/03/31	95	80 - 120	98	80 - 120	<0.90	ug/L	NC	20		
7274526	Dissolved Iron (Fe)	2021/03/31	99	80 - 120	100	80 - 120	<100	ug/L	NC	20		

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7274526	Dissolved Lead (Pb)	2021/03/31	96	80 - 120	95	80 - 120	<0.50	ug/L	NC	20		
7274526	Dissolved Magnesium (Mg)	2021/03/31	100	80 - 120	102	80 - 120	<50	ug/L	1.0	20		
7274526	Dissolved Manganese (Mn)	2021/03/31	98	80 - 120	100	80 - 120	<2.0	ug/L	NC	20		
7274526	Dissolved Molybdenum (Mo)	2021/03/31	98	80 - 120	98	80 - 120	<0.50	ug/L	NC	20		
7274526	Dissolved Nickel (Ni)	2021/03/31	95	80 - 120	98	80 - 120	<1.0	ug/L	NC	20		
7274526	Dissolved Phosphorus (P)	2021/03/31	105	80 - 120	104	80 - 120	<100	ug/L	NC	20		
7274526	Dissolved Potassium (K)	2021/03/31	103	80 - 120	104	80 - 120	<200	ug/L	1.1	20		
7274526	Dissolved Selenium (Se)	2021/03/31	99	80 - 120	98	80 - 120	<2.0	ug/L	NC	20		
7274526	Dissolved Silicon (Si)	2021/03/31	103	80 - 120	103	80 - 120	<50	ug/L	3.7	20		
7274526	Dissolved Silver (Ag)	2021/03/31	95	80 - 120	95	80 - 120	<0.090	ug/L	NC	20		
7274526	Dissolved Sodium (Na)	2021/03/31	99	80 - 120	99	80 - 120	<100	ug/L	0.34	20		
7274526	Dissolved Strontium (Sr)	2021/03/31	99	80 - 120	100	80 - 120	<1.0	ug/L	0.59	20		
7274526	Dissolved Thallium (Tl)	2021/03/31	99	80 - 120	98	80 - 120	<0.050	ug/L	NC	20		
7274526	Dissolved Titanium (Ti)	2021/03/31	99	80 - 120	100	80 - 120	<5.0	ug/L	NC	20		
7274526	Dissolved Uranium (U)	2021/03/31	98	80 - 120	96	80 - 120	<0.10	ug/L	5.9	20		
7274526	Dissolved Vanadium (V)	2021/03/31	97	80 - 120	99	80 - 120	<0.50	ug/L	NC	20		
7274526	Dissolved Zinc (Zn)	2021/03/31	97	80 - 120	98	80 - 120	<5.0	ug/L	NC	20		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

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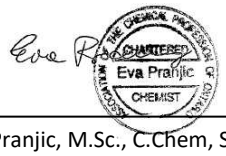
BV Labs Job #: C178913
Report Date: 2021/03/31

exp Services Inc
Client Project #: LON-00017696-GE
Site Location: Mount Pleasant Lands
Sampler Initials: M.B

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Ewa Pranjic, M.Sc., C.Chem, Scientific Specialist

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports.
For Service Group specific validation please refer to the Validation Signature Page.

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IMMEDIATE

Bureau Veritas Laboratories
6379 & 6381-6423 Meadowbrook Drive, London Ontario Canada N6L 1E7 Tel (519) 652-9444 Toll-free:800-563-6266 Fax (519) 652-8189 www.bvlabs.com

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24-Mar-21 15:47
Christine Gripton
C178913

Page of

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:			
Company Name:	#28124 exp Services Inc	Company Name:		Quotation #:	B91718 J L	ENV-1333	Bottle Order #: 817254
Attention:	Accounts Payable	Attention:		P.O. #:			
Address:	15701 Robin's Hill Rd Unit 2 London ON N5V 0A5	Address:		Project:	LON-00017696-GE		
Tel:	(519) 963-3000 Fax: (519) 963-1152	Tel:	Fax:	Project Name:		COC #: C#817254-01-01	Project Manager: Christine Gripton
Email:	AP@exp.com, karen.Burke@exp.com, Lo-Ellen.Mitton	Email:	Eric.Buchanan@exp.com	Site #:	Mount Pleasant Lands		
				Sampled By:	M. Bondi		

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BV LABS DRINKING WATER CHAIN OF CUSTODY

Regulation 153 (2011): ☐ Table 1 ☐ Res/Park ☐ Medium/Fine ☐ Table 2 ☐ Ind/Comm ☐ Coarse ☐ Table 3 ☐ Agri/Other ☐ For RSC ☐ Table ___

Other Regulations: ☐ CCME ☐ Sanitary Sewer Bylaw ☐ Reg 558 ☐ Storm Sewer Bylaw ☐ MISA Municipality ☐ PWQO ☐ Reg 406 Table ☐ Other

Special Instructions

Include Criteria on Certificate of Analysis (Y/N)? ___

ANALYSIS REQUESTED (PLEASE BE SPECIFIC)

Turnaround Time (TAT) Required:
Please provide advance notice for rush projects

Regular (Standard) TAT: ☒
(will be applied if Rush TAT is not specified)
Standard TAT = 5-7 Working days for most tests.
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission)
Date Required: ___ Time Required: ___ ☐
Rush Confirmation Number: ___ *(call lab for #)*

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle): Metals / Hg / Cr VI	RCAp - Comprehensive (Lab Filtered)	RCAP - Surface Water	Dissolved Metals	# of Bottles	Comments
1		MW103	March 24/21	PM	GW		X			3	Lab to filter Dissolved Metals
2		MW3D		PM	GW		X			3	
3		MW4D		PM	GW		X			3	
4		MW104		PM	GW		X			3	
5		SW #1 PW01			SW			X	X	4	
6											
7											
8											
9											
10											no cooling media present

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted	Laboratory Use Only			
Marcello Bondi	21/03/24		Lu Bai	2021/3/24	15:47		Time Sensitive	Temperature (°C) on Receipt: 9, 11, 12	Custody Seal Present / Intact	Yes / No ✓

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BV LABS' STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVLABS.COM/TERMS-AND-CONDITIONS.

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

** SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT WWW.BVLABS.COM/RESOURCES/CHAIN-OF-CUSTODY-FORMS.

SAMPLES MUST BE KEPT COOL (< 10° C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BV LABS

White: BV Labs Yellow: Client

Bureau Veritas Canada (2019) Inc.

Appendix I – Water Balance Assessment

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Appendix I
Water Balance

TABLE I1 - PRE-DEVELOPMENT WATER BALANCE CALCULATIONS

	Impervious Area (m^2)	Pervious Area (m^2)	Total Area (m^2)	Soil Type	Soil Group	Water Holding Capacity (mm)	Infiltration Factor	T_{rain} (°C)	T_{snow} (°C)	Meltmax (%/100)
	0	206340	**206340**	Clay Loam	CD	200	0.5	3.3	-10.0	0.92

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Totals
Average Temperature (°C)	-5.6	-4.5	-0.1	6.8	13.1	18.3	20.8	19.7	15.5	9.2	3.4	-2.6	
Total Precipitation (mm/month)	74.2	65.5	71.5	83.4	89.8	91.7	82.7	82.9	103.0	81.3	98.0	87.5	1011.5
Precipitation as rain (mm/month)	24.5	27.1	53.2	83.4	89.8	91.7	82.7	82.9	103.0	81.3	98.0	48.7	
Precipitation as snow (mm/month)	49.7	38.4	18.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	38.8	
Potential Snow Melt (mm/month)	20.9	32.8	49.1	26.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.9	
Actual Snow Melt (mm/month)	20.9	32.8	49.1	22.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.9	
Snow Storage (mm/month)	47.7	53.4	22.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.9	
AREA 1													
Estimated Actual Evapotranspiration (mm/month)	8.9	10.8	20.3	38.4	70.3	102.6	116.8	92.1	56.3	30.5	16.0	10.0	573.0
Surplus (mm/month)	36.5	49.1	82.0	67.6	19.5	-10.9	-34.1	-9.2	46.7	50.8	82.0	58.6	438.5
Estimated Runoff (mm/month)	36.5	49.1	61.5	33.8	9.8	0.0	0.0	0.0	23.4	25.4	41.0	58.6	338.9
Estimated Infiltration (mm/month)	0.0	0.0	20.5	33.8	9.8	0.0	0.0	0.0	23.4	25.4	41.0	0.0	153.8
Estimated Actual Evapotranspiration (m^3/month)	**1836**	**2228**	**4189**	**7923**	**14506**	**21170**	**24101**	**19004**	**11617**	**6293**	**3301**	**2063**	**118233**
Estimated Runoff (m^3/month)	**7537**	**10122**	**12687**	**6972**	**2012**	**0**	**0**	**0**	**4818**	**5241**	**8460**	**12082**	**69931**
Estimated Infiltration (m^3/month)	**0**	**0**	**4229**	**6972**	**2012**	**0**	**0**	**0**	**4818**	**5241**	**8460**	**0**	**31732**

TABLE I2 - POST-DEVELOPMENT WATER BALANCE CALCULATIONS

	Impervious Area (m^2)	Pervious Area (m^2)	Total Area (m^2)	Soil Type	Soil Group	Water Holding Capacity (mm)	Infiltration Factor	T_{rain} (°C)	T_{snow} (°C)	Meltmax (%/100)
	92853	113487	**206340**	Clay Loam	CD	100	0.5	3.3	-10.0	0.92

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Totals
Average Temperature (°C)	-5.6	-4.5	-0.1	6.8	13.1	18.3	20.8	19.7	15.5	9.2	3.4	-2.6	
Total Precipitation (mm/month)	74.2	65.5	71.5	83.4	89.8	91.7	82.7	82.9	103.0	81.3	98.0	87.5	1011.5
Precipitation as rain (mm/month)	24.5	27.1	53.2	83.4	89.8	91.7	82.7	82.9	103.0	81.3	98.0	48.7	
Precipitation as snow (mm/month)	49.7	38.4	18.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	38.8	
Potential Snow Melt (mm/month)	20.9	32.8	49.1	26.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.9	
Actual Snow Melt (mm/month)	20.9	32.8	49.1	22.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.9	
Snow Storage (mm/month)	47.7	53.4	22.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.9	
LANDSCAPED AREA													
Estimated Actual Evapotranspiration (mm/month)	8.9	10.8	20.3	38.4	70.3	102.6	114.8	89.7	56.3	30.5	16.0	10.0	568.6
Surplus (mm/month)	36.5	49.1	82.0	67.6	19.5	-10.9	-32.1	-6.8	46.7	50.8	82.0	58.6	442.9
Estimated Runoff (mm/month)	36.5	49.1	61.5	33.8	9.8	0.0	0.0	0.0	23.4	25.4	41.0	58.6	338.9
Estimated Infiltration (mm/month)	0.0	0.0	20.5	33.8	9.8	0.0	0.0	0.0	23.4	25.4	41.0	0.0	153.8
Estimated Actual Evapotranspiration (m^3/month)	**1010**	**1226**	**2304**	**4358**	**7978**	**11644**	**13028**	**10180**	**6389**	**3461**	**1816**	**1135**	**64529**
Estimated Runoff (m^3/month)	**4145**	**5567**	**6978**	**3835**	**1106**	**0**	**0**	**0**	**2650**	**2883**	**4653**	**6645**	**38462**
Estimated Infiltration (m^3/month)	**0**	**0**	**2326**	**3835**	**1106**	**0**	**0**	**0**	**2650**	**2883**	**4653**	**0**	**17453**
HARD SURFACED AREA													
Estimated Actual Evapotranspiration (mm/month)	9.1	12.0	20.5	21.2	18.0	18.3	16.5	16.6	20.6	16.3	19.6	13.7	202.3
Surplus (mm/month)	36.3	47.9	81.8	84.8	71.8	73.4	66.2	66.3	82.4	65.0	78.4	54.8	809.2
Estimated Runoff (mm/month)	36.3	47.9	81.8	84.8	71.8	73.4	66.2	66.3	82.4	65.0	78.4	54.8	809.2
Estimated Infiltration (mm/month)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Estimated Actual Evapotranspiration (m^3/month)	**844**	**1112**	**1899**	**1968**	**1668**	**1703**	**1536**	**1540**	**1913**	**1510**	**1820**	**1273**	**18784**
Estimated Runoff (m^3/month)	**3374**	**4446**	**7598**	**7873**	**6671**	**6812**	**6143**	**6158**	**7651**	**6039**	**7280**	**5092**	**75137**
Estimated Infiltration (m^3/month)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
POST-DEVELOPMENT TOTALS													
Estimated Actual Evapotranspiration (m^3/month)	1854	2337	4203	6326	9646	13347	14564	11719	8302	4971	3636	2408	83313
Estimated Runoff (m^3/month)	7520	10014	14576	11707	7777	6812	6143	6158	10301	8922	11933	11737	113599
Estimated Infiltration (m^3/month)	0	0	2326	3835	1106	0	0	0	2650	2883	4653	0	17453

MITIGATION			
Fraction of Runoff Reduction	0.15		
Effectiveness	0.5		
Total Precipitation	208,713		
Area (with mitigation)	206,340		
Total Actual Evapotranspiration	86,181	0.729	72.9
Total Infiltration (with mitigation)	25,973	0.819	81.9
Estimated Runoff (with Mitigation)	96,559	1.381	138.1

TABLE I3 - PRE VERSUS POST-DEVELOPMENT WATER BALANCE CALCULATIONS

		Pre-Development	Post-Development	Post-Development with Mitigation	% Change from Pre to Post Development	% Change with Mitigation
Estimated Evapotranspiration	m^3/year	118,233	83,313	86,181	70%	73%
Estimated Runoff	m^3/year	69,931	113,599	96,559	162%	138%
Estimated Infiltration	m^3/year	31,732	17,453	25,973	55%	82%

LIMITATIONS AND USE OF REPORT

BASIS OF REPORT

This report ("Report") is based on site conditions known or inferred by the geotechnical investigation undertaken as of the date of the Report. Should changes occur which potentially impact the geotechnical condition of the site, or if construction is implemented more than one year following the date of the Report, the recommendations of EXP may require re-evaluation.

The Report is provided solely for the guidance of design engineers and on the assumption that the design will be in accordance with applicable codes and standards. Any changes in the design features which potentially impact the geotechnical analyses or issues concerning the geotechnical aspects of applicable codes and standards will necessitate a review of the design by EXP. Additional field work and reporting may also be required.

Where applicable, recommended field services are the minimum necessary to ascertain that construction is being carried out in general conformity with building code guidelines, generally accepted practices and EXP's recommendations. Any reduction in the level of services recommended will result in EXP providing qualified opinions regarding the adequacy of the work. EXP can assist design professionals or contractors retained by the Client to review applicable plans, drawings, and specifications as they relate to the Report or to conduct field reviews during construction.

Contractors contemplating work on the site are responsible for conducting an independent investigation and interpretation of the test pit results contained in the Report. The number of test pits necessary to determine the localized underground conditions as they impact construction costs, techniques, sequencing, equipment and scheduling may be greater than those carried out for the purpose of the Report.

Classification and identification of soils, rocks, geological units, contaminant materials, building envelopment assessments, and engineering estimates are based on investigations performed in accordance with the standard of care set out below and require the exercise of judgment. As a result, even comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations or building envelope descriptions involve an inherent risk that some conditions will not be detected. All documents or records summarizing investigations are based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated. Some conditions are subject to change over time. The Report presents the conditions at the sampled points at the time of sampling. Where special concerns exist, or the Client has special considerations or requirements, these should be disclosed to EXP to allow for additional or special investigations to be undertaken not otherwise within the scope of investigation conducted for the purpose of the Report.

RELIANCE ON INFORMATION PROVIDED

The evaluation and conclusions contained in the Report are based on conditions in evidence at the time of site inspections and information provided to EXP by the Client and others. The Report has been prepared for the specific site, development, building, design or building assessment objectives and purpose as communicated by the Client. EXP has relied in good faith upon such representations, information and instructions and accepts no responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of any misstatements, omissions, misrepresentation or fraudulent acts of persons providing information. Unless specifically stated otherwise, the applicability and reliability of the findings, recommendations, suggestions or opinions expressed in the Report are only valid to the extent that there has been no material alteration to or variation from any of the information provided to EXP.

STANDARD OF CARE

The Report has been prepared in a manner consistent with the degree of care and skill exercised by engineering consultants currently practicing under similar circumstances and locale. No other warranty, expressed or implied, is made. Unless specifically stated otherwise, the Report does not contain environmental consulting advice.

COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment form part of the Report. This material includes, but is not limited to, the terms of reference given to EXP by its client ("Client"), communications between EXP and the Client, other reports, proposals or documents prepared by EXP for the Client in connection with the site described in the Report. In order to properly understand the suggestions, recommendations and opinions expressed in the Report, reference must be made to the Report in its entirety. EXP is not responsible for use by any party of portions of the Report.

USE OF REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. No other party may use or rely upon the Report in whole or in part without the written consent of EXP. Any use of the Report, or any portion of the Report, by a third party are the sole responsibility of such third party. EXP is not responsible for damages suffered by any third party resulting from unauthorized use of the Report.

REPORT FORMAT

Where EXP has submitted both electronic file and a hard copy of the Report, or any document forming part of the Report, only the signed and sealed hard copy shall be the original documents for record and working purposes. In the event of a dispute or discrepancy, the hard copy shall govern. Electronic files transmitted by EXP have utilize specific software and hardware systems. EXP makes no representation about the compatibility of these files with the Client's current or future software and hardware systems. Regardless of format, the documents described herein are EXP's instruments of professional service and shall not be altered without the written consent of EXP.

Legal Notification

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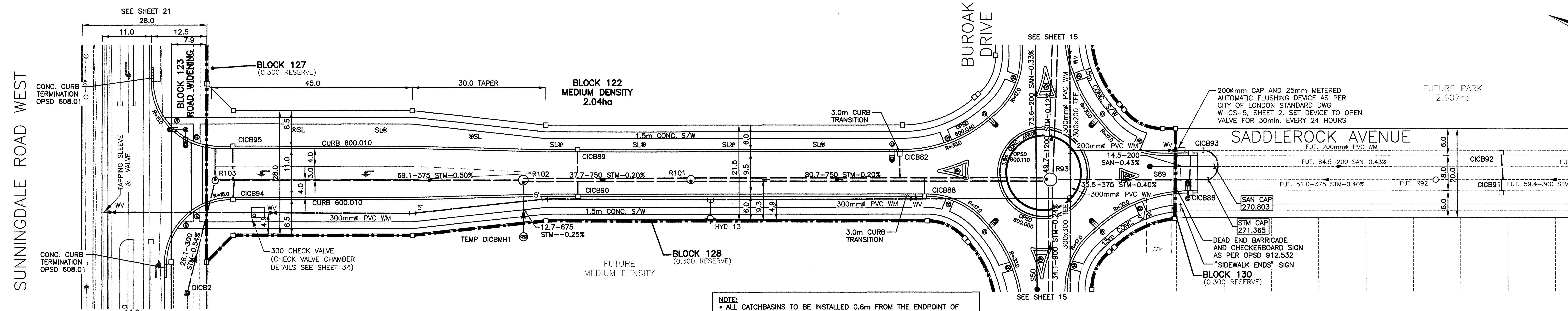
Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. EXP Services Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this report.

Appendix D EXISTING SERVICES PLANS



FAIR OAKS BOULEVARD

BARRIER CURB WITH WIDER GUTTER AS PER OPSD 600.010

NOTE:
- ALL CATCHBASINS TO BE INSTALLED 0.6m FROM THE ENDPOINT OF CURVATURE UNLESS OTHERWISE NOTED
- CATCHBASINS TO BE SETBACK IN CURB AS PER C. of L. DWG. No. SR–3.0
- PROPOSED LID ELEVATIONS FOR CB's & CICB's ARE SET TO EDGE OF PAVEMENT GRADES
- ALL WATER SERVICES WILL BE 25mm IN SIZE. (TYPICAL)
- STORM & SANITARY PRIVATE DRAIN CONNECTIONS ARE TO HAVE A MIN. OF 500mm CLEARANCE UNDER/OVER MAINS
- ALL SANITARY PDCs TO BE PROVIDED WITH CLEANOUTS AS PER SW–6.4

NOTE:
THE OWNER AGREES TO PROVIDE AND INSTALL PARSON MANHOLE INSERTS (OR APPROVED ALTERNATIVE SATISFACTORY TO THE CITY ENGINEER) IN ALL SANITARY MAINTENANCE HOLES WITHIN THIS PLAN, UNLESS APPROVED OTHERWISE BY THE CITY ENGINEER, AT THE TIME OF THE INSTALLATION OF THE SANITARY MAINTENANCE HOLE. THE OWNER FURTHER AGREES THAT THESE INSERTS ARE TO REMAIN IN PLACE UNTIL ASSUMPTION OF THE SUBDIVISION, AND THAT THEY WILL BE REMOVED, BY THE OWNER, AT NO COST TO THE CITY.

NOTE:
THE STANDARD CONTRACT DOCUMENTS FOR MUNICIPAL CONSTRUCTION PROJECTS, AS ADOPTED BY THE COUNCIL ON MAY 30, 1994 AND LAWS AMENDED FROM TIME TO TIME, ARE TO BE APPLIED TO THIS PROJECT. WHERE ANY DISCREPANCY EXISTS BETWEEN THE ADOPTED STANDARD CONTRACT DOCUMENTS AND THE STANDARDS AND SPECIFICATIONS NOTED ON THESE DRAWINGS, THE CURRENT STANDARD CONTRACT DOCUMENTS WILL GOVERN UNLESS OTHERWISE APPROVED BY THE CITY ENGINEER.

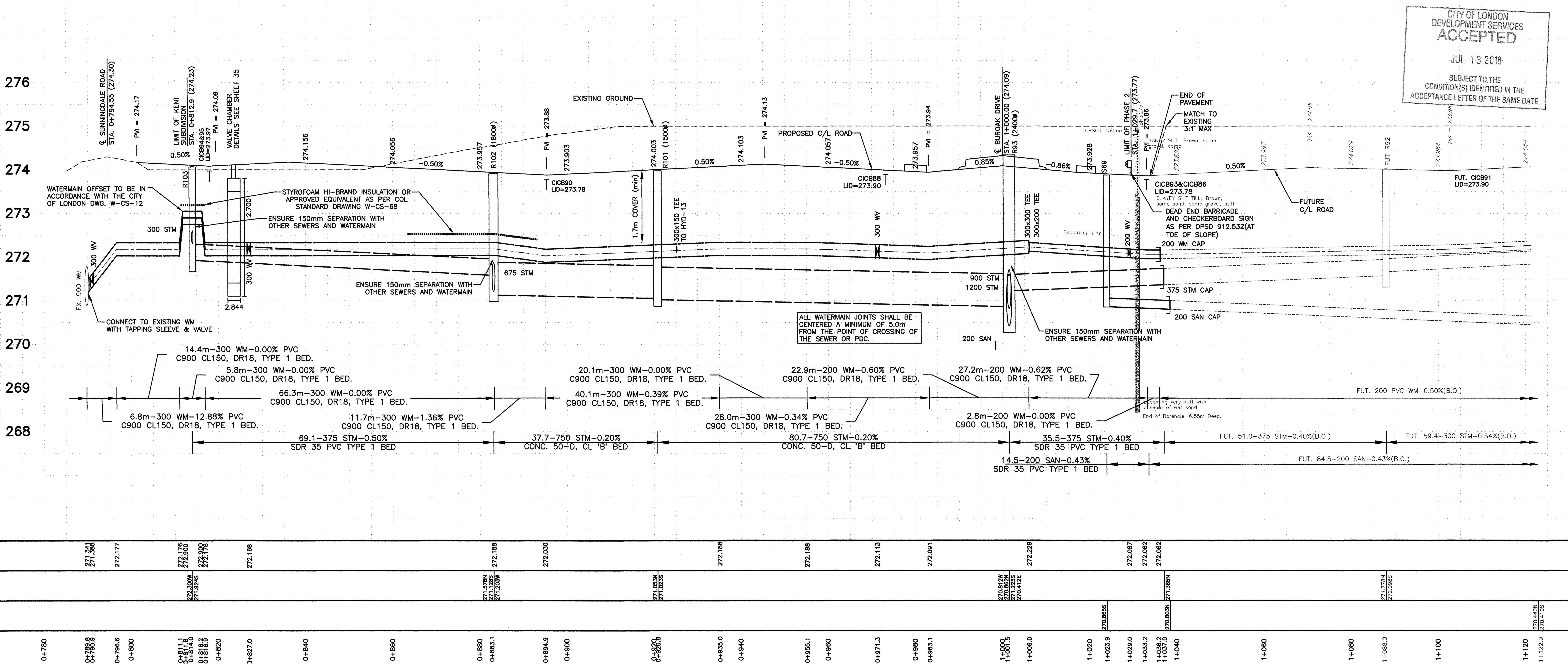
NOTE:
MANHOLE JOINT WRAPPING REQUIRED WHERE GROUNDWATER IS ENCOUNTERED DURING EXCAVATION/INSTALLATION

NOTE:
WATER SERVICES ADJACENT TO A SANITARY/STORM MANHOLE ARE TO BE INSULATED WITHIN 1.5m FROM THE EXTERIOR OF THE MANHOLE

NO PDC's ARE TO GO INTO SANITARY MH's

✧	DENOTES 3–WAY FIRE HYDRANT C/W STORZ CONNECTION
BH4	DENOTES BOREHOLE LOCATION
®	DENOTES SIDEWALK RAMP AS PER CITY OF LONDON SPECIFICATION SR–1.2 c/w TACTILE PLATES AS PER CoL SPECIFICATION 2.1.15
151	DENOTES REGISTERED PLAN LOT/BLOCK NUMBERS
4	DENOTES PROPOSED REGISTERED PLAN LOT/BLOCK NUMBERS
CMB	DENOTES COMMUNITY MAILBOX LOCATION

CITY OF LONDON
DEVELOPMENT SERVICES
ACCEPTED
JUL 13 2018
SUBJECT TO THE CONDITION(S) IDENTIFIED IN THE ACCEPTANCE LETTER OF THE SAME DATE



SUBJECT TO THE ISSUANCE OF THE ENVIRONMENTAL COMPLIANCE APPROVAL FROM THE MINISTRY OF ENVIRONMENT

NO CONNECTION OF WEEPING TILES WILL BE ALLOWED TO THE SANITARY SEWER SYSTEM. NO GRAVITY CONNECTION OF WEEPING TILES TO THE STORM SEWER WILL BE ALLOWED UNLESS THE SYSTEM HAS THE CAPACITY TO PROVIDE FOR SUCH CONNECTIONS.

EXISTING SERVICES	DRAWING #, SOURCE	DATE	CONSTRUCTED SERVICES	COMPLETION

DETAILS		No.	REVISIONS	DATE
DESIGN	JBH	1.	1st SUBMISSION COMMENTS	NOVEMBER 2017
DRAWN BY	JBH	2.	2nd SUBMISSION COMMENTS	FEBRUARY 2018
CHECKED	TJS	3.	3rd SUBMISSION COMMENTS	APRIL 2018
APPROVED	TJS	4.	4th SUBMISSION COMMENTS	JUNE 2018
DATE	JULY–2017	5.	5th SUBMISSION COMMENTS	JULY 2018

CONSULTANT OR DIVISION: Stantec

600 - 171 Queens Avenue, London, ON, N6A 5J7, www.stantec.com

The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing - any errors or omissions shall be reported to Stantec without delay. The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.

ENGINEER'S STAMP: LICENSED PROFESSIONAL ENGINEER, 7/13/2018, D. VUCETIC, 100208125, PROVINCE OF ONTARIO

CORPORATION OF THE CITY OF LONDON

SCALE: HORZ – 1 : 500; VERT – 1 : 50

TITLE: **KENT SUBDIVISION – PHASE 2**
FOXHOLLOW NORTH KENT DEVELOPMENTS INC.

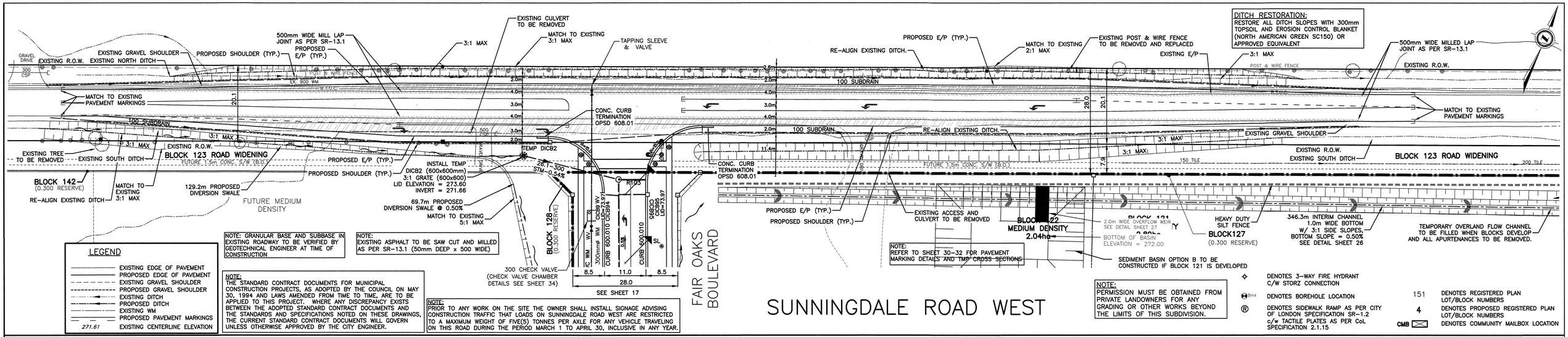
FAIR OAKS BOULEVARD
STA 0+780 TO STA 1+120

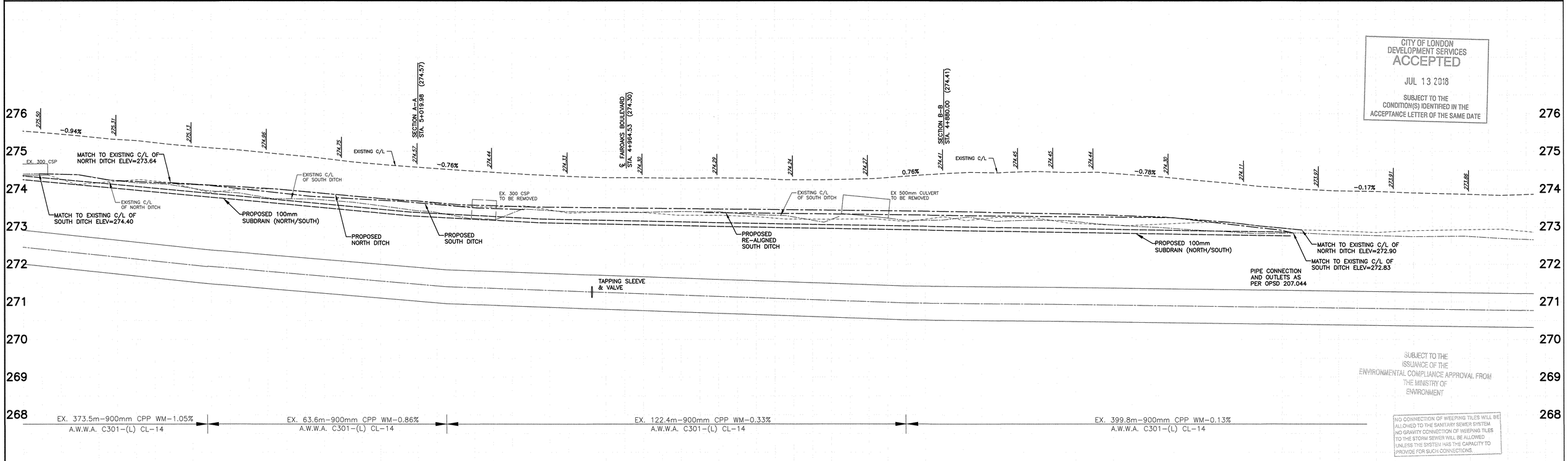
35

PROJECT No. 1614–13447

SHEET No. 17 of 40

PLAN FILE No.





CITY OF LONDON
DEVELOPMENT SERVICES
ACCEPTED
JUL 13 2018
SUBJECT TO THE CONDITION(S) IDENTIFIED IN THE ACCEPTANCE LETTER OF THE SAME DATE

SUBJECT TO THE ISSUANCE OF THE ENVIRONMENTAL COMPLIANCE APPROVAL FROM THE MINISTRY OF ENVIRONMENT

NO CONNECTION OF WEEPING TILES WILL BE ALLOWED TO THE SANITARY SEWER SYSTEM. NO GRAVITY CONNECTION OF WEEPING TILES TO THE STORM SEWER WILL BE ALLOWED UNLESS THE SYSTEM HAS THE CAPACITY TO PROVIDE FOR SUCH CONNECTIONS.

EXISTING SERVICES	DRAWING #, SOURCE	DATE	CONSTRUCTED SERVICES	COMPLETION

DETAILS	
DESIGN	JBH
DRAWN BY	JBH
CHECKED	TJS
APPROVED	TJS
DATE	JULY 2017

No.	REVISIONS	DATE
1.	1st SUBMISSION COMMENTS	NOVEMBER 2017
2.	2nd SUBMISSION COMMENTS	FEBRUARY 2018
3.	3rd SUBMISSION COMMENTS	APRIL 2018
4.	4th SUBMISSION COMMENTS	JUNE 2018
5.	5th SUBMISSION COMMENTS	JULY 2018

CONSULTANT OR DIVISION

Stantec

600 - 171 Queens Avenue
London, ON. N6A 5J7
www.stantec.com

ENGINEER'S STAMP
LICENSED PROFESSIONAL ENGINEER
7/13/2018
D. VUCETIC
100209369
PROVINCE OF ONTARIO

London CANADA
CORPORATION OF THE CITY OF LONDON

SCALE
HORZ - 1 : 500
5 0 10m
VERT - 1 : 50
0.5 0 1m

TITLE
KENT SUBDIVISION - PHASE 2
FOXHOLLOW NORTH KENT DEVELOPMENTS INC.
SUNNINGDALE ROAD WEST
STA 4+740 TO STA 5+120
39

PROJECT No. 1614-13447
SHEET No. 21 of 40
PLAN FILE No.

SEE SHEET No. S1

SEE SHEET No. S3

LOT 24
CONCESSION 6

LOT 23
CONCESSION 6

LOT 24
CONCESSION 5

LOT 23
CONCESSION 5

VERDEL
MN. 1535

WOOD FENCE

ASPHALT DRIVE

RETAINING WALL

4.9m

3-WAY FH & VALVE
C/W STORZ CONNECTION

300 CSP

BELL PED

HP

579.545

400 CSP

GRAVEL DRIVE

900 CPP WM

B.T.U.C.

BH 21

℄ CHAMBER No. 9
AIR RELEASE

4753500N
474100E

TEST STATION

TP

CLARE

7.5m±
TO W/S

25mm
MAINSTOP

250 CSP

SIB

30.491

15.275

587.373

POST & WIRE FENCE

5+600

5+578.0

5+500

5+400

5+390.0

5+334.2

5+300

20.107

GRAVEL

STONE PILLAR

579.762

602.584

4753130N
477220E

4753250N
477470E

SUNNINGDALE ROAD

STATION 5+610

STATION 5+230

FINISHED C/L OF ROAD

GROUND
OVER WATERMAIN

C/L ROAD

C/L NORTH DITCH

0 B.T.U.C.

50mm sand & gravel FILL.
Brown, silty clay FILL.

Brown, very stiff, silty CLAY, smeddled sand & gravel (TILL), becoming grey at 3.8m depth.

End of Borehole

0°03'47" VERTICAL DEFL.
0°36'16" VERTICAL DEFL.

150mm TO EH
(NORTH SIDE)

25mm MAINSTOP
(NORTH SIDE)

8.0m-900mm CPP WM-0.00%
A.W.W.A. C301-(L) CL-14

252.5m-900mm CPP WM-0.11%
A.W.W.A. C301-(L) CL-14

373.5m-900mm CPP WM-1.05%
A.W.W.A. C301-(L) CL-14

278
277
276
275
274
273
272
271
270

C/L WATERMAIN ELEVATION	274.973	275.083	275.200	275.200	274.297	273.860	273.562
STORM INVERT ELEVATION							
SANITARY INVERT ELEVATION							
STATION	5+610 / 5+600	5+500	5+400	5+394.0 / 5+390.0 / 5+386.0	5+334.2	5+300	5+259.0 / 5+230

AS CONSTRUCTED NOTES

1. SEE DRAWING No. 1 FOR FURTHER DETAILS
2. SEWER DESIGN: WIDTH OR AS NOTED
3. REFERENCE B.M. No (SEE DWG 1) ELEVATION

AS CONSTRUCTED SERVICES	COMPLETION
WATERMAIN & WATERMAIN SERVICES	JULY 1996
HL4 SURFACE ASPHALT	AUG. 1996
GRANULAR 'A'	JULY 1996

DESIGN DCC
DRAWN DJ
CHECKED RL
APPROVED
DATE JAN. 1996

No.	REVISIONS	DATE	BY
1.	'AS-CONSTRUCTED'	OCT. 1996	DJ

CONSULTANT OR DIVISION

PARKER CONSULTANTS

C.C. Parker Consultants Limited
Consulting Professional Engineers
562 Wellington Street, London
Ontario N6A 3R5 (519)432-7591

JOB No. 95360

PROJECT ENGINEER

ENGINEER'S STAMP

LICENSED PROFESSIONAL ENGINEER
D.C. CARTER
DEC 5/96
PROVINCE OF ONTARIO

DIVISION HEAD

CORPORATION OF THE CITY OF LONDON

CITY ENGINEER

SCALE

SCALE - 1 : 500
5 0 10m

SCALE - 1 : 50
0.5 0 1m

TITLE

NORTHWEST TRUNK WATERMAIN PH. 3

SUNNINGDALE ROAD

FROM 1764m WEST OF WONDERLAND ROAD (5+230)
TO 2144m WEST OF WONDERLAND ROAD (5+610)

PROJECT No. EW 3670 (96-17)

SHEET No. S2

PLAN FILE No. 14,426

14,426

D:\WINNT\Profiles\All Users\Desktop\AG\ 4 Dec 14:18:55 1996

AS CONSTRUCTED NOTES	AS CONSTRUCTED SERVICES	COMPLETION		No.	REVISIONS	DATE	BY
1. SEE DRAWING No. 1 FOR FURTHER DETAILS	WATERMAIN & WATERMAIN SERVICES	JULY /96	DESIGN DCC	1.	'AS-CONSTRUCTED'	OCT. 1996	DJ
2. SEWER DESIGN: WIDTH OR AS NOTED	HL4 SURFACE ASPHALT	AUG. /96	DRAWN DJ				
3. REFERENCE B.M. No (SEE DWG 1) ELEVATION	GRANULAR 'A'	JULY /96	CHECKED RL				
			APPROVED				
			DATE JAN. 1996				

CONSULTANT OR DIVISION

PARKER CONSULTANTS

C.C. Parker Consultants Limited
Consulting Professional Engineers
562 Wellington Street, London
Ontario N6A 3R5 (519)432-7591

JOB No. 95360

PROJECT ENGINEER

ENGINEER'S STAMP: LICENSED PROFESSIONAL ENGINEER — D.C. CARTER — DEC 5/96 — PROVINCE OF ONTARIO

CORPORATION OF THE CITY OF LONDON

DIVISION HEAD   CITY ENGINEER

SCALE – 1 : 500
SCALE – 1 : 50

TITLE
NORTHWEST TRUNK WATERMAIN PH. 3

SUNNINGDALE ROAD

FROM 2144m WEST OF WONDERLAND ROAD (5+610)
TO HYDE PARK ROAD (5+938.1)

PROJECT No. EW 3670 (96–17)
SHEET No. S1
PLAN FILE No. 14,425

14,425

LEGEND

(symbol)	LIMIT OF SUBDIVISION
(symbol)	DRAINAGE AREA
(symbol)	EX. SANITARY SEWER
(symbol)	PROPOSED SANITARY SEWER
(symbol)	FUTURE SANITARY SEWER
O	PROPOSED MANHOLE
O	EX. MANHOLE
O	FUTURE MANHOLE
B.O.	BY OTHERS
151	DENOTES DRAFT PLAN LOT/BLOCK NUMBERS
(4)	DENOTES REGISTERED PLAN LOT/BLOCK NUMBERS
5	DENOTES PLAN & PROFILE DRAWING No.

SANITARY SEWER DESIGN SHEET
CITY OF LONDON

RESIDENTIAL COMMERCIAL AND INSTITUTIONAL POPULATION DENSITIES

THE FOLLOWING POPULATION ALLOWANCES WILL APPLY WHEN DESIGNING SANITARY SEWERS:

LOW DENSITY (SINGLE-FAMILY / SEMI-DETACHED)	= 30 UNITS / HECTARE @ 3 PEOPLE / UNIT
MEDIUM DENSITY (MULTI-FAMILY / TOWNHOUSE / ROWHOUSE)	= 75 UNITS / HECTARE @ 2.4 PEOPLE / UNIT
HIGH DENSITY (APARTMENTS)	= 150 - 300 UNIT / HECTARE @ 1.6 PEOPLE / UNIT
COMMERCIAL / INSTITUTIONAL	= 100 PEOPLE / HECTARE
SECONDARY SCHOOL	= 1500 PEOPLE
ELEMENTARY SCHOOL	= 400 PEOPLE

PROJECT NAME: FOX HOLLOW TRUNK SANITARY SEWER

DESIGN CRITERIA
SEWAGE = 250 LITRE / CAPITA / DAY
INFILTRATION = 8640 LITRES / HECTARE / DAY
PEAKING FACTOF $1 + \frac{14}{4 + P^{0.5}}$

DATE: April 2010
DESIGNED BY: CJH

PROJECT FILE NO. 165500610

LOCATION				AREA			POPULATION						SEWAGE FLOWS			SEWER DESIGN						PROFILE				
AREA No.	STREET	FROM MANHOLE	MANHOLE	NET OR GROSS	HECTARES	TOTAL HECTARES	HECTARE	PER LOT	NO. OF LOTS	DELTA POP.	TOTAL POP.	PEAKING FACTOR	INFILT L/s	SEWAGE L/s	Q TOTAL L/s	PIPE SIZE mm	n	SLOPE %	CAP L/s	VELOCITY m/s	LENGTH m	FALL IN SEWER	HEADLOSS IN U.S. MH	DROP IN MANHOLE	INVERT ELEVATION U.S.	INVERT ELEVATION D.S.
EXT3a		-	S3		20.23	20.23				1946	1946	3.59	2.02	22.27	24.29											
EXT3b		-	S3		21.49	21.49				2064	2064	3.58	2.15	23.49	25.64											
EXT3c		-	S3		63.50	63.50				4105	4105	3.32	6.35	43.42	49.77											
-	STREET A	S4	S3		0.00	105.22				0	8115	3.04	10.52	78.63	89.15	525	0.013	0.11	142.63	0.66	55.7	0.061	0.000	0.000	263.577	263.516
-	STREET A	S3	S2		0.00	105.22				0	8115	3.04	10.52	78.63	89.15	600	0.013	0.11	203.64	0.72	98.0	0.108	0.000	0.075	263.441	263.333
-	STREET A	S2	S1		0.00	105.22				0	8115	3.04	10.52	78.63	89.15	600	0.013	0.15	237.80	0.84	24.1	0.036	0.000	0.030	263.303	263.267
EXT2		-	S1		212.13	317.35				11668	11668	2.89	31.74	107.25	138.98											
-	Medway Park Drive (Trunk)	S1	S50		0.00	317.35				0	19783	2.66	31.74	167.32	199.05	600	0.013	0.12	212.69	0.75	28.0	0.034	0.000	0.030	263.237	263.203
	Medway Park Drive (Trunk)	S50	S51		0.00	317.35				0	19783	2.66	31.74	167.32	199.05	600	0.013	0.24	300.79	1.06	44.5	0.107	0.000	0.030	263.173	263.066
	Medway Park Drive (Trunk)	S51	S52		0.00	317.35				0	19783	2.66	31.74	167.32	199.05	600	0.013	0.19	267.63	0.95	63.8	0.121	0.000	0.030	263.036	262.915
	Medway Park Drive (Trunk)	S52	S53		0.00	317.35				0	19783	2.66	31.74	167.32	199.05	600	0.013	0.20	274.59	0.97	88.6	0.177	0.000	0.030	262.885	262.708
	Medway Park Drive (Trunk)	S53	Ex. S7A		0.00	317.35				0	19783	2.66	31.74	167.32	199.05	600	0.013	0.11	203.64	0.72	10.9	0.012	0.000	0.030	262.678	262.666
EXT 1	Medway Park Drive (Local)	S6	Ex. S7A			3.26					162	4.18	0.33	2.16	2.48											
Existing	Medway Park Drive	Ex. S7A	Ex. S7	N	0.07	320.68		3	0	0	19945	2.65	32.07	168.46	200.53	600	0.013	0.18	260.49	0.92	39.8	0.072	-	0.030	262.679	262.607

EXISTING SERVICES	DRAWING #, SOURCE	DATE	CONSTRUCTED SERVICES	COMPLETION	DETAILS	No.	REVISIONS	DATE	CONSULTANT
					DESIGN CJH	1	ISSUED FOR TENDER	JUN. 2010	STANTEC
					DRAWN BY CJH	2	RECORD DRAWINGS	APR. 2011	STANTEC
					CHECKED RCH				
					APPROVED RCH				
					DATE MAY 2010				
					165500610 Sanitary.dwg				

CONSULTANT OR DIVISION

Stantec

Stantec Consulting Ltd.
171 Queens Avenue
London ON Canada
N6A 5J7
Tel. 519.645.2007
Fax. 519.645.6575
www.stantec.com

ENGINEER'S STAMP
LICENSED PROFESSIONAL ENGINEER
R. C. HUGHES
PROVINCE OF ONTARIO

London CANADA

CORPORATION OF THE CITY OF LONDON

SCALE
SCALE - 1 : 5000
50 0 100m

TITLE
FOX HOLLOW TRUNK SANITARY SEWER
THE CORPORATION OF THE CITY OF LONDON

SANITARY DRAINAGE AREA PLAN & SANITARY DESIGN SHEET

PROJECT No. 1655-00610

SHEET No. 2 of 7

PLAN FILE No. 22398

V:\01655\active\165500610 - Fox Hollow Trunk Sanitary Sewer\design\drawing\As Constructed\City\165500610_AB_Sanitary.dwg
2011-04-19 02:12PM By: lalbanati

MTE FILE No: 41995-134-SANITARY-3

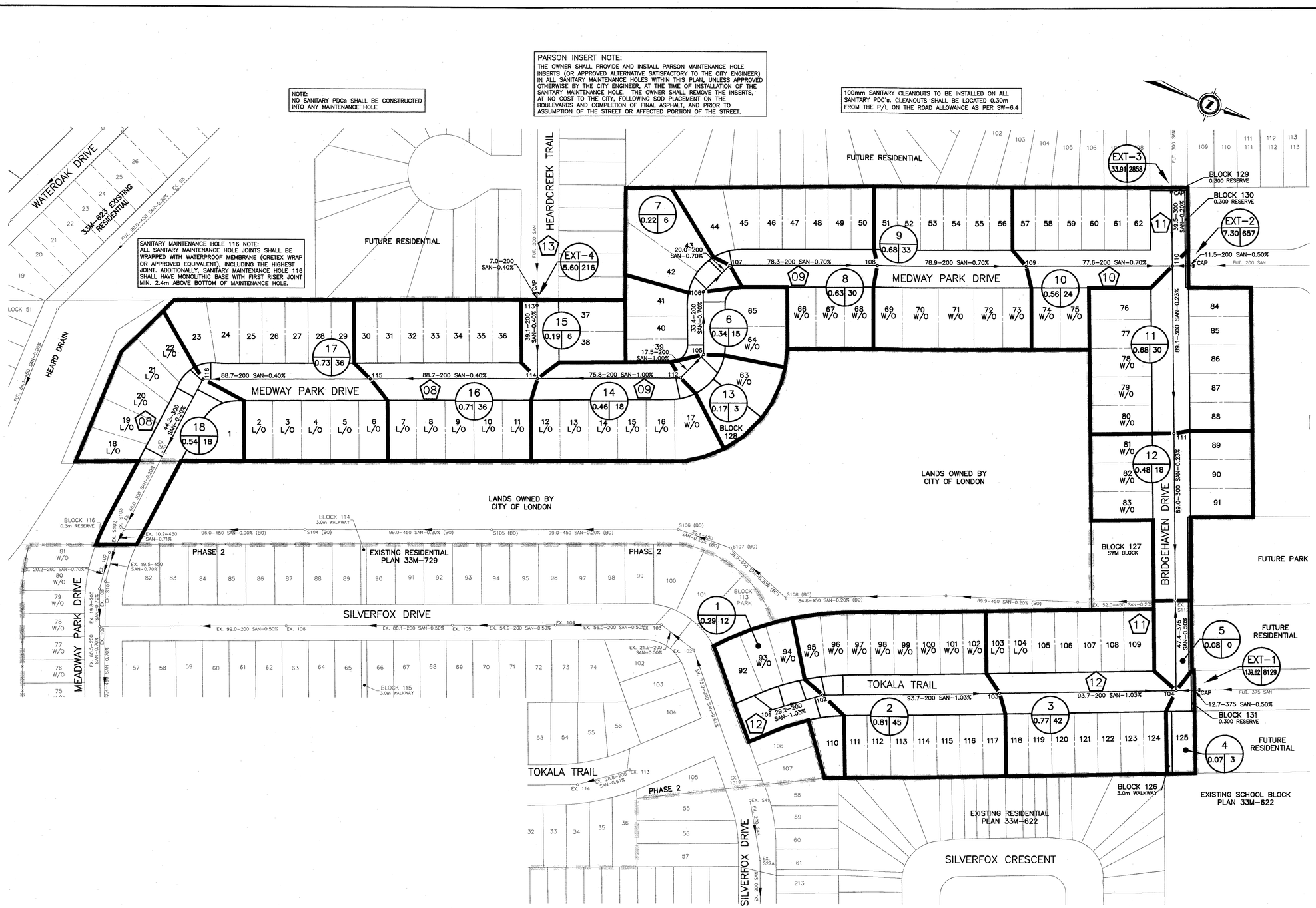
P:\PV41995\134\41995-134.DWG

PARSON INSERT NOTE:
THE OWNER SHALL PROVIDE AND INSTALL PARSON MAINTENANCE HOLE INSERTS (OR APPROVED ALTERNATIVE SATISFACTORY TO THE CITY ENGINEER) IN ALL SANITARY MAINTENANCE HOLES WITHIN THIS PLAN, UNLESS APPROVED OTHERWISE BY THE CITY ENGINEER, AT THE TIME OF INSTALLATION OF THE SANITARY MAINTENANCE HOLE. THE OWNER SHALL REMOVE THE INSERTS, AT NO COST TO THE CITY, FOLLOWING SOD PLACEMENT ON THE BOULEVARDS AND COMPLETION OF FINAL ASPHALT, AND PRIOR TO ASSUMPTION OF THE STREET OR AFFECTED PORTION OF THE STREET.

NOTE:
NO SANITARY PDCs SHALL BE CONSTRUCTED INTO ANY MAINTENANCE HOLE

100mm SANITARY CLEANOUTS TO BE INSTALLED ON ALL SANITARY PDC's. CLEANOUTS SHALL BE LOCATED 0.30m FROM THE P/L ON THE ROAD ALLOWANCE AS PER SW-6.4

SANITARY MAINTENANCE HOLE 116 NOTE:
ALL SANITARY MAINTENANCE HOLE JOINTS SHALL BE WRAPPED WITH WATERPROOF MEMBRANE (CRETEX WRAP OR APPROVED EQUIVALENT), INCLUDING THE HIGHEST JOINT. ADDITIONALLY, SANITARY MAINTENANCE HOLE 116 SHALL HAVE MONOLITHIC BASE WITH FIRST RISER JOINT MIN. 2.4m ABOVE BOTTOM OF MAINTENANCE HOLE.



LEGEND

- 129 — DENOTES LOT NUMBERS
- PHASE LIMIT
- 110 — SANITARY MAINTENANCE HOLE
- 13 — STORM MAINTENANCE HOLE OR MAINTENANCE HOLE TEE
- SANITARY SEWER
- STORM SEWER
- CB — CATCH BASIN
- CICB — CURB INLET CATCH BASIN
- TICB — TWIN-INLET CATCH BASIN
- 09 — PLAN & PROFILE DRAWING NUMBER
- HOUSE SETBACK LIMITS / EASEMENTS
- EXISTING STORM SEWER
- EXISTING SANITARY SEWER
- WATER MAIN
- FIRE HYDRANT
- WV — WATER VALVE

KEY
3 — AREA NUMBER
0.77 — AREA (IN ha)
42 — POPULATION
CATCHMENT AREA

CITY OF LONDON
DEVELOPMENT SERVICES
ACCEPTED
SEP 13 2018
SUBJECT TO THE CONDITION(S) IDENTIFIED IN THE ACCEPTANCE LETTER OF THE SAME DATE

SUBJECT TO THE ISSUANCE OF THE ENVIRONMENTAL COMPLIANCE APPROVAL FROM THE MINISTRY OF ENVIRONMENT

NO CONNECTION OF ROOFING TILES WILL BE ALLOWED TO THE SANITARY SEWER SYSTEM. NO GRAVITY CONNECTION OF ROOFING TILES TO THE STORM SEWER WILL BE ALLOWED UNLESS THE OWNER HAS THE CAPABILITY TO CONSTRUCT REDUCTION SYSTEMS.

EXISTING SERVICES	DRAWING #, SOURCE	DATE	CONSTRUCTED SERVICES	COMPLETION

DETAILS		No.	REVISIONS	DATE	CONSULTANT
DESIGN	AH	1	REVISED AS PER CITY COMMENTS	APRIL 2018	AH
DRAWN BY	AH	2	REVISED AS PER CITY COMMENTS	JUNE 2018	AH
CHECKED	RC				
APPROVED	KAM/GK				
DATE	FEB. 2018				

CONSULTANT OR DIVISION
MTE
Engineers | Scientists | Surveyors

ENGINEER'S STAMP
LICENSED PROFESSIONAL ENGINEER
G. W. KARUGU
100113507
21/06/2018
PROVINCE OF ONTARIO

CORPORATION OF THE CITY OF LONDON
London CANADA

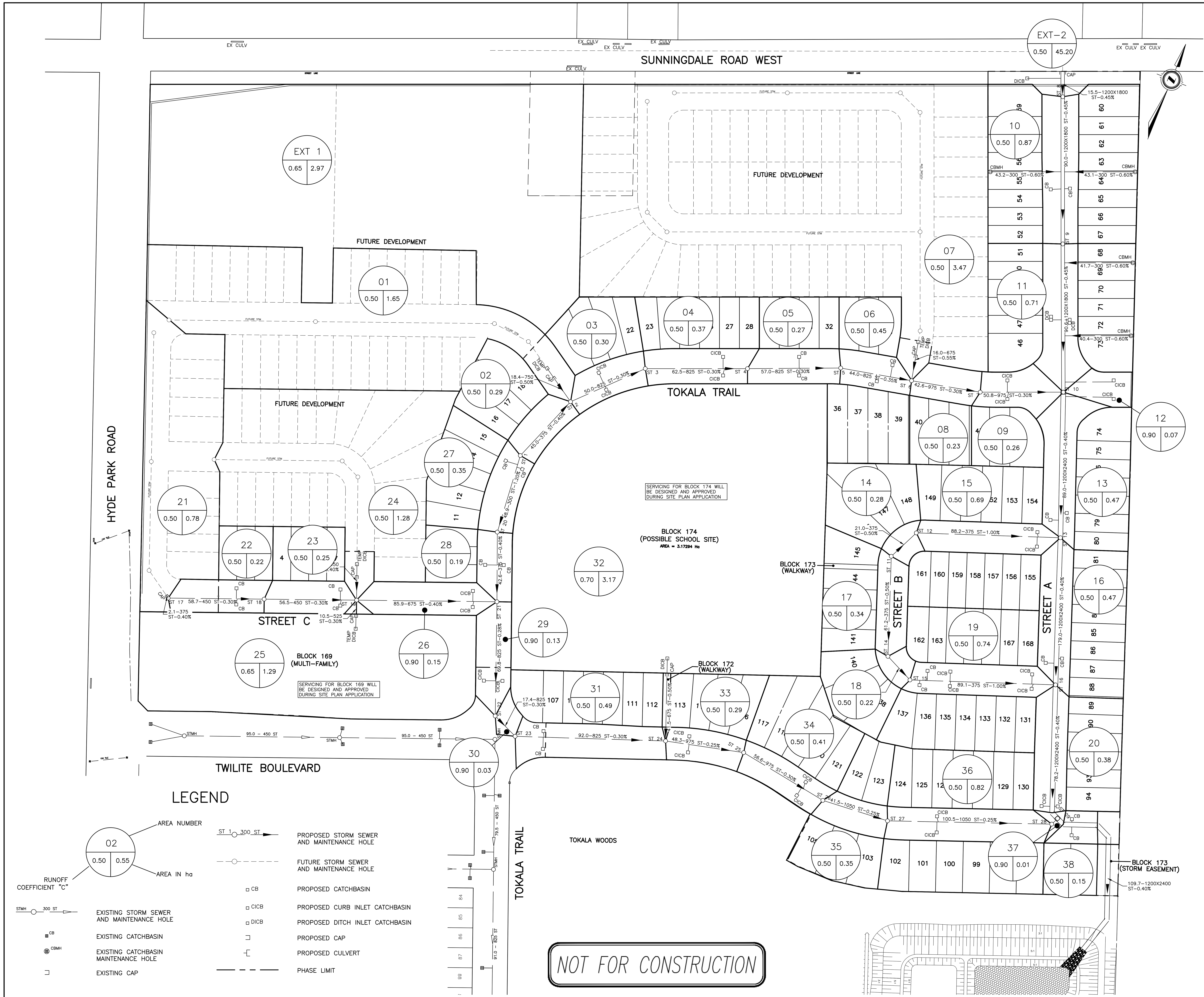
SCALE
HORIZONTAL SCALE - 1 : 1000
10m 0 20m

CREEK VIEW SUBDIVISION – PHASE 3
LANDEA DEVELOPMENTS INC.

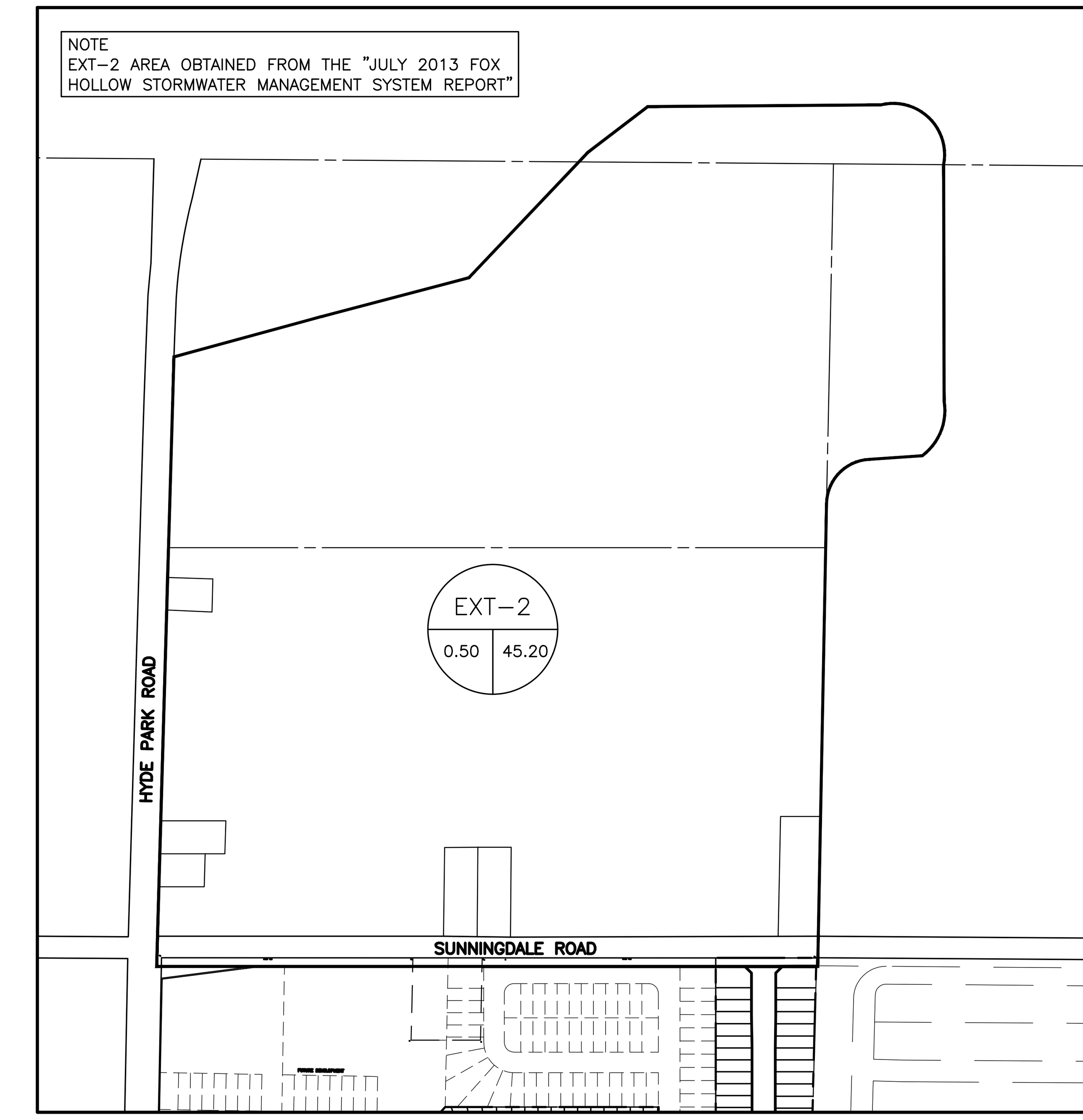
SANITARY AREA PLAN

T05512-42

PROJECT No. 41995-134
SHEET No. 3
PLAN FILE No.



NOTE
EXT–2 AREA OBTAINED FROM THE "JULY 2013 FOX HOLLOW STORMWATER MANAGEMENT SYSTEM REPORT"



EXTERNAL STORM AREA
SCALE: 1:5000

STORM SEWER DESIGN SHEET
FOXWOOD SUBDIVISION PHASE 3
LONDON, ONTARIO
2 YEAR RETURN WITH 50 YEAR FROM EXT 2

FLOW
Q = 2.78CiA
Q = PEAK FLOW (LITRES PER SECOND)
C = RUNOFF COEFFICIENT
i = RAINFALL INTENSITY (mm/hr)
A = AREA (HECTARES)

RUNOFF COEFFICIENT " C "
PARKS & PLAYGROUNDS: 0.20
SINGLE-FAMILY RESIDENTIAL : 0.50
TOWNHOUSES : 0.65
APARTMENTS : 0.65 - 0.70
COMMERCIAL & INDUSTRIAL : 0.70 - 0.90
DENSELY BUILT, PAVED: 0.9

DESIGNED BY: HJF
CHECKED BY: MTP
APPROVED BY: RJD
DATE: DECEMBER 2018
SHEET: 1 OF 1

SEWER LOCATION				AREA		TOTAL (A X C)			RAINFALL INTENSITY				SEWER DESIGN									PROFILE			
AREA No.	STREET	FROM MH	TO MH	INCR. (ha)	TOTAL (ha)	" C "	INCR. A X C	TOTAL SEWER	TIME OF ENTRY (mins.) SECTION	CUM.	INTENSITY (mm/hr)	Q (L/s)	LENGTH (m)	PIPE SIZE (mm)	SLOPE (%)	n	CAP (L/s)	VEL (m/s)	D.S.HEAD LOSS (m)	TIME OF FLOW (mins.)	FALL IN SEWER (m)	DROP IN D.S. MH (m)	INVERT U.S.	INVERT D.S.
EXT1	EXT 1			2.97	2.97	0.65	1.93	1.93																
01	FUTURE DEVELOPMENT	STUB	ST 1	1.65	4.62	0.50	0.83	2.76		19.00	74.7	571.9	18.4	750	0.50%	0.013	787.2	1.78		0.17	0.092	0.075	273.679	273.587
									0.17	19.17														
02	TOKALA TRAIL	ST1	ST2	0.29	0.29	0.50	0.15	0.15		19.00	74.7	30.1	45.0	375	0.40%	0.013	110.9	1.00		0.75	0.180	0.450	274.142	273.962
									0.75	19.75														
03	TOKALA TRAIL	ST 2	ST 3	0.30	5.21	0.50	0.15	3.05	0.75	19.75	73.0	618.9	50.0	825	0.30%	0.013	786.2	1.47		0.57	0.150	0.030	273.512	273.362
04	TOKALA TRAIL	ST 3	ST 4	0.37	5.58	0.50	0.19	3.24	0.57	20.31	71.8	645.4	62.5	825	0.30%	0.013	786.2	1.47		0.71	0.188	0.030	273.332	273.144
05	TOKALA TRAIL	ST 4	ST 5	0.27	5.85	0.50	0.14	3.37	0.71	21.02	70.3	658.7	57.0	825	0.30%	0.013	786.2	1.47		0.65	0.171	0.030	273.114	272.943
06	TOKALA TRAIL	ST 5	ST 6	0.45	6.30	0.50	0.23	3.60	0.65	21.67	69.0	689.9	44.0	825	0.35%	0.013	849.2	1.59		0.46	0.154	0.150	272.913	272.759
									0.46	22.13														
07	*FUTURE DEVELOPMENT	STUB	ST 6	3.47	3.47	0.50	1.74	1.74		18.00	77.1	371.6	15.0	600	0.55%	0.013	455.4	1.61		0.16	0.088	0.300	272.997	272.909
									0.16	18.16														
08	TOKALA TRAIL	ST 6	ST 7	0.23	10.00	0.50	0.12	5.45	0.46	22.13	68.1	1031.5	42.6	975	0.30%	0.013	1227.5	1.64		0.43	0.129	0.035	272.609	272.480
09	TOKALA TRAIL	ST 7	ST 10	0.26	10.26	0.50	0.13	5.58	0.43	22.56	67.3	1043.7	50.8	975	0.30%	0.013	1227.5	1.64		0.52	0.152	0.225	272.445	272.293
									0.52	23.08														
EXT2	EXT 2	STUB	ST 8	45.20	45.20	0.50	22.60	22.60		23.42	65.8	6550.0	15.5	1200x1800	0.45%	0.013	7154.0	3.31		0.08	0.070	0.000	272.950	272.880
10	STREET A	ST 8	ST 9	0.87	46.07	0.50	0.44	23.04	0.08	23.50	65.7	6629.0	90.0	1200x1800	0.45%	0.013	7154.0	3.31		0.45	0.405	0.000	272.880	272.475
11	STREET A	ST 9	ST 10	0.71	46.78	0.50	0.36	23.39	0.45	23.95	64.9	6770.3	90.6	1200x1800	0.45%	0.013	7154.0	3.31		0.46	0.407	0.000	272.475	272.068
									0.46	24.41														
12	TOKALA TRAIL	CB	ST10	0.07	0.07	0.90	0.06	0.06																
13	STREET A	ST 10	ST 13	0.47	47.32	0.50	0.24	23.69	0.46	24.41	64.1	7744.6	89.0	1200x2400	0.40%	0.013	9967.0	3.46		0.43	0.357	0.000	272.068	271.711
									0.43	24.84														
14	STREET B	ST 11	ST 12	0.28	0.28	0.50	0.14	0.14		19.00	74.7	29.1	21.0	375	0.50%	0.013	124.0	1.12		0.31	0.105	0.080	273.605	273.500
15	STREET B	ST 12	ST 13	0.68	0.96	0.50	0.34	0.48	0.31	19.31	73.9	98.7	88.2	375	1.00%	0.013	175.3	1.59		0.93	0.884	0.825	273.420	272.536
									0.93	20.24														
16	STREET A	ST 13	ST 16	0.47	48.75	0.50	0.24	24.40	0.93	24.41	64.1	7844.7	90.0	1200x2400	0.40%	0.013	9967.0	3.46		0.43	0.360	0.000	271.711	271.351
									0.43	24.84														
17	STREET B	ST 11	ST 14	0.34	0.34	0.50	0.17	0.17		19.00	74.7	35.3	61.2	375	0.50%	0.013	124.0	1.12		0.91	0.304	0.070	273.606	273.302
18	STREET B	ST 14	ST 15	0.22	0.56	0.50	0.11	0.28	0.91	19.91	72.6	56.5	19.8	375	0.50%	0.013	124.0	1.12		0.29	0.098	0.070	273.232	273.134
19	STREET B	ST 15	ST 16	0.74	1.30	0.50	0.37	0.65	0.29	20.20	72.0	130.1	89.1	375	0.90%	0.013	166.3	1.51		0.99	0.888	0.825	273.064	272.176
									0.99	21.19														
20	STREET A	ST 16	ST 29	0.38	50.43	0.50	0.19	25.24	0.99	24.84	63.4	8005.6	83.1	1200x2400	0.40%	0.013	9967.0	3.46		0.40	0.332	0.000	271.351	271.019
									0.40	25.24														
21	*FUTURE DEVELOPMENT	STUB	ST 17	0.78	0.78	0.50	0.39	0.39		19.00	74.7	80.9	3.0	375	0.40%	0.013	110.9	1.00		0.05	0.008	0.075	274.307	274.299
22	STREET C	ST 17	ST 18	0.22	1.00	0.50	0.11	0.50	0.05	19.05	74.5	103.6	57.0	450	0.30%	0.013	156.2	0.98		0.97	0.176	0.050	274.224	274.048
23	STREET C	ST 18	ST 19	0.25	1.25	0.50	0.13	0.63	0.97	20.02	72.4	125.8	56.5	450	0.30%	0.013	156.2	0.98		0.96	0.169	0.225	273.998	273.829
									0.96	20.98														
24	*FUTURE DEVELOPMENT	STUB	ST 19	1.28	1.28	0.50	0.64	0.64		19.00	74.7	132.8	15.0	450	0.40%	0.013	180.3	1.13		0.22	0.060	0.225	273.889	273.829
									0.22	19.22														
25	BLOCK 169	STUB	ST 19	1.29	1.29	0.65	0.84	0.84		18.00	77.1	179.6	12.0	525	0.30%	0.013	235.6	1.09		0.18	0.032	0.150	273.786	273.754
									0.18	18.18														
26	STREET C	ST 19	ST 21	0.15	3.97	0.90	0.14	2.24	0.96	20.98	70.4	438.0	85.6	675	0.39%	0.013	524.9	1.47		0.97	0.343	0.150	273.604	273.261
									0.97	21.95														
27	TOKALA TRAIL	ST 1	ST 20	0.35	0.35	0.50	0.18	0.18		19.00	74.7	36.3	21.0	300	1.20%	0.013	105.9	1.50		0.23	0.587	0.030	274.349	273.762
28	TOKALA TRAIL	ST 20	ST 21	0.18	0.18	0.50	0.09	0.27	0.23	19.23	74.1	54.6	88.2	375	0.40%	0.013	110.9	1.00		1.46	0.171	0.450	273.732	273.561
									1.46	20.70														
29	TOKALA TRAIL	ST 21	ST 22	0.35	4.50	0.90	0.32	2.82	1.46	21.95	68.5	536.6	69.8	825	0.28%	0.013	759.6	1.42		0.82	0.198	0.030	273.111	272.913
30	TOKALA TRAIL	ST 22	ST 23	0.03	4.53	0.90	0.03	2.85	0.82	22.77	67.0	529.7	17.4	825	0.30%	0.013	786.2	1.47		0.20	0.052	0.030	272.883	272.831
31	TWILITE	ST 23	ST 24	0.49	5.02	0.50	0.25	3.09	0.20	22.97	66.6	572.3	92.8	825	0.30%	0.013	786.2	1.47		1.05	0.279	0.150	272.801	272.522
32	BLOCK 174	DICB	ST 24	3.19	3.19	0.70	2.23	2.23		19.00	74.7	463.5	44.0	675	0.50%	0.013	594.4	1.66		0.44	0.207	0.300	272.879	272.672
									0.44	19.44														
33	TWILITE BOULEVARD	ST 24	ST 25	0.30	8.51	0.50	0.15	5.47	1.05	24.02	64.8	985.8	47.5	975	0.25%	0.013	1120.5	1.50		0.53	0.119	0.030	272.372	272.253
34	TWILITE BOULEVARD	ST 25	ST 26	0.41	8.92	0.50	0.21	5.68	0.53	24.54	63.9	1008.9	56.6	975	0.30%	0.013	1227.5	1.64		0.57	0.170	0.075	272.223	272.053
35	TWILITE BOULEVARD	ST 26	ST 27	0.35	9.27	0.50	0.18	5.85	0.57	22.52	67.4	1096.9	41.5	1050	0.25%	0.013	1365.4	1.58		0.44	0.102	0.030	271.978	271.876
36	TWILITE BOULEVARD	ST 27	ST 28	0.82	10.09	0.50	0.41	6.26	0.44	22.96	66.6	1159.9	100.5	1050	0.25%	0.013	1365.4	1.58		1.06	0.249	0.416	271.846	271.597
37	TWILITE BOULEVARD	ST 28	ST 29	0.01	10.10	0.90	0.01	6.27	1.06	24.02	64.8	1129.5	4.9	1050	0.25%	0.013	1365.4	1.58		0.05	0.012	0.150	271.181	271.169
									0.05	24.07														
38	TWILITE BOULEVARD	ST 29	HW1	0.15	60.53	0.50	0.08	31.52	0.40	25.24	62.8	9070.8	109.7	1200x2400	0.40%	0.013	9967.0	3.46		0.53	0.439	0.000	271.019	270.580

METRIC

DISTANCES SHOWN ON THIS PLAN ARE IN METERS AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

EXISTING SERVICES	DRAWING #, SOURCE	DATE	AS CONSTRUCTED SERVICES	COMPLETION	DETAILS		No.	REVISIONS	DATE	CONSULTANT
					DESIGN	HJF				
					DRAWN BY	HJF				
					CHECKED	RD				
					APPROVED	MTP				
					DATE	DEC 2018				

CONSULTANT OR DIVISION
DILLON CONSULTING

ENGINEER'S STAMP
LICENSED PROFESSIONAL ENGINEER
M. T. PLETCH
100225226
Dec 20 2018
PROVINCE OF ONTARIO

London CANADA
CORPORATION OF THE CITY OF LONDON

SCALE
SCALE – 1 : 1250
12.5 0 25

TITLE
FOXWOOD SUBDIVISIONS (PHASE 3)
FOXWOOD DEVELOPMENTS

STORM AREA PLAN
AND DESIGN SHEET

PROJECT No. 18–0644
SHEET No. 02
PLAN FILE No.

C:\projectwise\working directory\projects 2018\10hjf\dms25178\180644–AREA PLANS.dwg

Appendix E PROPOSED SERVICES

Stantec

Memo

To:	City of London	From:	Stantec Consultant Ltd.
File:	161413708	Date:	October 14, 2021

Reference: Updated Draft Plan Hydraulic Analysis – 1521 Sunningdale Road West

The intent of this letter is to address the changes to the previously proposed draft plan relating to the water servicing of the proposed site. The proposed revision of the draft plan has some changes to the subdivision layout. Refer to the appendix for the new proposed draft plan.

In June 2021, Stantec has carried out a hydraulic analysis for the proposed subdivision. The study included the assessment and analysis for water servicing of the site through the connection to the existing 300mm on Fair Oaks Boulevard. The study assessed the water distribution system configuration, water demands, and the results of the analysis. The assessment was based on a population of 1,589 people based on the previous draft plan which will produce an anticipated demand of 323,850 L/day (3.75 L/s) based on the City of London Watermain Design Standard. Based on an assumed factor of 3.5, the maximum day demand is 13.13 L/s, and based on an assumed factor of 7.8, the peak hour demand is 29.25 L/s. Based on running the simulation under several scenarios, the analysis indicated that the existing 300mm watermain can provide sufficient capacity to meet London water system performance standards under design peak hour and fire flow conditions. Refer to the appendix for more details about the water analysis.

The newly proposed draft plan will maintain the same connection points for the proposed 300mm at both Street A on Sunningdale Road, and on Street B on Hyde Park Road. The connection at the existing 300mm watermain located at Fair Oaks Boulevard will be maintained.

Based on the previous discussion, Stantec draws the conclusion that the previously completed water service analysis for the previously proposed draft plan, is still in consistent and applicable under the newly proposed draft plan.

Submitted with respect.

Stantec Consulting Ltd.

Mohammad Meqdad MEng., P.Eng., PMP, LEED Green Associate
Project Manager, Community Development

Phone:
Fax: Fax Number
Mohammad.Meqdad@stantec.com

Attachment: Attachment

c. C.C.

Stantec

Memo

To:	Dan Vucetic Stantec (London, ON)	From:	Kevin Alemany, Alex Cropp Stantec (Ottawa, ON)
File:	161413708	Date:	June 11, 2021

Reference: Hydraulic Analysis – 1521 Sunningdale Road West

1 ANALYSIS OBJECTIVE

The objective of this analysis is to:

- Update the City of London's Water Distribution Model to include 1521 Sunningdale Road West development;
- Verify that the original Hyde Pump Station design is sufficient to meet the additional demand and required fire flow of 90 L/s; and,
- Confirm that velocities are within the design guidelines.

Figures referenced in the memorandum are included at the end of the document.

2 REFERENCE INFORMATION

Model updates made to represent the watermain constructed to serve the planned future 1521 Sunningdale Road West development were based on the *"DRAFT PLAN OF SUBDIVISION"* certified January 28, 2021 and the "*PRELIMINARY TRANSPORTATION & LINKAGE PLAN*" certified February 1, 2021.

3 CONDITIONS FOR SYSTEM ANALYSIS

3.1 STUDY AREA WATER DISTRIBUTION SYSTEM CONFIGURATION

The 1521 Sunningdale Rd W area of interest is located in the far central north part of the London water system service area, north of Sunningdale Rd W and east of Hyde Park Rd. Watermains that will service this development have not been installed at the time of writing this report. Therefore, it has been assumed that the development will be connected to the existing 300 mm watermain located in Fair Oaks Blvd and be serviced by the Hyde Park Zone.

An additional connection to the low zone has also been assumed at the intersection of Sunningdale Rd W and Hyde Park Rd to provide additional firefighting capacity if required as detailed in **Figure 1**.

3.2 STUDY AREA WATER DEMANDS

As noted previously, the 1521 Sunningdale Rd W development was not accounted for in the existing London water distribution system model used for this analysis. New water demands for this development area were estimated and incorporated into the model prior to completing this performance system analysis.

Reference: **Hydraulic Analysis – 1521 Sunningdale Road West**

This proposed development has an estimated population of 1,589 based on the concept Draft Plan included herein which will produce an anticipated demand of 323,850 L/day (3.75 L/s) based on the City's Watermain Design Standards as shown in **Table 1**.

Table 1: 1521 Sunningdale Road West

Land Use	Estimated Population	Demands	
		(L/day)	L/s
Low Density Residential		124,695	1.44
Multi-Family Residential	500	127,500	1.48
Elementary School	281 (600)	71,655 (18,000)	0.83
Total	***1,589***	***323,580 (270,195)***	***3.75***

Note:

- Elementary School demand based on critical between population assumed as 600 people with consumption of 30 L/day or 35 units/ha at 2.4 people/unit with domestic unit demand of 255 /L/cap/day.
- Low Density population estimated based on 178 units (11 m lot frontage) for total of 3 people/unit.
- Multi-Family based on 35 units/ha at 2.4 people/unit with domestic unit demand of 255 L/cap/day as per City's Standards.

The Maximum Day/Average Day peaking factor was assumed to be 3.5 and the Peak Hour/Average Day Demand peaking factor was assumed to be 7.8 as detailed in **Table 2**. For the purpose of this analysis, a necessary fire flow value of 90 L/s was assumed.

Table 2: Demand Factors

Scenarios	Factors	Demand (L/s)
Average Day Demand	-	3.75
Maximum Day Demand	3.5	13.13
Peak Hour Demand	7.8	29.25

3.3 STUDY AREA BOUNDARY CONDITIONS

For this analysis, all three pumps were turned on at Hyde Pump Station, with suction and discharge hydraulic gradelines (HGLs) of 290 and 307 m, respectively.

4 SYSTEM ANALYSIS RESULTS

Distribution system model simulations were performed to assess conditions within 1521 Sunningdale Rd W development under maximum day, and peak hour demand conditions.

Separate simulations were run to estimate available fire flow throughout the development and to assess system performance for a hypothetical 90 L/s fire flow under maximum day demand at particular nodes both with an active connection to the Low Zone and if for some reason the valve between the Hyde Park and Low Zone was not able to open. At build-out of 1521 Sunningdale Rd W development, design maximum day

water demands are estimated to total approximately 13.13 L/s. Observations from each run are summarized below.

- **90 L/s fire flow under Maximum Day Demand Conditions – Connection (check valve) between the Low and Hyde Park Zone**

  Model results show that both the connections to the Low Zone are active during a fire flow event (90 L/s) within the development. The model estimates that of the 90 L/s required for fire flow, around 38 L/s would be supplied from the Hyde Pump Station while the remaining 52 L/s would be through the connections. The available fire flow results show that greater than 90 L/s is available when there is a check valve connection between the Low Zone and the Hyde Park Zone. The full results from this available fire flow analysis are illustrated in **Figure 2**.

- **90 L/s fire flow under Maximum Day Demand Conditions – No connection between the Low and Hyde Park Zone**

  Model results show that due to the headloss through the Fair Oaks Blvd connection, the resulting pressure within the development would drop below the minimum 20 psi requirement as illustrated in **Figure 3**.

- **90 L/s fire flow under Maximum Day Demand Conditions – No connection between the Low and Hyde Park Zone but additional Hyde Park Connection**

  Due to the failure of the fire flow for the previous scenario, an additional 300 mm pipeline was added between Twilite Blvd and Sunningdale Rd W. With this additional connection the resulting pressure within the development during a fire flow event would remain above the 20 psi minimum requirement as illustrated in **Figure 4**. Therefore, this is considered an acceptable solution if the connections between the Low and Hyde Park Zone failure for any reason.

- **Peak Hour Demand Conditions**

  At build-out of the 1521 Sunningdale Rd W development, design peak hour water demands are estimated to total approximately 29.25 L/s. Model results show that this flow can be satisfied by Hyde Pump Station. With the additional demand, pressure throughout the development drops approx. 2 psi from existing conditions to about 42 psi (with the boundary conditions at Hyde PS as noted in **Section 3.3**) which is consistent with the pressure in the Hyde Park Zone as illustrated in **Figure 5**.

  Due to the pipelines being sized for fire flow, head loss and flow velocities in the pipe network under peak hour conditions are below that set forth by the design criteria (1.5 m/s) as illustrated in **Figure 5** and **Figure 6**.

- **Hyde Pump Station**

  The Hyde Pump Station currently consists of three individual pumps with horsepower ranging from 30 to 75 as detailed in **Table 3**. The pump station was designed to accommodate residential fire flow of 76 L/s (4,560 L/min) and ICI of 151 L/s (9,060 L/min). Stantec also calculated the firm capacity of the pump station (i.e., with the largest pump out of service) as 308 L/s. This firm capacity or 151 L/s designed fire flow, is significantly above the 90 L/s required by 1521 Sunningdale Rd W development. Therefore, the Hyde Pump Station should be able to accommodate the proposed development without any changes or upgrades to the Hyde Pump Station. As stated earlier in this report, two 300

mm connections to the current distribution system will be required if fire flow is proposed to be solely provided by the Hyde Pump Station.

Table 3: Hyde Pump Station Specifications

Pump	Horsepower	Constant Power	Flow (L/s)	TDH (m)
HYDE_P1	30	19	100	18.2
HYDE_P2	75	56	208	18.2
HYDE_P3	75	56	208	18.2
Firm Capacity	-	-	308	18.2

5 CONCLUSIONS AND SUMMARY

Simulation results from this analysis indicate that the existing watermain installed to serve the 1521 Sunningdale Rd W development provides sufficient capacity to meet London water system performance standards under design peak hour and fire flow conditions with peak hour velocities below 1.5 m/s due to the pipeline size.

Under fire flow conditions, the development can be supplied from the 900 mm Low Zone pipeline running along Sunningdale Rd W with just a single 300 mm pipeline from the intersection of Twilite Blvd and Applerock Ave to Sunningdale Rd W. However, if fire flow is required to be provided from only the Hyde Park Zone, then an additional 300 mm pipeline will be required from Twilite Blvd and Tokala Trail along Hyde Park Rd to the intersection of Hyde Park Rd and Sunningdale Rd W. This is to maintain pressures during fire flow above 20 psi in both the development and the existing pipelines around Red Pine Cross and Wateroak Dr.

As noted earlier in the report, the Hyde Pump Station has been to a fire flow capacity of 151 L/s which is well above the 90 L/s required by the development. Therefore, no pump station upgrades should be required as part of this development.

Reference: **Hydraulic Analysis – 1521 Sunningdale Road West**

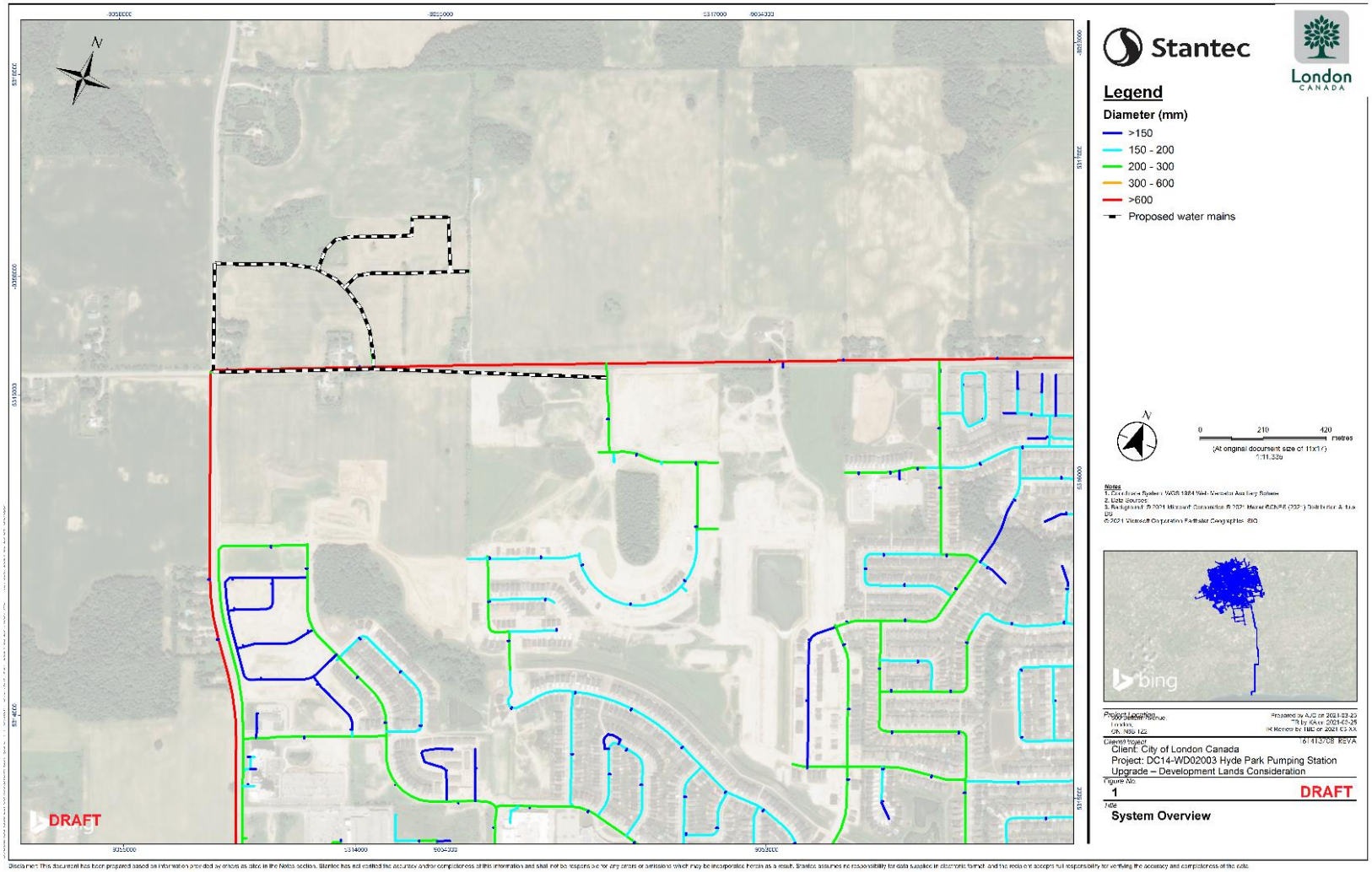


Figure 1: System Overview

Reference: **Hydraulic Analysis – 1521 Sunningdale Road West**

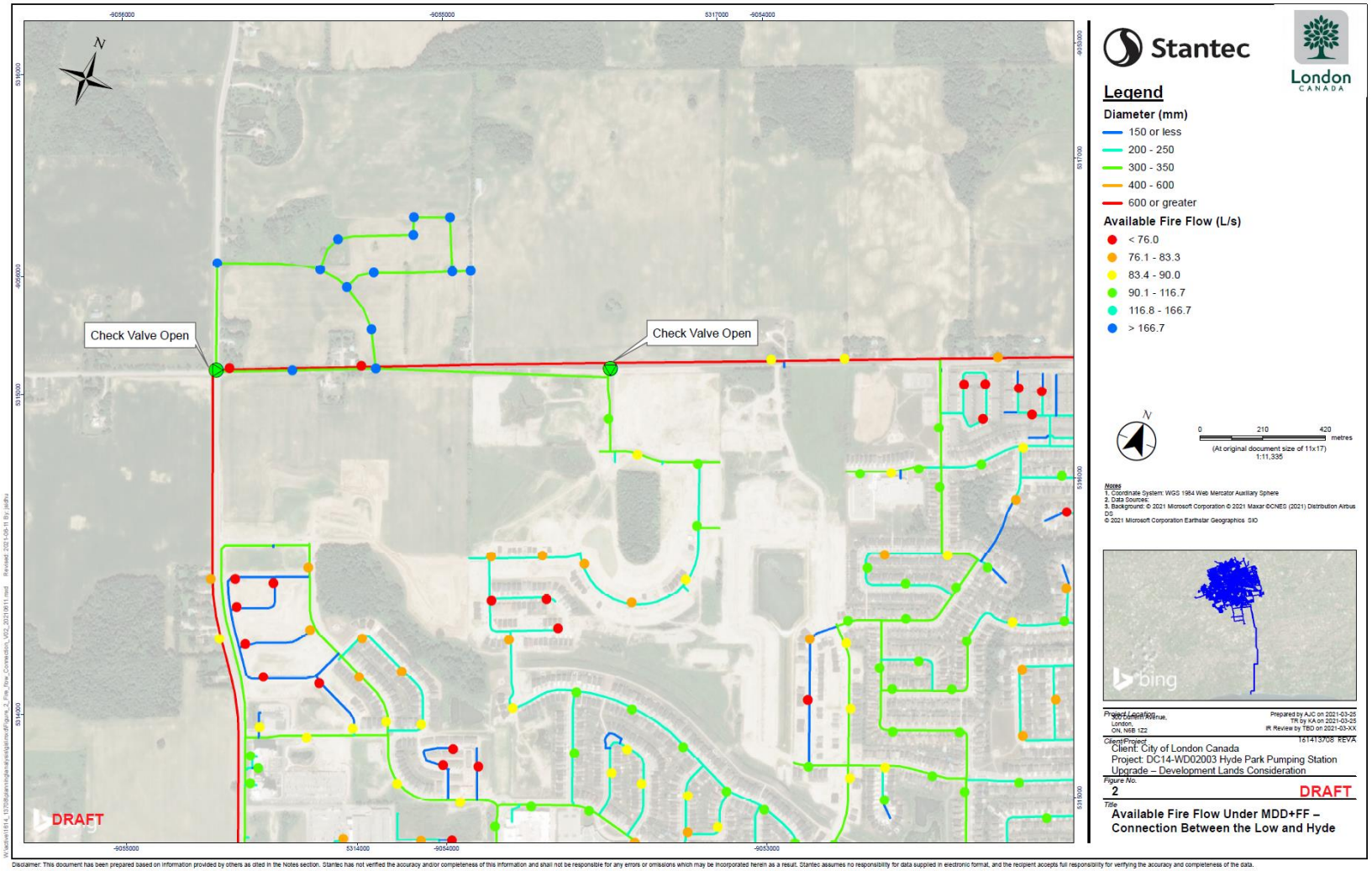


Figure 2: Available Fire Flow Under MDD+FF – Connection Between the Low and Hyde Park Zones

Reference: **Hydraulic Analysis – 1521 Sunningdale Road West**

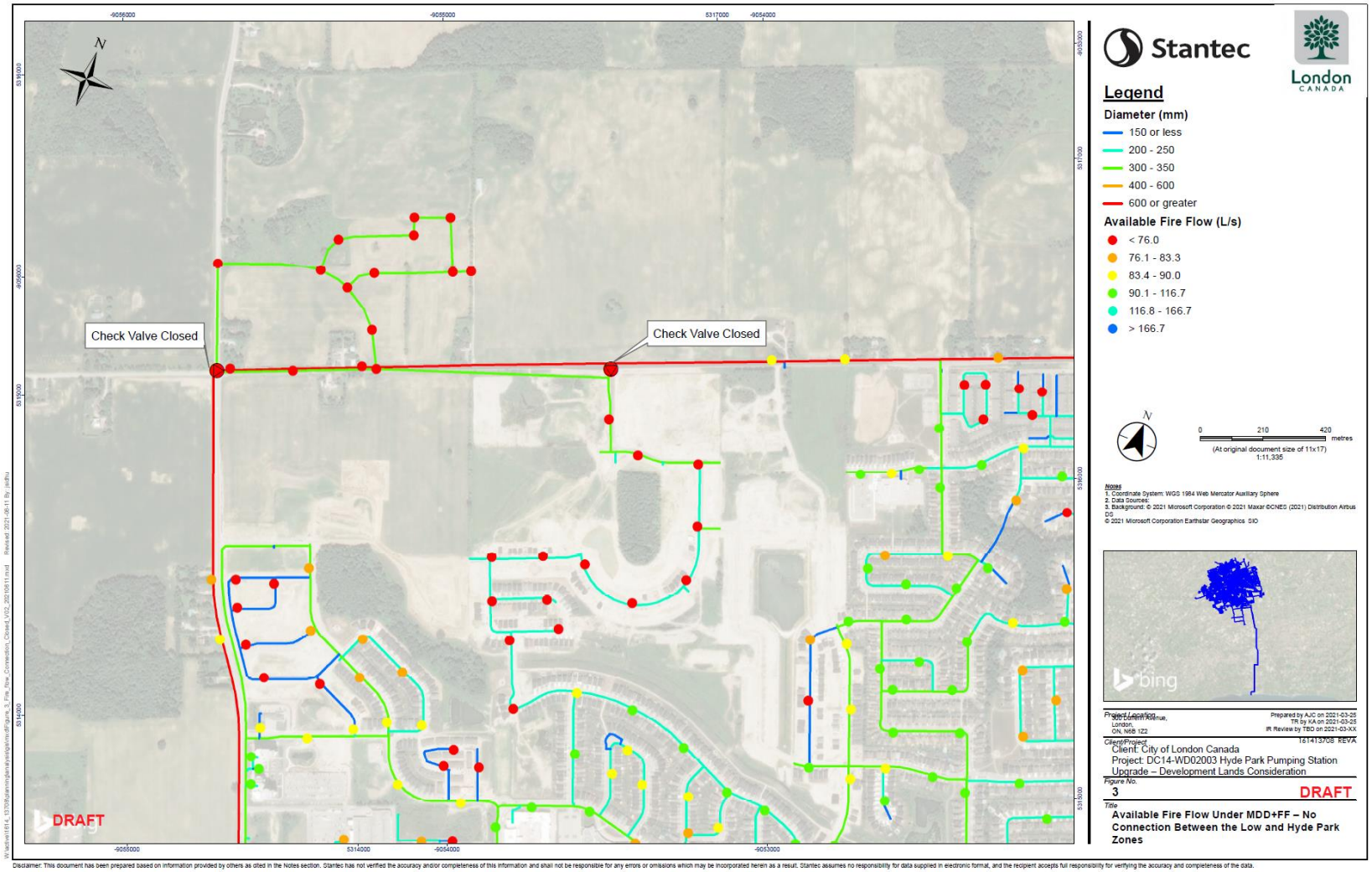


Figure 3: Available Fire Flow Under MDD+FF – No Connection Between the Low and Hyde Park Zones

Reference: **Hydraulic Analysis – 1521 Sunningdale Road West**

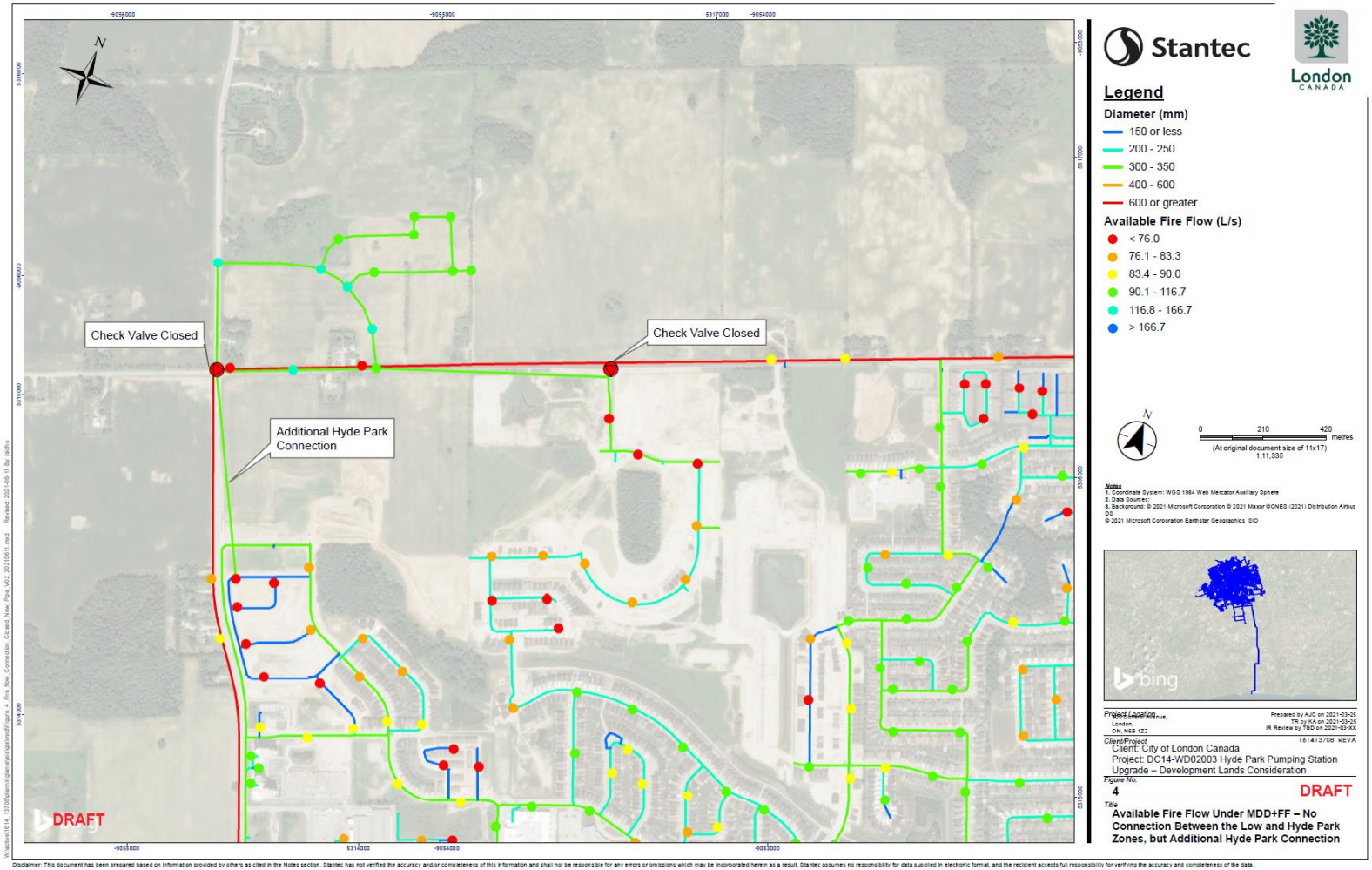


Figure 4: Available Fire Flow Under MDD+FF – No Connection Between the Low and Hyde Park Zones, but Additional Hyde Park Connection

Reference: **Hydraulic Analysis – 1521 Sunningdale Road West**

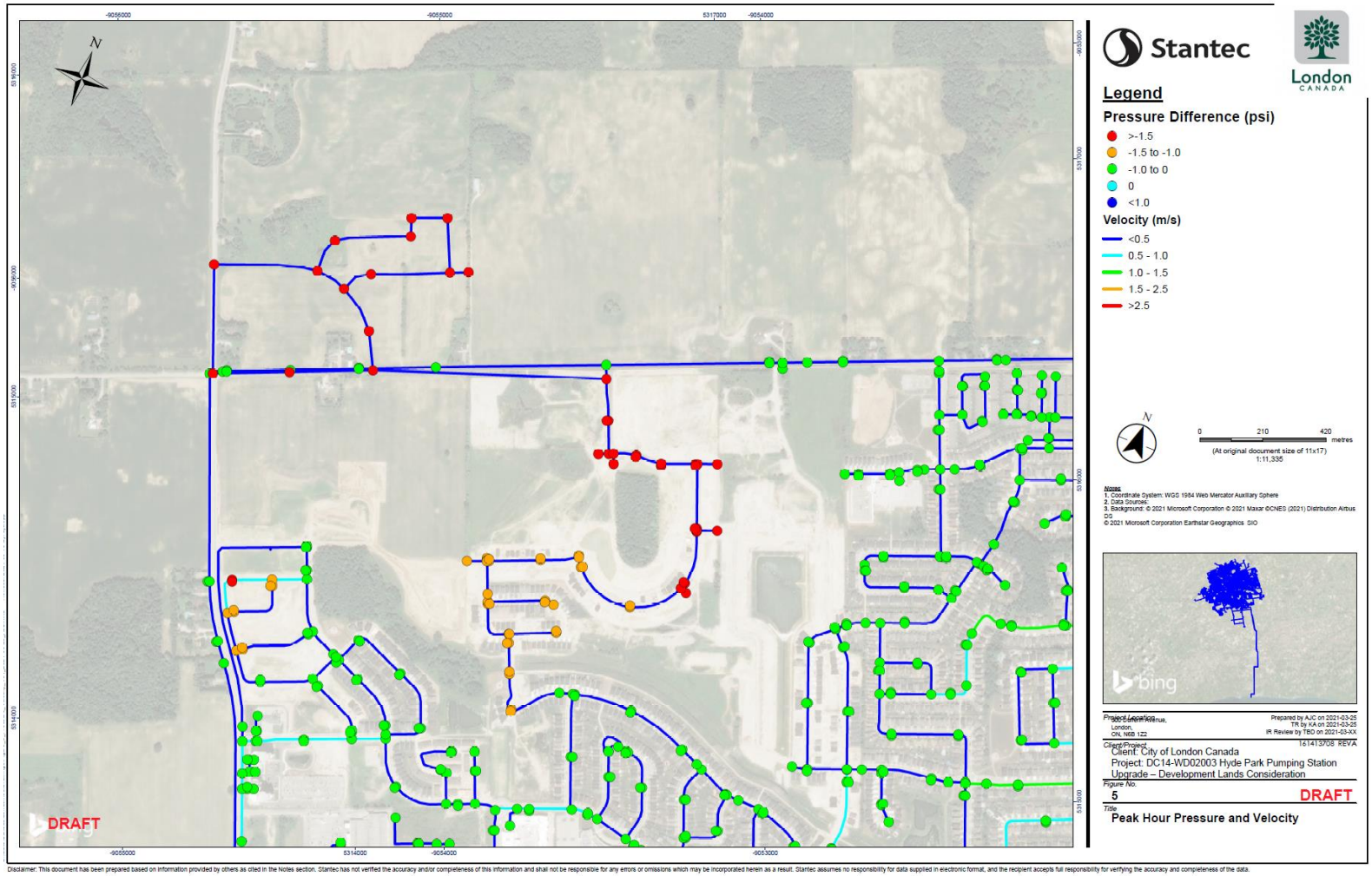


Figure 5: Peak Hour Pressure and Velocity

Reference: **Hydraulic Analysis – 1521 Sunningdale Road West**

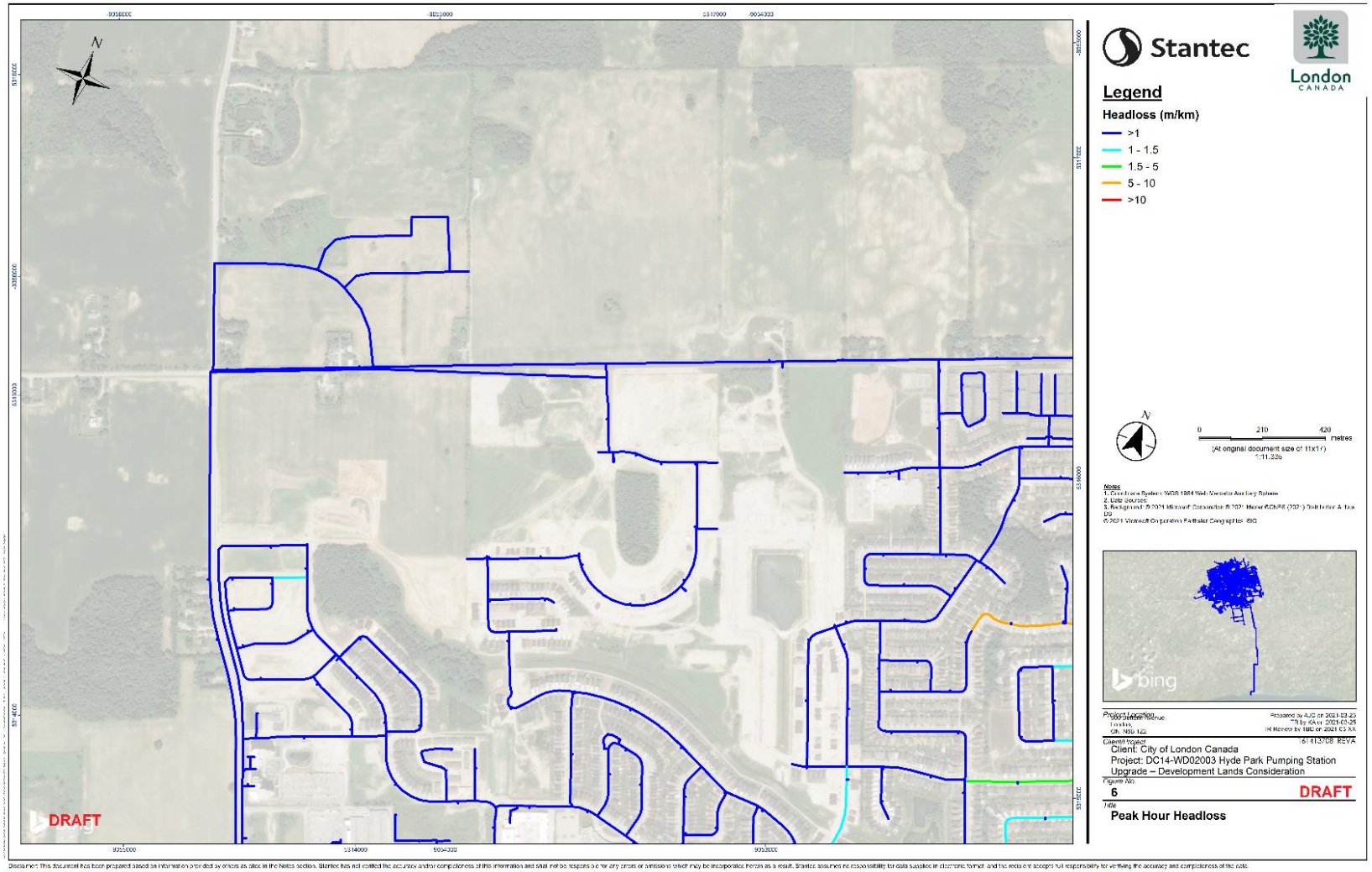


Figure 6: Peak Hour Headloss

Appendix F DC CLAIM

Initial Proposal Report (IPR) Claimable Works & DC Revenue Estimate Worksheet
City of London - Development Finance
Development Charges By-law C.P.-1551-227

Development:	"Mt. Pleasant" Subdivision	**TS File #:**	TS2020-009
Address:	1521 Sunningdale Road West and 2631 Hyde Park Road	**Prepared By:**	Dan Vucetic, Stantec Consulting Ltd.
Applicant:	AUBURN DEVELOPMENTS INC.	**Date Prepared:**	October 12, 2021

Claimable Works

Provide a general listing and cost estimate of anticipated development charge claimable works triggered by the proposed development.

DC Claimable Works	DC Background Study Estimate ($) (if applicable)	Initial Proposal Report Estimate ($)	Notes / Description
Minor Roadworks[1]		$838,860	channelization on arterial road at Sunningdale/Street A & Hyde Park/Street B.Cost per average recent actual costs 2021 DC Study.
Road Oversizing[1]		$30,000	Internal Road Widening Beyond 10m, estimated at $30,000 for Street A & Street B based on similar scope of work on previous projects.
Wastewater Oversizing		$39,060	Oversizing internal 300mm sanitary sewer (620m length with subsidy of $63/m)
Storm Sewer Oversizing		$457,840	590 l.m of oversized 1500mm Storm sewer @ $776/m
Watermain Oversizing		$66,000	1200 lm of oversized 300mm watermain at subsidy of $55/m
LID Subsidy			
Trunk Sewer[1]		$4,185,640	SAN along Sunningdale Road W (1200 l.m. 300-375mm dia. SAN) & 470 l.m 1345x2110 box STM sewer along Sunningdale to onsite
Major SWM Works[1]		$2,680,277	Dry SWMF Construction Cost per 2019 One Water Development Charge Update Study, February 2019 methodology.
Land			
Other			
Total	**$ -**	**$ 8,297,677**	

DC Revenue Estimate

Provide summary of proposed units/floor space to calculate estimated revenue. Use typical unit/ha densities for blocks and actual lot counts if available.

Residential		**Hectares**	**Units per Hectare**	**Proposed Units**	**CSRF Rate ($/unit)**	**CSRF Revenue**
Low Density Single & Semi Detached		**7.5**	**35.0**	262.4	$34,158	$ 8,961,693
Medium Density Multiples / Row Housing		**7.0**	**75.0**	526.0	$23,100	$ 12,150,023
High Density	Apartment < 2 bedroom			0.0	$15,108	$ -
	Apartment >= 2 bedroom			0.0	$20,473	$ -
Non-Residential		**Hectares**	**Sq m. per Hectare**	**Proposed Floor Space**	**CSRF Rate ($/m2)**	**CSRF Revenue**
Commercial				0.0	$289.34	$ -
Institutional				0.0	$178.49	$ -
Industrial				0.0	$206.26	$ -
					Total	**$ 21,111,715.38**

Notes:
1. Claimable works subject to submission of a Work Plan by the Owner's consulting engineer for City review and approval at time of first submission of Engineering drawings.
2. Development Charges By-Law C.P.-1551-227 rates effective from January 1, 2021 to December 31, 2021
3. This Form is for "Inside Urban Growth Areas" only and excludes lands "Outside Urban Growth Areas".

LICENSED PROFESSIONAL ENGINEER
Oct 13/2021
D. VUCETIC
100209129
PROVINCE OF ONTARIO