390 Second Street Subdivision Phase 1

Functional Servicing and SWM Report

Project Location:

Part of Lot 25, Concession 3 SER, Geographic Township of Adelaide in the Municipality of Strathroy-Caradoc

Prepared for:

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Prepared by:

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August 9, 2022
Revised: December 8, 2023

MTE File No.: 45927-100

Engineers, Scientists, Surveyors.

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1.0 INTRODUCTION

MTE Consultants Inc. was retained by Northgrove Meadows Inc. to complete a Functional Servicing Report for the Phase 1 of new residential subdivision development to be constructed in Strathroy-Caradoc, Ontario (herein referred to as 'the Site'). The site is legally described as Part of Lot 25, Concession 3 South of Egremont Road in the Geographic Township of Adelaide, in the Municipality of Strathroy-Caradoc. This report will outline the Functional Servicing strategy for the proposed development.

The Site comprises an area of approximately 8.61 ha of undeveloped agricultural land per the latest Draft Plan of Subdivision by MTE OLS, dated November 2023. The site is bounded by Second Street to the north, agricultural fields and a residential lot to the east, agricultural fields and forested area to the south (also future Phase 2), and agricultural fields to the west, as shown on Figure 1. Phase 1 is intended to be developed as three blocks; Block 1 with the area of 2.23 ha zoned for site specific 'High-Density Residential' (R3-17-H-5 zoning), Block 2 with the area of 3.52 ha zoned for site specific 'High-Density Residential' (R3-18-H-5 zoning), and Block 3 with the area of 0.99 ha zoned for site specific 'Medium-Density Residential' (R2-26-H-5 zoning).

The remaining areas per the Draft Plan are planned for Street "A", Thorne Drive, a temporary stormwater management (SWM) pond facility block (Open Space OS zone), road widening, and sanitary pumping station.

FIG.1

Date: NOV.29/23
Scale: N.T.S.

LOCATION PLAN

MTE
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Project No.: 51563-100

P:\P\45927\100\FIGURES\45927-100-FIGURES_12-11-2023.dwg

2.0 EXISTING CONDITIONS

There is a Provincially Significant Wetland (PSW) in the southwest corner of the subdivision area and a woodlot in the southeast corner of the subdivision area. Per the Strathroy-Caradoc Official Plan and the North Meadows Secondary Plan (February 2021) a development on lands adjacent to wetlands and woodlots shall not be permitted unless it can be demonstrated that there will be no negative impacts on the natural features or on the ecological functions. In accordance with Section 3.3.7 of the Official Plan, adjacent lands are generally defined as those within 50m of a woodland, and 120m of a wetland. All of the Phase 1 developments and Phase 1 related developments will be outside of the 120m wetland buffer and 50m woodlot buffer.

2.1 Topographical Information

Existing topographic information was obtained from MTE OLS in December 2022. In the existing condition, surface runoff from the Site to be developed drains from the northwest to the southeast corner.

The existing topography slopes from a high point in the northwest (~236.3) towards the south property line of the site (~234.3). The average slope of the site under existing conditions is approximately 0.84%.

2.2 Geotechnical Information

In May 2019 MTE carried out a preliminary geotechnical investigation for the proposed Subdivision. The fieldwork for the investigation involved the excavation of 8 test pits.

Based on the results of MTE geotechnical investigation, the subsurface stratigraphy at the site generally consists of topsoil overlying deposits of clayey silts, sandy silts, and sand. Test pits were dry during the excavation and no free groundwater was observed in any of the test pits at the time of the fieldwork on May 14, 2019. For further geotechnical information, the Preliminary Geotechnical Investigation completed by MTE can be found in Appendix ‘A’.

2.3 Hydrological Assessment

A hydrogeological assessment was conducted by EXP in 2021 and a report was completed in April 2022. The report provides a preliminary assessment of the hydrogeological characteristics of the Site, including soil conditions, groundwater flow and quality, as well as an assessment of potential impacts to the groundwater as a result of the proposed development. The assessment was conducted using 4 monitoring wells. The monitoring well readings indicate stabilized groundwater elevations of 7.3 to 7.9m below ground surface.

An assessment report for the 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 subject Site is located within a Significant Groundwater Recharge Area (SGRA).

The Thames-Sydenham and Region Source Protection Committee has determined, using the Intrinsic Susceptibility Index (ISI) method, that the subject site is located within a Highly Vulnerable Aquifer (HVA).

The report recommends the use of secondary infiltration opportunities to reduce the variation between pre-development and post-development conditions. In terms of maintaining infiltration rates in post-development, the most effective stormwater management practices include

installing infiltration trenches, lot grading, roof leader discharge to soakaway pits/pervious areas, using pervious pipes, and installing pervious catch-basins.

For more details, refer to the Hydrogeological Assessment by EXP provided in Appendix ‘B’.

2.4 Existing Servicing

2.4.1 Water

There is an existing 400mmØ PVC municipal watermain on Second Street, and a 400mmØ PVC municipal watermain on Adair Boulevard north of Second Street

2.4.2 Sanitary

There is an existing 300mmØ sanitary sewer on Second Street conveying flows westward.

2.4.3 Storm

There is an existing 750mmØ to 825mmØ storm sewer on Second Street conveying flows eastward.

3.0 PROPOSED GRADING AND SERVICING STRATEGY

Conceptual grading and servicing strategies for the proposed development will be developed based on the concept plan/site plan in conjunction with the topographic survey, and requirements for the storm flows from the Site to the existing wetland and watercourse south of the site.

3.1 Proposed Grading

Proposed grading strategy will ensure storm flows are conveyed safely towards the south border of the Site and outside towards the proposed SWM pond.

3.2 Proposed Servicing

3.2.1 Sanitary Servicing

Due to the existing topography of the site, gravitational conveyance of the sanitary flows is not recommended out to Second Street sewer. Phase 1 will be serviced with local gravitational sanitary sewers that will convey flows south towards the sanitary pumping station (SPS). It is proposed to install a sanitary pumping station on the extension of Adair Boulevard, south of Thorne Drive, outside of the 120m wetland buffer. The SPS will pump sanitary flows through a forcemain to the existing Second Street sanitary sewer. Please refer to Figure 2 for the conceptual sanitary servicing layout.

The SPS will be designed for the ultimate buildout of the subdivision and is proposed to become Municipally owned and maintained. All of the Phase 1 blocks will be privately owned.

Based on the Draft Plan of Subdivision, the block zoning, and the latest Strathroy-Caradoc Servicing Standards (SCSS), the maximum possible population for Phase 1 is 1,031 people. Population was calculated based on the zoning unit density and block areas. Total expected peak flow is 15.47 l/s. Detailed calculations presented in Appendix C.

In the ultimate buildout of the subdivision, the sanitary flows will be rerouted and conveyed to Head Street sanitary sewer through Thorne Drive. Based on the sanitary design sheet of the subdivision to the west, Creekside Subdivision, there is sufficient capacity to convey the sanitary flows from the subject subdivision. Please refer to the *Creekside Meadows Sanitary Area Plan* and *Creekside Meadows Storm and Sanitary Design Sheets,* drawings by MTE, dated July 2020 for more information located in Appendix C.

The neighbouring development at 392 Second Street will have a temporary sanitary connection to the Second Street sanitary sewer with a future proposed connection to the 390 Second Street Subdivision Phase 1 sanitary sewers. Based on the sanitary design sheet information provided by the CJDL Consulting Engineers, the expected population for 392 Second Street site is 192 people, which will result in the peak sanitary flow of 3.76 l/s.

Sanitary servicing design will be updated based on the Block layouts and the proposed population (from the future concept plan/site plan) in the detailed design stage.

3.2.2 Proposed Water and Fire Servicing

The Site will be serviced via two connections to the existing 400mmØ Second Street watermain for looping and redundancy purposes based on the number of residential units. One connection

will be at the intersection of Adair Boulevard extension and Second Street, and a second connection is proposed along the east border of the Site, just west of 392 Second Street. A servicing easement can be arranged through Block 1 if required for the looped connection. Based on the Draft Plan of Subdivision and zoning, maximum possible population of 1,031 people and SCSS, expected Phase 1 average day demand is 2.98 l/s, max day demand is 10.44 l/s and peak hour demand is 23.27 l/s. Watermain sizes will be determined at a detail design stage using a hydraulic model and will consider other developments in the North Meadows Secondary Plan.

Hydrant testing will be performed in order to determine the available pressures and flows in the existing municipal infrastructure.

Fire protection infrastructure will be designed in consultation with Municipality. Conceptual water supply servicing plan is presented in Figure 3.

Water Supply servicing design will be updated based on the Block layouts and the proposed population (from the future concept plan/site plan) in the detailed design stage.

3.2.3 Storm

Runoff from the site will be directed to a proposed temporary wet SWM pond south of Thorne Drive, and east of Phase 2 residential lots, which will outlet via a channel to the existing watercourse in the southeast corner of the 390 Second Street Subdivision lands. Storm Sewers are designed in a way that allows redirection to the ultimate buildout SWM facility. Minor flows of up to 2-year storm events will be collected and conveyed by local storm sewers to the SWM pond and major flows will be safely conveyed on roads towards the SWM pond.

392 Second Street Site has a temporary proposed connection to the Second Street storm sewer and a future proposed connection to the 390 Second Street Phase 1 storm sewers. Storm sewers will be sized to allow for 392 Second Street flows to outlet to the regional SWM pond once it has been constructed.

A temporary wet SWM pond is considered for Phase 1 and sized for Phase 1 lands. Quantity and quality controls will be provided by the wet SWM pond. Conceptual storm servicing plan is presented in Figure 4.

SWM servicing design design will be updated based on the Block layouts (from the future concept plan/site plan) in the detailed design stage.

4.0 STORMWATER MANAGEMENT APPROACH

The following sections will:

- Recommend a comprehensive plan to deal with stormwater runoff from the site which meet the standards of Strathroy-Caradoc and St. Clair Region Conservation Authority;
- Identify the pre-development flows and determine the required volumetric size of the SWM pond for quantity and quality control;
- Evaluate the performance of the proposed facilities based on the single event design storms used by the Strathroy-Caradoc (i.e. 2, 5, 10, 25, 50, 100, and 250 year);

4.1 Pre-Development Conditions

4.1.1 Hydrologic Modelling

Pre-development peak flow rates were determined by the single event hydrologic modeling program Visual OTTHYMO (VO). This program allows the user to analyze the impact on new and existing systems, using accepted rainfall data to represent design storms of various durations and aid in the design of the SWM facilities. Parameter selection for the model is discussed below.

4.1.2 Curve Number

Referring to the Ministry of Agriculture, Food and Rural Affairs map, the Site soils have been classified as a hydrologic soil group ‘C’ (soil label ‘Beverly’).

Curve numbers for the pervious areas under pre- and post-development conditions were selected per the MTO Drainage Management Manual Design Chart 1.09: Soil/Land Use Curve Numbers. The following conditions are applied:

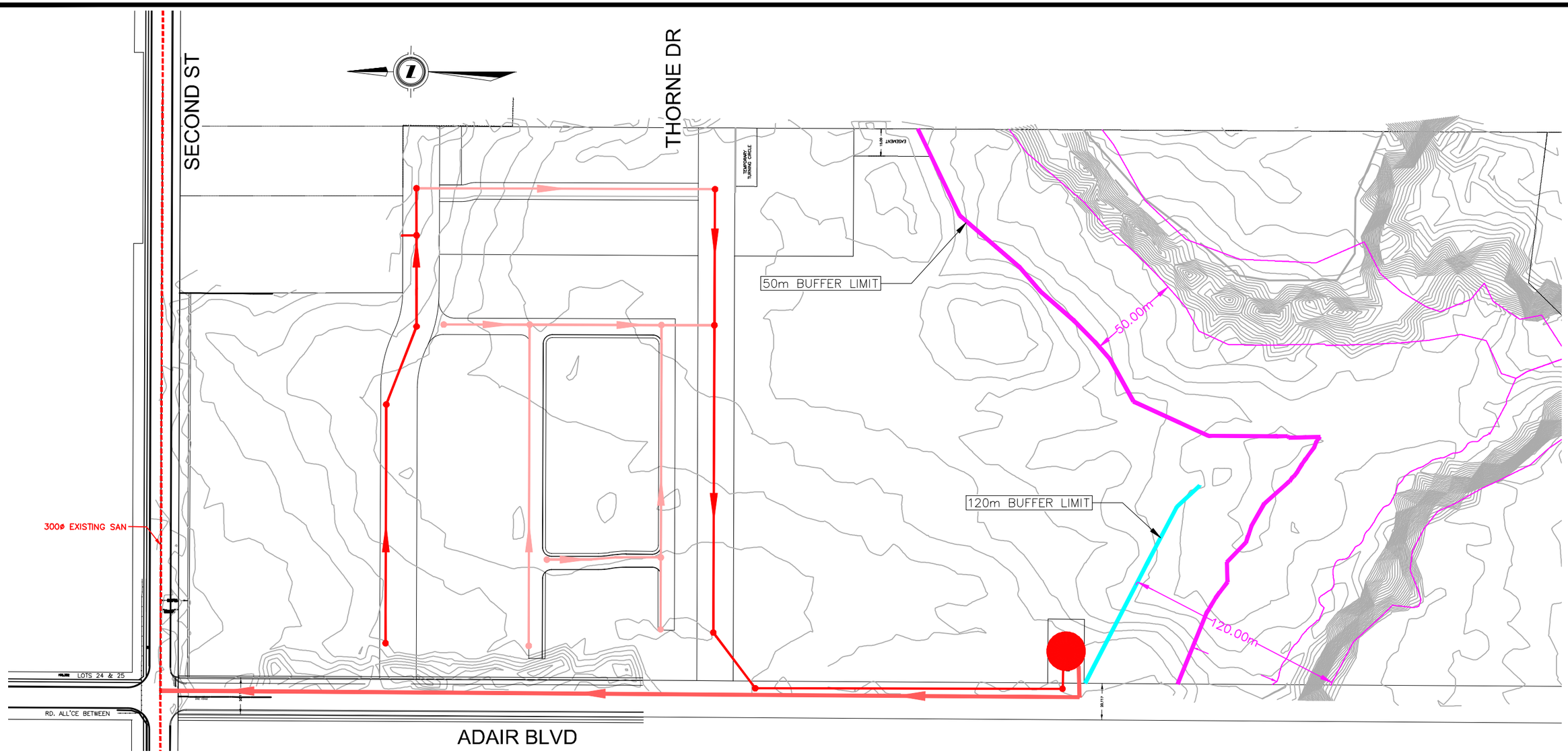
- For Agricultural Lands, it was assumed that row crops were implemented and the soils were in good hydrologic condition. Based on these assumptions, the pre-development condition was assigned a curve number of 85.
- Post-development pervious areas were assumed to be urban lawns in good hydrologic condition. Based on these assumptions, the post-development pervious surfaces were assigned a curve number of 74.

4.1.3 Initial Abstraction

Per the SCSS initial abstraction value of 8.0mm is used in the VO model for all pre-development pervious areas, 2.0mm initial abstraction for impervious surfaces. Assumed an initial abstraction of 5.0mm for post-development pervious areas.

4.1.4 Time to Peak

The Airport Method was utilized to calculate the time of concentration for the pre-development condition of the site. Time to peak is assumed to be 66.6% of the time of concentration. Based on the flow length, slope, and runoff coefficient, time of concentration was calculated to be ~118.75 min, and time to peak was calculated to be 1.32 hours. Refer to Appendix ‘C’ for detailed calculations.



LEGEND

- 50m BUFFER LINE
- FORCEMAIN
- 120m BUFFER LIMIT
- CONCEPTUAL SANITARY SEWERS
- SANITARY SEWERS
- TEMPORARY PUMPING STATION (TPS)

FIG.2

Date: DEC.8/23
Scale: 1:2200

PRELIMINARY SANITARY PLAN

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SECOND ST

THORNE DR

TEMPORARY TURNING CIRCLE

EASEMENT

50m BUFFER LIMIT

120m BUFFER LIMIT

50.00m

120.00m

CONNECTION TO EXISTING WM

400ø EXISTING WM

CONNECTION TO EXISTING WM

LOTS 24 & 25

RD. ALL'CE BETWEEN

PUMPING STATION

ADAIR BLVD

LEGEND

- 50m BUFFER LINE
- EX. WATERMAIN
- PROP. WATER MAIN
- 120m BUFFER LIMIT
- CONCEPTUAL WATER MAIN

FIG.3

Date: DEC.8/23

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WATER SUPPLY SERVICING PLAN

MTE

Engineers, Scientists, Surveyors

Project No.: 45927-100

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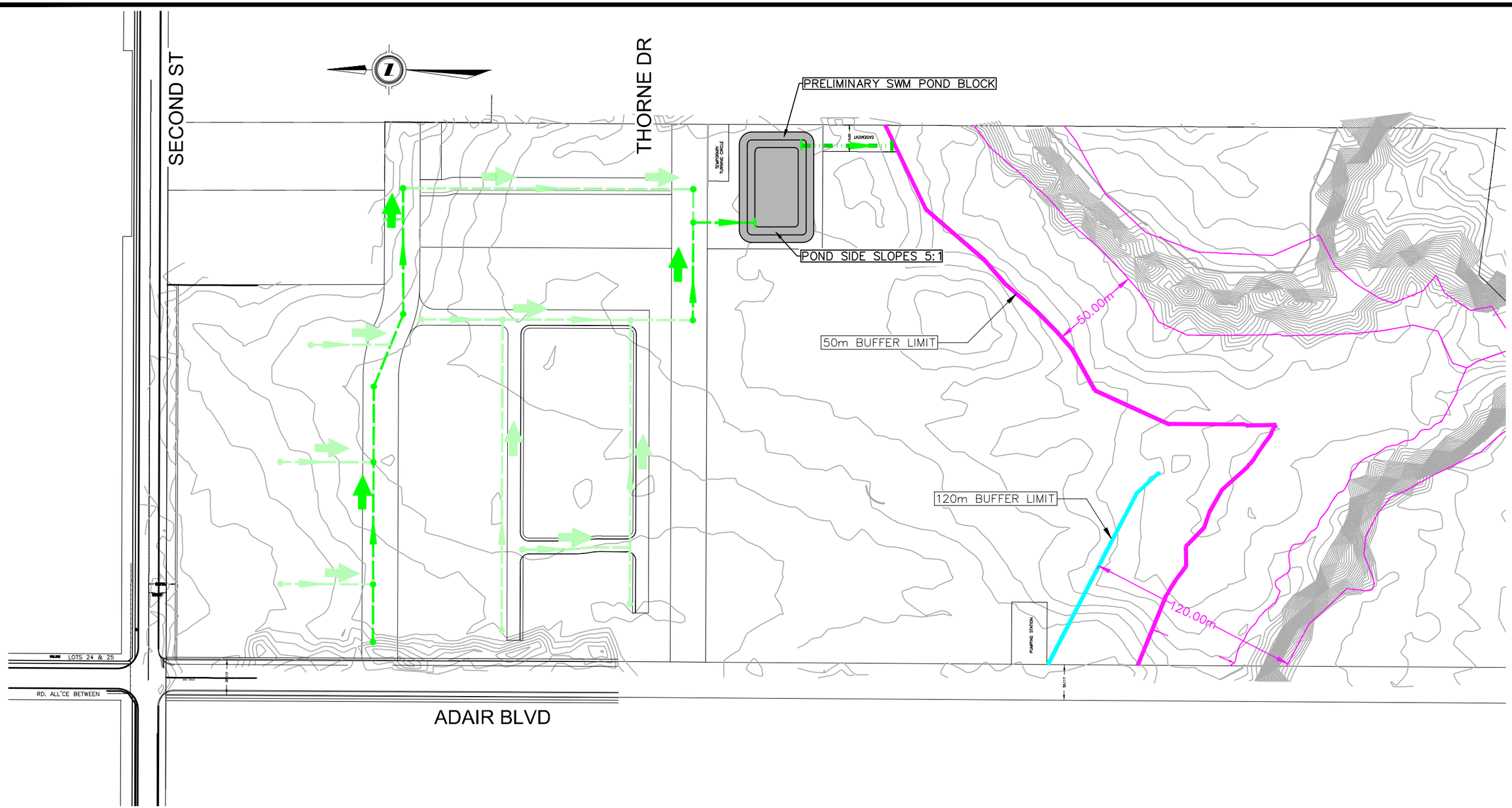

LEGEND

- 50m BUFFER LINE
- MINOR FLOW STORM SEWERS
- OVERLAND FLOW ROUTE (MAJOR STORM)
- CONCEPTUAL STORM SEWERS
- 120m BUFFER LIMIT
- SWM POND BLOCK

FIG.4

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PRELIMINARY SWM PLAN

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4.1.5 Storm Parameters

The Strathroy-Caradoc IDF curve parameters were used for the rainfall data. The 3 hour, Chicago Storm Distribution model, with a time to peak ratio of 0.33, was used for determining peak flow rates for the 2-year through 100-year storm events. SCSS parameters were used for the 250-year regional storm, with the duration of 24 hours and peak ratio of 0.33. SCSS provides an intensity-duration curve for the 2-year event. 2-year storm event A, B, and C parameters were obtained using VO IDF curve tool. A, B, and C parameters were used to create a 2-year 3 hour Chicago Storm with the peak ratio of 0.33. Please refer to Appendix 'C' for more detail.

Table 3.1 provides the VO parameters used in the hydrologic modelling. Refer to Appendix 'D' for the pre-development VO modeling input and output files.

Table 4-1 – PRE-DEVELOPMENT CALIB NASHYD INPUT

Catchment ID	Area (ha)	CN	Initial Abstraction (mm)	Time to Peak (hrs)	Time Step (min)	Description
101	8.41	85	8.0	1.32	5	Phase 1 Subdivision Lands

4.1.6 Existing Hydrology

Existing hydrologic conditions were evaluated using VO hydrologic simulation software. The 25mm storm event, 2, 5, 10, 25, 50, 100, and 250-year storm events were all modelled using design parameters outlined by Strathroy-Caradoc. The model results are summarized in the following table.

Table 4-2 – PRE-DEVELOPMENT PEAK FLOWS

Storm Event	Pre-Development Catchment 101 (m^3/s)
25mm storm	0.033
2-year	0.112
5-year	0.130
10-year	0.175
25-year	0.239
50-year	0.294
100-year	0.341
250-year	0.426

4.2 POST-DEVELOPMENT CONDITIONS AND SWM DESIGN

It is proposed to collect the post-development flows from Phase 1 and convey them towards a SWM pond south of the site that will outflow into the Creek. Minor flows of up to 2-year events will be captured and conveyed by local storm sewers, while the major flows will be safely conveyed on the roads towards the SWM pond. Roads will feature curbs and gutters for flow conveyance purposes.

A temporary wet SWM pond is proposed immediately south of Phase 1 to provide the required quantity and quality control. A SWM pond block is sized based on the volumetric water quality requirement.

4.2.1 Hydrological Modeling

Stormwater runoff was determined by the single event hydrologic modeling program VO. Currently, under the post-development scenario, it is assumed the entire area will be captured and conveyed to the SWM pond. Based on the zoning minimum landscape requirement of 30% and SCSS post-development imperviousness for the Site is 70% and directly connected imperviousness is 60%. Pervious areas have a CN curve value of 74. Initial abstraction of 2.0mm for impervious areas and 5.0mm for pervious areas. Refer to Appendix 'C' for detailed calculations. The summary of post-development catchment parameters is presented in Table 4-3.

Table 4-3 – POST-DEVELOPMENT DESIGN INPUT

Catchment ID	Area (ha)	CN	Imperviousness (%)		Time Step (min)	Slope (%)	Description
			TIMP	XIMP			
201	8.41	74	70	60	2	2	Post-development Phase 1

4.3 SWM Wet Pond Design

The SWM wet pond design will be finalized in the detailed design stage. The wet pond design will adhere to Ministry of Environment SWM Planning & Design Manual (SWMPDM) and SCSS. Wet pond will be designed with a maximum depth of 3.0 meters above the lowest point within the stormwater basin. Maximum active storage of 2.0m above the permanent pool water level, and the permanent pool depth shall range between 1.0 and 1.5 meters. A maximum slope of 5:1 is to be used around the perimeter of all permanent pools. Extended detention zone shall not exceed a depth of 1.0m above the permanent pool water level.

4.4 SWM Quantity Control

The proposed pond will be designed to attenuate the post-development peak discharges to below the pre-development rates. Phase 1 post-development peak flows are summarized in Table 4-4.

Table 4-4 – POST-DEVELOPMENT PEAK FLOWS

Storm Event	Post-Development Peak Discharges to the SWM Pond (m^3/s)
25mm storm	0.725
2-year	1.639
5-year	1.661
10-year	2.083
25-year	2.591
50-year	2.969
100-year	3.301
250-year	3.553

4.5 SWM Quality Control

The enhanced level of stormwater quality control of 80% total suspended solids (TSS) is required. Per the SWMPDM, the required storage volume to achieve enhanced protection level of the subject site is 100 m^3/ha based on the area and imperviousness. Therefore, the required permanent pool volume is approximately 1,556 m^3 and the required extended detention volume is approximately 336 m^3. The wet pond permanent pool volume and extended detention volume will be finalized in the detailed design stage according to the required storage volumes. A detention time of 24 hours will be targeted.

5.0 CONCLUSIONS

Based on the foregoing analysis, it is concluded that:

- The proposed grading design will respect the boundary conditions and facilitate the conveyance of the flows to the existing watercourses south of the site.
- Domestic water will be provided by two connections to the existing infrastructure on Second Street. Any required infrastructure will be designed at the detailed design stage.
- Sanitary flows will be conveyed south to a sanitary pumping station that will pump the flows through a forcemain to the existing sanitary sewer on Second Street.
- A temporary wet SWM pond will provide the quantity and quality control. Major and minor flows will be conveyed to the SWM pond.

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

All of which is respectfully submitted,

MTE Consultants Inc.

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Appendix A

Preliminary Geotechnical Investigation

PROPOSED STRATHROY SUBDIVISION

Preliminary Geotechnical Investigation

Project Location:
390 Second Street
Strathroy, ON

Prepared for:
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May 21, 2019

MTE File No.: 45927-100

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TABLES

APPENDICES

1.0 INTRODUCTION

MTE Consultants Inc. (MTE) was retained by 2503544 Ontario Inc. to conduct a preliminary geotechnical investigation for a proposed residential subdivision at 390 Second Street in Strathroy, Ontario, as shown on **Figure 1 in Appendix A**. The property is currently an agricultural field.

The property is bordered to the north by Second Street; to the east by a residential lot and agricultural fields; to the south by a forested area and golf course; and to the west by agricultural fields. The ground surface at the site gradually slopes towards the south with elevations ranging from 235.5 metres (m) near Second Street to 232.8 m at the south end of the property. No detailed design information was available at the time of preparing this preliminary report.

The purpose of this preliminary geotechnical investigation is to determine the soil and groundwater conditions in the area of the proposed development and provide preliminary geotechnical engineering recommendations for site grading, site servicing, foundations, basements, floor slabs, pavement design, subdrainage requirements, and preliminary stormwater infiltration.

2.0 FIELD AND LABORATORY PROGRAM

The fieldwork for this investigation was carried out on May 14, 2019 and involved the excavation of eight test pits (TP101-19 to TP108-19) to a depth of 3.0 to 3.6 m below existing grade. The locations of the test pits are shown on the Site Plan, **Figure 2 in Appendix A**.

The test pits were advanced with a backhoe supplied by the client. Upon completion of excavation, the test pits were backfilled with soil cuttings in accordance with Ontario Regulation 468/10 (formerly O. Reg. 903) under the provinces Water Resources Act.

The fieldwork was monitored throughout by a member of our geotechnical engineering staff, who directed the excavation procedures; documented the soil stratigraphies; and monitored the groundwater conditions.

The ground surface elevations at the test pit locations were surveyed by MTE and referenced to geodetic datum.

3.0 SOIL CONDITIONS

Reference is provided to the appended test pit logs for soil stratigraphy details, and groundwater observations. Soil conditions encountered at the site typically include topsoil overlying native clayey silt, sandy silt, silty sand and sand deposits.

3.1 Topsoil

Topsoil was encountered surficially in all of the test pits and was 250 to 400 millimetres (mm) thick at the test pit locations (average = 315 mm). The composition of the topsoil was typically dark brown/black silty sand with surficial organics and was moist to very moist at the time of the fieldwork. Topsoil was determined through visual observation and no nutrient testing for

applicable plant growth was performed as part of the scope of work for this project.

3.2 Clayey Silt

Clayey silt deposits were encountered beneath the topsoil in test pits TP101-19, TP103-19, TP105-19 and TP106-19. The clayey silt layers were about 0.7 to 1.0 m thick at the test pit locations.

3.3 Sandy Silt

Sandy silt deposits were encountered beneath the topsoil in TP102-19 and TP104-19 and were approximately 0.7 and 0.8 m thick.

3.4 Silty Sand

A 1.0 m thick layer of silty sand was encountered beneath the clayey silt in TP103-19.

3.5 Sand

Sand deposits were encountered beneath the topsoil in TP107-19 and TP108-19, beneath the clayey silt in TP101-19, TP105-19 and TP106-19, beneath the sandy silt in TP102-19 and TP104-19 and beneath the silty sand in TP103-19. The sand deposits extend to the termination depth of each test pit. The sand typically contained trace to some amounts of silt and was fine to medium grained.

4.0 GROUNDWATER CONDITIONS

Groundwater observations were carried out in the open test pits at the time of excavation and are summarized on the test pit logs. No free groundwater was observed in any of the test pits at the time of the fieldwork on May 14, 2019.

It should be noted that the groundwater levels can vary and are subject to seasonal fluctuations and local variations.

5.0 DISCUSSION AND RECOMMENDATIONS

5.1 General

The project involves the design of a proposed subdivision development located at 390 Second Street in Strathroy, Ontario. It is understood that the proposed residential lots will have full municipal services and a new roadway is proposed to provide access from Second Street. No detailed design information was available at the time of preparing this preliminary report.

The subsurface stratigraphy at the site generally comprises topsoil overlying clayey silt, sandy silt, silty sand and an extensive sand deposit. No free groundwater was observed in the test pits during excavation on May 14, 2019.

Based on the results of this preliminary geotechnical investigation, the site is considered suitable for the proposed development. The following subsections of this report contain preliminary geotechnical recommendations pertaining to development of the property including

site grading, site servicing, foundations, basements, floor slabs, pavement design, subdrainage requirements, and stormwater infiltration.

5.2 Site Preparation

The first construction activity that will be required for the proposed development will be grading. Prior to carrying out any cutting and engineering fill operations, the surficial topsoil must be removed from these areas and stockpiled. The average topsoil thickness measured in the test pits is 315 mm. It is recommended the average topsoil thickness across the site be increased by 50 mm for removal/stripping calculations to account for variations at the site. The topsoil could be used in landscaping areas.

The majority of the native soils above the groundwater table are suitable for reuse as engineered fill. All fill should be placed in maximum 300 mm thick lifts and compacted to the following percentages;

TABLE 1 - ENGINEERED FILL REQUIREMENTS

Fill Use	Minimum Compaction Required
Structural fill to support buildings	100% SPMDD
Subgrade fill beneath pavements or services	95% SPMDD
Bulk fill in landscape areas	90% SPMDD

The subgrade soils are susceptible to disturbance and it is recommended that construction traffic on the subgrade be minimized.

Structural fill used for raising grades beneath the residential buildings should comprise granular material. Subgrade fill material beneath the proposed pavement areas and services should meet the requirements of Ontario Provincial Standard Specifications (OPSS) Select Subgrade Material. Any imported fill should be tested and verified by a geotechnical engineer prior to placement.

Structural fill pads should extend a minimum 0.3 m beyond the edge of the footing envelope of any building and down to subgrade at an angle of 45 degrees to the horizontal. Full time testing by geotechnical personnel is recommended during fill placement and compaction to monitor material quality, lift thickness, and verify the compaction by insitu density testing.

In order to minimize the effects of weather and groundwater, fill operations onsite should be carried out in the dry summer months.

5.3 Site Servicing

5.3.1 Excavations and Dewatering

The development will be serviced to provide the individual lots with full municipal services. It is understood that the invert levels for the watermain and sanitary sewers will be at conventional depths.

Temporary excavations to depths for installation of underground pipes and foundations at this site must comply with the Ontario Occupational Health and Safety Act and Regulations for Construction Projects. The predominate soils encountered in the test pits would be classified as

Type 3 soils (O. Reg. 213/91, s. 226 (4)). Temporary side slopes must be cut at an inclination of 1.0 horizontal to 1.0 vertical or less from the base of the excavation for open cut pipe installation and foundations, exclusive of groundwater effects.

Trench side slopes must be continuously inspected especially after periods of heavy rainfall or snow melt to identify areas of instability. Surface water should be directed away from entering the trench.

Minor groundwater seepage could occur perched within the upper silty sand and sandy silt deposits; however, it is anticipated that conventional sump pumping techniques will be sufficient to control the inflow. It will be necessary to flatten the excavation side slopes where groundwater seepage is occurring to ensure stability. Every excavation that a worker may be required to enter shall be kept reasonably free of water (O. Reg. 213/91, s. 230).

5.3.2 Pipe Bedding

It is anticipated invert elevation of the pipes will be at conventional 2 to 3 m depths below ground surface. No bearing problems are anticipated for pipes set on native inorganic subsoil or imported structural fill. The bedding material may need to be thickened if sub-excavation encounters soft or spongy soil from the base of the service trench.

Pipe bedding for water and sewer services should be conventional Class 'B' pipe bedding comprising a minimum 150 mm thick layer of OPSS Granular 'A' aggregate below the pipe invert. Granular 'A' type aggregate should be provided around the pipe to at least 300 mm above the pipe and the bedding aggregate should be compacted to a minimum 95% standard Proctor maximum dry density (SPMDD).

5.3.3 Trench Backfilling

The trenches above the specified pipe bedding should be backfilled with inorganic onsite soils placed in 300 mm thick lifts and compacted to at least 95% SPMDD. Any additional material required at the site should comprise imported granular soils such as OPSS Select Subgrade Material.

To minimize potential problems, backfilling operations should follow closely after excavation so that only a minimal length of trench is exposed. Care should be taken to protect side slopes of excavations by diverting surface run-off away from the excavations. If construction extends into the winter, then additional steps should be taken to minimize frost and ensure that frozen material is not used as backfill.

5.4 Pavements

It is understood pavements will be constructed for the proposed roadways at the site. The pavement subgrade soils will comprise native inorganic soils or imported structural fill.

The following table provides pavement structure components for construction on a properly shaped and prepared subgrade as per Benkelman Beam spring rebound coefficients for silt and sand subgrades for residential local roadways.

TABLE 2 - PAVEMENT DESIGN

Pavement Component	Local Residential Streets	Heavy Duty Areas
Asphalt Hot Mix	90 mm	110 mm
OPSS 1010 Granular 'A' Base	150 mm	150 mm
OPSS 1010 Granular 'B' Subbase	300 mm	400 mm

Heavy duty pavement designs should be used in areas of frequent large vehicle traffic such as garbage trucks or fire truck turn arounds.

Samples of aggregates should be checked for conformance to OPSS 1010 prior to utilization on site and during construction. The Granular 'B' subbase and Granular 'A' base courses must be compacted to 100% SPMDD, as verified by insitu density testing.

The asphaltic concrete paving materials should conform to the requirements of OPSS 1150. The asphalt should be placed and compacted in accordance with OPSS 310.

The asphaltic concrete should comprise 40 mm of HL3 surface asphalt over 50 mm of HL8 binder asphalt for the local residential streets pavement option and 50 mm of HL3 surface asphalt over 60 mm of HL8 binder asphalt for the heavy duty pavement option.

Subdrains are required where the subgrade soils comprise clay materials in accordance with the Municipality of Strathroy-Caradoc Servicing Standards dated October 2016. The locations where subdrains will be required should be confirmed onsite during construction by a geotechnical engineer. The work of subdrain installation shall be in accordance with OPSS 405 and OPSD 216.021. The subdrain shall be 100 or 150 mm diameter perforated pipe conforming to OPSS 1801 or 1840, and wrapped with geotextile conforming to OPSS 1860.

The pavement design is based on the assumption that construction will be carried out during the drier time of the year and that the subgrade soil is stable as determined by proof-rolling inspected by a geotechnical engineer. If the subgrade is wet and unstable, additional granular subbase may be required.

All materials and construction services required for the work should be in accordance with the relevant sections of the Ontario Provincial Standard Specifications.

5.5 Curbs and Gutter and Sidewalks

The concrete for curbs, gutters and sidewalks should be proportioned, mixed, placed and cured in accordance with the requirements of OPSS 353, and OPSS 1350 and shall meet the following specific requirements (OPSS 353.05.01), as per the Municipality of Strathroy-Caradoc Servicing Standards, dated October, 2016:

- Minimum compressive strength = 30 MPa at 28 days
- Coarse aggregate = 19.0 mm nominal max. size
- Maximum slump = 60 mm for curb and gutter, 70 mm for sidewalks
- Air entrainment = 6.0 ± 1.0%

During cold weather, any freshly placed concrete must be covered with insulating blankets to protect against freezing as per OPSS 904. Three cylinders from each days pour should be taken for compressive strength testing. Air entrainment, temperature and slump tests should be conducted on the same batch of concrete from the test cylinders made.

5.6 Residential Foundation Design

It is understood that the proposed house designs may be constructed with full basements.

In general, the undisturbed native sand deposits or approved structural fill is considered suitable to support house foundations. The bearing capacity of the soils should be investigated in further detail in a more detailed geotechnical report following the detailed design of the proposed development.

The soil in trenches beneath footings for sewer and watermain services shall be compacted by tamping up to the level of the footing base, or shall be filled with concrete having a strength not less than 10 MPa, to support the footing.

The footing areas must be inspected by a geotechnical engineer to ensure that the soil conditions encountered at the time of construction are suitable to support the design resistances prior to pouring concrete. Any loose, disturbed, organic and deleterious material identified during the inspection should be removed from the footing areas and replaced with structural fill or concrete.

All exterior floor slabs and footings in unheated areas must be provided with a minimum 1.2 m of earth cover after final grading in order to minimize the potential of damage due to frost action. If construction is undertaken during the winter, the subgrade soil and concrete should be protected from freezing.

Where spread footings are constructed at different elevations, the difference in elevation in the individual footing should not be greater than one half of the clear distance between the footings. The lower footing should be constructed first so that if it is necessary to construct the lower footings at a greater depth than anticipated, the elevation of the upper footings can be adjusted accordingly. Stepped strip footings should be constructed in accordance with OBC Section 9.15.3.8.

A Site Classification ‘D’ should be used for earthquake load and effects in accordance with Table 4.1.8.4.A. of the 2012 Ontario Building Code.

In general, the native soils excavated from the foundation trench areas will be suitable for reuse as foundation wall backfill. The backfill should be placed in 300 mm thick lifts and compacted to at least 95% SPMDD on the outside of the building; and 100% SPMDD on the inside of the building. The backfill must be brought up evenly on both sides of walls not designed to resist lateral earth pressure.

The water to cement ratio and slump of the concrete utilized in the floor slab should be strictly controlled to minimize shrinkage of the slab. Control joints should be sawed into the slabs at regular intervals within 12 hours of initial concrete placement in order to pre-locate shrinkage cracks.

Concrete testing should be performed onsite to determine the slump, temperature, and air entrainment; and concrete cylinders should be cast for compressive strength testing.

5.6.1 Basements

Basements at this site must be provided with perimeter weeping tile systems as per the Ontario Building Code (Section 9.14). The drain tile or pipe should be laid on undisturbed or well-compacted soil so that the top of the tile or pipe (minimum 100 mm diameter) is below the bottom of the basement floor slab. The top and sides of the drain tile or pipe shall be surrounded with not less than 150 mm of crushed stone or other clean coarse granular material containing no more than 10% of material that will pass the 4 mm sieve. The crushed stone should be wrapped with filter cloth. The weeping tile must drain to a suitable frost-free outlet or sump equipped with an automatic pump that will discharge water into a storm sewer service.

The portion of the exterior basement wall and floor slab below finished ground level must be waterproofed as per the Ontario Building Code (Subsection 9.13.3). Free-draining sand materials should be used for basement wall backfill. The basement wall backfill should be graded to allow drainage away from the foundation.

The basement walls should be designed to resist the lateral earth pressure. For calculating the lateral earth pressure, the coefficient of earth pressure (K) may be assumed as 0.50 for cohesionless sandy soils and 1.0 for silt and clay (Section 24.12.3.3 Canadian Foundation Engineering Manual). The bulk unit weight of the retained backfill may be taken as 21 kN/m^3 for well-compacted soil. An appropriate factor of safety should be employed.

The subgrade for the basement floor slabs should comprise undisturbed native soil or well-compacted fill. A minimum 100 mm thick layer of coarse clean granular material containing not more than 10% material that will pass a 4 mm sieve shall be placed beneath slabs in houses as per Subsection 9.16.2 of the Ontario Building Code. If the subgrade soil is wet, we strongly recommend that subfloor weeping tiles be placed and connected to the sump pit.

If a moisture-sensitive floor finish is to be applied to the slab, then we recommend that a 15 mil polyethylene moisture vapour barrier be installed directly beneath the slab as per Article 9.13.2.7 of the Ontario Building Code. The purpose of the vapour barrier is to reduce moisture transfer by diffusion as per Article 5.5.1.2 of the Ontario Building Code. Joints in the vapour barrier should be lapped not less than 100 mm.

Concrete testing should be performed onsite to determine the slump, temperature, and air entrainment; and concrete cylinders should be cast for compressive strength testing.

5.7 Stormwater Infiltration

At-source infiltration of stormwater runoff from the proposed development may be considered for this site. Soak-away pits generally require soils with a minimum percolation rate of 15 mm/hr and a minimum separation between the bottom of the pit and the seasonally high water table of 1 m (MOE, 2003). No laboratory testing was performed on the excavated material at the site during the preliminary investigation field work.

Based on the soil conditions encountered in the test pits, the native sand soils at the site below a depth of about 1.0 m are considered suitable for potential infiltration at the site. Any infiltration gallery must be constructed at least 5 m from any structure and the base of the gallery at least 1 m below any foundation. Detailed infiltration calculations can be performed as part of the detailed geotechnical report for the site.

6.0 ADDITIONAL INVESTIGATION AND CONSTRUCTION INSPECTION AND TESTING

A full detailed geotechnical report, including boreholes and laboratory testing, should be undertaken once the detailed design of the proposed development is completed. The detailed report will provide in-depth soil testing, bearing capacity values for the native soils and infiltration calculations for LID measures. MTE recommends that geotechnical inspection and testing procedures be conducted throughout the various construction phases of the project.

Engineer site visits should be conducted to confirm geotechnical bearing resistances for footings. Soil compaction testing should be carried out on structural fill beneath the residential buildings, foundation wall backfill, subslab granular fill, and trench backfill. Laboratory and field testing of the pavement structure components (granulars and asphaltic concrete) should be conducted, as well as concrete testing for foundations, curbs and sidewalks.

MTE offers soil compaction, concrete, and asphalt testing and soil inspection services through our Stratford and London offices.

7.0 LIMITATIONS OF REPORT

Services performed by **MTE Consultants Inc.** (MTE) were conducted in a manner consistent with the level of care and skill ordinarily exercised by members of the Geotechnical Engineering & Consulting profession practicing under similar conditions in the same geographic area were the services are provided. No other warranty or representation expressed or implied as to the accuracy of the information, conclusions or recommendations is included or intended in this report.

This report was completed for the sole use of the Client. This report is not intended to be exhaustive in scope or to imply a risk-free site. As such, this report may not deal with all issues potentially applicable to the site and may omit aspects which are or may be of interest to the reader.

In addition, it should be recognized that a soil sample result represents one distinct portion of a site at the time it is collected, and that the findings of this report are based on conditions as they existed during the time period of the investigation. The material in the report reflects our best judgment using the information available at the time the report was written. The soil and groundwater conditions between and beyond the test holes may differ from those encountered in the test holes. Should subsurface conditions arise that are different from those in the test holes MTE should be notified to determine whether or not changes should be made as a result of these conditions.

It should be recognized that the passage of time may affect the views, conclusions and recommendations (if any) provided in this report because groundwater conditions of a property

can change, along with regulatory requirements. All design details were not known at the time of submission of this report and it is recommended MTE should be retained to review the final design documents prior to construction to confirm they are consistent with our report recommendations. Should additional or new information become available, MTE recommends that it be brought to our attention in order that we may determine whether it affects the contents of this report.

Any use which another party makes of this report, or any reliance on, or decisions to be made based upon it, are the responsibility of such parties. MTE accepts no responsibility for liabilities incurred by or damages, if any, suffered by another party as a result of decisions made or actions taken, based upon this report. Others with interest in the site should undertake their own investigations and studies to determine how or if the condition affects them or their plans. The contractors bidding on this project or undertaking the construction should make their own interpretation of the factual information and draw their own conclusions as to how subsurface conditions may affect their work.

The benchmark and elevations provided in this report are primarily established to identify differences between the test hole locations and should not be used for other purposes such as, planning, development, grading, and excavation.

Respectfully submitted,

MTE CONSULTANTS INC.

Brett Thorner, P.Eng.
Geotechnical Engineer

Dan Gonser. P.Eng.
Geotechnical Engineer

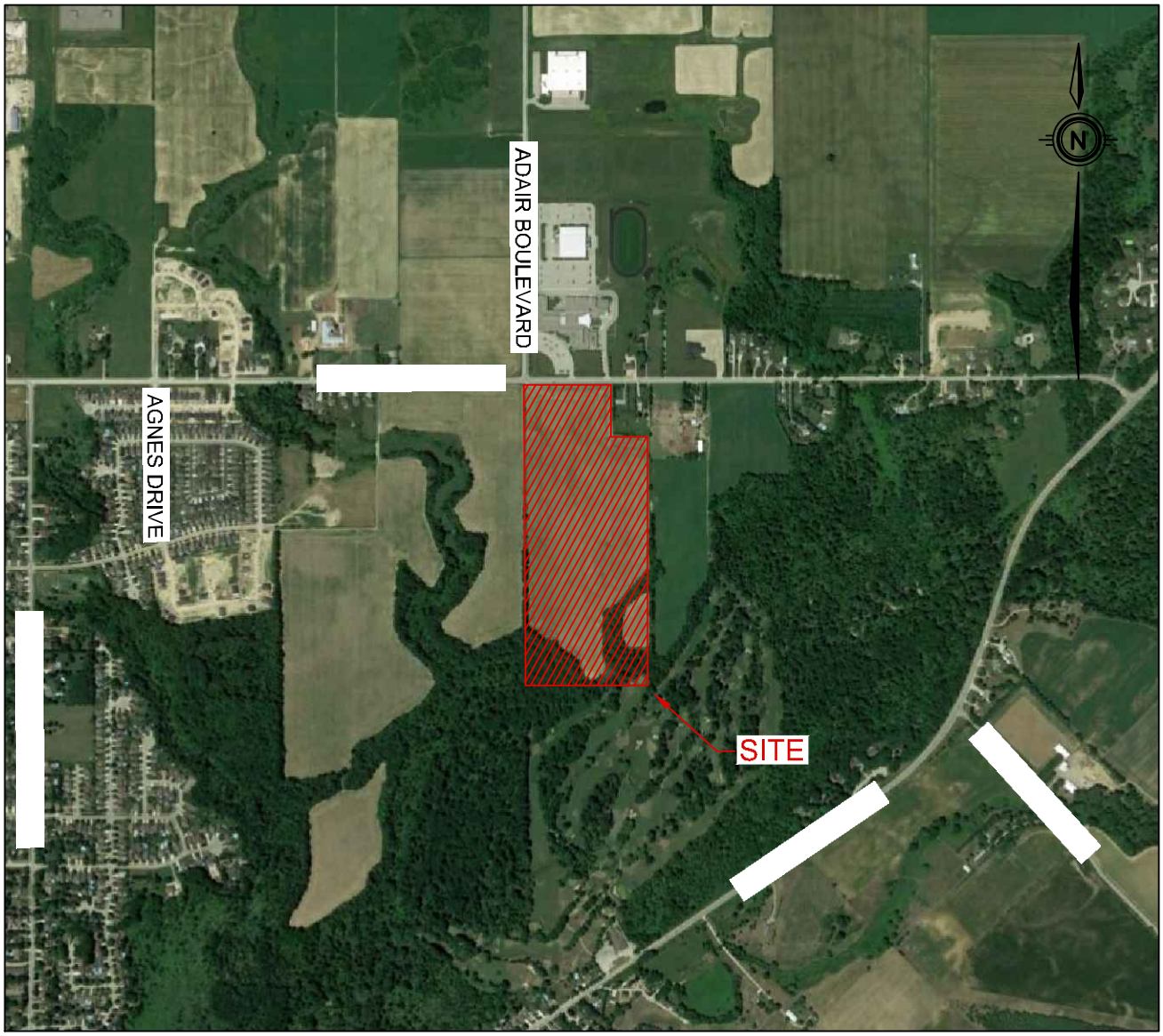
BXT:DMG:

APPENDIX A

FIGURES

Figure 1- Location Plan
Figure 2 - Site Plan

FIGURE 1 - LOC-TION PL- Project: 45927-100 C-D: P:\P\45927\100\BH FIGURES\45927-100-BHFIGURES-CDP-16_05_2019.DWG



REFERENCES:

- AERIAL IMAGE FROM GOOGLE EARTH PRO.

MTE
Engineers |Scientists |Surveyors

LO□□TIO□ PL□□

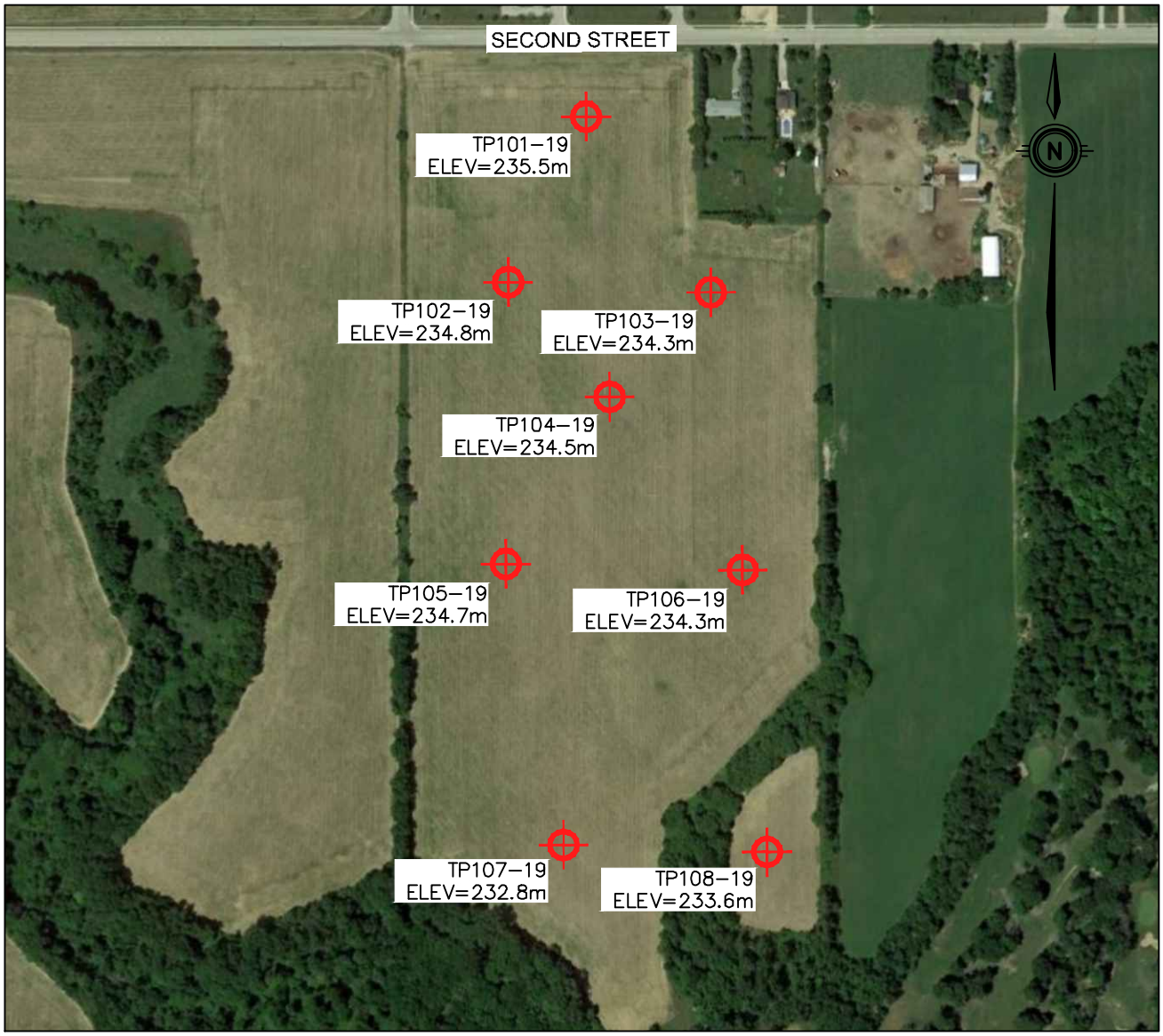
Project Name

S□□DIVISIO□ PR□LIMI□□R□ I□V□STI□□TIO□

Site	Client
390 SECOND STREET, STRATHROY, ON	2503544 ONTARIO INC.

Scale. (8.5x11)	MTE Project No.	Date	Figure No.
N.T.S.	45927-100	MAY 16, 2019	□

FIGURE 2 - SITE PLAN Project: 45927-100 CAD: P:\P\45927\100\BH FIGURES\45927-100-BHFIGURES-CDP-16_05_2019.DWG



LEGEND

TP101-19 MTE TEST PIT

REFERENCES:

- AERIAL IMAGE FROM GOOGLE EARTH PRO.
- TEST PIT LOCATIONS S□RVEYED BY MTE.

MTE
Engineers | Scientists | Surveyors

SIT□ PL□□

Project Name
S□□DIVISIO□ PR□LIMI□□R□ I□V□STI□□TIO□

Site	Client
390 SECOND STREET, STRATHROY, ON	2503544 ONTARIO INC.

Scale. (8.5x11)	MTE Project No.	Date	Figure No.
1:5000	45927-100	MAY 16, 2019	□

APPENDIX B

TEST PIT LOGS

Table 101

TABLE 101

SUMMARY OF TEST PITS

Proposed Strathroy Subdivision
2503544 Ontario Inc.
390 Second Street, Strathroy, ON

TEST PIT	ELEVATION	DEPTH (m)	DESCRIPTION	REMARKS
TP101-19	235.5	0.00 to 0.30	Brown silty sand **TOPSOIL**	Test pit dry during excavation.
		0.30 to 1.30	Brown **CLAYEY SILT**, some sand	
		1.30 to 3.40	Brown **SAND**, fine to medium, trace to some silt	
TP102-19	234.8	0.00 to 0.25	Brown silty sand **TOPSOIL**	Test pit dry during excavation.
		0.25 to 0.90	Brown **SANDY SILT**, trace clay	
		0.90 to 3.20	Brown **SAND**, fine to medium, trace to some silt	
TP103-19	234.3	0.00 to 0.40	Brown silty sand **TOPSOIL**	Test pit dry during excavation.
		0.40 to 1.05	Brown **CLAYEY SILT**, some sand	
		1.05 to 2.00	Brown **SILTY SAND**	
		2.00 to 3.40	Brown **SAND**, fine to medium, trace to some silt	
TP104-19	234.5	0.00 to 0.30	Brown silty sand **TOPSOIL**	Test pit dry during excavation.
		0.30 to 1.05	Brown **SANDY SILT**, some clay	Some caving of sands at 2.0m.
		1.05 to 3.00	Brown **SAND**, fine to medium, trace to some silt	
TP105-19	234.7	0.00 to 0.30	Brown silty sand **TOPSOIL**	Test pit dry during excavation.
		0.30 to 1.15	Brown **CLAYEY SILT**, some sand	
		1.15 to 3.60	Brown **SAND**, fine to medium, trace to some silt	
TP106-19	234.3	0.00 to 0.30	Brown silty sand **TOPSOIL**	Test pit dry during excavation.
		0.30 to 1.10	Brown **CLAYEY SILT**, some sand	
		1.10 to 3.20	Brown **SAND**, fine to medium, trace to some silt	
TP107-19	232.8	0.00 to 0.40	Brown silty sand **TOPSOIL**	Test pit dry during excavation.
		0.40 to 3.00	Brown **SAND**, fine to medium, trace to some silt	
TP108-19	233.6	0.00 to 0.25	Brown silty sand **TOPSOIL**	Test pit dry during excavation.
		0.25 to 3.20	Brown **SAND**, fine to medium, trace to some silt	

NOTES:
1. Test pits excavated on May 14, 2019, see Figure 2 for test pit locations.
2. Table to be read in conjunction with accompanying report.

Appendix B

Hydrogeological Assessment

Emil Pattyn

Hydrogeological Assessment

Project Name
Proposed Residential Development
Adair Boulevard and Second Street
Strathroy, Ontario

Project Number
LON-21001218-A0

Prepared By:
EXP Services Inc.
15701 Robin's Hill Road
London, ON N5V 0A5
Canada

Date Submitted
November 19, 2021
Updated April 11, 2022

Emil Pattyn

Hydrogeological Assessment

Project Name:
Proposed Residential Development
Adair Boulevard and Second Street
Strathroy, Ontario

Project Number:
LON-21001218-A0

Prepared By:
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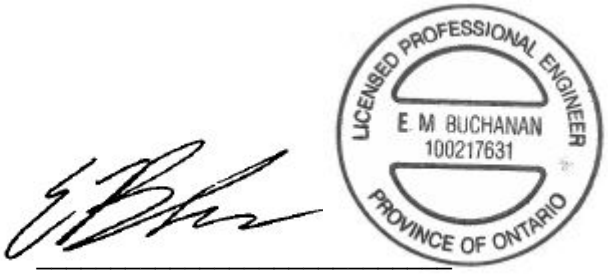
Jasneel Mahal, M. Sc., G.I.T.
Earth and Environment



Eric Buchanan, P.Eng.
Earth and Environment

Botel Chiu, M.Eng., P.Eng.
Vice President, Earth and Environment
Southwestern Ontario

Date Submitted:
November 19, 2021
Updated April 11, 2022

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1 Introduction and Background

1.1 Background

EXP Services Inc. (EXP) was retained by **Emil Pattyn** to complete a Hydrogeological Assessment of the proposed residential development located at Adair Boulevard and Second Street (County Road 33) in Strathroy, Ontario, hereinafter referred to as the 'Site' (**Drawing 1**).

This report provides a preliminary assessment of the hydrogeological characteristics of the Site, including soil conditions, groundwater flow and quality, as well as an assessment of potential impacts to the groundwater as a result of the proposed development. The objective of the assessment is to examine and summarize the hydrogeological characteristics of the subject Site by reviewing available information on the geological and hydrogeological characteristics of the area, the Ontario Ministry of the Environment, Conservation and Parks (MECP) Water Well Records (WWR) and soil and groundwater information provided from a series of sampled boreholes, and monitoring wells at the subject Site. The assessment provides comments pertaining to potential impacts on hydrogeological conditions at the Site from development activities and provides design/construction measures, where applicable, to mitigate this potential for impact. This report has been prepared for submission to the Town of Strathroy as part of the detailed design for the proposed residential development.

Based on a preliminary concept plan provided by the client, it is understood that the development may include the construction of five to six storey apartment buildings, townhouse blocks, single family residences and a potential school block. The development is expected to be serviced with municipal sewer and water.

1.2 Scope of Work

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

1. Desktop Study:

   This task consisted of a review of existing information including Site plans, geological maps, groundwater level information, borehole logs, and MECP Water Well Records (WWR). The background information was used to develop a Site-specific conceptual hydrogeologic model.

2. Field Program:

   The advancement of four (4) monitoring wells was carried out as part of the hydrogeological field program. Water levels were measured, groundwater samples were collected, and single well response tests (SWRTs) were completed for the purpose of characterizing the hydrogeological conditions at the Site.

3. Data Evaluation:

   This task consisted of the evaluation of the available field and laboratory data, assessment of the dewatering requirements, potential dewatering effects on the surrounding environment and groundwater impact assessment due to construction activities as applicable.

4. 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).

2 Field Work Methods

2.1 Borehole Drilling and Monitoring Well Installation

The fieldwork (drilling program) for the Site included the completion of four (4) boreholes with installation of monitoring wells to allow for hydrogeological evaluation. Borehole drilling and monitoring well installation was completed on February 4, 2021 by London Soil Test Ltd. in London, ON under the technical supervision of EXP. Boreholes were advanced to depths of about 7.6 to 9.1 m below ground surface (bgs). A summary of the well installation details is provided in **Table 1**, with well locations shown in **Drawing 1**.

Boreholes were advanced using a track-mounted drill rig and standard 15 cm (6") or 21 cm (8") OD hollow stem auger drilling techniques. During the drilling, the stratigraphy in the boreholes was examined and logged in the field by EXP personnel. Representative samples of the soil found in the boreholes were submitted for laboratory testing that included routine moisture content determinations and four (4) grain size analyses. Copies of the borehole (well) logs are provided in **Appendix A**.

Groundwater monitoring wells were installed within all boreholes. 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 wells. The well screens consisted of PVC pipe with 0.010-inch factory-generated slots. Well construction details are provided in **Table 1**.

A primary filter pack consisting of silica sand was placed around the well screen in the borehole and extended approximately 0.6 m 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 boring, was used as a seal above the filter pack to approximately 0.3 m bgs. A concrete mixture was poured on top of bentonite clay to surface after well installation to secure an aluminum protective casing.

The ground surface elevation at each borehole location was surveyed to top of spindle of fire hydrant at northeast corner of the intersection of Adair Boulevard and Second Street (Temporary Benchmark: Assumed Elevation 100.000 m) and top of pipe elevations of the monitoring wells were measured by EXP personnel.

Table 1: Monitoring Well Construction Details

Well ID	Completion Depth (m bgs)	Screen Length (m)	Assumed Ground Surface Elevation (m)	Assumed Top of Pipe Elevation (m)	Assumed Bottom of Well Elevation (m)	Screened Strata
BH1/MW	7.62	1.52	95.58	96.32	87.96	Sand
BH2/MW	7.62	1.52	95.58	96.28	87.96	Sand
BH3/MW	9.14	1.52	97.55	98.23	88.41	Sand
BH4/MW	9.14	1.52	97.88	98.57	88.74	Sand

Note: bgs denotes below ground surface.

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.

2.2 Water Level Monitoring

Water level monitoring in each monitoring well was generally completed on a seasonal basis since well installation on February 4, 2021. A total of five (5) readings were taken. Measurements were manually collected using a battery-signal water level tape.

2.3 Hydraulic Conductivity Testing

Hydraulic conductivity estimates for the soils were determined using two methods. The first method is applicable to saturated soils at depth and involves single well recovery tests (SWRTs) within an installed monitoring well. The second method involves a calculated estimation of hydraulic conductivity based on soil sample particle size analysis using the Hazen method. The two methods used for this study area described in the following subsections.

2.3.1 Single Well Response Tests (SWRTs)

Single well response tests (SWRTs) were completed on BH1/MW and BH4/MW to evaluate the hydraulic characteristics of the local overburden. The test method consisted of an initial purging of the well and subsequent monitoring the rise in the water level in the well over time. Results can be found in Section 4.5.1 and **Appendix C**.

2.3.2 Grain Size Analyses

Grain size analyses were completed on four (4) selected soil samples collected from the boreholes. Hydraulic conductivity values were determined by Hazen's or Beyer's empirical formulas. Results can be found in Section 4.5.1 and **Appendix B**.

2.4 Groundwater Sampling

Groundwater samples were collected from monitoring wells BH1/MW and BH4/MW on April 8, 2021 and May 7, 2021 to establish baseline water quality. Prior to collecting the groundwater sample for chemical analysis, the stagnant water in the well was removed ("purged") to allow groundwater representative of the aquifer to enter the well. A minimum of three casing volumes of water was purged from the well immediately prior to sampling.

The monitoring wells were purged using a rigid high-density polyethylene (HDPE) tubing fitted with Waterra™ inertial pumps. The water sample was collected by direct transfer of groundwater from the Waterra™ pumping system into appropriate pre-labelled containers, with filtering and preservation as appropriate, before submission to Bureau Veritas (BV Labs) in London, Ontario for chemical analysis. The groundwater samples were submitted for laboratory analysis of dissolved metals, cations and anions, nitrogen species (nitrate, nitrite, and ammonia), phosphate and chloride.

3 Site Description

3.1 Site Location and Description

The Site is located on the south side of Second Street near the intersection of Adair Boulevard in Strathroy, Ontario. The Site is irregular in shape and is currently used for agricultural purposes with a woodlot in the south end. It is bounded by agricultural fields to the east and west, Strathroy Collegiate Institute and Holly Cross Catholic Secondary School to the North and a golf course to the south. Several residential dwellings exist northeast of the Site. The Sydenham River Wetland Complex is located southwest of the Site with a portion in the southwest corner. The Site measures approximately 19.3 hectares in area.

Based on a preliminary concept plan provided by the client, it is understood that the development may include the construction of five to six storey apartment buildings, townhouse blocks, single family residences and a potential school block. The development is expected to be serviced with municipal sewer and water.

3.2 Site Geology

3.3.1 Bedrock Geology

The Site is underlain by Middle Devonian aged shale bedrock of the Hamilton Group (OGS, 2011). This group consists of 80 to 300 feet (24 to 91 m) of mostly grey shale interbedded with grey crystalline cherty limestone (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 indicates the bedrock surface at an elevation of about 160 m (525 feet) to 168 m (550 feet) near the Site. Regionally, the bedrock surface generally slopes to the south in this area.

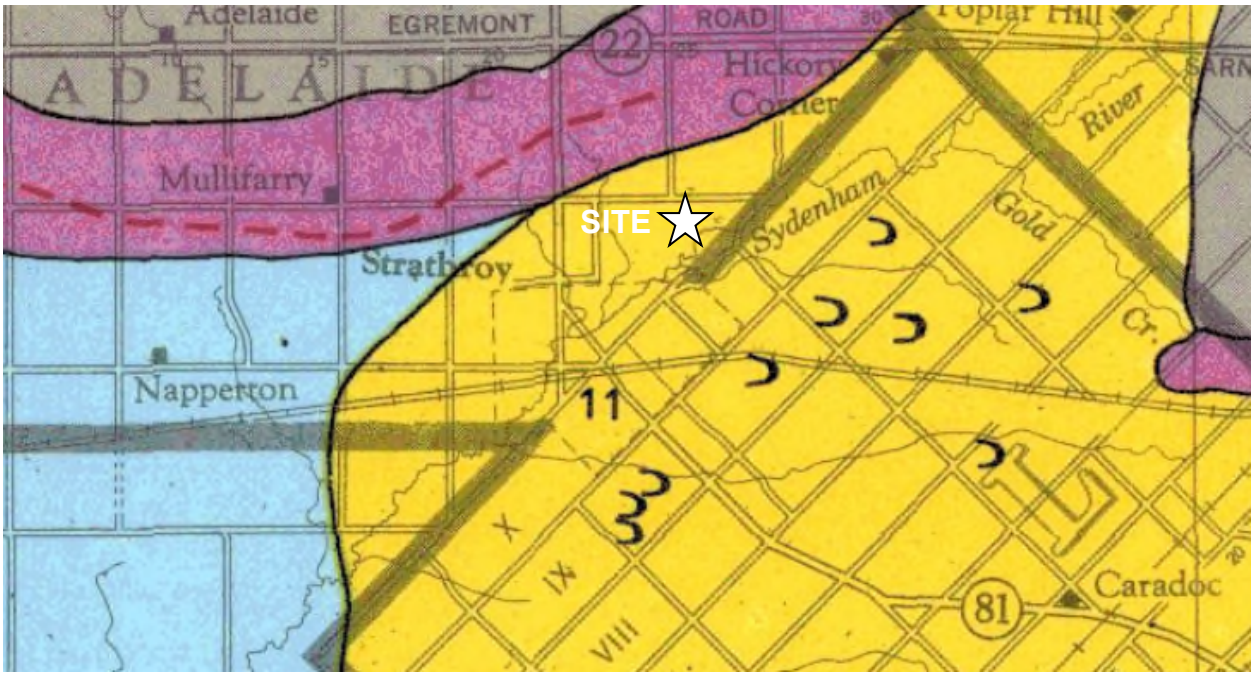
Review of MECP Water Well Records for the area indicate that none of the wells within 500 m of the Site intersected bedrock. Bedrock was not encountered during the investigation completed at the Site.

3.3.2 Physiography and 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.

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.

The surficial deposits were mapped and categorized into several physiographic regions by Chapman and Putnam (1984). The physiographic regional mapping for the area indicates that the Site is situated within the Caradoc Sand Plains and London Annex (Chapman and Putnam, 1984).



Review of physiographic landform mapping, above, indicates that the Site is located within sand plains. Quaternary mapping completed by Barnett *et. al.* (1981) indicates that the quaternary geology at the Site consists of glaciolacustrine deposits. The glaciolacustrine deposits are characterized by silt and clay, minor sand; basin and quiet water deposits.

Surficial geology at the Site has been described as being coarse textured glaciolacustrine deposits consisting of sand, gravel, minor silt and clay across the Site.

3.3.3 Site Specific Surficial Geology

The detailed stratigraphy encountered in the boreholes is shown in the borehole logs found in **Appendix A** and is summarized below. It must be noted that boundaries of soil indicated in the borehole logs are inferred from non-continuous sampling and observations during drilling. These boundaries are intended to reflect transition zones for the purposes of geotechnical design and should not be interpreted as exact planes of geological change.

Topsoil

All boreholes were surfaced with a layer of topsoil which varied in thickness from approximately 200 mm to 280 mm.

Silt

Beneath the topsoil and extending to between n2.1 m and 2.9 m below ground surface (bgs) in each borehole was a layer of silt. The silt was brown in colour, contained trace to some clay (occasionally clayey), some sand and was generally in a moist state (*in situ* moisture contents of 10 to 26 percent).

Silty Sand

A layer of silty sand was observed below the silt in each borehole and extended to between 4.0 m and 5.6 m bgs. The silty sand was generally described as brown and moist (*in situ* moisture contents of 8 to 13 percent).

Sand

Each borehole was terminated in a stratum of sand. The sand was typically brown in colour, fine to medium grained with trace to some silt and occasionally trace gravel. It was generally damp to moist (*in situ* moisture contents of 2 to 7 percent) becoming wet with depth (tactile examination and observed groundwater seepage).

4 Hydrogeologic Setting

In additional to the shallow groundwater information collected from the boreholes completed 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
- MECP Water Well Records (WWR) within 500 m of the perimeter of the Site.

4.1 Regional Aquifers

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 is described as consisting of glaciolacustrine sands. 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 (bgs)) and deep overburden aquifers (>30 m bgs) aquifers in the area of the Site generally consist of saturated permeable sand/silt deposits in the overburden. In general, intermediate depth and deep overburden aquifers are generally confined by overlying silt, clay and glacial till deposits which limit vertical migration of shallow ground water. It should be noted that the documented wells within 500 m of the Site were not set within intermediate or deep overburden aquifers.

4.1.2 Bedrock Aquifer

The bedrock aquifer consists of shale and limestone from the Hamilton Group. The water quality is generally good with elevated levels of iron, sodium and chloride in some wells. As with the intermediate depth and deep overburden aquifers, the bedrock aquifer is confined by the overlying clayey material. Wells extending into the shallow fractured bedrock (up to about 3m) 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 Site Specific Groundwater Elevations and Flow

Water levels in the monitoring wells were measured on five (5) occasions, with details summarized in **Table 2**.

Table 2: Groundwater Elevation Measurements

Well ID	Assumed Ground Surface Elevation (m)	Assumed Top of Pipe Elevation (m)	Assumed Groundwater Elevation (m)				
			23-Feb-21	24-Mar-21	5-May-21	11-Jun-21	11-Nov-21
BH1/MW	95.58	96.32	88.25	88.35	88.28	88.21	88.33
BH2/MW	95.58	96.28	87.98	88.10	88.05	87.98	88.11
BH3/MW	97.55	98.23	89.60	89.64	89.61	89.59	89.66
BH4/MW	97.88	98.57	90.04	90.03	90.01	89.98	90.05

Shallow groundwater flow across the Site is typically affected by hydraulic conductivity, topography and drainage. The monitoring wells installed at the Site are screened in the shallow groundwater, which is contained within the natural sand soils. Based on the groundwater elevations in the monitoring wells, the direction of shallow groundwater flow is generally to the southeast, likely influenced by the Sydenham River.

4.3 Local Water Use

A search of the Ontario Ministry of Environment, Conservation and Parks (MECP) Water Well Record (WWR) database resulted in the identification of 19 records for an area within approximately 500 m of the Site boundary. Water uses in the area include domestic water supply (12 wells), irrigation water supply (2 wells), and monitoring or test holes (3 wells). Two (2) wells were listed as being abandoned. The summary of the MECP well completion details is provided in **Appendix D**.

Domestic water supply in the area is typically from the confined sand aquifers.

4.4 Hydraulic Characteristics

The grain size analyses were carried out on select sand samples collected within or near the screened interval in each of the boreholes, with results summarized in **Table 3**, and shown graphically in **Appendix B**. Estimated hydraulic conductivity values were determined using either Hazen's or Beyer's empirical formulas, where appropriate.

Based on grain size analyses, the hydraulic conductivities for the sand materials was found to range from 3.6×10^{-3} cm/s to 2.2×10^{-2} cm/s.

Two (2) Single Well Response Tests (SWRTs) were performed on monitoring wells BH1/MW and BH4/MW to evaluate the hydraulic characteristics of the sand overburden. The mathematical solution by Hvorslev (1951) was used to interpret the data and involved matching a straight-line solution to water-level displacement data collected during the recovery test. The time required for the water level in the well to reach 37% of the initial change (To) is determined from the plot, and used in the following equation to estimate the hydraulic conductivity (K);

$$K = [\ r^2 \ln(L/R)\ ] / [\ 2\ L\ To\ ]$$

Results are summarized in **Table 3** and calculated in **Appendix C**.

Table 3: Gradation Results & Hydraulic Conductivity

Sample ID	Lithology	Estimated Hydraulic Conductivity (cm/s)
Grain Size		
BH1/MW (6.1 m)	Sand, trace Silt	2.2×10^{-2}
BH2/MW (6.1 m)	Sand, trace Silt	6.2×10^{-3}
BH3/MW (6.1 m)	Sand, trace Silt, trace Gravel	6.7×10^{-3}
BH4/MW (6.1 m)	Sand, some Silt	3.6×10^{-3}
SWRT		
BH1/MW	Sand, trace Silt	1.9×10^{-2}
BH4/MW	Sand, trace to some Silt	5.7×10^{-2}

The results of the hydraulic conductivity testing of the sand indicates an average hydraulic conductivity of approximately 1.9×10^{-2} cm/s. These results are generally consistent with values reported by Freeze and Cherry (1979) for similar soils.

4.5 Groundwater Quality

Groundwater samples were taken from BH1/MW and BH4/MW on April 8, 2021 and May 7, 2021. 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 ODWQS guidelines are used for comparison sake only and to establish background concentrations. In comparison to these guidelines, no exceedance of the Maximum Allowable Concentrations were detected. Exceedances of the Aesthetic Objectives and Operational Guidelines were detected in the groundwater samples collected from BH1/MW for hardness with results of 320 mg/L (April 8 & May 7, 2021) and for Dissolved Manganese with results of 63 ug/L (April 8, 2021). Exceedances were detected in groundwater samples collected from BH4/MW for hardness with results of 410 mg/L (April 8 & May 7, 2021). All of the other tested parameters were at concentrations below or within the guidelines of ODWQS. The groundwater results are tabulated in **Appendix E**.

4.6 Significant Groundwater Recharge Areas (SGRA)

Groundwater recharge is largely controlled by soil conditions, and typically occurs in upland areas. 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 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 subject Site is located within a SGRA.

4.7 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:

- Intrinsic susceptibility index (ISI).
- Aquifer vulnerability index (AVI).
- Surface to aquifer advection time (SAAT).
- 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 subject Site is located within a HVA.

5 Impact Assessment for Potential Receptors

5.1 Potable Wells

Review of well records in the MECP database indicated that potable water within 500 m of the Site is generally drawn from the shallow to intermediate overburden sand aquifer.

The potential impacts on these shallow to intermediate wells as a result of the development is minimal due to the anticipated maximum excavation depths of 4 m below existing grades. It is not expected that any significant drawdown of the shallow groundwater will be carried out as part of the construction process. Final basement depths at the Site will be in the neighbourhood of 2.1 m below finished grades. Based on the groundwater monitoring carried out to date, the seasonal high groundwater table ranges between 7.23 m and 7.96 m below ground surface (bgs) (Assumed Elevations 87.98 m to 90.05 m) across the Site.

No significant long-term impact is anticipated on the shallow overburden wells, either quantitatively or qualitatively since the services for the proposed subdivision are not expected to be deep enough to penetrate into the underlying aquifers and the final basement depths are anticipated to be approximately 5 m above the seasonal high groundwater levels. 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 aquifers supplying domestic water to homeowners near the Site.

Monitoring wells have been installed at the Site as part of the Site investigations to document existing 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.

5.2 Surface Water Features

A wetland is located in the southwest part of the Site and is designated as a Provincially Significant Wetland (PSW) by the Ministry of Natural Resources and Forestry (MNRF). The wetland is part of the Sydenham River Wetland Complex. The Sydenham River passes through the wetland complex approximately 150 m to 250 m south of the Site.

Topographic mapping on the MNRF's website indicate a ground surface elevation of 235 mASL in the northern part of the Site near monitoring well BH4/MW, which implies Site groundwater levels in the range of 227 m to 225 m, north to south respectively. The mapping indicates the elevation of the PSW and Sydenham River to be approximately 225 m, and therefore are partially sourced from groundwater baseflow. Any water accumulated from precipitation is expected to follow Site topography.

Standard environmental setbacks from the PSW should be maintained as per Provincial and Municipal policies. Low Impact Development (LID) measures should be implemented to maintain groundwater base flows to the features. Refer to Section 5.4 for further comments and recommendations pertaining to the implementation of LID systems.

The PSW is 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 the PSW:

- 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 feature;
- A Best Management Practise (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.

5.3 Construction Dewatering Impacts

The depth to the stabilized groundwater level recorded in the monitoring wells ranged between 7.23 m and 7.96 m below ground surface (Assumed Elevations 87.98 m to 90.05 m) over the monitored period. Based on the scope of development including townhouses and municipal servicing, it is anticipated that the basement and service trench excavations will extend to maximum depths of approximately 4 m bgs. Once final grading and servicing plans are available, this office should be contacted for review and comment.

In areas where excavations extend to the above mentioned depth and minor groundwater infiltration is encountered, it can be accommodated using conventional sump pumping techniques. Where the base of excavations penetrate the groundwater table, base stabilization techniques including the placement of additional HL8 stone should be utilized to avoid the need for moderate groundwater removal during construction.

Given the results of the groundwater monitoring and anticipated excavation depths, groundwater removal quantities well less than 50,000 L/day are anticipated for this Site.

It is noteworthy to mention that new legislation came into force in Ontario on March 29, 2016 to regulate groundwater takings for construction dewatering purposes. Prior to March 29, 2016, a Category 2 Permit to Take Water (PTTW) was required from the MECP for groundwater takings related to construction dewatering, where taking volumes in excess of 50,000 L/day, but less than 400,000 L/day, and the taking duration was no more than 30 consecutive days. The new legislation replaces the Category 2 PTTW for construction dewatering with a new process under the Environmental Activity and Sector Registry (EASR). The EASR is an on-line registry, which allows persons engaged in prescribed activities, such as water takings, to register with the MECP instead of applying for a PTTW.

To be eligible for the new EASR process, the construction dewatering taking must be less than 400,000 L/day under normal conditions. The water taking can be groundwater, surface water, or a combination of both. It should be noted that the 30-consecutive day limit on the water taking under the old Category 2 PTTW process has been removed in the new EASR process. Also, it should be noted that the EASR process requires two technical studies be prepared by a Qualified Person, prior to any water taking. These studies include a Water Taking Report, which provides assurance that the taking will not cause any unacceptable impacts, and a Discharge Plan, which provides assurance that the discharge will not result in any adverse impacts to the environment.

5.4 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.

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. Reference is made to industry accepted documents regarding LID practices and recommendations. Such references include the City of Toronto's 2006 *Wet Weather Flow Management Guidelines*, the Credit Valley Conservation (CVC) and Toronto and Region Conservation Authority (TRCA) 2010 *Low Impact Development Stormwater Management Planning and Design Guide*, and the Ontario Ministry of the Environment's 2003 Stormwater Planning and Design Manual.

For residential developments, some examples of on-site stormwater management practices include:

- Routing pavement runoff to grassed areas;
- Planting of trees and bushes;
- Installing pervious pavement;
- Installing soakaway areas;
- Infiltrating roof runoff onto grassed areas;
- Implementing rainwater harvesting (i.e. to re-use in toilet flushing and irrigation, etc.);
- Installing green roof technologies;
- Using filters/bio-retention (i.e. islands, parking areas, etc.);
- Installing absorbent landscaping; and,
- Installing oil/grit separators.

In terms of maintaining infiltration rates in post-development, the most effective stormwater management practices include installing infiltration trenches, lot grading, roof leader discharge to soakaway pits/pervious areas, using pervious pipes, and installing pervious catch-basins.

It is recommended that some of these practices be utilized in site planning and design in order to mitigate the impact of increased runoff, stormwater pollution, and to maintain base flows to the surface water features. By implementing LID practices during development, infiltration volumes can be effectively stored and returned to the natural environment by various development technologies and methods described above.

5.5 Mitigation Measures

As noted in Sections 4.6 and 4.7, the Site is within a SGRA and a HVA. The use of secondary infiltration opportunities will help in maintain infiltration values under post-development conditions similar to those under pre-development which will reduce the impact of a development on the SGRA and HVA areas.

The following comments are provided with recommendations to help minimize impact to shallow groundwater documented in the monitoring wells:

- 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.
- The use of BMPs to enhance post development infiltration should be considered at the Site. These measures will have limited effectiveness in areas with low permeability silty clay soils. However, opportunities exist to infiltrate into the higher permeability silty sand and sand soils. Where infiltration of run-off from roads or parking lots is considered, additional measures to treat the water may be required to minimize potential for groundwater contamination.
- Re-establishing vegetative cover in disturbed areas following the completion of the construction work, where appropriate.

- Limit the use of commercial fertilizers in landscaped areas which border the open-space area to the south of the Site and surface water features.
- Limit the use of salts or other additives for ice and snow control on the roadways.

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.

5.6 Groundwater Quality & Monitoring Considerations

A monitoring program to assess the characteristics of the shallow groundwater collected in the monitoring wells at the Site has been carried out. As discussed in Section 4.5, baseline water quality testing was carried out on samples of the shallow groundwater collected from BH1/MW and BH4/MW. The water samples were submitted to Bureau Veritas for baseline water quality testing. Groundwater quality was compared to Ontario Drinking Water Standards, although the groundwater on Site is not planned to be used as a potable source.

There are a number of items which can be considered during construction and for the future residential development which can assist in maintaining groundwater 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 406 for residential land use;
- Contractors working at the Site should ensure that construction equipment is in good working order. Equipment operators should have spill-prevention kits, where appropriate; and,
- 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.

6 Experience & Qualifications

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 Jasneel Mahal, who has been trained to conduct Hydrogeological Assessments and Phase I/Phase II Environmental Science Assessments in accordance with the CSA Standard. Mr. Mahal obtained his Bachelor of Environmental Science from the University of Windsor in 2014. He pursued a Master's degree in Geology at Wayne State University, Detroit, Michigan. He has been practising Geoscience for 2 years. Mr. Mahal is registered with Professional Geoscientists of Ontario (PGO) as a Geoscientist In Training (G.I.T) since May 2019. He has a broad understanding of ESAs and hydrogeological programs with proficiency in both office and field assignments.

This report was co-authored by Mr. Eric Buchanan, P.Eng. Mr. Buchanan works in the Earth and Environment Discipline and has been thoroughly trained in conducting geotechnical and hydrogeological assessments. He obtained a Bachelor of Engineering Degree from Lakehead University and has been working in the geo-science field for 10 years. He has authored and reviewed reports for numerous projects including residential and commercial developments that require geotechnical and hydrogeological input, Level 2 hydrogeological assessments for underwater aggregate extraction, groundwater impact assessments and calculated groundwater removal quantities for short- and long-term construction. Mr. Buchanan oversees coordinating all of EXP's hydrogeological field operations for London and surrounding area. His responsibilities include designing work plans and hydrogeological modelling.

This report was reviewed by Mr. Botel Chiu, M.Eng., P. Eng., QP. who has been thoroughly trained in conducting geotechnical and hydrogeological assessments. He has obtained a master's degree specializing in geotechnical engineering, environmental and hydrogeological assessments and is a Qualified Person (QP) registered with the Ontario Ministry of Environment, Conservation and Parks (MECP). He has been a geoscience practitioner with over 30 years of direct experience in the environmental and geotechnical consulting industry. Over 15,000 projects were completed under his direction and supervision. Mr. Chiu is currently the Vice President of Earth and Environment for Southwestern Ontario and is practising geoscience assessment under the Guideline of Professional Engineers Providing Geotechnical Engineering Services within the Professional Engineers Act in Ontario. He is a recognized technical specialist within the EXP organization and in the industry for the geotechnical and environmental fields. He has been qualified as an Exempted Engineer to conduct geoscience assessment such as hydrogeological evaluation and groundwater taking. Mr. Chiu has been retained by various developers, municipalities and conservation authorities as the geotechnical expert in hydrogeological assessments and has testified as an expert witness in Ontario Municipal Board hearings and Municipal Councils related to groundwater hydrogeology and geotechnical matters for land development and construction. He has been retained by the City of London and other municipalities, and Provincial Agencies to be a consultant for his field of expertise.

7 References

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8 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 **Emil Pattyn** 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.

Drawings

-NOTES-

1. The site plan was reproduced from Google Earth Pro and should be read in conjunction with EXP Report LON-21001218-A0.

-LEGEND-

Approximate Site Boundary

BH1/MW Approximate Monitoring Well Location

Hydrogeological Assessment

Proposed Residential Development

Adair Blvd and Second St, Strathroy, Ontario

CLIENT	Emil Pattyn
TITLE	Monitoring Well Location Plan
Prepared By: J.M.	Reviewed By: B.C.

EXP Services Inc.
15701 Robin's Hill Road, London, ON, N5V 0A5

DATE	APPROXIMATE SCALE	PROJECT NO.	DWG.
April 2022	1:8,000	LON-21001218-A0	1

Appendix A – Borehole Logs

BOREHOLE LOG

BH1/MW
Sheet 1 of 1

CLIENT **Emil Pattyn** PROJECT NO. **LON-21001218-A0**

PROJECT **Proposed Residential Development** DATUM **Local**

LOCATION **Adair Blvd and Second St, Starthroy, Ontario** DATES: Boring **February 04, 2021** Water Level **Mar 24/21**

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	**95.6**								
	95.3	**TOPSOIL** - 250 mm							
		SILT - brown, trace to some clay, some sand, loose to compact, moist			SS	SS1	400	4	18
1					SS	SS2	300	10	12
					SS	SS3	400	16	10
2	93.5								
		SILTY SAND - brown, compact, moist			SS	SS4	400	25	8
3					SS	SS5	300	26	8
4	91.5								
		SAND - brown, fine to medium grained, trace silt, compact, damp			SS	SS6	350	17	4
5									
6					SS	SS7	300	18	2
7									
	88.0	- becoming wet near 7.3 m bgs							
		End of Borehole at 7.6 m bgs.							
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 interpretation requires assistance by EXP before use by others. Borehole Logs must be read in conjunction with EXP Report LON-21001218-A0.
2) bgs denotes below ground surface.
3) Water Level Readings:
February 23, 2021 - 7.33 m bgs, Assumed Elevation 88.25 m
March 24, 2021 - 7.23 m bgs, Assumed Elevation 88.35 m
May 5, 2021 - 7.30 m bgs, Assumed Elevation 88.28 m
June 11, 2021 - 7.37 m bgs, Assumed Elevation 88.21 m
November 11, 2021 - 7.25 m bgs, Assumed Elevation 88.33 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

BH2/MW
Sheet 1 of 1

CLIENT **Emil Pattyn** PROJECT NO. **LON-21001218-A0**
PROJECT **Proposed Residential Development** DATUM **Local**
LOCATION **Adair Blvd and Second St, Starthroy, Ontario** DATES: Boring **February 04, 2021** Water Level **Mar 24/21**

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	95.6								
	95.3	**TOPSOIL** - 280 mm							
		SILT - brown, trace to some clay, some sand, very loose, moist			SS	SS1	400	3	15
1					SS	SS2	300	3	16
					SS	SS3	300	2	19
2					SS	SS4	350	2	19
	92.7								
3		**SILTY SAND** - brown, compact to dense, moist			SS	SS5	400	10	12
4									
					SS	SS6	300	33	9
5	90.0								
		SAND - brown, fine to medium grained, trace silt, dense, damp							
6					SS	SS7	350	44	4
7	88.0	- becoming wet near 7.5 m bgs							
		End of Borehole at 7.6 m bgs.							
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 interpretation requires assistance by EXP before use by others. Borehole Logs must be read in conjunction with EXP Report LON-21001218-A0.
2) bgs denotes below ground surface.
3) Water Level Readings:
February 23, 2021 - 7.60 m bgs, Assumed Elevation 87.98 m
March 24, 2021 - 7.48 m bgs, Assumed Elevation 88.10 m
May 5, 2021 - 7.53 m bgs, Assumed Elevation 88.05 m
June 11, 2021 - 7.60 m bgs, Assumed Elevation 87.98 m
November 11, 2021 - 7.47 m bgs, Assumed Elevation 88.11 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

BH3/MW
Sheet 1 of 1

CLIENT **Emil Pattyn** PROJECT NO. **LON-21001218-A0**
PROJECT **Proposed Residential Development** DATUM **Local**
LOCATION **Adair Blvd and Second St, Starthroy, Ontario** DATES: Boring **February 04, 2021** Water Level **Mar 24/21**

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
	97.6								
0	97.4	**TOPSOIL** - 200 mm							
		SILT - brown, clayey to trace clay, some sand, very loose to loose, moist			SS	SS1	400	8	25
1					SS	SS2	400	3	25
					SS	SS3	350	7	11
2	95.4								
		SILTY SAND - brown, compact, moist			SS	SS4	300	23	13
3					SS	SS5	300	16	8
4	93.5								
		SAND - brown, fine to medium grained, trace silt, trace gravel, compact, damp to moist			SS	SS6	300	14	2
5									
6					SS	SS7	300	28	6
7									
8		- becoming wet near 7.9 m bgs							
9	88.4								
		End of Borehole at 9.1 m bgs.							

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 interpretation requires assistance by EXP before use by others. Borehole Logs must be read in conjunction with EXP Report LON-21001218-A0.
2) bgs denotes below ground surface.
3) Water Level Readings:
February 23, 2021 - 7.95 m bgs, Assumed Elevation 89.60 m
March 24, 2021 - 7.91 m bgs, Assumed Elevation 89.64 m
May 5, 2021 - 7.94 m bgs, Assumed Elevation 89.61 m
June 11, 2021 - 7.96 m bgs, Assumed Elevation 89.59 m
November 11, 2021 - 7.89 m bgs, Assumed Elevation 89.66 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

BH4/MW
Sheet 1 of 1

CLIENT **Emil Pattyn** PROJECT NO. **LON-21001218-A0**
PROJECT **Proposed Residential Development** DATUM **Local**
LOCATION **Adair Blvd and Second St, Starthroy, Ontario** DATES: Boring **February 04, 2021** Water Level **Mar 24/21**

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	97.9								
	97.6	**TOPSOIL** - 250 mm							
		SILT - brown, clayey to trace clay, some sand, very loose to loose, moist			SS	SS1	400	8	26
1					SS	SS2	350	7	24
					SS	SS3	300	4	17
2	95.8								
		SILTY SAND - brown, compact, moist			SS	SS4	350	10	12
3					SS	SS5	400	10	10
	93.8								
4		**SAND** - brown, fine to medium grained, trace to some silt, compact, moist							
					SS	SS6	300	26	7
5									
6					SS	SS7	350	27	6
7									
8		- becoming wet near 7.8 m bgs							
9	88.7								
		End of Borehole at 9.1 m bgs.							

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 interpretation requires assistance by EXP before use by others. Borehole Logs must be read in conjunction with EXP Report LON-21001218-A0.
2) bgs denotes below ground surface.
3) Water Level Readings:
February 23, 2021 - 7.84 m bgs, Assumed Elevation 90.04 m
March 24, 2021 - 7.85 m bgs, Assumed Elevation 90.03 m
May 5, 2021 - 7.87 m bgs, Assumed Elevation 90.01 m
June 11, 2021 - 7.90 m bgs, Assumed Elevation 89.98 m
November 11, 2021 - 7.83 m bgs, Assumed Elevation 90.05 m

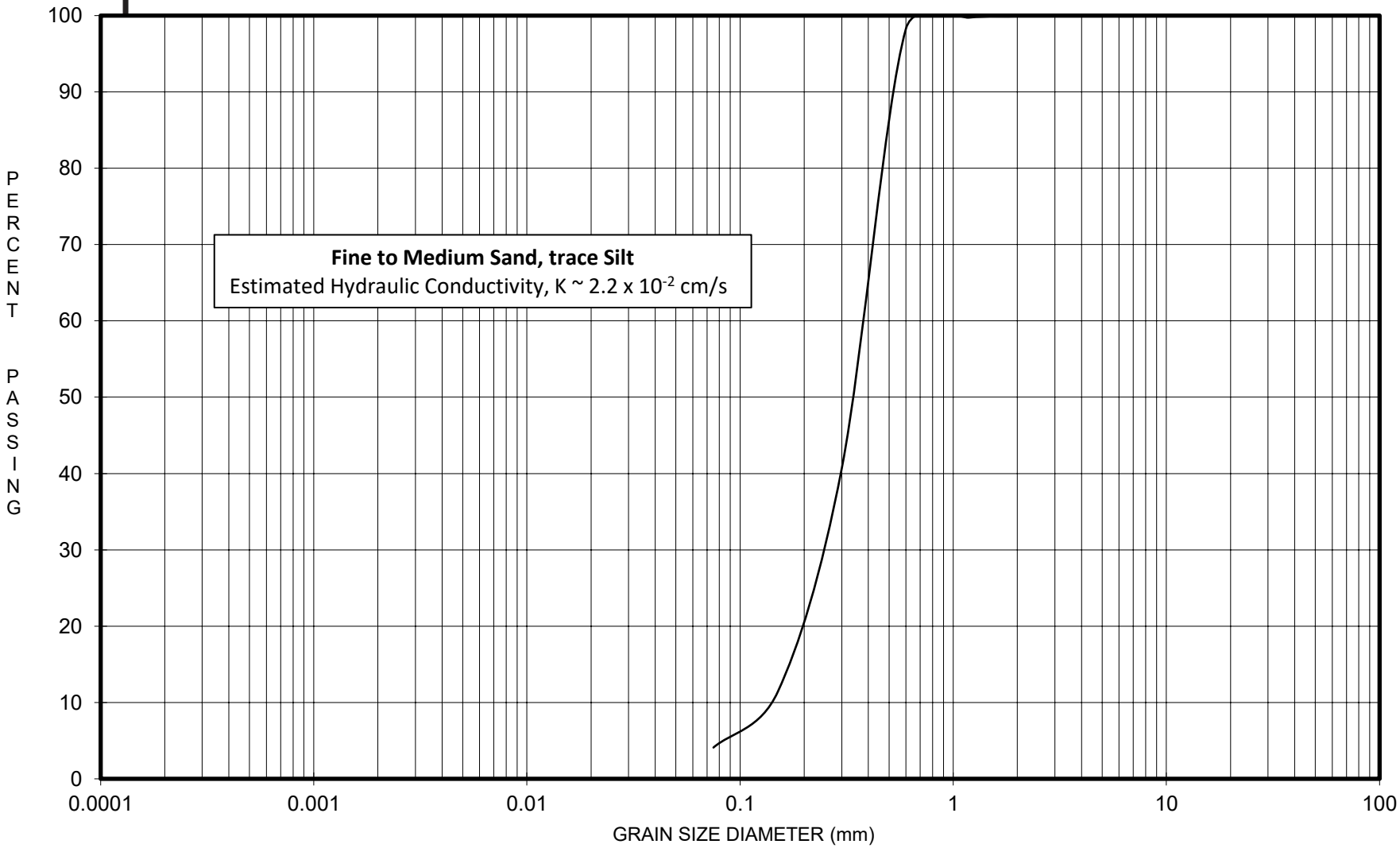
SAMPLE LEGEND
AS Auger Sample SS Split Spoon ST Shelby Tube
Rock Core (eg. BQ, NQ, etc.) VN Vane Sample

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)

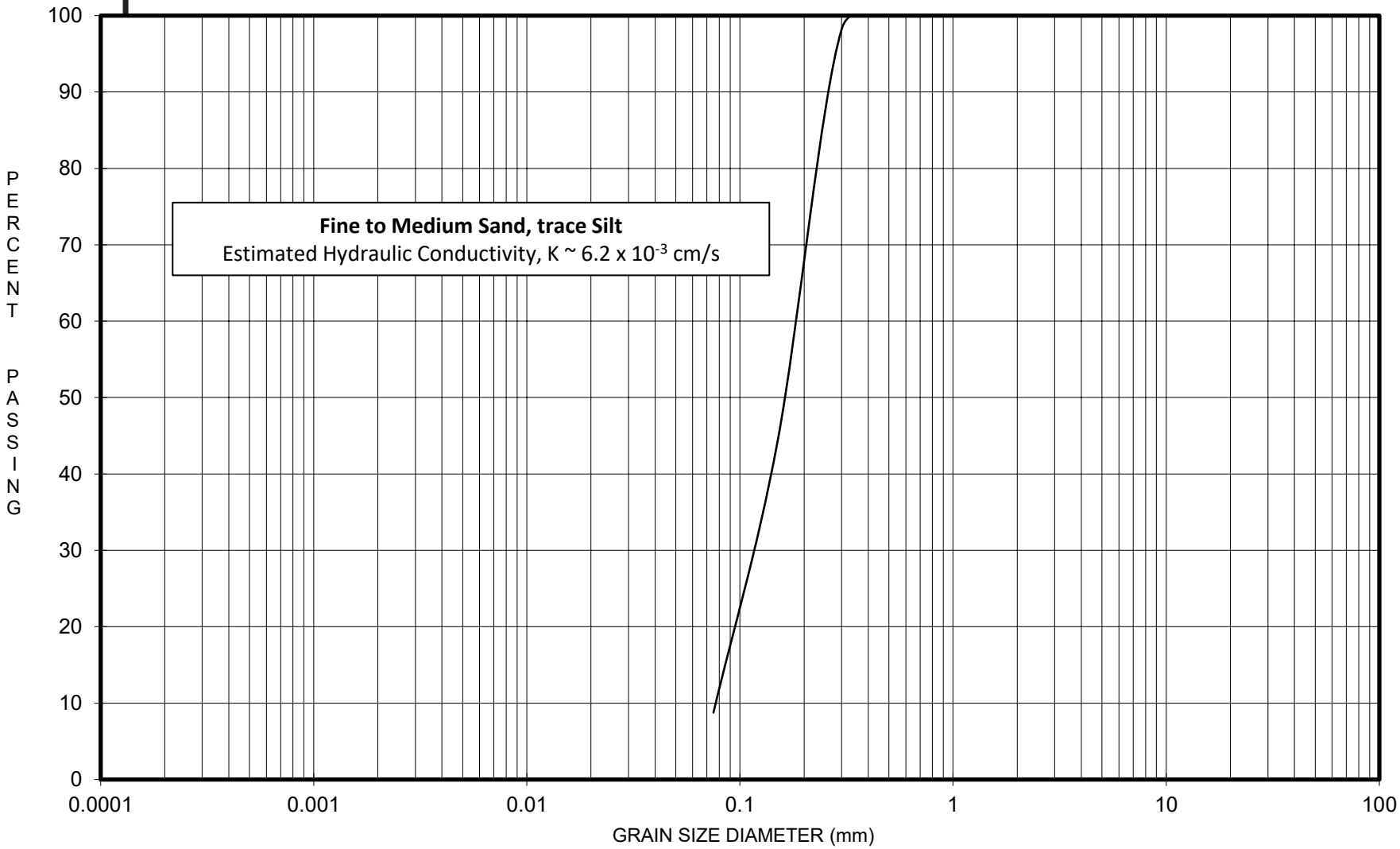
Appendix B – Grain Size Analyses

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 (BH1 S7, 6.1 to 6.6 m depth)**						**Adair Blvd & Second St, Strathroy Project: LON-21001218-A0**			**Figure 1**

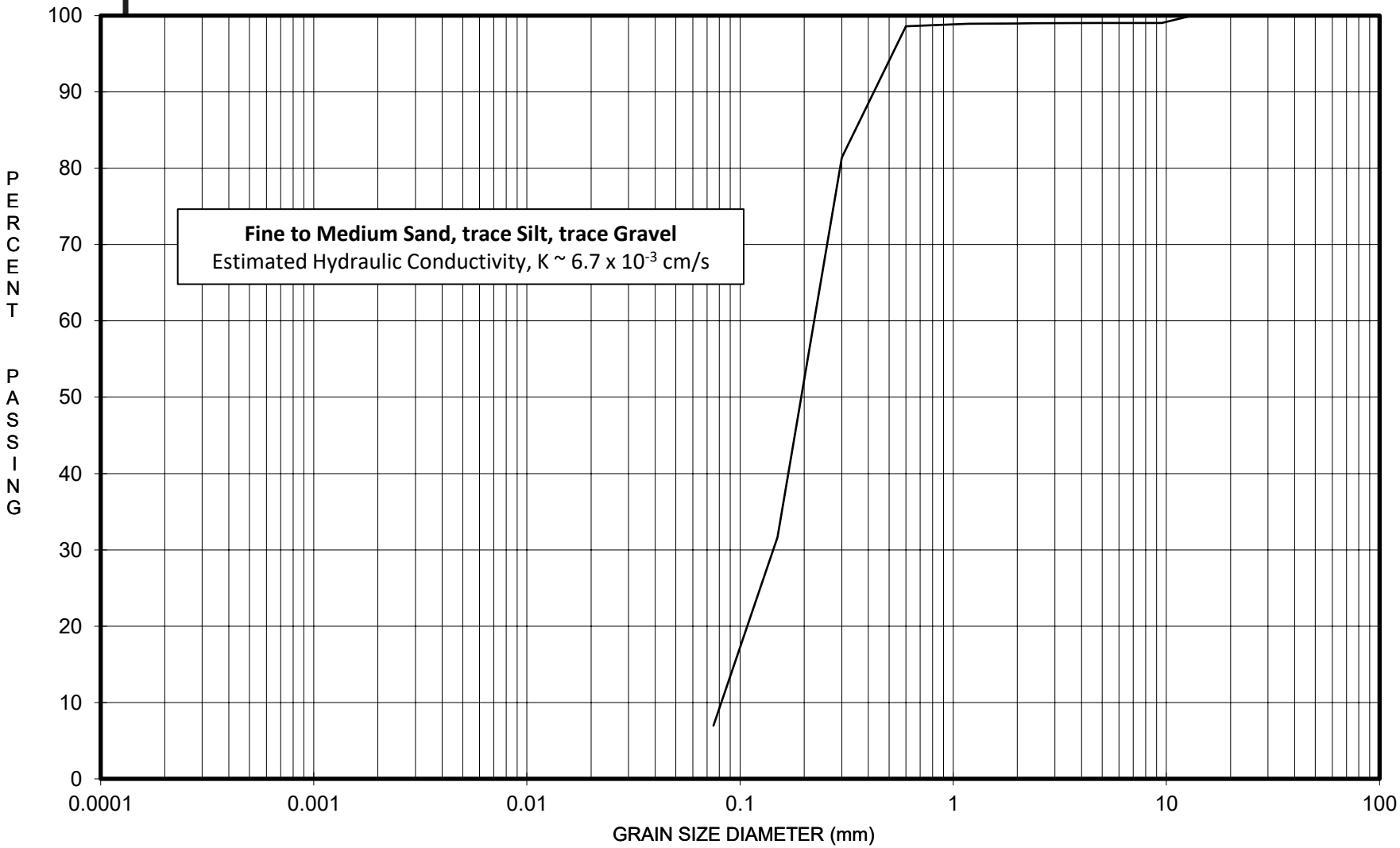
MECHANICAL GRAIN SIZE ANALYSIS



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	
	SILT			SAND			GRAVEL			

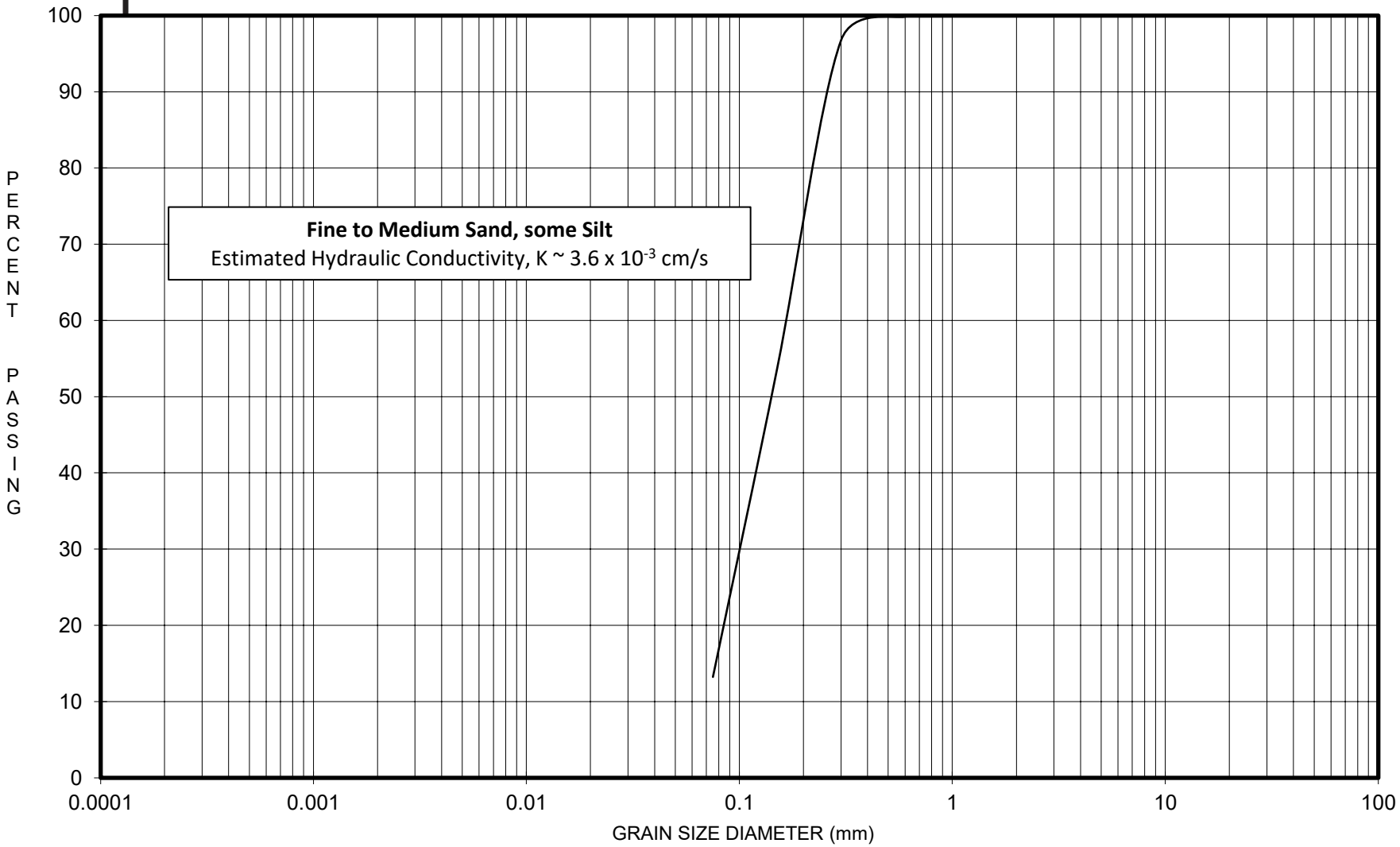
MODIFIED M.I.T. CLASSIFICATION	**Sample Description:** **Sand (BH2 S7, 6.1 to 6.6 m depth)**	**Adair Blvd & Second St, Strathroy** **Project: LON-21001218-A0**	**Figure 2**

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 (BH3 S7, 6.1 to 6.6 m depth)**						**Adair Blvd & Second St, Strathroy Project: LON-21001218-A0**			**Figure 3**

MECHANICAL GRAIN SIZE ANALYSIS

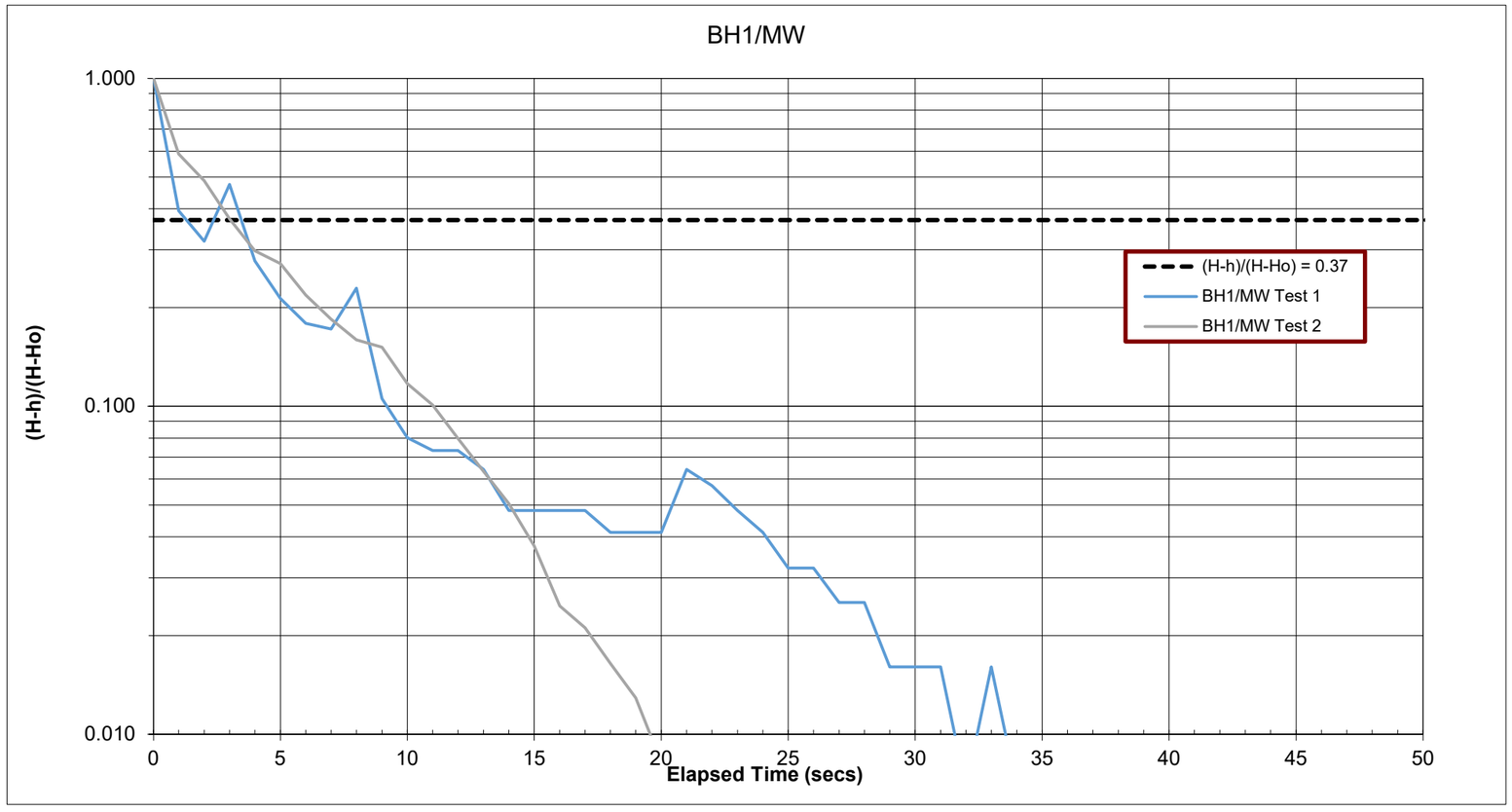


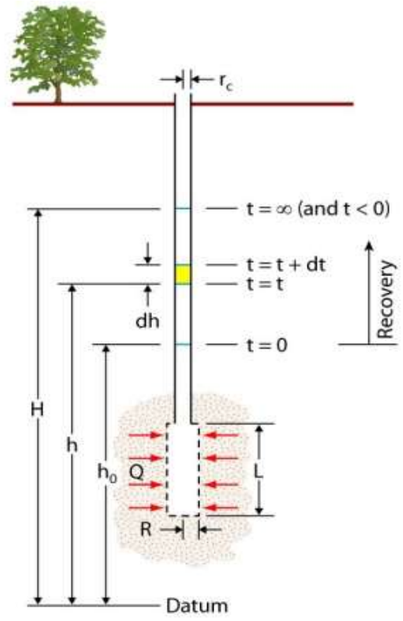
CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	
	SILT			SAND			GRAVEL			
MODIFIED M.I.T. CLASSIFICATION	**Sample Description: Sand (BH4 S7, 6.1 to 6.6 m depth)**						**Adair Blvd & Second St, Strathroy Project: LON-21001218-A0**			**Figure 4**

Appendix C – Single Well Response Tests

Recovery Testing - Hvorslev Method (1951)

Project Number	LON-21001218-A0
Date ot Test	9-Apr-21
Completed by	M.Bondi





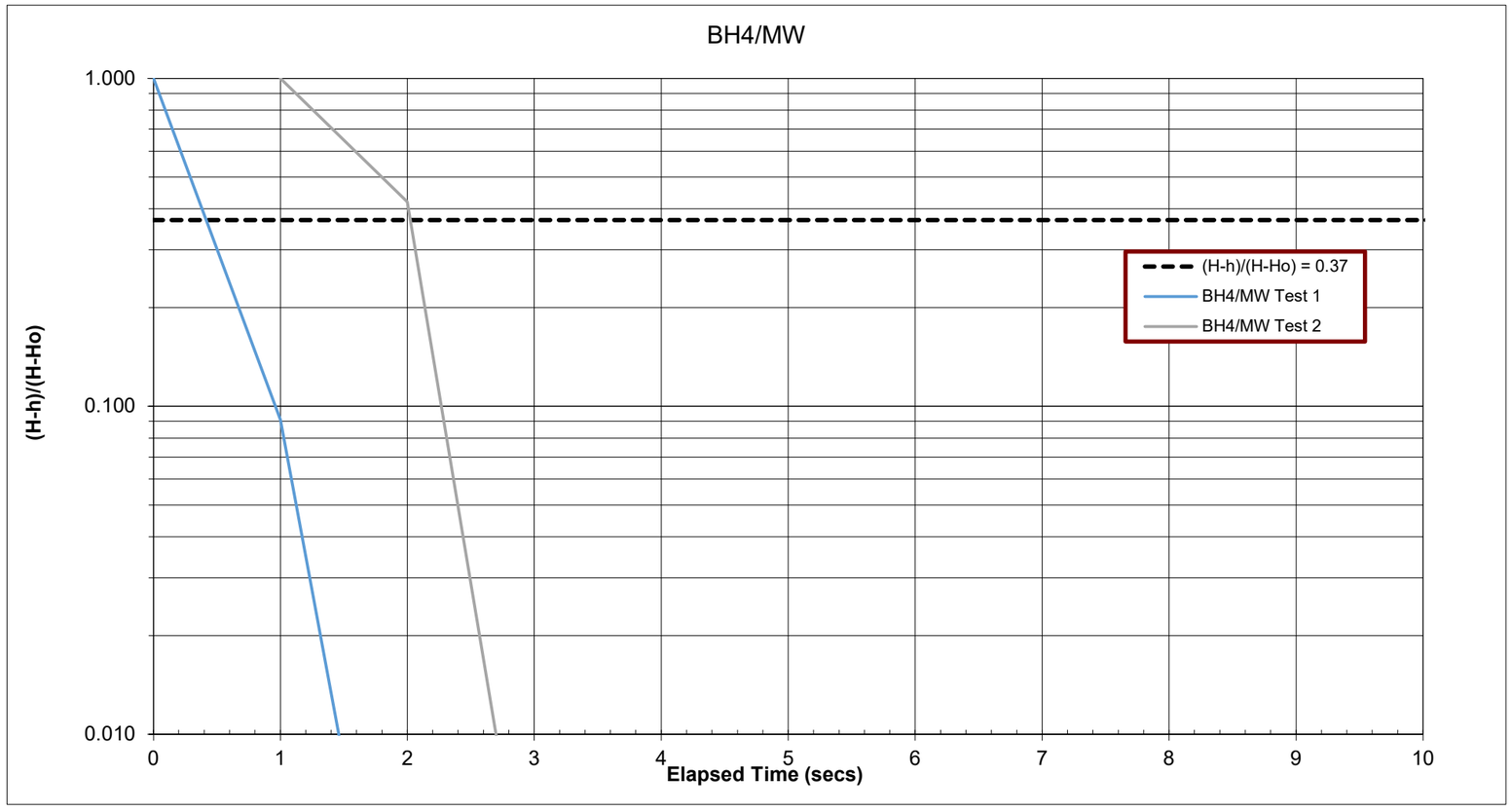
Initial Water Level	7.16 m bgs
Maximum Drawdown	0.26 m
r (m) =	0.0254
L (m) =	1.53
R (m) =	0.1048
T_o (sec) =	3
K (m/s) =	1.9E-04

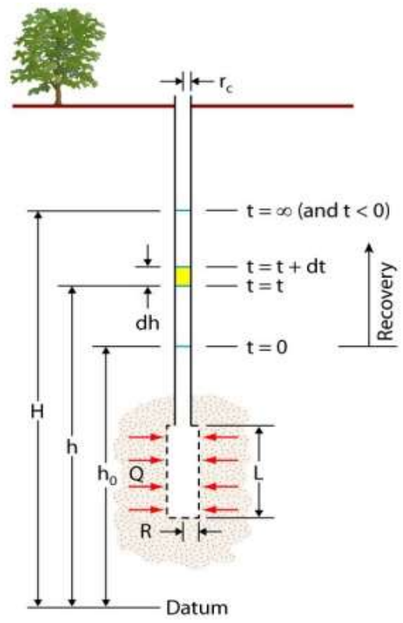
Note:
1 - T_o is determined from plots where (H-h)/(H-Ho) = 0.37

K = Hydraulic Conductivity
r = radius of well casing
R = Radius of well screen or filter pack
L = Length of the well screen (in Slug Test) or the length of submerged portion of the well screen (in Rising Head)
T_0 = time for water level to rise or fall to 37% of the initial change

Recovery Testing - Hvorslev Method (1951)

Project Number	LON-21001218-A0
Date ot Test	9-Apr-21
Completed by	M.Bondi





Initial Water Level	7.77 m bgs
Maximum Drawdown	0.53 m
r (m) =	0.0254
L (m) =	1.53
R (m) =	0.1048
T_o (sec) =	1
K (m/s) =	5.7E-04

Note:
1 - T_o is determined from plots where (H-h)/(H-Ho) = 0.37

K = Hydraulic Conductivity
r = radius of well casing
R = Radius of well screen or filter pack
L = Length of the well screen (in Slug Test) or the length of submerged portion of the well screen (in Rising Head)
T_0 = time for water level to rise or fall to 37% of the initial change

Appendix D – Summary of MECP Well Records

Table E1 - Summary of MECP Well Records

Well ID	Well Type	Date Completed	Depth (m)	Water Use	Water Status	Screened Lithology	Water Found at Depth (m)	Static Water Level (m)
4100047	Overburden	8/4/1962	21.3	Domestic	Water Supply	Sand	16.8	10.7
4106597	Overburden	8/22/1973	11.6	Domestic	Water Supply	Sand	9.4	7.3
4106911	Overburden	7/16/1974	13.7	Domestic	Water Supply	Sand	11.6	6.1
4107173	Overburden	4/26/1975	15.5	Domestic	Water Supply	Sand	12.8	7.0
4109499	Overburden	6/22/1981	14.3	Domestic	Water Supply	Sand	11.9	7.9
4109933	Overburden	11/10/1983	18.0	Domestic	Water Supply	Sand	8.5	8.5
4110302	Overburden	7/27/1985	16.5	Domestic	Water Supply	Sand	11.6	7.6
4111260	Overburden	5/30/1988	18.0	Domestic	Water Supply	Sand	13.7	7.9
4111413	Overburden	9/20/1988	8.1	Domestic	Water Supply	Sand	4.3	4.3
4111967	Overburden	1/23/1990	15.2	Domestic	Water Supply	Sand	7.9	7.9
4115638	Overburden	5/14/2004	14.9	Domestic	Water Supply	Sand	8.2	7.6
4116499	Overburden	2/27/2006	21.9	Irrigation	Water Supply	Sand	13.7	11.3
7131960*	Overburden	9/23/2009	14.3	-	Abandoned	-	-	7.9
7222166	Overburden	5/20/2014	14.6	Domestic	Water Supply	Sand	8.2	7.6
7222630	Overburden	5/23/2014	14.0	-	Abandoned	-	-	-
7268723	Overburden	6/13/2016	19.2	Irrigation	Water Supply	Sand	15.2	9.4
7298451	Overburden	9/25/2017	10.0	Test Hole	Monitoring	Sand	7.6	-
7298452	Overburden	9/25/2017	10.3	Test Hole	Monitoring	Sand	7.9	-
7298453	Overburden	9/25/2017	9.1	Test Hole	Monitoring	Sand	7.6	-

*Notes: Likely decommission record for MECP Well No. 4109499

Appendix E – Water Quality

Groundwater Quality Results
Proposed Residential Development
Project No. LON-21001218-A0

CRITERIA	ODWQS			UNITS	8-Apr-21	8-Apr-21	7-May-21	7-May-21
	Maximum Allowable Concentration	Aesthetic Objectives	Operational Guidelines		BH1/MW	BH4/MW	BH1/MW	BH4/MW
Calculated Parameters								
Anion Sum				me/L	6.68	12.7	6.54	11.8
Bicarb. Alkalinity (calc. as CaCO3)				mg/L	280	340	280	330
Calculated TDS				mg/L	360	710	350	650
Carb. Alkalinity (calc. as CaCO3)				mg/L	2.4	2.2	1.8	1.7
Cation Sum				me/L	6.64	13.3	6.50	12.1
Hardness (CaCO3)			80 - 100	mg/L	**320**	**410**	**320**	**410**
Ion Balance (% Difference)				%	0.290	2.11	0.280	1.09
Langelier Index (@ 20C)				N/A	0.984	0.983	0.850	0.878
Langelier Index (@ 4C)				N/A	0.736	0.736	0.601	0.631
Saturation pH (@ 20C)				N/A	6.97	6.86	6.98	6.86
Saturation pH (@ 4C)				N/A	7.21	7.10	7.23	7.11
Inorganics								
Total Ammonia-N				mg/L	<0.050	<0.050	<0.050	<0.050
Conductivity				umho/cm	620	1,300	610	1,200
Dissolved Organic Carbon				mg/L	1.1	1.1	1.3	0.88
Orthophosphate (P)				mg/L	<0.010	<0.010	<0.010	<0.010
pH		6.5 - 8.5		pH	7.95	7.84	7.83	7.74
Dissolved Sulphate (SO4)				mg/L	4.4	15	5.5	13
Alkalinity (Total as CaCO3)			500	mg/L	280	340	280	330
Dissolved Chloride (Cl-)				mg/L	11	190	12	160
Nitrite (N)	1			mg/L	<0.010	<0.010	<0.010	<0.010
Nitrate (N)	10			mg/L	8.11	3.02	7.36	4.52
Nitrate + Nitrite (N)				mg/L	8.11	3.02	7.36	4.52
Dissolved Metals								
Dissolved Aluminum (Al)			100	ug/L	<4.9	<4.9	<4.9	5.5
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	<1.0
Dissolved Barium (Ba)	1,000			ug/L	10	20	8.7	15
Dissolved Beryllium (Be)				ug/L	<0.40	<0.40	<0.40	<0.40
Dissolved Boron (B)	5,000			ug/L	10	18	13	18
Dissolved Cadmium (Cd)	5			ug/L	<0.090	<0.090	<0.090	<0.090
Dissolved Calcium (Ca)				ug/L	100,000	130,000	100,000	130,000
Dissolved Chromium (Cr)	50			ug/L	<5.0	<5.0	<5.0	<5.0
Dissolved Cobalt (Co)				ug/L	<0.50	<0.50	<0.50	<0.50
Dissolved Copper (Cu)		1,000		ug/L	2.0	2.0	3.0	3.6
Dissolved Iron (Fe)		300		ug/L	<100	<100	<100	<100
Dissolved Lead (Pb)	10			ug/L	<0.50	<0.50	<0.50	<0.50
Dissolved Magnesium (Mg)				ug/L	16,000	19,000	16,000	20,000
Dissolved Manganese (Mn)		50		ug/L	**63**	38	<2.0	3.1
Dissolved Molybdenum (Mo)				ug/L	2.4	<0.50	<0.50	<0.50
Dissolved Nickel (Ni)				ug/L	2.2	1.7	<1.0	1.0
Dissolved Phosphorus (P)				ug/L	<100	<100	<100	<100
Dissolved Potassium (K)				ug/L	1,000	3,200	980	3,000
Dissolved Selenium (Se)	10			ug/L	<2.0	<2.0	<2.0	<2.0
Dissolved Silicon (Si)				ug/L	4,500	5,400	4,600	5,600
Dissolved Silver (Ag)				ug/L	<0.090	<0.090	<0.090	<0.090
Dissolved Sodium (Na)		200,000		ug/L	3,300	120,000	3,100	89,000
Dissolved Strontium (Sr)				ug/L	120	220	120	220
Dissolved Thallium (Tl)				ug/L	<0.050	<0.050	<0.050	<0.050
Dissolved Titanium (Ti)				ug/L	<5.0	<5.0	<5.0	<5.0
Dissolved Uranium (U)	20			ug/L	0.25	0.23	0.22	0.17
Dissolved Vanadium (V)				ug/L	<0.50	<0.50	<0.50	<0.50
Dissolved Zinc (Zn)		5,000		ug/L	<5.0	<5.0	<5.0	<5.0

NOTES:

Results compared Ontario Drinking Water Standards, Objectives and Guidelines, June 2006.

Values highlighted grey and bold exceed ODWQS parameter guidelines

Your Project #: 21001218
Site Location: ALDAIR
Your C.O.C. #: 821742-01-01

Attention: Mark Bertens

exp Services Inc
London Branch
15701 Robin's Hill Rd
Unit 2
London, ON
CANADA N5V 0A5

Report Date: 2021/04/15
Report #: R6596656
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C194421
Received: 2021/04/09, 09:10

Sample Matrix: Water
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity	2	N/A	2021/04/12	CAM SOP-00448	SM 23 2320 B m
Carbonate, Bicarbonate and Hydroxide	2	N/A	2021/04/13	CAM SOP-00102	APHA 4500-CO2 D
Chloride by Automated Colourimetry	2	N/A	2021/04/13	CAM SOP-00463	SM 23 4500-Cl E m
Conductivity	2	N/A	2021/04/12	CAM SOP-00414	SM 23 2510 m
Dissolved Organic Carbon (DOC) (1)	2	N/A	2021/04/12	CAM SOP-00446	SM 23 5310 B m
Hardness (calculated as CaCO3)	2	N/A	2021/04/14	CAM SOP 00102/00408/00447	SM 2340 B
Lab Filtered Metals by ICPMS	2	2021/04/13	2021/04/14	CAM SOP-00447	EPA 6020B m
Ion Balance (% Difference)	2	N/A	2021/04/14		
Anion and Cation Sum	2	N/A	2021/04/14		
Total Ammonia-N	2	N/A	2021/04/14	CAM SOP-00441	USGS I-2522-90 m
Nitrate (NO3) and Nitrite (NO2) in Water (2)	2	N/A	2021/04/15	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH	2	2021/04/12	2021/04/12	CAM SOP-00413	SM 4500H+ B m
Orthophosphate	2	N/A	2021/04/13	CAM SOP-00461	EPA 365.1 m
Sat. pH and Langelier Index (@ 20C)	2	N/A	2021/04/14		Auto Calc
Sat. pH and Langelier Index (@ 4C)	2	N/A	2021/04/14		Auto Calc
Sulphate by Automated Colourimetry	2	N/A	2021/04/13	CAM SOP-00464	EPA 375.4 m
Total Dissolved Solids (TDS calc)	2	N/A	2021/04/14		Auto Calc

Remarks:

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

Your Project #: 21001218
Site Location: ALDAIR
Your C.O.C. #: 821742-01-01

Attention: Mark Bertens

exp Services Inc
London Branch
15701 Robin's Hill Rd
Unit 2
London, ON
CANADA N5V 0A5

Report Date: 2021/04/15
Report #: R6596656
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C194421
Received: 2021/04/09, 09:10

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.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
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.

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 #: C194421
Report Date: 2021/04/15

exp Services Inc
Client Project #: 21001218
Site Location: ALDAIR
Sampler Initials: MB

RCAP - COMPREHENSIVE (LAB FILTERED)

BV Labs ID		PHA665			PHA666		
Sampling Date		2021/04/08			2021/04/08		
COC Number		821742-01-01			821742-01-01		
	UNITS	BH4	RDL	QC Batch	BH1	RDL	QC Batch
Calculated Parameters							
Anion Sum	me/L	12.7	N/A	7290964	6.68	N/A	7290964
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	340	1.0	7290850	280	1.0	7290850
Calculated TDS	mg/L	710	1.0	7290967	360	1.0	7290967
Carb. Alkalinity (calc. as CaCO3)	mg/L	2.2	1.0	7290850	2.4	1.0	7290850
Cation Sum	me/L	13.3	N/A	7290964	6.64	N/A	7290964
Hardness (CaCO3)	mg/L	410	1.0	7291870	320	1.0	7291870
Ion Balance (% Difference)	%	2.11	N/A	7290963	0.290	N/A	7290963
Langelier Index (@ 20C)	N/A	0.983		7290965	0.984		7290965
Langelier Index (@ 4C)	N/A	0.736		7290966	0.736		7290966
Saturation pH (@ 20C)	N/A	6.86		7290965	6.97		7290965
Saturation pH (@ 4C)	N/A	7.10		7290966	7.21		7290966
Inorganics							
Total Ammonia-N	mg/L	<0.050	0.050	7295991	<0.050	0.050	7295991
Conductivity	umho/cm	1300	1.0	7293643	620	1.0	7293643
Dissolved Organic Carbon	mg/L	1.1	0.40	7293446	1.1	0.40	7293446
Orthophosphate (P)	mg/L	<0.010	0.010	7294372	<0.010	0.010	7294372
pH	pH	7.84		7293646	7.95		7293646
Dissolved Sulphate (SO4)	mg/L	15	1.0	7294369	4.4	1.0	7294369
Alkalinity (Total as CaCO3)	mg/L	340	1.0	7293640	280	1.0	7293640
Dissolved Chloride (Cl-)	mg/L	190	2.0	7294367	11	1.0	7294367
Nitrite (N)	mg/L	<0.010	0.010	7294669	<0.010	0.010	7294672
Nitrate (N)	mg/L	3.02	0.10	7294669	8.11	0.10	7294672
Nitrate + Nitrite (N)	mg/L	3.02	0.10	7294669	8.11	0.10	7294672
Metals							
Dissolved Aluminum (Al)	ug/L	<4.9	4.9	7296042	<4.9	4.9	7296042
Dissolved Antimony (Sb)	ug/L	<0.50	0.50	7296042	<0.50	0.50	7296042
Dissolved Arsenic (As)	ug/L	<1.0	1.0	7296042	<1.0	1.0	7296042
Dissolved Barium (Ba)	ug/L	20	2.0	7296042	10	2.0	7296042
Dissolved Beryllium (Be)	ug/L	<0.40	0.40	7296042	<0.40	0.40	7296042
Dissolved Boron (B)	ug/L	18	10	7296042	10	10	7296042
Dissolved Cadmium (Cd)	ug/L	<0.090	0.090	7296042	<0.090	0.090	7296042

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

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

BV Labs Job #: C194421
Report Date: 2021/04/15

exp Services Inc
Client Project #: 21001218
Site Location: ALDAIR
Sampler Initials: MB

RCAP - COMPREHENSIVE (LAB FILTERED)

BV Labs ID		PHA665			PHA666		
Sampling Date		2021/04/08			2021/04/08		
COC Number		821742-01-01			821742-01-01		
	UNITS	BH4	RDL	QC Batch	BH1	RDL	QC Batch
Dissolved Calcium (Ca)	ug/L	130000	200	7296042	100000	200	7296042
Dissolved Chromium (Cr)	ug/L	<5.0	5.0	7296042	<5.0	5.0	7296042
Dissolved Cobalt (Co)	ug/L	<0.50	0.50	7296042	<0.50	0.50	7296042
Dissolved Copper (Cu)	ug/L	2.0	0.90	7296042	2.0	0.90	7296042
Dissolved Iron (Fe)	ug/L	<100	100	7296042	<100	100	7296042
Dissolved Lead (Pb)	ug/L	<0.50	0.50	7296042	<0.50	0.50	7296042
Dissolved Magnesium (Mg)	ug/L	19000	50	7296042	16000	50	7296042
Dissolved Manganese (Mn)	ug/L	38	2.0	7296042	63	2.0	7296042
Dissolved Molybdenum (Mo)	ug/L	<0.50	0.50	7296042	2.4	0.50	7296042
Dissolved Nickel (Ni)	ug/L	1.7	1.0	7296042	2.2	1.0	7296042
Dissolved Phosphorus (P)	ug/L	<100	100	7296042	<100	100	7296042
Dissolved Potassium (K)	ug/L	3200	200	7296042	1000	200	7296042
Dissolved Selenium (Se)	ug/L	<2.0	2.0	7296042	<2.0	2.0	7296042
Dissolved Silicon (Si)	ug/L	5400	50	7296042	4500	50	7296042
Dissolved Silver (Ag)	ug/L	<0.090	0.090	7296042	<0.090	0.090	7296042
Dissolved Sodium (Na)	ug/L	120000	100	7296042	3300	100	7296042
Dissolved Strontium (Sr)	ug/L	220	1.0	7296042	120	1.0	7296042
Dissolved Thallium (Tl)	ug/L	<0.050	0.050	7296042	<0.050	0.050	7296042
Dissolved Titanium (Ti)	ug/L	<5.0	5.0	7296042	<5.0	5.0	7296042
Dissolved Uranium (U)	ug/L	0.23	0.10	7296042	0.25	0.10	7296042
Dissolved Vanadium (V)	ug/L	<0.50	0.50	7296042	<0.50	0.50	7296042
Dissolved Zinc (Zn)	ug/L	<5.0	5.0	7296042	<5.0	5.0	7296042

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

BV Labs Job #: C194421
Report Date: 2021/04/15

exp Services Inc
Client Project #: 21001218
Site Location: ALDAIR
Sampler Initials: MB

TEST SUMMARY

BV Labs ID: PHA665
Sample ID: BH4
Matrix: Water

Collected: 2021/04/08
Shipped:
Received: 2021/04/09

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7293640	N/A	2021/04/12	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	7290850	N/A	2021/04/13	Automated Statchk
Chloride by Automated Colourimetry	KONE	7294367	N/A	2021/04/13	Deonarine Ramnarine
Conductivity	AT	7293643	N/A	2021/04/12	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	7293446	N/A	2021/04/12	Nimarta Singh
Hardness (calculated as CaCO3)		7291870	N/A	2021/04/14	Automated Statchk
Lab Filtered Metals by ICPMS	ICP/MS	7296042	2021/04/13	2021/04/14	Prempal Bhatti
Ion Balance (% Difference)	CALC	7290963	N/A	2021/04/14	Automated Statchk
Anion and Cation Sum	CALC	7290964	N/A	2021/04/14	Automated Statchk
Total Ammonia-N	LACH/NH4	7295991	N/A	2021/04/14	Alina Dobreanu
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	7294669	N/A	2021/04/15	Nimarta Singh
pH	AT	7293646	2021/04/12	2021/04/12	Surinder Rai
Orthophosphate	KONE	7294372	N/A	2021/04/13	Avneet Kour Sudan
Sat. pH and Langelier Index (@ 20C)	CALC	7290965	N/A	2021/04/14	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	7290966	N/A	2021/04/14	Automated Statchk
Sulphate by Automated Colourimetry	KONE	7294369	N/A	2021/04/13	Avneet Kour Sudan
Total Dissolved Solids (TDS calc)	CALC	7290967	N/A	2021/04/14	Automated Statchk

BV Labs ID: PHA666
Sample ID: BH1
Matrix: Water

Collected: 2021/04/08
Shipped:
Received: 2021/04/09

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7293640	N/A	2021/04/12	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	7290850	N/A	2021/04/13	Automated Statchk
Chloride by Automated Colourimetry	KONE	7294367	N/A	2021/04/13	Deonarine Ramnarine
Conductivity	AT	7293643	N/A	2021/04/12	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	7293446	N/A	2021/04/12	Nimarta Singh
Hardness (calculated as CaCO3)		7291870	N/A	2021/04/14	Automated Statchk
Lab Filtered Metals by ICPMS	ICP/MS	7296042	2021/04/13	2021/04/14	Prempal Bhatti
Ion Balance (% Difference)	CALC	7290963	N/A	2021/04/14	Automated Statchk
Anion and Cation Sum	CALC	7290964	N/A	2021/04/14	Automated Statchk
Total Ammonia-N	LACH/NH4	7295991	N/A	2021/04/14	Alina Dobreanu
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	7294672	N/A	2021/04/15	Nimarta Singh
pH	AT	7293646	2021/04/12	2021/04/12	Surinder Rai
Orthophosphate	KONE	7294372	N/A	2021/04/13	Avneet Kour Sudan
Sat. pH and Langelier Index (@ 20C)	CALC	7290965	N/A	2021/04/14	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	7290966	N/A	2021/04/14	Automated Statchk
Sulphate by Automated Colourimetry	KONE	7294369	N/A	2021/04/13	Avneet Kour Sudan
Total Dissolved Solids (TDS calc)	CALC	7290967	N/A	2021/04/14	Automated Statchk

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Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

BV Labs Job #: C194421
Report Date: 2021/04/15

exp Services Inc
Client Project #: 21001218
Site Location: ALDAIR
Sampler Initials: MB

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	0.7°C

Results relate only to the items tested.

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BV Labs Job #: C194421
Report Date: 2021/04/15

QUALITY ASSURANCE REPORT

exp Services Inc
Client Project #: 21001218
Site Location: ALDAIR
Sampler Initials: MB

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7293446	Dissolved Organic Carbon	2021/04/12	97	80 - 120	98	80 - 120	<0.40	mg/L	1.4	20
7293640	Alkalinity (Total as CaCO3)	2021/04/12			96	85 - 115	<1.0	mg/L	1.2	20
7293643	Conductivity	2021/04/12			102	85 - 115	<1.0	umho/cm	0.89	25
7293646	pH	2021/04/12			102	98 - 103			0.20	N/A
7294367	Dissolved Chloride (Cl-)	2021/04/13	121 (1)	80 - 120	102	80 - 120	<1.0	mg/L	1.3	20
7294369	Dissolved Sulphate (SO4)	2021/04/13	119	75 - 125	103	80 - 120	<1.0	mg/L	4.5	20
7294372	Orthophosphate (P)	2021/04/13	107	75 - 125	101	80 - 120	<0.010	mg/L	NC	25
7294669	Nitrate (N)	2021/04/14	99	80 - 120	101	80 - 120	<0.10	mg/L	NC	20
7294669	Nitrite (N)	2021/04/14	95	80 - 120	100	80 - 120	<0.010	mg/L	1.4	20
7294672	Nitrate (N)	2021/04/15	100	80 - 120	102	80 - 120	<0.10	mg/L	NC	20
7294672	Nitrite (N)	2021/04/15	105	80 - 120	105	80 - 120	<0.010	mg/L	NC	20
7295991	Total Ammonia-N	2021/04/14	NC	75 - 125	101	80 - 120	<0.050	mg/L	11	20
7296042	Dissolved Aluminum (Al)	2021/04/14	101	80 - 120	101	80 - 120	<4.9	ug/L		
7296042	Dissolved Antimony (Sb)	2021/04/14	102	80 - 120	99	80 - 120	<0.50	ug/L		
7296042	Dissolved Arsenic (As)	2021/04/14	100	80 - 120	99	80 - 120	<1.0	ug/L		
7296042	Dissolved Barium (Ba)	2021/04/14	94	80 - 120	96	80 - 120	<2.0	ug/L		
7296042	Dissolved Beryllium (Be)	2021/04/14	104	80 - 120	100	80 - 120	<0.40	ug/L		
7296042	Dissolved Boron (B)	2021/04/14	116	80 - 120	94	80 - 120	<10	ug/L		
7296042	Dissolved Cadmium (Cd)	2021/04/14	101	80 - 120	99	80 - 120	<0.090	ug/L		
7296042	Dissolved Calcium (Ca)	2021/04/14	99	80 - 120	102	80 - 120	<200	ug/L	2.0	20
7296042	Dissolved Chromium (Cr)	2021/04/14	97	80 - 120	97	80 - 120	<5.0	ug/L		
7296042	Dissolved Cobalt (Co)	2021/04/14	96	80 - 120	101	80 - 120	<0.50	ug/L		
7296042	Dissolved Copper (Cu)	2021/04/14	98	80 - 120	98	80 - 120	<0.90	ug/L		
7296042	Dissolved Iron (Fe)	2021/04/14	97	80 - 120	98	80 - 120	<100	ug/L	NC	20
7296042	Dissolved Lead (Pb)	2021/04/14	97	80 - 120	97	80 - 120	<0.50	ug/L		
7296042	Dissolved Magnesium (Mg)	2021/04/14	98	80 - 120	98	80 - 120	<50	ug/L	1.4	20
7296042	Dissolved Manganese (Mn)	2021/04/14	97	80 - 120	97	80 - 120	<2.0	ug/L	0.63	20
7296042	Dissolved Molybdenum (Mo)	2021/04/14	100	80 - 120	95	80 - 120	<0.50	ug/L		
7296042	Dissolved Nickel (Ni)	2021/04/14	96	80 - 120	100	80 - 120	<1.0	ug/L		
7296042	Dissolved Phosphorus (P)	2021/04/14	103	80 - 120	99	80 - 120	<100	ug/L		
7296042	Dissolved Potassium (K)	2021/04/14	87	80 - 120	98	80 - 120	<200	ug/L	0.82	20

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Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7296042	Dissolved Selenium (Se)	2021/04/14	102	80 - 120	104	80 - 120	<2.0	ug/L		
7296042	Dissolved Silicon (Si)	2021/04/14	102	80 - 120	99	80 - 120	<50	ug/L		
7296042	Dissolved Silver (Ag)	2021/04/14	90	80 - 120	97	80 - 120	<0.090	ug/L		
7296042	Dissolved Sodium (Na)	2021/04/14	99	80 - 120	99	80 - 120	<100	ug/L	0.96	20
7296042	Dissolved Strontium (Sr)	2021/04/14	98	80 - 120	95	80 - 120	<1.0	ug/L		
7296042	Dissolved Thallium (Tl)	2021/04/14	97	80 - 120	101	80 - 120	<0.050	ug/L		
7296042	Dissolved Titanium (Ti)	2021/04/14	98	80 - 120	95	80 - 120	<5.0	ug/L		
7296042	Dissolved Uranium (U)	2021/04/14	98	80 - 120	97	80 - 120	<0.10	ug/L		
7296042	Dissolved Vanadium (V)	2021/04/14	100	80 - 120	99	80 - 120	<0.50	ug/L		
7296042	Dissolved Zinc (Zn)	2021/04/14	97	80 - 120	97	80 - 120	<5.0	ug/L		

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.

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 (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

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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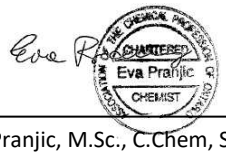
BV Labs Job #: C194421
Report Date: 2021/04/15

exp Services Inc
Client Project #: 21001218
Site Location: ALDAIR
Sampler Initials: MB

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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Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

Bureau Veritas Laboratories
109 & 110, 4023 Meadowbrook Drive, London, Ontario Canada N6L 1E7 Tel:(519) 652-9444 Toll-free 800-563-6266 Fax:(519) 652-8189 www.bvlabs.com

Page of

CHAIN OF CUSTODY RECORD

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:		Laboratory Use Only:	
Company Name:	#28124 exp Services Inc	Company Name:		Quotation #:	B91718	BV Labs Job #:	Bottle Order #:
Attention:	Accounts Payable	Attention:	Mark Bertens	P.O. #:			821742
Address:	15701 Robin's Hill Rd Unit 2	Address:		Project:	21001218		
	London ON N5V 0A5			Project Name:	Aldair	COC #:	Project Manager:
Tel:	(519) 963-3000 Fax: (519) 963-1152	Tel:	(519) 276-7925 Fax:	Site #:		C#821742-01-01	Christine Gripton
Email:	AP@exp.com, Karen.Burke@exp.com	Email:	mark.bertens@exp.com	Sampled By:	Marcello B		

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)	Other Regulations	Special Instructions
☐ Table 1 ☐ Res/Park ☐ Medium/Fine	☐ CCME ☐ Sanitary Sewer Bylaw	
☐ Table 2 ☐ Ind/Comm ☐ Coarse	☐ Reg 558 ☐ Storm Sewer Bylaw	
☐ Table 3 ☐ Agri/Other ☐ For RSC	☐ MISA Municipality	
☐ Table ___	☐ PWQO ☐ Reg 406 Table	
	☐ Other	

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: X
(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)	# of Bottles	Comments
1		BH4	April 8/2021	PM.	GW		X	3	
2		BH1	↓	PM	GW		X	3	
3					GW				
4					GW				
5					GW				
6									
7									
8									
9									
10									

09-Apr-21 09:10
Christine Gripton
C194421
ATM ENV-1354

REC'D IN LONDON
ON ICE

* 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: Time Sensitive	Temperature (°C) on Recei	Custody Seal	Yes	No
Marcello B/Marcello B	21/04/08	8:20	C.Gripton/C.Gripton	21/04/09	9:10			1,0 1°C	Present		✓
			Dipika Singh	2021/04/09	17:24				Intact		

* 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.

2/2/2

Your C.O.C. #: 691797-01-01

Attention: Eric Buchanan

exp Services Inc
London Branch
15701 Robin's Hill Rd
Unit 2
London, ON
CANADA N5V 0A5

Report Date: 2021/05/13
Report #: R6632682
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C1C3802
Received: 2021/05/07, 14:19

Sample Matrix: Water
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity	2	N/A	2021/05/10	CAM SOP-00448	SM 23 2320 B m
Carbonate, Bicarbonate and Hydroxide	2	N/A	2021/05/11	CAM SOP-00102	APHA 4500-CO2 D
Chloride by Automated Colourimetry	2	N/A	2021/05/11	CAM SOP-00463	SM 23 4500-Cl E m
Conductivity	2	N/A	2021/05/10	CAM SOP-00414	SM 23 2510 m
Dissolved Organic Carbon (DOC) (1)	1	N/A	2021/05/11	CAM SOP-00446	SM 23 5310 B m
Dissolved Organic Carbon (DOC) (1)	1	N/A	2021/05/12	CAM SOP-00446	SM 23 5310 B m
Hardness (calculated as CaCO3)	2	N/A	2021/05/13	CAM SOP 00102/00408/00447	SM 2340 B
Lab Filtered Metals by ICPMS	2	2021/05/11	2021/05/13	CAM SOP-00447	EPA 6020B m
Ion Balance (% Difference)	2	N/A	2021/05/13		
Anion and Cation Sum	2	N/A	2021/05/13		
Total Ammonia-N	2	N/A	2021/05/12	CAM SOP-00441	USGS I-2522-90 m
Nitrate (NO3) and Nitrite (NO2) in Water (2)	2	N/A	2021/05/10	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH	2	2021/05/10	2021/05/10	CAM SOP-00413	SM 4500H+ B m
Orthophosphate	2	N/A	2021/05/11	CAM SOP-00461	EPA 365.1 m
Sat. pH and Langelier Index (@ 20C)	2	N/A	2021/05/13		Auto Calc
Sat. pH and Langelier Index (@ 4C)	2	N/A	2021/05/13		Auto Calc
Sulphate by Automated Colourimetry	2	N/A	2021/05/11	CAM SOP-00464	EPA 375.4 m
Total Dissolved Solids (TDS calc)	2	N/A	2021/05/13		Auto Calc

Remarks:

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.

Your C.O.C. #: 691797-01-01

Attention: Eric Buchanan

exp Services Inc
London Branch
15701 Robin's Hill Rd
Unit 2
London, ON
CANADA N5V 0A5

Report Date: 2021/05/13
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CERTIFICATE OF ANALYSIS

BV LABS JOB #: C1C3802
Received: 2021/05/07, 14:19

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.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
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.

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
==========
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.

RCAP - COMPREHENSIVE (LAB FILTERED)

BV Labs ID		PNB902			PNB903		
Sampling Date		2021/05/07			2021/05/07		
COC Number		691797-01-01			691797-01-01		
	UNITS	BH4	RDL	QC Batch	BH1	RDL	QC Batch
Calculated Parameters							
Anion Sum	me/L	11.8	N/A	7341797	6.54	N/A	7341797
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	330	1.0	7341791	280	1.0	7341791
Calculated TDS	mg/L	650	1.0	7341792	350	1.0	7341792
Carb. Alkalinity (calc. as CaCO3)	mg/L	1.7	1.0	7341791	1.8	1.0	7341791
Cation Sum	me/L	12.1	N/A	7341797	6.50	N/A	7341797
Hardness (CaCO3)	mg/L	410	1.0	7341794	320	1.0	7341794
Ion Balance (% Difference)	%	1.09	N/A	7341795	0.280	N/A	7341795
Langelier Index (@ 20C)	N/A	0.878		7341789	0.850		7341789
Langelier Index (@ 4C)	N/A	0.631		7341790	0.601		7341790
Saturation pH (@ 20C)	N/A	6.86		7341789	6.98		7341789
Saturation pH (@ 4C)	N/A	7.11		7341790	7.23		7341790
Inorganics							
Total Ammonia-N	mg/L	<0.050	0.050	7343383	<0.050	0.050	7343383
Conductivity	umho/cm	1200	1.0	7342765	610	1.0	7342765
Dissolved Organic Carbon	mg/L	0.88	0.40	7342108	1.3	0.40	7342074
Orthophosphate (P)	mg/L	<0.010	0.010	7344708	<0.010	0.010	7344708
pH	pH	7.74		7342764	7.83		7342764
Dissolved Sulphate (SO4)	mg/L	13	1.0	7344700	5.5	1.0	7344700
Alkalinity (Total as CaCO3)	mg/L	330	1.0	7342759	280	1.0	7342759
Dissolved Chloride (Cl-)	mg/L	160	2.0	7344707	12	1.0	7344707
Nitrite (N)	mg/L	<0.010	0.010	7342155	<0.010	0.010	7342155
Nitrate (N)	mg/L	4.52	0.10	7342155	7.36	0.10	7342155
Nitrate + Nitrite (N)	mg/L	4.52	0.10	7342155	7.36	0.10	7342155
Metals							
Dissolved Aluminum (Al)	ug/L	5.5	4.9	7346018	<4.9	4.9	7346018
Dissolved Antimony (Sb)	ug/L	<0.50	0.50	7346018	<0.50	0.50	7346018
Dissolved Arsenic (As)	ug/L	<1.0	1.0	7346018	<1.0	1.0	7346018
Dissolved Barium (Ba)	ug/L	15	2.0	7346018	8.7	2.0	7346018
Dissolved Beryllium (Be)	ug/L	<0.40	0.40	7346018	<0.40	0.40	7346018
Dissolved Boron (B)	ug/L	18	10	7346018	13	10	7346018
Dissolved Cadmium (Cd)	ug/L	<0.090	0.090	7346018	<0.090	0.090	7346018
Dissolved Calcium (Ca)	ug/L	130000	200	7346018	100000	200	7346018

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

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

RCAP - COMPREHENSIVE (LAB FILTERED)

BV Labs ID		PNB902			PNB903		
Sampling Date		2021/05/07			2021/05/07		
COC Number		691797-01-01			691797-01-01		
	UNITS	BH4	RDL	QC Batch	BH1	RDL	QC Batch
Dissolved Chromium (Cr)	ug/L	<5.0	5.0	7346018	<5.0	5.0	7346018
Dissolved Cobalt (Co)	ug/L	<0.50	0.50	7346018	<0.50	0.50	7346018
Dissolved Copper (Cu)	ug/L	3.6	0.90	7346018	3.0	0.90	7346018
Dissolved Iron (Fe)	ug/L	<100	100	7346018	<100	100	7346018
Dissolved Lead (Pb)	ug/L	<0.50	0.50	7346018	<0.50	0.50	7346018
Dissolved Magnesium (Mg)	ug/L	20000	50	7346018	16000	50	7346018
Dissolved Manganese (Mn)	ug/L	3.1	2.0	7346018	<2.0	2.0	7346018
Dissolved Molybdenum (Mo)	ug/L	<0.50	0.50	7346018	<0.50	0.50	7346018
Dissolved Nickel (Ni)	ug/L	1.0	1.0	7346018	<1.0	1.0	7346018
Dissolved Phosphorus (P)	ug/L	<100	100	7346018	<100	100	7346018
Dissolved Potassium (K)	ug/L	3000	200	7346018	980	200	7346018
Dissolved Selenium (Se)	ug/L	<2.0	2.0	7346018	<2.0	2.0	7346018
Dissolved Silicon (Si)	ug/L	5600	50	7346018	4600	50	7346018
Dissolved Silver (Ag)	ug/L	<0.090	0.090	7346018	<0.090	0.090	7346018
Dissolved Sodium (Na)	ug/L	89000	100	7346018	3100	100	7346018
Dissolved Strontium (Sr)	ug/L	220	1.0	7346018	120	1.0	7346018
Dissolved Thallium (Tl)	ug/L	<0.050	0.050	7346018	<0.050	0.050	7346018
Dissolved Titanium (Ti)	ug/L	<5.0	5.0	7346018	<5.0	5.0	7346018
Dissolved Uranium (U)	ug/L	0.17	0.10	7346018	0.22	0.10	7346018
Dissolved Vanadium (V)	ug/L	<0.50	0.50	7346018	<0.50	0.50	7346018
Dissolved Zinc (Zn)	ug/L	<5.0	5.0	7346018	<5.0	5.0	7346018

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

TEST SUMMARY

BV Labs ID: PNB902
Sample ID: BH4
Matrix: Water

Collected: 2021/05/07
Shipped:
Received: 2021/05/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7342759	N/A	2021/05/10	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	7341791	N/A	2021/05/11	Automated Statchk
Chloride by Automated Colourimetry	KONE	7344707	N/A	2021/05/11	Deonarine Ramnarine
Conductivity	AT	7342765	N/A	2021/05/10	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	7342108	N/A	2021/05/12	Nimarta Singh
Hardness (calculated as CaCO3)		7341794	N/A	2021/05/13	Automated Statchk
Lab Filtered Metals by ICPMS	ICP/MS	7346018	2021/05/11	2021/05/13	Prempal Bhatti
Ion Balance (% Difference)	CALC	7341795	N/A	2021/05/13	Automated Statchk
Anion and Cation Sum	CALC	7341797	N/A	2021/05/13	Automated Statchk
Total Ammonia-N	LACH/NH4	7343383	N/A	2021/05/12	Amanpreet Sappal
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	7342155	N/A	2021/05/10	Chandra Nandlal
pH	AT	7342764	2021/05/10	2021/05/10	Surinder Rai
Orthophosphate	KONE	7344708	N/A	2021/05/11	Avneet Kour Sudan
Sat. pH and Langelier Index (@ 20C)	CALC	7341789	N/A	2021/05/13	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	7341790	N/A	2021/05/13	Automated Statchk
Sulphate by Automated Colourimetry	KONE	7344700	N/A	2021/05/11	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	7341792	N/A	2021/05/13	Automated Statchk

BV Labs ID: PNB902 Dup
Sample ID: BH4
Matrix: Water

Collected: 2021/05/07
Shipped:
Received: 2021/05/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7342759	N/A	2021/05/10	Surinder Rai
Conductivity	AT	7342765	N/A	2021/05/10	Surinder Rai
pH	AT	7342764	2021/05/10	2021/05/10	Surinder Rai

BV Labs ID: PNB903
Sample ID: BH1
Matrix: Water

Collected: 2021/05/07
Shipped:
Received: 2021/05/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7342759	N/A	2021/05/10	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	7341791	N/A	2021/05/11	Automated Statchk
Chloride by Automated Colourimetry	KONE	7344707	N/A	2021/05/11	Deonarine Ramnarine
Conductivity	AT	7342765	N/A	2021/05/10	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	7342074	N/A	2021/05/11	Nimarta Singh
Hardness (calculated as CaCO3)		7341794	N/A	2021/05/13	Automated Statchk
Lab Filtered Metals by ICPMS	ICP/MS	7346018	2021/05/11	2021/05/13	Prempal Bhatti
Ion Balance (% Difference)	CALC	7341795	N/A	2021/05/13	Automated Statchk
Anion and Cation Sum	CALC	7341797	N/A	2021/05/13	Automated Statchk
Total Ammonia-N	LACH/NH4	7343383	N/A	2021/05/12	Amanpreet Sappal
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	7342155	N/A	2021/05/10	Chandra Nandlal
pH	AT	7342764	2021/05/10	2021/05/10	Surinder Rai
Orthophosphate	KONE	7344708	N/A	2021/05/11	Avneet Kour Sudan
Sat. pH and Langelier Index (@ 20C)	CALC	7341789	N/A	2021/05/13	Automated Statchk

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Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

BV Labs Job #: C1C3802
Report Date: 2021/05/13

exp Services Inc
Sampler Initials: MB

TEST SUMMARY

BV Labs ID: PNB903
Sample ID: BH1
Matrix: Water

Collected: 2021/05/07
Shipped:
Received: 2021/05/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Sat. pH and Langelier Index (@ 4C)	CALC	7341790	N/A	2021/05/13	Automated Statchk
Sulphate by Automated Colourimetry	KONE	7344700	N/A	2021/05/11	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	7341792	N/A	2021/05/13	Automated Statchk

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GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	4.7°C

Results relate only to the items tested.

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BV Labs Job #: C1C3802
Report Date: 2021/05/13

QUALITY ASSURANCE REPORT

exp Services Inc
Sampler Initials: MB

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7342074	Dissolved Organic Carbon	2021/05/11	99	80 - 120	98	80 - 120	<0.40	mg/L	1.7	20
7342108	Dissolved Organic Carbon	2021/05/12	NC	80 - 120	97	80 - 120	<0.40	mg/L	0.85	20
7342155	Nitrate (N)	2021/05/10	100	80 - 120	95	80 - 120	<0.10	mg/L	5.6	20
7342155	Nitrite (N)	2021/05/10	88	80 - 120	107	80 - 120	<0.010	mg/L	NC	20
7342759	Alkalinity (Total as CaCO3)	2021/05/10			97	85 - 115	<1.0	mg/L	0.70	20
7342764	pH	2021/05/10			102	98 - 103			0.22	N/A
7342765	Conductivity	2021/05/10			100	85 - 115	<1.0	umho/cm	0.084	25
7343383	Total Ammonia-N	2021/05/12	100	75 - 125	99	80 - 120	<0.050	mg/L	NC	20
7344700	Dissolved Sulphate (SO4)	2021/05/11	96	75 - 125	107	80 - 120	<1.0	mg/L	1.8	20
7344707	Dissolved Chloride (Cl-)	2021/05/11	NC	80 - 120	103	80 - 120	<1.0	mg/L	0.52	20
7344708	Orthophosphate (P)	2021/05/11	112	75 - 125	102	80 - 120	<0.010	mg/L	NC	25
7346018	Dissolved Aluminum (Al)	2021/05/13	95	80 - 120	96	80 - 120	<4.9	ug/L	NC	20
7346018	Dissolved Antimony (Sb)	2021/05/13	107	80 - 120	106	80 - 120	<0.50	ug/L	NC	20
7346018	Dissolved Arsenic (As)	2021/05/13	102	80 - 120	100	80 - 120	<1.0	ug/L	NC	20
7346018	Dissolved Barium (Ba)	2021/05/13	102	80 - 120	101	80 - 120	<2.0	ug/L	2.3	20
7346018	Dissolved Beryllium (Be)	2021/05/13	102	80 - 120	102	80 - 120	<0.40	ug/L	NC	20
7346018	Dissolved Boron (B)	2021/05/13	100	80 - 120	97	80 - 120	<10	ug/L	0.70	20
7346018	Dissolved Cadmium (Cd)	2021/05/13	103	80 - 120	101	80 - 120	<0.090	ug/L	NC	20
7346018	Dissolved Calcium (Ca)	2021/05/13	97	80 - 120	99	80 - 120	<200	ug/L	1.3	20
7346018	Dissolved Chromium (Cr)	2021/05/13	103	80 - 120	101	80 - 120	<5.0	ug/L	NC	20
7346018	Dissolved Cobalt (Co)	2021/05/13	101	80 - 120	100	80 - 120	<0.50	ug/L	NC	20
7346018	Dissolved Copper (Cu)	2021/05/13	103	80 - 120	101	80 - 120	<0.90	ug/L	3.0	20
7346018	Dissolved Iron (Fe)	2021/05/13	99	80 - 120	97	80 - 120	<100	ug/L	NC	20
7346018	Dissolved Lead (Pb)	2021/05/13	102	80 - 120	100	80 - 120	<0.50	ug/L	NC	20
7346018	Dissolved Magnesium (Mg)	2021/05/13	100	80 - 120	99	80 - 120	<50	ug/L	0.31	20
7346018	Dissolved Manganese (Mn)	2021/05/13	102	80 - 120	99	80 - 120	<2.0	ug/L	0.016	20
7346018	Dissolved Molybdenum (Mo)	2021/05/13	107	80 - 120	103	80 - 120	<0.50	ug/L	NC	20
7346018	Dissolved Nickel (Ni)	2021/05/13	100	80 - 120	97	80 - 120	<1.0	ug/L	NC	20
7346018	Dissolved Phosphorus (P)	2021/05/13	107	80 - 120	107	80 - 120	<100	ug/L	NC	20
7346018	Dissolved Potassium (K)	2021/05/13	105	80 - 120	100	80 - 120	<200	ug/L	0.96	20
7346018	Dissolved Selenium (Se)	2021/05/13	100	80 - 120	99	80 - 120	<2.0	ug/L	NC	20

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Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7346018	Dissolved Silicon (Si)	2021/05/13	98	80 - 120	99	80 - 120	<50	ug/L	1.4	20
7346018	Dissolved Silver (Ag)	2021/05/13	100	80 - 120	101	80 - 120	<0.090	ug/L	NC	20
7346018	Dissolved Sodium (Na)	2021/05/13	101	80 - 120	100	80 - 120	<100	ug/L	1.1	20
7346018	Dissolved Strontium (Sr)	2021/05/13	99	80 - 120	96	80 - 120	<1.0	ug/L	0.051	20
7346018	Dissolved Thallium (Tl)	2021/05/13	103	80 - 120	100	80 - 120	<0.050	ug/L	NC	20
7346018	Dissolved Titanium (Ti)	2021/05/13	98	80 - 120	97	80 - 120	<5.0	ug/L	NC	20
7346018	Dissolved Uranium (U)	2021/05/13	100	80 - 120	101	80 - 120	<0.10	ug/L	13	20
7346018	Dissolved Vanadium (V)	2021/05/13	100	80 - 120	98	80 - 120	<0.50	ug/L	NC	20
7346018	Dissolved Zinc (Zn)	2021/05/13	101	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.

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 (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

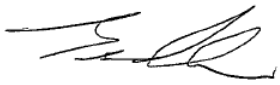
NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

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

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Brad Newman, B.Sc., C.Chem., Scientific Service 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.

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

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Maxxam
A Bureau Veritas Group Company

Maxxam Analytics International Corporation o/a Maxxam Analytics
109 & 110, 4023 Meadowbrook Drive, London, Ontario Canada N6L 1E7 Tel.(519) 652-9444 Toll-free 800-563-6266 Fax.(519) 652-8189 www.maxxam.ca

REC'D IN LONDON

07-May-21 14:19
Christine Gripton
C1C3802
VRV ENV-1108

Page of

Bottle Order #: 691797

Project Manager: Christine Gripton

C#691797-01-01

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:	
Company Name:	#28124 exp Services Inc	Company Name:		Quotation #:	B45998
Attention:	Accounts Payable	Attehtion:		P.O. #:	
Address:	15701 Robin's Hill Rd Unit 2	Address:		Project:	
	London ON N5V 0A5			Project Name:	
Tel:	(519) 963-3000 Fax: (519) 963-1152	Tel:	Fax:	Site #:	
Email:	AP@exp.com, karen.Burke@exp.com	Email:	erin.buchanan@exp.com	Sampled By:	MMirello

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE MAXXAM 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
- ☐ Other ___

Special Instructions

Include Criteria on Certificate of Analysis (Y/N)? ___

Field Filtered (please circle): Metals / Hg / Cr VI

ANALYSIS REQUESTED (PLEASE BE SPECIFIC)

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	RCAp - Comprehensive	# of Bottles	Comments
1		BH4	May 7	AM	GW	X	3	
2		BH1	May 7	AM	GW	X	3	
3								
4								
5								
6								
7								
8								
9								
10								On Ice

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 #)*

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time
M. B/Mirello B	21/05/07	8	[illegible] Lu Bai	2021/5/7	14:19
			Dipika & DIPIKA SINGH	21/05/07	17:50

jars used and not submitted

Laboratory Use Only

Time Sensitive	Temperature (°C) on Recei	Custody Seal Present	Yes	No
	6.7.1	Intact		✓

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO MAXXAM'S 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.MAXXAM.CA/TERMS.

* 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 HTTP://MAXXAM.CA/WP-CONTENT/UPLOADS/ONTARIO-COC.PDF.

SAMPLES MUST BE KEPT COOL (< 10° C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

White: Maxxa Yellow: Client

0/0/3 WB#204207

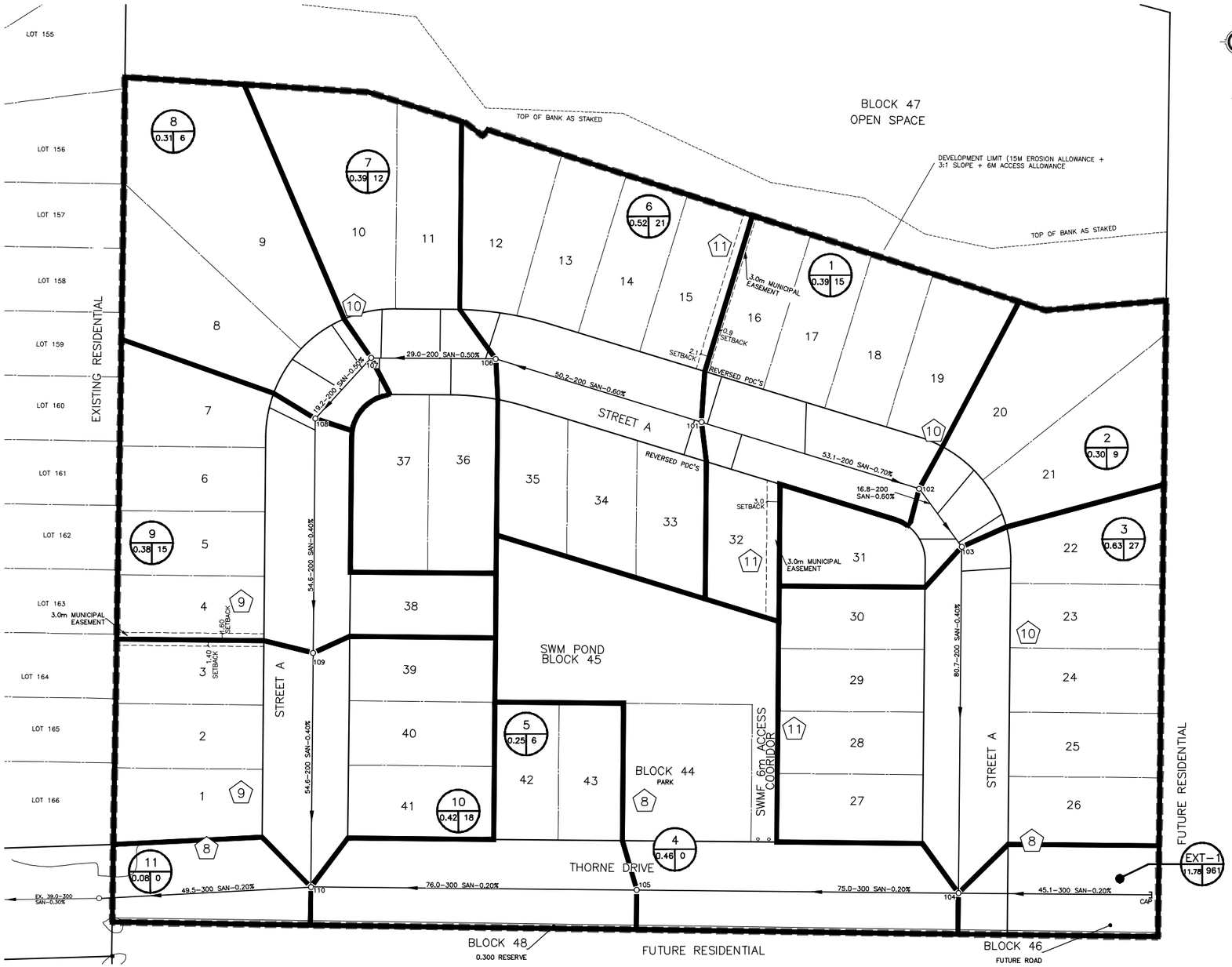
Maxxam Analytics International Corporation o/a Maxxam Analytics

Appendix C

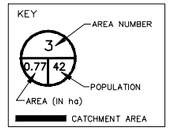
Design Parameters

MTE FILE No: 42025-104 -3

P:\P\42025\104\42025-104-W1



KEY

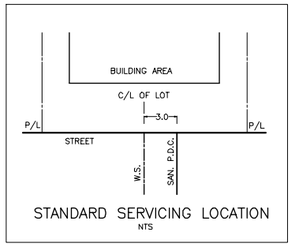


100mm SANITARY CLEANOUTS TO BE INSTALLED ON ALL SANITARY PDC's. CLEANOUTS SHALL BE LOCATED 0.3m FROM THE P/L ON THE ROAD ALLOWANCE AS PER SCSD-20

SANITARY SEWERS SHALL BE LOCATED IN ACCORDANCE WITH THE STANDARD UTILITY LOCATION DRAWINGS SCSD-1, SCSD-2 AND SCSD-3.

LEGEND

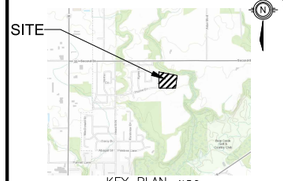
- 129 — DENOTES LOT NUMBERS
- LIMIT OF CONSTRUCTION
- 110 — SANITARY MANHOLE
- SANITARY SEWER
- 09 — PLAN & PROFILE DRAWING NUMBER
- EXISTING SANITARY SEWER



STANDARD SERVICING LOCATION
NTS

LOT SERVICES TO BE INSTALLED IN ACCORDANCE WITH THE MUNICIPALITY OF STRATHROY-CARADOC DWG (SCSD-15)

MUNICIPALITY OF STRATHROY-CARADOC



KEY PLAN N.T.S.

GEODETIC BM ELEV. =230.002m
Township: STRATHROY MOFFETT & POWEL LUMBER SUPPLIES OFFICE BUILDING, SOUTH SIDE OF COUNTY ROAD NO. 39, 1.0 KM WEST OF INTERSECTION OF HIGHWAY NO. 81, TABLET IN SOUTH SIDE OF CONCRETE FOUNDATION, 23 CM FROM SOUTHEAST CORNER, 90 CM BELOW WOOD SIDING, AT ROAD LEVEL.

SITE BENCHMARK ELEV. =235.970m
SIB AT THE SOUTH WEST CORNER OF BLOCK 48

NOTE TO CONTRACTOR :

DO NOT SCALE DRAWINGS.

CONTRACTORS MUST CHECK AND VERIFY ALL DIMENSIONS AND REPORT ANY DISCREPANCIES TO THE ENGINEER BEFORE PROCEEDING WITH THE WORK.

ALL DRAWINGS REMAIN THE PROPERTY OF THE ENGINEER AND SHALL NOT BE REPRODUCED OR REUSED WITHOUT THE ENGINEER'S WRITTEN PERMISSION.

THE OWNER/ARCHITECT/CONTRACTOR IS ADVISED THAT M.T.E. CONSULTANTS INC. CANNOT CERTIFY ANY COMPONENT OF THE SITE WORKS NOT INSPECTED DURING CONSTRUCTION. IT IS THE RESPONSIBILITY OF THE GENERAL CONTRACTOR TO NOTIFY M.T.E. CONSULTANTS INC. PRIOR TO COMMENCEMENT OF CONSTRUCTION TO ARRANGE FOR INSPECTION.

No.	REVISION	BY	DATE
8.			
7.			
6.			
5.			
4.			
3.	REVISED PER COMMENTS	JJM	JUL./20
2.	REVISED PER COMMENTS	JJM	MAR./20
1.	FOR CITY REVIEW	JJM	SEPT./19

MTE
Engineers, Scientists, Surveyors
519-204-6510 www.mte85.com

2020-10-02

OWNER

2634876 ONTARIO INC.

PROJECT

CREEKSIDE MEADOWS

DRAWING

SANITARY AREA PLAN

Project Manager: R. LUCAS	Project No.: 42025-104
Design By: RC	Checked By: JJM
Drawn By: JAC	Checked By: RC
Surveyed By:	Drawing No.: 3
Date: Aug.13/20	
Scale: 1:500	Sheet of

MTE FILE No: 42025-104 -4

P:\P\42025\104\42025-104-W1

RESIDENTIAL POPULATION DENSITIES

THE FOLLOWING POPULATION ALLOWANCES WILL APPLY WHEN DESIGNING SANITARY SEWERS:

(A) HECTARE BASIS

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

(B) LOT BASIS

SINGLE FAMILY	= 3 PEOPLE
DUPLEX / SEMI	= 6 PEOPLE

SANITARY SEWER DESIGN SHEET

MUNICIPALITY OF STRATHROY-CARADOC

ENGINEERING & PUBLIC WORKS

- FUTURE/EXTERNAL/EXISTING DESIGN

PROJECT NAME : CREEKSIDE MEADOWS SUBDIVISION

DATE : SEPT 2019
DESIGNED BY : RC
CHECKED BY : JJM
FILE No : 42025-104
SHEET : 1

DESIGN CRITERIA

SEWAGE = 365 L/DAY/CAP = 0.00422 x 1.1 l/s/person
INFILTRATION = 6740 L/HA/DAY = infilt. of 0.078 l/s/ha
PEAKING FACTOR = HARMON FORMULA $M = 1 + \frac{14}{4 + P^{0.5}}$

LOCATION				AREA (HECTARES)			POPULATION					SEWAGE FLOW				SEWER DESIGN					PROFILE					
AREA	STREET	FROM	TO	NET OR	DELTA	TOTAL	PER	PER	No. OF	DELTA	TOTAL	M	SEWAGE	INFILT.	TOTAL	DIA.	SLOPE		VELOCITY	CAP.	LENGTH	FALL IN		DROP IN	INVERT EL.EV.	
No.		M.H.	M.H.	GROSS	AREA ha	AREA ha	ha	LOT	LOTS	POP.	POP.	Min.2.0	l/s	l/s	l/s	mm	%	n	m / s	l / s	M	SEWER	HEADLOSS	MANHOLE	U.S.	D.S.
1		101	102		0.39	0.39		3	5	15.00	15	4.40	0.31	0.03	**0.34**	200	0.70	0.013	0.87	27.44	53.10	0.372			233.826	233.454
2		102	103		0.30	0.69		3	3	9.00	24	4.37	0.49	0.05	**0.54**	200	0.60	0.013	0.81	25.41	16.80	0.101		0.050	233.404	233.303
3		103	104		0.63	1.32		3	9	27.00	51	4.31	1.02	0.10	**1.12**	200	0.40	0.013	0.66	20.74	80.70	0.323		0.050	233.253	232.930
EXT-1		CAP	104		11.78	11.78				961.00	951	3.81	16.84	0.92	**17.76**	300	0.20	0.013	0.61	43.25	45.10	0.090			232.970	232.880
4		104	105		0.46	13.56		3	0	0.00	1002	3.80	17.69	1.06	**18.75**	300	0.20	0.013	0.61	43.25	75.00	0.150		0.100	232.830	232.680
5		105	110		0.25	13.81		3	2	6.00	1008	3.80	17.80	1.08	**18.88**	300	0.20	0.013	0.61	43.25	76.00	0.152		0.025	232.655	232.503
6		101	106		0.52	0.52		3	7	21.00	21	4.38	0.43	0.04	**0.47**	200	0.60	0.013	0.81	25.41	50.20	0.301			233.731	233.430
7		106	107		0.39	0.91		3	4	12.00	33	4.35	0.67	0.07	**0.74**	200	0.50	0.013	0.74	23.19	29.00	0.145		0.050	233.380	233.235
8		107	108		0.31	1.22		3	2	6.00	39	4.34	0.79	0.10	**0.89**	200	0.50	0.013	0.74	23.19	19.20	0.096		0.050	233.185	233.089
9		108	109		0.38	1.60		3	5	15.00	54	4.31	1.08	0.12	**1.20**	200	0.40	0.013	0.66	20.74	54.60	0.218		0.050	233.039	232.821
10		109	110		0.42	2.02		3	6	18.00	72	4.28	1.43	0.16	**1.59**	200	0.40	0.013	0.66	20.74	54.60	0.218		0.025	232.796	232.578
11		110	EX. MH		0.08	15.91		3	0	0.00	1080	3.78	18.97	1.24	**20.21**	300	0.20	0.013	0.61	43.25	49.50	0.099		0.025	232.478	232.379
		EX. MH	EX. MH		10.62	26.53				376.00	1456	3.69	24.97	2.07	**27.04**	300	0.30	0.013	0.75	52.97	39.00	0.117		0.025	232.354	232.237

STORM SEWER DESIGN SHEET

RUNOFF COEFFICIENT 'C'

PARKS & PLAYGROUNDS		0.20
RESIDENTIAL	SINGLE FAMILY	0.35
	MULTI FAMILY	0.65
	APARTMENTS	0.70
COMMERCIAL & INDUST.		0.70
DENSELY BUILT, PAVED		0.90

FLOW Q = 2.78 CiA
WHERE Q = PEAK FLOW IN LITRES PER SECOND (l/s)
A = AREA IN HECTARES (ha)
C = RUNOFF COEFFICIENT
i = RAINFALL INTENSITY IN MILLIMETRES PER HOUR (mm/hr.)

Return Period _____5_____ **Years**

MUNICIPALITY OF STRATHROY-CARADOC

ENGINEERING & PUBLIC WORKS

- FUTURE/EXTERNAL/EXISTING DESIGN

PROJECT NAME : CREEKSIDE MEADOWS SUBDIVISION

DATE : SEPT 2019
DESIGNED BY : RC
CHECKED BY : JJM
FILE No. : 42025-104
SHEET : 2

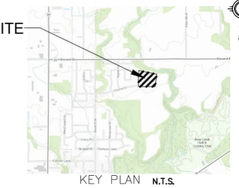
LOCATION				AREA (A)			TOTAL A x C						RAINFALL INTENSITY			Q	SEWER DESIGN							PROFILE				
AREA	STREET	FROM	TO	AREA DIM.	DELTA	TOTAL		DELTA	SECTION	LATERAL	SEWER	TOTAL	TIME ENTRY min.		INTENSITY		DIA.	SLOPE		VEL.	CAP.	LENGTH	T of Q	FALL IN		DROP IN	INVERT ELEV.	
No.		M.H.	M.H.	Sq. m	AREA ha	AREA ha	'C'	A x C	A x C	A x C	A x C	2.78 AxC	SECT.	ACCUM.	I'mm/hr.	l/s	mm	%	n	m/s	l/s	m	Min.	SECTION	HEADLOSS	MANHOLE	U.S.	D.S.
1	Street A	1	2		0.09	0.09	0.35	0.032	0.000		0.032	0.089		10.00	104.90	9	300	0.43	0.013	0.90	63	38.0	0.70	0.163			234.720	234.557
2	Street A	2	3		0.15	0.24	0.35	0.053	0.032		0.085	0.236	0.70	10.70	101.85	24	300	0.43	0.013	0.90	63	30.8	0.57	0.132	0.022	0.050	234.507	234.375
3	Street A	3	4		0.27	0.51	0.35	0.095	0.085		0.180	0.500	0.57	11.27	100.33	50	375	0.32	0.013	0.90	99	21.7	0.40	0.069	0.045	0.075	234.300	234.231
4	Street A	4	5		0.20	0.71	0.35	0.070	0.180		0.250	0.695	0.40	11.67	98.81	69	375	0.32	0.013	0.90	99	52.4	0.97	0.168	0.043	0.050	234.181	234.013
5	Lot 4/3	RYCBMH	5		0.27	0.27	0.35	0.095	0.000		0.095	0.264		10.00	104.90	28	300	0.43	0.013	0.90	63	39.3	0.73	0.169			234.257	234.088
6	Street A	5	6		0.26	1.24	0.35	0.091	0.250	0.095	0.436	1.212	0.97	12.64	94.49	115	450	0.25	0.013	0.90	143	61.1	1.13	0.153		0.075	233.938	233.785
7	Thorne Drive	6	7		0.16	1.40	0.35	0.056	0.436		0.492	1.368	1.13	13.77	90.93	124	450	0.25	0.013	0.90	143	54.2	1.00	0.136		0.075	233.710	233.574
8	Thorne Drive	7	12		0.14	1.54	0.35	0.049	0.492		0.541	1.504	1.00	14.77	87.88	132	525	0.21	0.013	0.91	197	54.3	0.99	0.114		0.075	233.499	233.385
9	Street A	8	9		0.32	0.32	0.35	0.112	0.000		0.112	0.311		10.00	104.90	33	300	0.43	0.013	0.90	63	32.0	0.59	0.138			234.217	234.079
10	Street A	9	10		0.19	0.51	0.35	0.067	0.112		0.179	0.498	0.59	10.59	102.87	51	375	0.32	0.013	0.90	99	18.6	0.34	0.060	0.062	0.075	234.004	233.944
11	Street A	10	11		0.43	0.94	0.35	0.151	0.179		0.330	0.917	0.34	10.93	101.09	93	450	0.25	0.013	0.90	143	85.0	1.57	0.213	0.036	0.075	233.869	233.656
12	Future Thorne Drive	TEMP. DICB	11		0.12	0.12	0.35	0.042	0.000		0.042	0.117		10.00	104.90	12	300	0.43	0.013	0.90	63	34.1	0.63	0.147			233.878	233.731
13	Thorne Drive	11	12		0.11	1.17	0.35	0.039	0.330	0.042	0.411	1.143	1.57	12.50	94.74	108	450	0.25	0.013	0.90	143	48.5	0.90	0.121		0.075	233.581	233.460
	SWM Access	12	13		0.00	2.71	0.35	0.000	0.541	0.411	0.952	2.647	See Note A	14.70	88.14	233	600	0.17	0.013	0.90	253	48.0	0.89	0.082		0.075	233.310	233.228
	SWM Pond	13	14		0.00	2.71	0.35	0.000	0.952		0.952	2.647	0.89	15.59	85.60	227	600	0.17	0.013	0.90	253	18.0	0.33	0.031		0.060	233.168	233.137
	SWM Pond	14	HEADWALL		0.00	2.71	0.35	0.000	0.952		0.952	2.647	0.33	15.92	84.33	223	600	0.17	0.013	0.90	253	7.5	0.14	0.013		0.060	233.077	233.064
14	SWM Easement	HEADWALL	15		0.93	3.64	0.35	0.326	0.952		1.278	3.553	0.14	16.06	84.07	299	600	0.50	0.013	1.54	434	15.0	0.16	0.075		0.000	233.200	233.125
	Street A	15	16			3.64	0.35	0.000	1.278		1.278	3.553	0.16	16.22	83.57	297	900	0.50	0.013	2.01	1280	45.5	0.38	0.228		0.447	232.678	232.450
	SWM Easement	16	17			3.64	0.35	0.000	1.278		1.278	3.553	0.38	16.60	82.55	293	900	0.50	0.013	2.01	1279	20.1	0.17	0.100		0.075	232.375	232.275
	SWM Easement	17	18			3.64	0.35	0.000	1.278		1.278	3.553	0.17	16.77	82.04	292	900	0.50	0.013	2.01	1280	49.9	0.41	0.250		0.075	232.200	231.950
	Block 47	18	HEADWALL			3.64	0.35	0.000	1.278		1.278	3.553	0.41	17.18	80.77	287	900	0.50	0.013	2.01	1280	25.9	0.21	0.130		0.075	231.875	231.745

*** Adjusted Tc based on the following:**

NOTE A: [((14.77+0.99)x132)+((12.5+0.90)x109)]/(132+109) = 14.69 min

MUNICIPALITY OF STRATHROY-CARADOC

SITE



KEY PLAN N.T.S.

GEODETIC BM ELEV. =230.002m
Township: STRATHROY MOFFETT & POWEL LUMBER SUPPLIES OFFICE BUILDING, SOUTH SIDE OF COUNTY ROAD NO. 39, 1.0 KM WEST OF INTERSECTION OF HIGHWAY NO. 81, TABLET IN SOUTH SIDE OF CONCRETE FOUNDATION, 23 CM FROM SOUTHEAST CORNER, 90 CM BELOW WOOD SIDING, AT ROAD LEVEL.

SITE BENCHMARK ELEV. =235.970m
SIB AT THE SOUTH WEST CORNER OF BLOCK 48

NOTE TO CONTRACTOR :

DO NOT SCALE DRAWINGS.

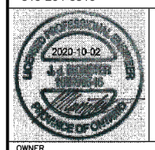
CONTRACTORS MUST CHECK AND VERIFY ALL DIMENSIONS AND REPORT ANY DISCREPANCIES TO THE ENGINEER BEFORE PROCEEDING WITH THE WORK.

ALL DRAWINGS REMAIN THE PROPERTY OF THE ENGINEER AND SHALL NOT BE REPRODUCED OR REUSED WITHOUT THE ENGINEER'S WRITTEN PERMISSION.

THE OWNER/ARCHITECT/CONTRACTOR IS ADVISED THAT M.T.E. CONSULTANTS INC. CANNOT CERTIFY ANY COMPONENT OF THE SITE WORKS NOT INSPECTED DURING CONSTRUCTION. IT IS THE RESPONSIBILITY OF THE GENERAL CONTRACTOR TO NOTIFY M.T.E. CONSULTANTS INC. PRIOR TO COMMENCEMENT OF CONSTRUCTION TO ARRANGE FOR INSPECTION.

No.	REVISION	BY	DATE
8.			
7.			
6.			
5.			
4.			
3.	REVISED PER COMMENTS	JJM	JUL./20
2.	REVISED PER COMMENTS	JJM	MAR./20
1.	FOR CITY REVIEW	JJM	SEPT./19

MTE
Engineers, Scientists, Surveyors
519-204-6510 www.mte85.com



OWNER

2634876 ONTARIO INC.

PROJECT

CREEKSIDE MEADOWS

DRAWING

STORM AND SANITARY DESIGN SHEETS

Project Manager R. LUCAS	Project No. 42025-104
Design By RC	Checked By JJM
Drawn By JAC	Checked By
Surveyed By	Drawing No. 4
Date Aug.13/20	
Scale 1:500 1:500	Sheet of

KNOWN AS SECOND STREET
(ROAD ALLOWANCE BETWEEN CONCESSIONS 2 AND 3 SOUTH OF THE EGREMONT ROAD)
P.I.N. 09616-0098 (WIDTH VARIES)

CENTRELINE OF ROAD ALLOWANCE

CENTRELINE OF ROAD ALLOWANCE

STREET LINE

STREET LINE

P.I.N. LIMIT

N89°45'14"W 10.058 (SET) 15.000

N89°45'14"W 210.586

N89°45'14"W 210.621

210.623

0.300 4.942

4.942 0.300

121.920

496.175

20.117

BLOCK 6
(0.300 RESERVE)

BLOCK 5
(STREET WIDENING)

BLOCK 1

PART 1, PLAN 33R-21525

P. I. N. 09615 - 0970

105.000

116.678

P.I.N. LIMIT

PART 1
PLAN 33R-6710
P.I.N. 09615-0559

RESIDENTIAL (R3)

P.I.N. LIMIT

PART 2
PLAN 33R-6710
P.I.N. 09615-0560

FUTURE DEVELOPMENT (FD)

P.I.N. LIMIT

N

N89°45'14"W 159.748

R=70.000
A=31.137
C=30.861
N77°00'40"W

R=50.000
A=22.276
C=22.092
N77°01'55"W

N00°01'28"W

N89°47'41"W

P.I.N. LIMIT

91.311

20.000

STREET "A"

N89°45'14"W 159.795

R=50.000
A=22.241
C=22.058
N77°00'40"W

R=70.000
A=31.187
C=30.929
N77°01'55"W

N89°47'41"W

21.275

38.000

91.275

32.000

20.000

246.847

BLOCK 8

12.000

N00°18'31"E 12.000

32.022
N89°47'41"W

141.847

PART 1
PLAN 33R-865
P.I.N. 09615-0561

RESIDENTIAL (R1)

PART 1
PLAN 33R-4652

FUTURE DEVELOPMENT (FD)

ROAD ALLOWANCE BETWEEN LOTS 24 AND 25
(NOT TRAVELLED) (20.117 WIDE)
P.I.N. 09615-0562

STREET LINE

153.675

BLOCK 2

P. I. N. 09615 - 0970

PART 1, PLAN 33R-21525

234.75

BLOCK 3

P.I.N. LIMIT

129.847

N00°18'31"E

N89°47'41"W 232.958

70.000

302.958

20.000

THORNE DRIVE

20.000

P.I.N. LIMIT

N89°47'41"W

232.866

302.983

38.117

32.000

TEMPORARY TURNING CIRCLE

12.000

12.000

32.000

65.000

BLOCK 4
(SWM POND)
OPEN SPACE

53.000

N00°18'31"E

N00°12'19"E

N89°47'41"W

70.000

15.00

EASEMENT

35.139

172.258

LOT 24 CONCESSION SOUTH OF THE EGREMONT ROAD)
(GEOGRAPHIC TOWNSHIP OF ADELAIDE)

LOT 25

50.00

FUTURE DEVELOPMENT (FD)

PART 1, PLAN 33R-21525

N89°37'13"W 35.000

N00°22'47"E 20.000

BLOCK 7
PUMPING STATION

20.000 N00°22'47"E

N89°37'13"W 35.000

20.117

50m BUFFER LIMIT

120m BUFFER LIMIT

103.062

135.184

50

120

50

TOP OF BANK

233.00

234.50

234.25

234.00

233.75

233.50

233.25

233.00

232.00

231.50

231.00

230.75

230.50

230.25

230.00

229.50

229.00

228.25

228.00

227.75

227.50

227.25

227.00

226.75

226.50

226.25

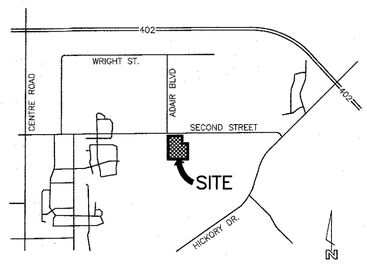
226.00

225.75

225.50

225.25

225.00



KEY PLAN – NOT TO SCALE

SUBJECT TO THE CONDITIONS, IF ANY, SET FORTH IN OUR LETTER DATED _____ DAY OF _____, 20___, THIS DRAFT PLAN IS APPROVED UNDER SECTION 51 FOR THE *PLANNING ACT* THIS _____ DAY OF _____, 20___

_____

DRAFT PLAN OF SUBDIVISION

OF PART OF

LOT 25, CONCESSION 3

SOUTH OF THE EGREMONT ROAD

(GEOGRAPHIC TOWNSHIP OF ADELAIDE)

IN THE

MUNICIPALITY OF STRATHROY-CARADOC

COUNTY OF MIDDLESEX

SCALE 1:750

0 3 6 9 12 15 30 45 METRES

609

MTE OLS LTD.
ONTARIO LAND SURVEYORS

METRIC:

DISTANCES AND COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

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

A) AS SHOWN
B) AS SHOWN
C) AS SHOWN
D) SINGLE FAMILY RESIDENTIAL
E) AS SHOWN
F) AS SHOWN
G) AS SHOWN
H) PIPED WATER TO BE PROVIDED
I) CLAY LOAM SOIL
J) AS SHOWN
K) STORM AND SANITARY SEWERS, GAS & HYDRO TO BE PROVIDED
L) AS SHOWN ON PLAN

SITE DATA

TOTAL SITE AREA	– 8.607 Ha.
AREA OF STREETS	– 1.215 Ha.
BLOCKS 1, 2, 3, 8 (MEDIUM DENSITY RESIDENTIAL)	– 6.757 Ha.
BLOCK 4 (SWM)	– 0.455 Ha.
BLOCK 5 (ROAD WIDENING)	– 0.104 Ha.
BLOCK 6 (0.300 RESERVE)	– 0.006 Ha.
BLOCK 7 (PUMPING STATION)	– 0.070 Ha.

OWNER'S CERTIFICATE:

I HEREBY SUBMIT THIS DRAFT PLAN OF SUBDIVISION TO THE MUNICIPALITY OF STRATHROY-CARADOC.

NOVEMBER 23, 2023
DATE

EMIL PATTYN
NORTHGROVE MEADOWS INC.

SURVEYOR'S CERTIFICATE:

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

NOVEMBER 23, 2023
DATE

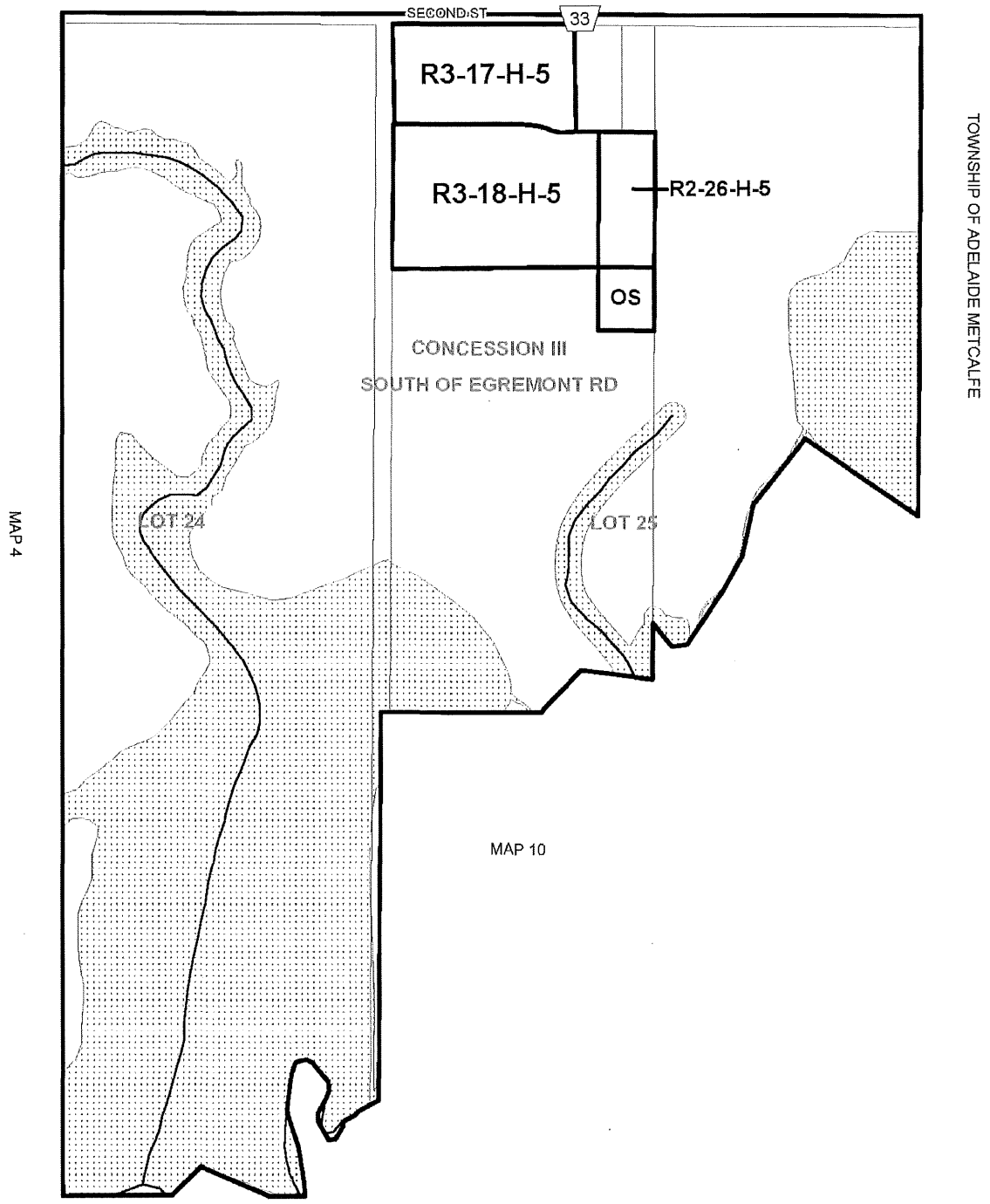
JEREMY C.E. MATTHEWS
ONTARIO LAND SURVEYOR

MTE ONTARIO LAND SURVEYORS LTD.
123 ST. GEORGE STREET
LONDON, ONTARIO, N6A 3A1
TEL: 519-204-6510

Surveyed By :	Checked By : JCEM	File No : 45927-202
Drawn By : DL	Date : NOV 21 2023	Cad File: 45927-202_D1.dwg

File: P:\P\45927\202\45927-202_D1.dwg last saved by DLEES, plotted 11/21/2023 1:06:13 PM on page size 30X48

SCHEDULE "A" TO BY-LAW NO. 14-23



STRATHROY-CARADOC
URBAN OPPORTUNITY - RURAL HOSPITALITY

MUNICIPALITY OF STRATHROY-CARADOC

LEGEND

Natural Environment Overlay

For further information, please contact the Conservation Authority having jurisdiction

1:6,500

0 65 130 260

Metres

N

Sanitary Flow Calculations

DATE:	December 5, 2023
JOB N0.:	MTE-45927-100

Client:	**Northgrove Meadows Inc.**
Project:	**390 Second Street**
Location:	**Strathroy-Caradoc**

SANITARY FLOWS

Block	Zone	Units	Area (ha)	Population	Harmon Peaking Factor	Infiltration (l/s)	Peak Flow (l/s)
Block 1	R3-17-H-5	335	2.229	536	4.35	0.18	8.28
Block 2	R3-18-H-5	264	3.520	423	4.41	0.28	6.76
Block 3	R2-26-H-5	30	0.993	72	4.71	0.08	1.26
Total		629		1031	4.17	0.54	**15.47**

Strathroy-Caradoc Design Criteria

Low Density Residential:	2.4	people/unit	
Medium Density Residential:	2.4	people/unit	
High Density Residential:	1.6	people/unit	
Average Flow Rate:	300	l/capita/day	0.003472222 l/cap/s
Infiltration Rate:	0.08	l/ha/s	

Peaking factor: Harmon Formula

$$M = 1.1 * (1 + \frac{14}{(4 + P^{\frac{1}{2}})})$$

where P is tributary population in thousands
M is the peaking factor
1.1 is the uncertainty factor

Peak Domestic Sewage Flows:

$$Q(d) = PM + IA$$

Water Supply Demand Calculations

DATE:	December 5, 2023
JOB N0.:	MTE-45927-100

Client:	**Northgrove Meadows Inc.**
Project:	**390 Second Street**
Location:	**Strathroy-Caradoc**

WATER SUPPLY DEMAND

Block	Zone	Units	Population	Average Day Demand (l/s)	Max Day Demand (l/s)	Peak Hour Demand (l/s)
Block 1	R3-17-H-5	335	536	1.55	5.43	12.10
Block 2	R3-18-H-5	264	423	1.22	4.28	9.55
Block 3	R2-26-H-5	30	72	0.21	0.73	1.63
Total		629	1031	**2.98**	**10.44**	**23.27**

Strathroy-Caradoc Design Criteria:

Low Density Residential:	2.4	people/unit
Medium Density Residential:	2.4	people/unit
High Density Residential:	1.6	people/unit
Average Flow Rate:	250	l/capita/day
Peaking factors:	3.5	Maximum Day Demand
	7.8	Peak Hour Demand

390 Second Street Subdivision Phase 1

STORMWATER MANAGEMENT

Strathroy-Caradoc, Ontario

Project Number:	45927-100
Date:	December 5, 2023
Design By:	BXP
File:	Q:\45927\100\SWM\45927-100 Master SWM Facility Design Sheet-Bogdan.xlsx

HYDROLOGIC PARAMETERS

Pre-Development Conditions

Sub-Catchment Number	Area (ha)	Overland Slope (%)	SCS Curve Number Pervious (AMC II)	SCS Curve Number Pervious (AMC III)	Percent Impervious (%)	Land Use	Comment
101	7.19	2	85	93	0	Agriculture	
Total	**8.41**				**0.00**		

Post-Development Conditions

Sub-Catchment Number	Area (ha)	Overland Slope (%)	SCS Curve Number Pervious (AMC II)	SCS Curve Number Pervious (AMC III)	Percent Impervious (%)	Land Use	Comment
Block 1	2.23	2	74	87	70	Cluster Housing	
Block 2	3.52	2	74	87	70	Cluster Housing	
Block 3	0.99	2	74	87	70	Low Density Housing	
Street A	0.61	2	74	87	70	Road	
Thorne Drive	0.61	2	74	87	70	Road	
Block 4 (SWM Block)	0.46	2	74	87	70	SWM Facility	
Total	**8.41**				**70.00**		

IDF PARAMETERS

Strathroy-Caradoc

Frequency (Years)	A	B	C	Comment
25mm (4hr)	538.850	6.331	0.809	
2		Based on SCSD-14		
5	1137.257	7.184	0.830	
10	1425.011	7.382	0.843	
25	1835.352	7.844	0.858	
50	2225.884	8.620	0.871	
100	2561.151	9.093	0.888	
250	3048.22	10.03	0.888	

390 Second Street Subdivision Phase 1
STORMWATER MANAGEMENT
Strathroy-Caradoc, Ontario

Project Number:	45927-100
Date:	December 5, 2023
Design By:	BXP
File:	Q:\45927\100\SWM\45927-100 Master SWM Facility Design Sheet-Bogdan.xlsx

Step 1: Choose Level of Water Quality Control

Enhanced 80% long-term S.S. removal

Step 2: Choose Type of Facility

Wet Pond

Step 3: Define Catchment area and Imperviousness

Catchment Area (ha)	Imperviousness (%)
8.41	70.00

Interpolated Storage Volume Requirement (m^3/ha)

225.00

Permanent Pool Required (m^3)

1556.23

Extended Detention Volume Required (m^3)

336.48

Table 3.2 Water Quality Storage Requirements based on Receiving Waters (from MOE Stormwater Management Planning and Design Manual, March 2003)

Protection Level	SWMP Type	Storage Volume (m^3/ha) for Impervious Level			
		35	55	70	85
Enhanced 80% long-term S.S. removal	*Wetlands*	80	105	120	140
	Hybrid Wet Pond/Wetland	110	150	175	195
	Wet Pond	140	190	225	250
Normal 70% long-term S.S. Removal	*Wetlands*	60	70	80	90
	Hybrid Wet Pond/Wetland	75	90	105	120
	Wet Pond	90	110	130	150
Basic 60% long-term S.S. Removal	*Wetlands*	60	60	60	60
	Hybrid Wet Pond/Wetland	60	70	75	80
	Wet Pond	60	75	85	95
	Dry Pond (Continuous Flow)	90	150	200	240

390 Second Street Subdivision Phase 1
STORMWATER MANAGEMENT
Strathroy-Caradoc, Ontario

Project Number:	45927-100
Date:	December 5, 2023
Design By:	BXP
File:	Q:\45927\100\SWM\45927-100 Master SWM Facility Design Sheet-Bogdan.xlsx

Time of Concentration

Airport Formula:

Tc=3.26*(1.1-C)*L^(0.5)/Sw^(0.33)

C=	0.2	/
L=	924	m
Sw=	0.42	/
Tc=	118.75	min
Tc=	1.98	hrs

Time to Peak

Tp=2/3*Tc

Tp=	1.32	hrs

Strathroy Caradoc IDF Parameters

Return Period (years)	A,B,C Parameters A	B	C
25mm (4hr)	538.850	6.331	0.809
2		Based on SCSD-14	
5	1137.257	7.184	0.830
10	1425.011	7.382	0.843
25	1835.352	7.844	0.858
50	2225.884	8.620	0.871
100	2561.151	9.093	0.888
250	3048.22	10.03	0.888

Pre-Development Flows (Visual OTTHYMO Model)

Coverage	**101 (Discharge)**
Area (ha)	8.41
Return Period	25mm
Pre-Development Peak Flow (m^3/s)	0.033
Return Period	2 year
Pre-Development Peak Flow (m^3/s)	0.112
Return Period	5 year
Pre-Development Peak Flow (m^3/s)	0.130
Return Period	10 year
Pre-Development Peak Flow (m^3/s)	0.175
Return Period	25 year
Pre-Development Peak Flow (m^3/s)	0.239
Return Period	50 year
Pre-Development Peak Flow (m^3/s)	0.294
Return Period	100 year
Pre-Development Peak Flow (m^3/s)	0.341
Return Period	250 year
Pre-Development Peak Flow (m^3/s)	0.426

Post-Development Flows (Visual OTTHYMO Model)

Coverage	**201**	**Total Flows**	**Attenuated Discharge**
Area (ha)	8.41		
Runoff Coefficient			
Return Period	25mm	25mm	Total
Post-Development Peak Flow (m^3/s)	0.725	0.725	TBD
Return Period	2 year	2 year	Total
Post-Development Peak Flow (m^3/s)	1.639	1.639	TBD
Return Period	5 year	5 year	Total
Post-Development Peak Flow (m^3/s)	1.661	1.661	TBD
Return Period	10 year	10 year	Total
Post-Development Peak Flow (m^3/s)	2.083	2.083	TBD
Return Period	25 year	25 year	Total
Post-Development Peak Flow (m^3/s)	2.591	2.591	TBD
Return Period	50 year	50 year	Total
Post-Development Peak Flow (m^3/s)	2.969	2.969	TBD
Return Period	100 year	100 year	Total
Post-Development Peak Flow (m^3/s)	3.301	3.301	TBD
Return Period	250 year	250 year	Total
Post-Development Peak Flow (m^3/s)	3.553	3.553	TBD

Resource Library

Library | Continuous

Save | Save As | Export | Import | Top Group | Sub Group | IDF Group | IDF Curve | Manual Input | Read-in | Chicago | MASS | Rain Gauge | Read-in | Water Quality | Remove | Add to Model | Help

File | Share | New Group | New IDF | New Design Storm | New Measured | Water Q... | Edit | Model | Help

Library Explorer

- Default(TRCA)
  - Design Storms
  - Storms - Observed
  - Storms - Regional
  - Water Quality
  - New IDF Group
    - 2-yr
    - 5-yr
    - 10-yr
    - 25-yr
    - 50-yr
    - 100-yr
  - New Chicago Design Storm

IDF Curve

Return Period (year) 2

Data Values

Data Points from Strathroy-Caradoc 2-year Curve

Duration (minute)	Rainfall Intensity (mm/hr)
5 minutes	143
10 minutes	107
15 minutes	87
30 minutes	57
1 hour	35
2 hours	19
6 hours	7
12 hours	3.7
24 hours	1.9

Fitted A, B, C

R2 = 0.9993

☐ Show Fitted Curve in Graph (Red)

A: 2016.901

B: 11.25

C: 0.956

i = A/(t+B)^C

Used for 2-year Chicago Storm Event

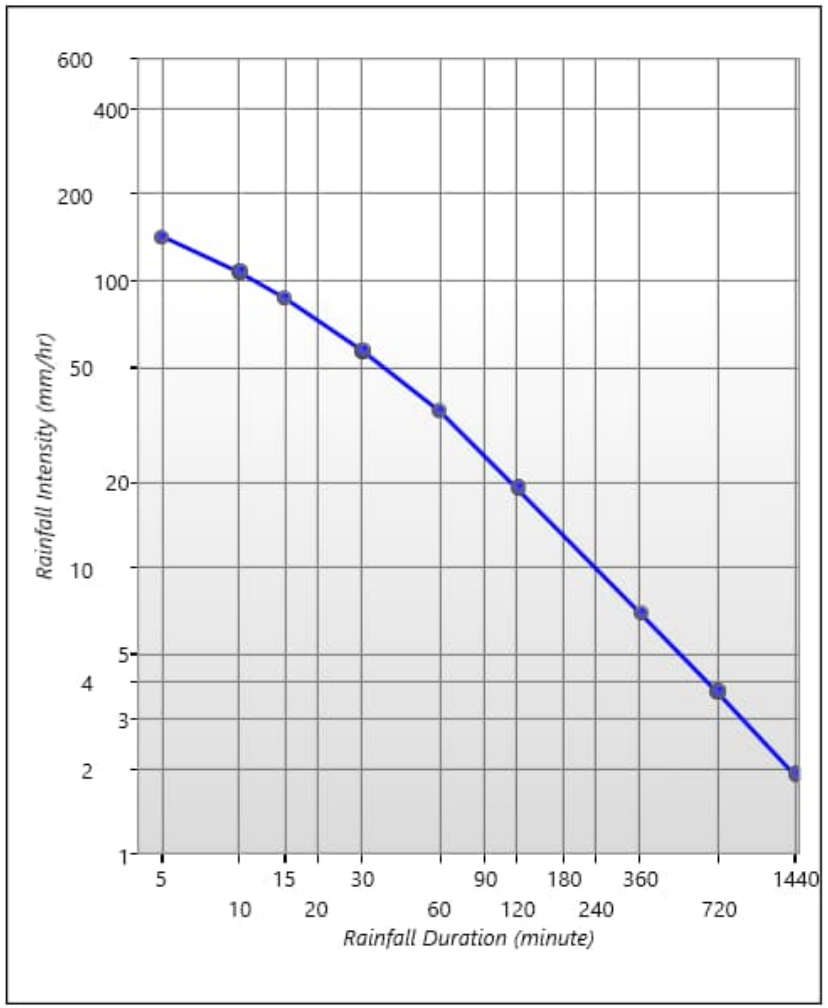
Where:

t - Duration (minute)

i - Intensity

Copy A,B,C

IDF Curve Graph



Resource Library

Library | Continuous

Save | Save As | Export | Import | Top Group | Sub Group | IDF Group | IDF Curve | Manual Input | Read-in | Chicago | MASS | Rain Gauge | Read-in | Water Quality | Remove | Add to Model | Help

File | Share | New Group | New IDF | New Design Storm | New Measured | Water Q... | Edit | Model | Help

Library Explorer

- 25 Year 6 Hour AES (Bloor, TRCA)
- 25 Year 12 Hour AES (Bloor, TRCA)
- 25 Year 24 Hour AES (Bloor, TRCA)
- 50 Year 6 Hour AES (Bloor, TRCA)
- 50 Year 12 Hour AES (Bloor, TRCA)
- 50 Year 24 Hour AES (Bloor, TRCA)
- 100 Year 6 Hour AES (Bloor, TRCA)
- 100 Year 12 Hour AES (Bloor, TRCA)
- 100 Year 24 Hour AES (Bloor, TRCA)
- 350y_12h_AES_CITY
- 500yr12hr_AES
- 2 Year 4 Hour Chicago
- 2-year Chicago Norfolk
- 2-year Chicago SC from IDF
- 2 Year Chicago Warwick
- 5 Year 4 Hour Chicago
- 5-year Chicago Norfolk
- 5-Year Chicago SC
- 5 Year Chicago Warwick
- 10 Year 4 Hour Chicago
- 10-year Chicago Norfolk
- 10-Year Chicago SC
- 10 Year Chicago Warwick
- 25mm 4 Hour Chicago
- 25 Year 4 Hour Chicago
- 25-year Chicago Norfolk

Basic Information

Name	2-year Chicago SC from IDF
Description	
Time Step (minute)	5
Total Duration (hour)	3
Peak Ratio	0.333
Unit	Metric

Unit

Parameters from IDF Curve Tool

A, B, C

A:	2016.901
B:	11.25
C:	0.956

i = A/(t+B)^C

Where:

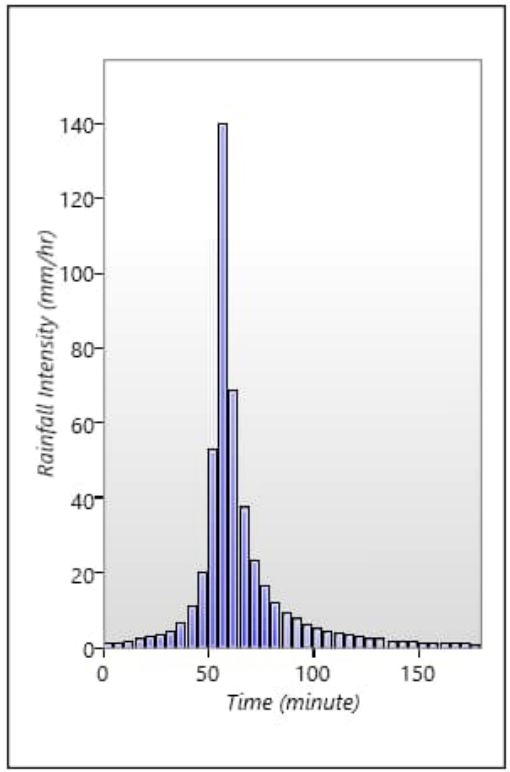
t - Duration (minute)

i - Intensity

Paste A,B,C

Time Series

	Time (minute)	Rainfall Intensity (mm/hr)
1	0	1.54
2	5	1.77
3	10	2.08
4	15	2.48
5	20	3.03
6	25	3.83
7	30	5.07
8	35	7.14
9	40	11.08
10	45	20.31
11	50	53.33
12	55	140.32
13	60	69.17
14	65	37.56
15	70	23.92
16	75	16.75
17	80	12.48



Appendix D

Hydrologic Modelling Input and Output Files

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        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
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                  *****  D E T A I L E D   O U T P U T *****


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  Summary filename: C:\Users\BPavlovic\AppData\Local\Civica\VH5\418c1dff-815b-4e73-8b14-cb211b59d3de\0553cc16-


DATE: 12/04/2023                          TIME: 02:51:08

USER:



COMMENTS: _____________________________________________________________


--------------------------------------------------------------------------------------------------------------
  ************************************************
  ** SIMULATION : 100-Year Chicago SC           **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=2561.151
| Ptotal= 76.21 mm |                          B=   9.093
--------------------                          C=   0.880
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  3.00 hrs
                       Storm time step    =  5.00 min
                       Time to peak ratio =  0.33

                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.00    4.61 |  0.75   37.56 |  1.50   16.61 |  2.25    6.40
                0.08    5.13 |  0.83   92.64 |  1.58   14.21 |  2.33    5.98
                0.17    5.79 |  0.92  249.64 |  1.67   12.38 |  2.42    5.61
                0.25    6.63 |  1.00  119.41 |  1.75   10.96 |  2.50    5.29
                0.33    7.76 |  1.08   65.98 |  1.83    9.81 |  2.58    5.00
                0.42    9.33 |  1.17   43.53 |  1.92    8.87 |  2.67    4.73
                0.50   11.65 |  1.25   31.69 |  2.00    8.10 |  2.75    4.50
                0.58   15.39 |  1.33   24.57 |  2.08    7.44 |  2.83    4.29
                0.67   22.19 |  1.42   19.89 |  2.17    6.88 |  2.92    4.10


------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0101)|   Area    (ha)=   8.41   Curve Number   (CN)= 85.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.32

     Unit Hyd Qpeak  (cms)=   0.243

     PEAK FLOW       (cms)=   0.341 (i)
     TIME TO PEAK    (hrs)=   2.583
     RUNOFF VOLUME    (mm)=  41.163
     TOTAL RAINFALL   (mm)=  76.212
     RUNOFF COEFFICIENT   =   0.540

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
==============================================================================================================

       V    V   I    SSSSS  U   U    A    L             (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
```

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        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```

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***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
Output filename: C:\Users\BPavlovic\AppData\Local\Civica\VH5\418c1dff-815b-4e73-8b14-cb211b59d3de\1f4abbab-
Summary filename: C:\Users\BPavlovic\AppData\Local\Civica\VH5\418c1dff-815b-4e73-8b14-cb211b59d3de\1f4abbab-

DATE: 12/04/2023 TIME: 02:51:08

USER:

COMMENTS: _____

****
** SIMULATION : 10-Year Chicago SC **
****

| CHICAGO STORM |
| Ptotal= 51.88 mm |

IDF curve parameters: A=1425.011
B= 7.382
C= 0.843
used in: INTENSITY = A / (t + B)^C

Duration of storm = 3.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	3.64	0.75	24.58	1.50	11.53	2.25	4.88
0.08	4.00	0.83	59.70	1.58	10.01	2.33	4.59
0.17	4.46	0.92	170.84	1.67	8.84	2.42	4.34
0.25	5.04	1.00	77.13	1.75	7.91	2.50	4.11
0.33	5.80	1.08	42.35	1.83	7.16	2.58	3.91
0.42	6.84	1.17	28.29	1.92	6.55	2.67	3.72
0.50	8.36	1.25	20.95	2.00	6.03	2.75	3.56
0.58	10.76	1.33	16.52	2.08	5.59	2.83	3.41
0.67	15.04	1.42	13.60	2.17	5.21	2.92	3.27

| CALIB |
| NASHYD (0101)| Area (ha)= 8.41 Curve Number (CN)= 85.0
|ID= 1 DT= 5.0 min | Ia (mm)= 8.00 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= 1.32

Unit Hyd Qpeak (cms)= 0.243

PEAK FLOW (cms)= 0.175 (i)
TIME TO PEAK (hrs)= 2.667
RUNOFF VOLUME (mm)= 21.703
TOTAL RAINFALL (mm)= 51.876
RUNOFF COEFFICIENT = 0.418

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```
        V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
        V    V   I    SS     U   U   A A   L
         V  V    I     SS    U   U  AAAAA  L
         V  V    I      SS   U   U  A   A  L
          VV     I    SSSSS  UUUUU  A   A  LLLLL
```

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        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```

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***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
Output filename: C:\Users\BPavlovic\AppData\Local\Civica\VH5\418c1dff-815b-4e73-8b14-cb211b59d3de\cc9c0be6-
Summary filename: C:\Users\BPavlovic\AppData\Local\Civica\VH5\418c1dff-815b-4e73-8b14-cb211b59d3de\cc9c0be6-

DATE: 12/04/2023 TIME: 02:51:08

USER:

COMMENTS: _____

****
** SIMULATION : 250-Year Regional 4 hr **
****

| CHICAGO STORM |
| Ptotal= 90.48 mm |

IDF curve parameters: A=3048.220
B= 10.030
C= 0.888
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	3.97	1.00	54.92	2.00	12.34	3.00	4.98
0.17	4.74	1.17	212.89	2.17	9.97	3.17	4.52
0.33	5.88	1.33	74.08	2.33	8.33	3.33	4.14
0.50	7.72	1.50	35.85	2.50	7.14	3.50	3.82
0.67	11.14	1.67	22.52	2.67	6.24	3.67	3.54
0.83	19.26	1.83	16.06	2.83	5.54	3.83	3.31

| CALIB |
| NASHYD (0101) |
|ID= 1 DT= 5.0 min |

Area (ha)= 8.41 Curve Number (CN)= 85.0
Ia (mm)= 8.00 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= 1.32

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	3.97	1.083	54.92	2.083	12.34	3.08	4.98
0.167	3.97	1.167	54.92	2.167	12.34	3.17	4.98
0.250	4.74	1.250	212.89	2.250	9.97	3.25	4.52
0.333	4.74	1.333	212.89	2.333	9.97	3.33	4.52
0.417	5.88	1.417	74.08	2.417	8.33	3.42	4.14
0.500	5.88	1.500	74.08	2.500	8.33	3.50	4.14
0.583	7.72	1.583	35.85	2.583	7.14	3.58	3.82
0.667	7.72	1.667	35.85	2.667	7.14	3.67	3.82
0.750	11.14	1.750	22.52	2.750	6.24	3.75	3.54
0.833	11.14	1.833	22.52	2.833	6.24	3.83	3.54
0.917	19.26	1.917	16.06	2.917	5.54	3.92	3.31
1.000	19.26	2.000	16.06	3.000	5.54	4.00	3.31

Unit Hyd Qpeak (cms)= 0.243

PEAK FLOW (cms)= 0.426 (i)
TIME TO PEAK (hrs)= 2.833
RUNOFF VOLUME (mm)= 53.441
TOTAL RAINFALL (mm)= 90.483
RUNOFF COEFFICIENT = 0.591

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

FINISH

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```
       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```

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***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
Output filename: C:\Users\BPavlovic\AppData\Local\Civica\VH5\418c1dff-815b-4e73-8b14-cb211b59d3de\1c359697-
Summary filename: C:\Users\BPavlovic\AppData\Local\Civica\VH5\418c1dff-815b-4e73-8b14-cb211b59d3de\1c359697-

DATE: 12/04/2023 TIME: 02:51:08

USER:

COMMENTS: _____

****
** SIMULATION : 25mm 4 Hour Chicago **
****

CHICAGO STORM	Ptotal= 25.04 mm

IDF curve parameters: A= 538.850
B= 6.331
C= 0.809
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	1.52	1.00	13.45	2.00	3.80	3.00	1.84
0.17	1.75	1.17	56.25	2.17	3.20	3.17	1.70
0.33	2.08	1.33	17.87	2.33	2.78	3.33	1.58
0.50	2.58	1.50	9.22	2.50	2.45	3.50	1.48
0.67	3.46	1.67	6.21	2.67	2.20	3.67	1.40
0.83	5.39	1.83	4.70	2.83	2.00	3.83	1.32

CALIB NASHYD (0101) ID= 1 DT= 5.0 min	Area (ha)= 8.41	Curve Number (CN)= 85.0
	Ia (mm)= 8.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 1.32	

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.52	1.083	13.45	2.083	3.80	3.08	1.84
0.167	1.52	1.167	13.45	2.167	3.80	3.17	1.84
0.250	1.75	1.250	56.25	2.250	3.20	3.25	1.70
0.333	1.75	1.333	56.25	2.333	3.20	3.33	1.70

0.417	2.08	1.417	17.87	2.417	2.78	3.42	1.58
0.500	2.08	1.500	17.87	2.500	2.78	3.50	1.58
0.583	2.58	1.583	9.22	2.583	2.45	3.58	1.48
0.667	2.58	1.667	9.22	2.667	2.45	3.67	1.48
0.750	3.46	1.750	6.21	2.750	2.20	3.75	1.40
0.833	3.46	1.833	6.21	2.833	2.20	3.83	1.40
0.917	5.39	1.917	4.70	2.917	2.00	3.92	1.32
1.000	5.39	2.000	4.70	3.000	2.00	4.00	1.32

Unit Hyd Qpeak (cms)= 0.243

PEAK FLOW (cms)= 0.033 (i)
TIME TO PEAK (hrs)= 3.250
RUNOFF VOLUME (mm)= 4.694
TOTAL RAINFALL (mm)= 25.042
RUNOFF COEFFICIENT = 0.187

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```
       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```

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***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
Output filename: C:\Users\BPavlovic\AppData\Local\Civica\VH5\418c1dff-815b-4e73-8b14-cb211b59d3de\94bb8095-
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DATE: 12/04/2023 TIME: 02:51:08

USER:

COMMENTS: _____

****
** SIMULATION : 25-Year Chicago SC **
****

CHICAGO STORM
Ptotal= 61.64 mm

IDF curve parameters: A=1835.352
B= 7.844
C= 0.858
used in: INTENSITY = A / (t + B)^C

Duration of storm = 3.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	4.06	0.75	29.44	1.50	13.47	2.25	5.51
0.08	4.48	0.83	72.48	1.58	11.63	2.33	5.17
0.17	5.01	0.92	205.33	1.67	10.22	2.42	4.87
0.25	5.69	1.00	93.76	1.75	9.11	2.50	4.61
0.33	6.59	1.08	51.29	1.83	8.21	2.58	4.37
0.42	7.83	1.17	34.00	1.92	7.48	2.67	4.16
0.50	9.65	1.25	24.97	2.00	6.86	2.75	3.97
0.58	12.53	1.33	19.55	2.08	6.34	2.83	3.79
0.67	17.74	1.42	15.98	2.17	5.90	2.92	3.63

```
| CALIB             |
| NASHYD   (  0101)|   Area    (ha)=   8.41   Curve Number   (CN)= 85.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.32

     Unit Hyd Qpeak  (cms)=   0.243

     PEAK FLOW       (cms)=   0.239 (i)
     TIME TO PEAK    (hrs)=   2.667
     RUNOFF VOLUME    (mm)=  29.221
     TOTAL RAINFALL   (mm)=  61.640
     RUNOFF COEFFICIENT   =   0.474

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
================================================================================================================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
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DATE: 12/04/2023                          TIME: 02:51:08

USER:



COMMENTS: _____________________________________________________________


--------------------------------------------------------------------------------------------------------------------
  ***********************************************
  ** SIMULATION : 2-year Chicago SC from IDF    **
  ***********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=2016.901
| Ptotal= 39.86 mm |                          B=  11.250
--------------------                          C=   0.956
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  3.00 hrs
                       Storm time step    =  5.00 min
                       Time to peak ratio =  0.33

                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.00    1.54 |  0.75   20.31 |  1.50    7.84 |  2.25    2.37
                0.08    1.77 |  0.83   53.33 |  1.58    6.48 |  2.33    2.17
                0.17    2.08 |  0.92  140.32 |  1.67    5.47 |  2.42    1.99
                0.25    2.48 |  1.00   69.17 |  1.75    4.69 |  2.50    1.84
                0.33    3.03 |  1.08   37.56 |  1.83    4.09 |  2.58    1.71
                0.42    3.83 |  1.17   23.92 |  1.92    3.60 |  2.67    1.60
                0.50    5.07 |  1.25   16.75 |  2.00    3.20 |  2.75    1.49
                0.58    7.14 |  1.33   12.48 |  2.08    2.87 |  2.83    1.40
                0.67   11.08 |  1.42    9.73 |  2.17    2.60 |  2.92    1.32


--------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD   (  0101)|   Area    (ha)=   8.41   Curve Number   (CN)= 85.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.32
```

```
     Unit Hyd Qpeak  (cms)=   0.243

     PEAK FLOW       (cms)=   0.112 (i)
     TIME TO PEAK    (hrs)=   2.583
     RUNOFF VOLUME    (mm)=  13.237
     TOTAL RAINFALL   (mm)=  39.861
     RUNOFF COEFFICIENT   =   0.332

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---------------------------------------------------------------------------
===========================================================================================================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
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DATE: 12/04/2023                          TIME: 02:51:08

USER:


COMMENTS: _____________________________________________________________


-------------------------------------------------------------------------------------------------------------
  ************************************************
  ** SIMULATION : 50-Year Chicago SC             **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=2225.884
| Ptotal= 69.59 mm |                          B=   8.620
--------------------                          C=   0.871
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  3.00 hrs
                       Storm time step    =  5.00 min
                       Time to peak ratio =  0.33

                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.00    4.36 |  0.75   33.91 |  1.50   15.21 |  2.25    6.00
                0.08    4.84 |  0.83   83.50 |  1.58   13.06 |  2.33    5.62
                0.17    5.44 |  0.92  228.89 |  1.67   11.42 |  2.42    5.28
                0.25    6.21 |  1.00  107.76 |  1.75   10.13 |  2.50    4.98
                0.33    7.24 |  1.08   59.36 |  1.83    9.10 |  2.58    4.72
                0.42    8.66 |  1.17   39.24 |  1.92    8.25 |  2.67    4.48
                0.50   10.76 |  1.25   28.68 |  2.00    7.55 |  2.75    4.26
                0.58   14.11 |  1.33   22.32 |  2.08    6.95 |  2.83    4.07
                0.67   20.20 |  1.42   18.14 |  2.17    6.44 |  2.92    3.89


---------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0101)|   Area    (ha)=   8.41   Curve Number   (CN)= 85.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.32

     Unit Hyd Qpeak  (cms)=   0.243

     PEAK FLOW       (cms)=   0.294 (i)
```

```
     TIME TO PEAK    (hrs)=   2.583
     RUNOFF VOLUME    (mm)=  35.644
     TOTAL RAINFALL   (mm)=  69.587
     RUNOFF COEFFICIENT   =   0.512

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---------------------------------------------------------------------------
===========================================================================================================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\BPavlovic\AppData\Local\Civica\VH5\418c1dff-815b-4e73-8b14-cb211b59d3de\06a0a13a-
  Summary filename: C:\Users\BPavlovic\AppData\Local\Civica\VH5\418c1dff-815b-4e73-8b14-cb211b59d3de\06a0a13a-


DATE: 12/04/2023                          TIME: 02:51:08

USER:


COMMENTS: _____________________________________________________________


-------------------------------------------------------------------------------------------------------------
  ***********************************************
  ** SIMULATION : 5-Year Chicago SC             **
  ***********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1137.257
| Ptotal= 44.35 mm |                          B=   7.184
--------------------                          C=   0.830
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  3.00 hrs
                       Storm time step    =  5.00 min
                       Time to peak ratio =  0.33

                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.00    3.29 |  0.75   21.03 |  1.50   10.08 |  2.25    4.38
                0.08    3.61 |  0.83   50.18 |  1.58    8.78 |  2.33    4.13
                0.17    4.01 |  0.92  142.78 |  1.67    7.78 |  2.42    3.90
                0.25    4.51 |  1.00   64.63 |  1.75    6.99 |  2.50    3.71
                0.33    5.17 |  1.08   35.80 |  1.83    6.35 |  2.58    3.53
                0.42    6.08 |  1.17   24.12 |  1.92    5.82 |  2.67    3.37
                0.50    7.38 |  1.25   17.99 |  2.00    5.37 |  2.75    3.22
                0.58    9.42 |  1.33   14.28 |  2.08    4.99 |  2.83    3.09
                0.67   13.03 |  1.42   11.82 |  2.17    4.66 |  2.92    2.97


---------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0101)|   Area    (ha)=   8.41   Curve Number   (CN)= 85.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.32

     Unit Hyd Qpeak  (cms)=   0.243

     PEAK FLOW       (cms)=   0.130 (i)
     TIME TO PEAK    (hrs)=   2.750
     RUNOFF VOLUME    (mm)=  16.280
     TOTAL RAINFALL   (mm)=  44.354
     RUNOFF COEFFICIENT   =   0.367
```

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```
       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```

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***** D E T A I L E D O U T P U T *****

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Summary filename: C:\Users\BPavlovic\AppData\Local\Civica\VH5\418c1dff-815b-4e73-8b14-cb211b59d3de\f6581ce1-

DATE: 12/05/2023 TIME: 11:41:40

USER:

COMMENTS: _____

** SIMULATION : 100-Year Chicago SC **

CHICAGO STORM	Ptotal= 76.21 mm

IDF curve parameters: A=2561.151
B= 9.093
C= 0.880
used in: INTENSITY = A / (t + B)^C

Duration of storm = 3.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	4.61	0.75	37.56	1.50	16.61	2.25	6.40
0.08	5.13	0.83	92.64	1.58	14.21	2.33	5.98
0.17	5.79	0.92	249.64	1.67	12.38	2.42	5.61
0.25	6.63	1.00	119.41	1.75	10.96	2.50	5.29
0.33	7.76	1.08	65.98	1.83	9.81	2.58	5.00
0.42	9.33	1.17	43.53	1.92	8.87	2.67	4.73
0.50	11.65	1.25	31.69	2.00	8.10	2.75	4.50
0.58	15.39	1.33	24.57	2.08	7.44	2.83	4.29
0.67	22.19	1.42	19.89	2.17	6.88	2.92	4.10

CALIB	STANDHYD (0201)	ID= 1 DT= 2.0 min

Area (ha)= 8.41
Total Imp(%)= 70.00 Dir. Conn.(%)= 60.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	5.89	2.52
Dep. Storage	(mm)=	2.00	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	236.78	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 2.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.033	4.61	0.800	37.56	1.567	16.61	2.33	6.40
0.067	4.61	0.833	37.56	1.600	15.41	2.37	5.98
0.100	4.87	0.867	92.64	1.633	14.21	2.40	5.98

0.133	5.13	0.900	92.64	1.667	14.21	2.43	5.80
0.167	5.13	0.933	171.14	1.700	12.38	2.47	5.61
0.200	5.79	0.967	249.64	1.733	12.38	2.50	5.61
0.233	5.79	1.000	249.64	1.767	11.67	2.53	5.29
0.267	6.21	1.033	119.41	1.800	10.96	2.57	5.29
0.300	6.63	1.067	119.41	1.833	10.96	2.60	5.14
0.333	6.63	1.100	92.70	1.867	9.81	2.63	5.00
0.367	7.76	1.133	65.98	1.900	9.81	2.67	5.00
0.400	7.76	1.167	65.98	1.933	9.34	2.70	4.73
0.433	8.54	1.200	43.53	1.967	8.87	2.73	4.73
0.467	9.33	1.233	43.53	2.000	8.87	2.77	4.62
0.500	9.33	1.267	37.61	2.033	8.10	2.80	4.50
0.533	11.65	1.300	31.69	2.067	8.10	2.83	4.50
0.567	11.65	1.333	31.69	2.100	7.77	2.87	4.29
0.600	13.52	1.367	24.57	2.133	7.44	2.90	4.29
0.633	15.39	1.400	24.57	2.167	7.44	2.93	4.19
0.667	15.39	1.433	22.23	2.200	6.88	2.97	4.10
0.700	22.19	1.467	19.89	2.233	6.88	3.00	4.10
0.733	22.19	1.500	19.89	2.267	6.64		
0.767	29.88	1.533	16.61	2.300	6.40		

			TOTALS
Max.Eff.Inten.(mm/hr)=	223.47	119.13	
over (min)	5.00	8.00	
Storage Coeff. (min)=	2.52 (ii)	6.40 (ii)	
Unit Hyd. Tpeak (min)=	4.00	8.00	
Unit Hyd. peak (cms)=	0.37	0.16	
PEAK FLOW (cms)=	2.90	0.66	3.301 (iii)
TIME TO PEAK (hrs)=	1.00	1.10	1.03
RUNOFF VOLUME (mm)=	74.21	37.67	59.59
TOTAL RAINFALL (mm)=	76.21	76.21	76.21
RUNOFF COEFFICIENT =	0.97	0.49	0.78

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 74.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```
       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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***** D E T A I L E D O U T P U T *****

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Output filename: C:\Users\BPavlovic\AppData\Local\Civica\VH5\418c1dff-815b-4e73-8b14-cb211b59d3de\7f0f35b9-
Summary filename: C:\Users\BPavlovic\AppData\Local\Civica\VH5\418c1dff-815b-4e73-8b14-cb211b59d3de\7f0f35b9-

DATE: 12/05/2023 TIME: 11:41:40

USER:

COMMENTS: _____

****
** SIMULATION : 10-Year Chicago SC **
****

CHICAGO STORM	IDF curve parameters: A=1425.011
Ptotal= 51.88 mm	B= 7.382
	C= 0.843

used in: INTENSITY = A / (t + B)^C

Duration of storm = 3.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	3.64	0.75	24.58	1.50	11.53	2.25	4.88
0.08	4.00	0.83	59.70	1.58	10.01	2.33	4.59
0.17	4.46	0.92	170.84	1.67	8.84	2.42	4.34
0.25	5.04	1.00	77.13	1.75	7.91	2.50	4.11
0.33	5.80	1.08	42.35	1.83	7.16	2.58	3.91
0.42	6.84	1.17	28.29	1.92	6.55	2.67	3.72
0.50	8.36	1.25	20.95	2.00	6.03	2.75	3.56
0.58	10.76	1.33	16.52	2.08	5.59	2.83	3.41
0.67	15.04	1.42	13.60	2.17	5.21	2.92	3.27

CALIB
STANDHYD (0201)
ID= 1 DT= 2.0 min

Area (ha)= 8.41
Total Imp(%)= 70.00 Dir. Conn.(%)= 60.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	5.89	2.52
Dep. Storage	(mm)=	2.00	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	236.78	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 2.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.033	3.64	0.800	24.58	1.567	11.53	2.33	4.88
0.067	3.64	0.833	24.59	1.600	10.77	2.37	4.59
0.100	3.82	0.867	59.70	1.633	10.01	2.40	4.59
0.133	4.00	0.900	59.70	1.667	10.01	2.43	4.47
0.167	4.00	0.933	115.27	1.700	8.84	2.47	4.34
0.200	4.46	0.967	170.84	1.733	8.84	2.50	4.34
0.233	4.46	1.000	170.84	1.767	8.37	2.53	4.11
0.267	4.75	1.033	77.13	1.800	7.91	2.57	4.11
0.300	5.04	1.067	77.13	1.833	7.91	2.60	4.01
0.333	5.04	1.100	59.74	1.867	7.16	2.63	3.91
0.367	5.80	1.133	42.35	1.900	7.16	2.67	3.91
0.400	5.80	1.167	42.35	1.933	6.85	2.70	3.72
0.433	6.32	1.200	28.29	1.967	6.55	2.73	3.72
0.467	6.84	1.233	28.29	2.000	6.55	2.77	3.64
0.500	6.84	1.267	24.62	2.033	6.03	2.80	3.56
0.533	8.36	1.300	20.95	2.067	6.03	2.83	3.56
0.567	8.36	1.333	20.95	2.100	5.81	2.87	3.41
0.600	9.56	1.367	16.52	2.133	5.59	2.90	3.41
0.633	10.76	1.400	16.52	2.167	5.59	2.93	3.34
0.667	10.76	1.433	15.06	2.200	5.21	2.97	3.27
0.700	15.04	1.467	13.60	2.233	5.21	3.00	3.27
0.733	15.04	1.500	13.60	2.267	5.05		
0.767	19.81	1.533	11.53	2.300	4.88		

Max.Eff.Inten.(mm/hr)=		152.32	60.78	
over (min)		5.00	8.00	
Storage Coeff. (min)=		2.94 (ii)	7.46 (ii)	
Unit Hyd. Tpeak (min)=		4.00	8.00	
Unit Hyd. peak (cms)=		0.34	0.15	
				TOTALS
PEAK FLOW	(cms)=	1.89	0.31	2.083 (iii)
TIME TO PEAK	(hrs)=	1.00	1.10	1.03
RUNOFF VOLUME	(mm)=	49.88	20.13	37.98
TOTAL RAINFALL	(mm)=	51.88	51.88	51.88
RUNOFF COEFFICIENT	=	0.96	0.39	0.73

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 74.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

==========

```
       V    V   I    SSSSS  U   U    A    L             (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
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DATE: 12/05/2023 TIME: 11:41:40

USER:

COMMENTS: _____

****
** SIMULATION : 250-Year Regional 4 hr **
****

| CHICAGO STORM |
| Ptotal= 90.48 mm |

IDF curve parameters: A=3048.220
B= 10.030
C= 0.888
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	3.97	1.00	54.92	2.00	12.34	3.00	4.98
0.17	4.74	1.17	212.89	2.17	9.97	3.17	4.52
0.33	5.88	1.33	74.08	2.33	8.33	3.33	4.14
0.50	7.72	1.50	35.85	2.50	7.14	3.50	3.82
0.67	11.14	1.67	22.52	2.67	6.24	3.67	3.54
0.83	19.26	1.83	16.06	2.83	5.54	3.83	3.31

| CALIB |
| STANDHYD (0201) |
|ID= 1 DT= 2.0 min |

Area (ha)= 8.41
Total Imp(%)= 70.00 Dir. Conn.(%)= 60.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	5.89	2.52
Dep. Storage	(mm)=	2.00	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	236.78	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 2.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.033	3.97	1.033	54.92	2.033	12.34	3.03	4.98
0.067	3.97	1.067	54.92	2.067	12.34	3.07	4.98
0.100	3.97	1.100	54.92	2.100	12.34	3.10	4.98
0.133	3.97	1.133	54.92	2.133	12.34	3.13	4.98
0.167	3.97	1.167	54.92	2.167	12.34	3.17	4.98
0.200	4.74	1.200	212.89	2.200	9.97	3.20	4.52
0.233	4.74	1.233	212.89	2.233	9.97	3.23	4.52
0.267	4.74	1.267	212.89	2.267	9.97	3.27	4.52

0.300	4.74	1.300	212.89	2.300	9.97	3.30	4.52
0.333	4.74	1.333	212.89	2.333	9.97	3.33	4.52
0.367	5.88	1.367	74.08	2.367	8.33	3.37	4.14
0.400	5.88	1.400	74.08	2.400	8.33	3.40	4.14
0.433	5.88	1.433	74.08	2.433	8.33	3.43	4.14
0.467	5.88	1.467	74.08	2.467	8.33	3.47	4.14
0.500	5.88	1.500	74.08	2.500	8.33	3.50	4.14
0.533	7.72	1.533	35.85	2.533	7.14	3.53	3.82
0.567	7.72	1.567	35.85	2.567	7.14	3.57	3.82
0.600	7.72	1.600	35.85	2.600	7.14	3.60	3.82
0.633	7.72	1.633	35.85	2.633	7.14	3.63	3.82
0.667	7.72	1.667	35.85	2.667	7.14	3.67	3.82
0.700	11.14	1.700	22.52	2.700	6.24	3.70	3.54
0.733	11.14	1.733	22.52	2.733	6.24	3.73	3.54
0.767	11.14	1.767	22.52	2.767	6.24	3.77	3.54
0.800	11.14	1.800	22.52	2.800	6.24	3.80	3.54
0.833	11.14	1.833	22.52	2.833	6.24	3.83	3.54
0.867	19.26	1.867	16.06	2.867	5.54	3.87	3.31
0.900	19.26	1.900	16.06	2.900	5.54	3.90	3.31
0.933	19.26	1.933	16.06	2.933	5.54	3.93	3.31
0.967	19.26	1.967	16.06	2.967	5.54	3.97	3.31
1.000	19.26	2.000	16.06	3.000	5.54	4.00	3.31

Max.Eff.Inten.(mm/hr)=	212.89	149.42		
over (min)	5.00	8.00		
Storage Coeff. (min)=	2.57 (ii)	6.53 (ii)		
Unit Hyd. Tpeak (min)=	4.00	8.00		
Unit Hyd. peak (cms)=	0.36	0.16		
			TOTALS	
PEAK FLOW (cms)=	2.91	0.80	3.553 (iii)	
TIME TO PEAK (hrs)=	1.33	1.40	1.33	
RUNOFF VOLUME (mm)=	88.48	48.95	72.67	
TOTAL RAINFALL (mm)=	90.48	90.48	90.48	
RUNOFF COEFFICIENT =	0.98	0.54	0.80	

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 74.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

FINISH

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V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
V    V   I    SS     U   U   A A   L
 V  V    I     SS    U   U  AAAAA  L
 V  V    I      SS   U   U  A   A  L
  VV     I    SSSSS  UUUUU  A   A  LLLLL

 OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
O   O    T      T    H   H   Y Y   MM MM  O   O
O   O    T      T    H   H    Y    M   M  O   O
 OOO     T      T    H   H    Y    M   M   OOO
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***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
Output filename: C:\Users\BPavlovic\AppData\Local\Civica\VH5\418c1dff-815b-4e73-8b14-cb211b59d3de\7941cbbf-
Summary filename: C:\Users\BPavlovic\AppData\Local\Civica\VH5\418c1dff-815b-4e73-8b14-cb211b59d3de\7941cbbf-

DATE: 12/05/2023 TIME: 11:41:40

USER:

COMMENTS: _____

****
** SIMULATION : 25mm 4 Hour Chicago **

****

CHICAGO STORM Ptotal= 25.04 mm	IDF curve parameters: A= 538.850 B= 6.331 C= 0.809

used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	1.52	1.00	13.45	2.00	3.80	3.00	1.84
0.17	1.75	1.17	56.25	2.17	3.20	3.17	1.70
0.33	2.08	1.33	17.87	2.33	2.78	3.33	1.58
0.50	2.58	1.50	9.22	2.50	2.45	3.50	1.48
0.67	3.46	1.67	6.21	2.67	2.20	3.67	1.40
0.83	5.39	1.83	4.70	2.83	2.00	3.83	1.32

CALIB STANDHYD (0201) ID= 1 DT= 2.0 min	Area (ha)= 8.41 Total Imp(%)= 70.00 Dir. Conn.(%)= 60.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	5.89	2.52
Dep. Storage	(mm)=	2.00	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	236.78	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 2.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.033	1.52	1.033	13.45	2.033	3.80	3.03	1.84
0.067	1.52	1.067	13.45	2.067	3.80	3.07	1.84
0.100	1.52	1.100	13.45	2.100	3.80	3.10	1.84
0.133	1.52	1.133	13.45	2.133	3.80	3.13	1.84
0.167	1.52	1.167	13.45	2.167	3.80	3.17	1.84
0.200	1.75	1.200	56.25	2.200	3.20	3.20	1.70
0.233	1.75	1.233	56.25	2.233	3.20	3.23	1.70
0.267	1.75	1.267	56.25	2.267	3.20	3.27	1.70
0.300	1.75	1.300	56.25	2.300	3.20	3.30	1.70
0.333	1.75	1.333	56.25	2.333	3.20	3.33	1.70
0.367	2.08	1.367	17.87	2.367	2.78	3.37	1.58
0.400	2.08	1.400	17.87	2.400	2.78	3.40	1.58
0.433	2.08	1.433	17.87	2.433	2.78	3.43	1.58
0.467	2.08	1.467	17.87	2.467	2.78	3.47	1.58
0.500	2.08	1.500	17.87	2.500	2.78	3.50	1.58
0.533	2.58	1.533	9.22	2.533	2.45	3.53	1.48
0.567	2.58	1.567	9.22	2.567	2.45	3.57	1.48
0.600	2.58	1.600	9.22	2.600	2.45	3.60	1.48
0.633	2.58	1.633	9.22	2.633	2.45	3.63	1.48
0.667	2.58	1.667	9.22	2.667	2.45	3.67	1.48
0.700	3.46	1.700	6.21	2.700	2.20	3.70	1.40
0.733	3.46	1.733	6.21	2.733	2.20	3.73	1.40
0.767	3.46	1.767	6.21	2.767	2.20	3.77	1.40
0.800	3.46	1.800	6.21	2.800	2.20	3.80	1.40
0.833	3.46	1.833	6.21	2.833	2.20	3.83	1.40
0.867	5.39	1.867	4.71	2.867	2.00	3.87	1.32
0.900	5.39	1.900	4.70	2.900	2.00	3.90	1.32
0.933	5.39	1.933	4.70	2.933	2.00	3.93	1.32
0.967	5.39	1.967	4.70	2.967	2.00	3.97	1.32
1.000	5.39	2.000	4.70	3.000	2.00	4.00	1.32

				TOTALS
Max.Eff.Inten.(mm/hr)=		56.25	11.83	
over (min)		5.00	12.00	
Storage Coeff. (min)=		4.38 (ii)	11.11 (ii)	
Unit Hyd. Tpeak (min)=		4.00	12.00	
Unit Hyd. peak (cms)=		0.26	0.10	
PEAK FLOW	(cms)=	0.71	0.05	0.725 (iii)
TIME TO PEAK	(hrs)=	1.33	1.50	1.33
RUNOFF VOLUME	(mm)=	23.04	5.14	15.88
TOTAL RAINFALL	(mm)=	25.04	25.04	25.04
RUNOFF COEFFICIENT	=	0.92	0.21	0.63

```
       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
================================================================================================================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\BPavlovic\AppData\Local\Civica\VH5\418c1dff-815b-4e73-8b14-cb211b59d3de\a3a3fc21-
  Summary filename: C:\Users\BPavlovic\AppData\Local\Civica\VH5\418c1dff-815b-4e73-8b14-cb211b59d3de\a3a3fc21-


DATE: 12/05/2023                          TIME: 11:41:40

USER:


COMMENTS: _____________________________________________________________


--------------------------------------------------------------------------------------------------------------------
  ***********************************************
  ** SIMULATION : 25-Year Chicago SC            **
  ***********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1835.352
| Ptotal= 61.64 mm |                          B=   7.844
--------------------                          C=   0.858
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  3.00 hrs
                       Storm time step    =  5.00 min
                       Time to peak ratio =  0.33

                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.00    4.06 |  0.75   29.44 |  1.50   13.47 |  2.25    5.51
                0.08    4.48 |  0.83   72.48 |  1.58   11.63 |  2.33    5.17
                0.17    5.01 |  0.92  205.33 |  1.67   10.22 |  2.42    4.87
                0.25    5.69 |  1.00   93.76 |  1.75    9.11 |  2.50    4.61
                0.33    6.59 |  1.08   51.29 |  1.83    8.21 |  2.58    4.37
                0.42    7.83 |  1.17   34.00 |  1.92    7.48 |  2.67    4.16
                0.50    9.65 |  1.25   24.97 |  2.00    6.86 |  2.75    3.97
                0.58   12.53 |  1.33   19.55 |  2.08    6.34 |  2.83    3.79
                0.67   17.74 |  1.42   15.98 |  2.17    5.90 |  2.92    3.63


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   8.41
|ID= 1 DT= 2.0 min |   Total Imp(%)=  70.00   Dir. Conn.(%)=  60.00
--------------------
                                IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       5.89          2.52
     Dep. Storage     (mm)=       2.00          5.00
     Average Slope     (%)=       2.00          2.00
     Length            (m)=     236.78         40.00
     Mannings n             =     0.013         0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   2.0 MIN. TIME STEP.
```

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.033	4.06	0.800	29.44	1.567	13.47	2.33	5.51
0.067	4.06	0.833	29.45	1.600	12.55	2.37	5.17
0.100	4.27	0.867	72.48	1.633	11.63	2.40	5.17
0.133	4.48	0.900	72.48	1.667	11.63	2.43	5.02
0.167	4.48	0.933	138.91	1.700	10.22	2.47	4.87
0.200	5.01	0.967	205.33	1.733	10.22	2.50	4.87
0.233	5.01	1.000	205.33	1.767	9.66	2.53	4.61
0.267	5.35	1.033	93.76	1.800	9.11	2.57	4.61
0.300	5.69	1.067	93.76	1.833	9.11	2.60	4.49
0.333	5.69	1.100	72.53	1.867	8.21	2.63	4.37
0.367	6.59	1.133	51.29	1.900	8.21	2.67	4.37
0.400	6.59	1.167	51.29	1.933	7.84	2.70	4.16
0.433	7.21	1.200	34.00	1.967	7.48	2.73	4.16
0.467	7.83	1.233	34.00	2.000	7.48	2.77	4.06
0.500	7.83	1.267	29.48	2.033	6.86	2.80	3.97
0.533	9.65	1.300	24.97	2.067	6.86	2.83	3.97
0.567	9.65	1.333	24.97	2.100	6.60	2.87	3.79
0.600	11.09	1.367	19.55	2.133	6.34	2.90	3.79
0.633	12.53	1.400	19.55	2.167	6.34	2.93	3.71
0.667	12.53	1.433	17.77	2.200	5.90	2.97	3.63
0.700	17.74	1.467	15.98	2.233	5.90	3.00	3.63
0.733	17.74	1.500	15.98	2.267	5.70		
0.767	23.59	1.533	13.47	2.300	5.51		

Max.Eff.Inten.(mm/hr)=	183.19	83.63		
over (min)	5.00	8.00		
Storage Coeff. (min)=	2.73 (ii)	6.93 (ii)		
Unit Hyd. Tpeak (min)=	4.00	8.00		
Unit Hyd. peak (cms)=	0.35	0.15		
			TOTALS	
PEAK FLOW (cms)=	2.32	0.44	2.591 (iii)	
TIME TO PEAK (hrs)=	1.00	1.10	1.03	
RUNOFF VOLUME (mm)=	59.64	26.85	46.52	
TOTAL RAINFALL (mm)=	61.64	61.64	61.64	
RUNOFF COEFFICIENT =	0.97	0.44	0.75	

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 74.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```
V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
V    V   I    SS     U   U   A A   L
 V  V    I     SS    U   U  AAAAA  L
 V  V    I      SS   U   U  A   A  L
  VV     I    SSSSS  UUUUU  A   A  LLLLL

 OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
O   O    T      T    H   H   Y Y   MM MM  O   O
O   O    T      T    H   H    Y    M   M  O   O
 OOO     T      T    H   H    Y    M   M   OOO
```

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***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
Output filename: C:\Users\BPavlovic\AppData\Local\Civica\VH5\418c1dff-815b-4e73-8b14-cb211b59d3de\32eb72a1-
Summary filename: C:\Users\BPavlovic\AppData\Local\Civica\VH5\418c1dff-815b-4e73-8b14-cb211b59d3de\32eb72a1-

DATE: 12/05/2023 TIME: 11:41:39

USER:

COMMENTS: _____

```
  ***********************************************
  ** SIMULATION : 2-year Chicago SC from IDF    **
  ***********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=2016.901
| Ptotal= 39.86 mm |                          B=  11.250
--------------------                          C=   0.956
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  3.00 hrs
                       Storm time step    =  5.00 min
                       Time to peak ratio =  0.33
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	1.54	0.75	20.31	1.50	7.84	2.25	2.37
0.08	1.77	0.83	53.33	1.58	6.48	2.33	2.17
0.17	2.08	0.92	140.32	1.67	5.47	2.42	1.99
0.25	2.48	1.00	69.17	1.75	4.69	2.50	1.84
0.33	3.03	1.08	37.56	1.83	4.09	2.58	1.71
0.42	3.83	1.17	23.92	1.92	3.60	2.67	1.60
0.50	5.07	1.25	16.75	2.00	3.20	2.75	1.49
0.58	7.14	1.33	12.48	2.08	2.87	2.83	1.40
0.67	11.08	1.42	9.73	2.17	2.60	2.92	1.32

```
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   8.41
|ID= 1 DT= 2.0 min |   Total Imp(%)=  70.00   Dir. Conn.(%)=  60.00
--------------------
```

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	5.89	2.52
Dep. Storage	(mm)=	2.00	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	236.78	40.00
Mannings n	=	0.013	0.250

```
    NOTE:  RAINFALL WAS TRANSFORMED TO   2.0 MIN. TIME STEP.
```

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.033	1.54	0.800	20.31	1.567	7.84	2.33	2.37
0.067	1.54	0.833	20.31	1.600	7.16	2.37	2.17
0.100	1.66	0.867	53.33	1.633	6.48	2.40	2.17
0.133	1.77	0.900	53.33	1.667	6.48	2.43	2.08
0.167	1.77	0.933	96.82	1.700	5.47	2.47	1.99
0.200	2.08	0.967	140.32	1.733	5.47	2.50	1.99
0.233	2.08	1.000	140.32	1.767	5.08	2.53	1.84
0.267	2.28	1.033	69.17	1.800	4.69	2.57	1.84
0.300	2.48	1.067	69.17	1.833	4.69	2.60	1.78
0.333	2.48	1.100	53.37	1.867	4.09	2.63	1.71
0.367	3.03	1.133	37.56	1.900	4.09	2.67	1.71
0.400	3.03	1.167	37.56	1.933	3.84	2.70	1.60
0.433	3.43	1.200	23.92	1.967	3.60	2.73	1.60
0.467	3.83	1.233	23.92	2.000	3.60	2.77	1.55
0.500	3.83	1.267	20.34	2.033	3.20	2.80	1.49
0.533	5.07	1.300	16.75	2.067	3.20	2.83	1.49
0.567	5.07	1.333	16.75	2.100	3.04	2.87	1.40
0.600	6.11	1.367	12.48	2.133	2.87	2.90	1.40
0.633	7.14	1.400	12.48	2.167	2.87	2.93	1.36
0.667	7.14	1.433	11.10	2.200	2.60	2.97	1.32
0.700	11.08	1.467	9.73	2.233	2.60	3.00	1.32
0.733	11.08	1.500	9.73	2.267	2.48		
0.767	15.69	1.533	7.84	2.300	2.37		

Max.Eff.Inten.(mm/hr)=		125.82	42.69	
	over (min)	5.00	10.00	
Storage Coeff.	(min)=	3.17 (ii)	8.05 (ii)	
Unit Hyd. Tpeak	(min)=	4.00	10.00	
Unit Hyd. peak	(cms)=	0.32	0.13	
				TOTALS
PEAK FLOW	(cms)=	1.55	0.20	1.639 (iii)
TIME TO PEAK	(hrs)=	1.03	1.17	1.03
RUNOFF VOLUME	(mm)=	37.86	12.65	27.78
TOTAL RAINFALL	(mm)=	39.86	39.86	39.86
RUNOFF COEFFICIENT	=	0.95	0.32	0.70

```
      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
```

```
           CN*  =  74.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
================================================================================================================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\BPavlovic\AppData\Local\Civica\VH5\418c1dff-815b-4e73-8b14-cb211b59d3de\aee17a00-
  Summary filename: C:\Users\BPavlovic\AppData\Local\Civica\VH5\418c1dff-815b-4e73-8b14-cb211b59d3de\aee17a00-


DATE: 12/05/2023                          TIME: 11:41:40

USER:


COMMENTS: _____________________________________________________________


--------------------------------------------------------------------------------------------------------------------
  ************************************************
  ** SIMULATION : 50-Year Chicago SC            **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=2225.884
| Ptotal= 69.59 mm |                          B=   8.620
--------------------                          C=   0.871
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  3.00 hrs
                       Storm time step    =  5.00 min
                       Time to peak ratio =  0.33

               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.00    4.36 |  0.75   33.91 |  1.50   15.21 |  2.25    6.00
               0.08    4.84 |  0.83   83.50 |  1.58   13.06 |  2.33    5.62
               0.17    5.44 |  0.92  228.89 |  1.67   11.42 |  2.42    5.28
               0.25    6.21 |  1.00  107.76 |  1.75   10.13 |  2.50    4.98
               0.33    7.24 |  1.08   59.36 |  1.83    9.10 |  2.58    4.72
               0.42    8.66 |  1.17   39.24 |  1.92    8.25 |  2.67    4.48
               0.50   10.76 |  1.25   28.68 |  2.00    7.55 |  2.75    4.26
               0.58   14.11 |  1.33   22.32 |  2.08    6.95 |  2.83    4.07
               0.67   20.20 |  1.42   18.14 |  2.17    6.44 |  2.92    3.89


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   8.41
|ID= 1 DT= 2.0 min |   Total Imp(%)=  70.00   Dir. Conn.(%)=  60.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       5.89         2.52
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     236.78        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   2.0 MIN. TIME STEP.
```

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.033	4.36	0.800	33.91	1.567	15.21	2.33	6.00
0.067	4.36	0.833	33.91	1.600	14.13	2.37	5.62
0.100	4.60	0.867	83.50	1.633	13.06	2.40	5.62
0.133	4.84	0.900	83.50	1.667	13.06	2.43	5.45
0.167	4.84	0.933	156.20	1.700	11.42	2.47	5.28
0.200	5.44	0.967	228.89	1.733	11.42	2.50	5.28
0.233	5.44	1.000	228.89	1.767	10.77	2.53	4.98
0.267	5.83	1.033	107.76	1.800	10.13	2.57	4.98
0.300	6.21	1.067	107.76	1.833	10.13	2.60	4.85
0.333	6.21	1.100	83.56	1.867	9.10	2.63	4.72
0.367	7.24	1.133	59.36	1.900	9.10	2.67	4.72
0.400	7.24	1.167	59.36	1.933	8.67	2.70	4.48
0.433	7.95	1.200	39.24	1.967	8.25	2.73	4.48
0.467	8.66	1.233	39.24	2.000	8.25	2.77	4.37
0.500	8.66	1.267	33.96	2.033	7.55	2.80	4.26
0.533	10.76	1.300	28.68	2.067	7.55	2.83	4.26
0.567	10.76	1.333	28.68	2.100	7.25	2.87	4.07
0.600	12.43	1.367	22.32	2.133	6.95	2.90	4.07
0.633	14.11	1.400	22.32	2.167	6.95	2.93	3.98
0.667	14.11	1.433	20.23	2.200	6.44	2.97	3.89
0.700	20.20	1.467	18.14	2.233	6.44	3.00	3.89
0.733	20.20	1.500	18.14	2.267	6.22		
0.767	27.05	1.533	15.21	2.300	6.00		

Max.Eff.Inten.(mm/hr)=	204.66	102.45	
over (min)	5.00	8.00	
Storage Coeff. (min)=	2.61 (ii)	6.63 (ii)	
Unit Hyd. Tpeak (min)=	4.00	8.00	
Unit Hyd. peak (cms)=	0.36	0.16	
			TOTALS
PEAK FLOW (cms)=	2.63	0.55	2.969 (iii)
TIME TO PEAK (hrs)=	1.00	1.10	1.03
RUNOFF VOLUME (mm)=	67.59	32.65	53.61
TOTAL RAINFALL (mm)=	69.59	69.59	69.59
RUNOFF COEFFICIENT =	0.97	0.47	0.77

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 74.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```
       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
Output filename: C:\Users\BPavlovic\AppData\Local\Civica\VH5\418c1dff-815b-4e73-8b14-cb211b59d3de\c05d945d-
Summary filename: C:\Users\BPavlovic\AppData\Local\Civica\VH5\418c1dff-815b-4e73-8b14-cb211b59d3de\c05d945d-

DATE: 12/05/2023 TIME: 11:41:40

USER:

COMMENTS: _____

****
** SIMULATION : 5-Year Chicago SC **

****

CHICAGO STORM Ptotal= 44.35 mm	IDF curve parameters: A=1137.257 B= 7.184 C= 0.830 used in: INTENSITY = A / (t + B)^C

Duration of storm = 3.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	3.29	0.75	21.03	1.50	10.08	2.25	4.38
0.08	3.61	0.83	50.18	1.58	8.78	2.33	4.13
0.17	4.01	0.92	142.78	1.67	7.78	2.42	3.90
0.25	4.51	1.00	64.63	1.75	6.99	2.50	3.71
0.33	5.17	1.08	35.80	1.83	6.35	2.58	3.53
0.42	6.08	1.17	24.12	1.92	5.82	2.67	3.37
0.50	7.38	1.25	17.99	2.00	5.37	2.75	3.22
0.58	9.42	1.33	14.28	2.08	4.99	2.83	3.09
0.67	13.03	1.42	11.82	2.17	4.66	2.92	2.97

CALIB STANDHYD (0201) ID= 1 DT= 2.0 min	Area (ha)= 8.41 Total Imp(%)= 70.00 Dir. Conn.(%)= 60.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	5.89	2.52
Dep. Storage	(mm)=	2.00	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	236.78	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 2.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.033	3.29	0.800	21.03	1.567	10.08	2.33	4.38
0.067	3.29	0.833	21.03	1.600	9.43	2.37	4.13
0.100	3.45	0.867	50.18	1.633	8.78	2.40	4.13
0.133	3.61	0.900	50.18	1.667	8.78	2.43	4.02
0.167	3.61	0.933	96.48	1.700	7.78	2.47	3.90
0.200	4.01	0.967	142.78	1.733	7.78	2.50	3.90
0.233	4.01	1.000	142.77	1.767	7.39	2.53	3.71
0.267	4.26	1.033	64.63	1.800	6.99	2.57	3.71
0.300	4.51	1.067	64.63	1.833	6.99	2.60	3.62
0.333	4.51	1.100	50.21	1.867	6.35	2.63	3.53
0.367	5.17	1.133	35.80	1.900	6.35	2.67	3.53
0.400	5.17	1.167	35.80	1.933	6.08	2.70	3.37
0.433	5.63	1.200	24.12	1.967	5.82	2.73	3.37
0.467	6.08	1.233	24.12	2.000	5.82	2.77	3.29
0.500	6.08	1.267	21.05	2.033	5.37	2.80	3.22
0.533	7.38	1.300	17.99	2.067	5.37	2.83	3.22
0.567	7.38	1.333	17.99	2.100	5.18	2.87	3.09
0.600	8.40	1.367	14.28	2.133	4.99	2.90	3.09
0.633	9.42	1.400	14.28	2.167	4.99	2.93	3.03
0.667	9.42	1.433	13.05	2.200	4.66	2.97	2.97
0.700	13.03	1.467	11.82	2.233	4.66	3.00	2.97
0.733	13.03	1.500	11.82	2.267	4.52		
0.767	17.03	1.533	10.08	2.300	4.38		

Max.Eff.Inten.(mm/hr)=		127.34	44.51	
over (min)		5.00	10.00	
Storage Coeff. (min)=		3.16 (ii)	8.02 (ii)	
Unit Hyd. Tpeak (min)=		4.00	10.00	
Unit Hyd. peak (cms)=		0.32	0.13	
				TOTALS
PEAK FLOW	(cms)=	1.55	0.21	1.661 (iii)
TIME TO PEAK	(hrs)=	1.03	1.17	1.03
RUNOFF VOLUME	(mm)=	42.35	15.33	31.54
TOTAL RAINFALL	(mm)=	44.35	44.35	44.35
RUNOFF COEFFICIENT	=	0.95	0.35	0.71

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 74.0 Ia = Dep. Storage (Above)
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THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
