932 Mapleview Drive East, Barrie
Functional Servicing Report Brief

970 Mapleview Inc.

R.J. Burnside & Associates Limited
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November 2020
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932 Mapleview Drive East, Barrie
Functional Servicing Report Brief
November 2020

Distribution List

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-	Yes	Yes	970 Mapleview Inc.
-	Yes	Yes	Jones Consulting Group
-	Yes	Yes	City of Barrie

Record of Revisions

Rev.	Date	Description
-	November 2020	Initial Submission to City of Barrie

R.J. Burnside & Associates Limited

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1.0 Introduction and Background

R.J. Burnside & Associates Limited (Burnside) has been retained by 970 Mapleview Inc. to prepare a Functional Servicing Report in support of the proposed residential subdivision at 932 Mapleview Drive East, Barrie. This Report will support the application for Draft Plan of Subdivision approval by demonstrating that the subject lands can be provided with municipal servicing in accordance with applicable regulatory requirements and criteria. 970 Mapleview Inc. also owns the lands directly north and east of the subject property and proposes to redline the previously approved draft plan to include the limits of this property within the draft plan. This Report also identifies conformity to the Sub-watershed Impact Study for the Hewitt's Creek Secondary Plan area (SIS).

1.1 Site Description and Context

932 Mapleview Drive East is a 0.17 ha property bound by Mapleview Drive to the south, 970 Mapleview to the north and east, and the existing Maple Court subdivision to the west. The subject site is currently a residential property, containing a single-family residence with direct access to Mapleview Drive East. The proposed redline draft plan incorporates 4 additional single-family detached lots at 932 Mapleview with proposed access and municipal servicing from Nottingham Road (Street H). The proposed development's drainage will ultimately be directed to Stormwater Management Facility 11 (SWMF11), consistent with the 2016 Burnside Subwatershed Impact Study (SIS), Functional Servicing Report (FSR) for 970 Mapleview Inc., and Stormwater Management Report for SWMF11, referenced below and throughout this document.

1.2 Background Studies and Documentations

The servicing concepts presented within this Report have been developed to comply with the infrastructure and stormwater management servicing framework that has been established for this area. The following documents, studies, and reports have been incorporated unless otherwise noted.

Document Title	Prepared By	Date
SIS	Burnside	Addendum No. 1: November 2017 Addendum No. 2: March 2020
FSR	Burnside	July 2017
SWMF 11 Report	Schaeffers	March 2020
970 Mapleview Detailed Design	Burnside	November 5, 2020

1.3 Existing Site Conditions

932 Mapleview Drive East is currently a residential land use site, with a single detached home currently serviced by an on-site well and septic bed. The site is within the Hewitt's Creek sub-watershed and currently drains to the ditch on the north side of Mapleview Drive which outlets to an existing City ditch inlet catchbasin located on the Mapleview Drive right-of-way (ROW) adjacent to the subject site. The site generally falls from north to south with an elevation difference of approximately 0.5 m.

Boreholes completed by Golder on the adjacent 970 Mapleview site indicate the surficial soils are dominated by coarse grained sediments including Sand - Trace Silt, and Silty Sand. This surficial layer ranges in depth from 0.1 m to 3.0 m and is generally underlain by a layer of finer, textured soils including Silty Clay, Sandy Silt and Clayey Sand. This layer occurs in varying thickness from 0.5 m to 2.0 m and was noted in some instances as being dense to very dense, and cohesive. Below this confining layer, a deep continuous Sand - Trace Silt, and Silty Sand layer was generally observed, noted as being compact to very dense. Groundwater was encountered in nearby boreholes on 970 Mapleview lands at approximately 5.0 m below existing ground.

2.0 Transportation

932 Mapleview currently has a driveway with vehicular access provided directly from Mapleview Drive East. At this location, Mapleview Drive is currently a two-lane rural ROW with ditches existing on either side of the road.

A road widening detailed design is currently being completed by Burnside for Mapleview Drive East which will alter the frontage along this property. Currently, the proposed Mapleview detailed design avoids 932 Mapleview, resulting in a non-standard ROW adjacent to 932 Mapleview.

As part of the 932 Mapleview development and the redline revision, the driveway providing vehicular access from 932 Mapleview to Mapleview Drive East will be eliminated and a 5.18 m widening will be conveyed to the City upon subdivision registration to allow for an uninterrupted and consistent ROW on Mapleview Drive East. A partial 5 x 10 daylighting triangle for Nottingham Road and Mapleview Drive East intersection will also be conveyed to the City upon registration.

As seen on the proposed redline Draft Plan (Appendix A), 932 Mapleview will be subdivided into 4 parcels from east to west. This plan allows for the proposed lots to have direct frontage along the (draft approved) Nottingham Road ROW. This frontage on Nottingham Road will provide each lot with driveway access.

No municipal ROWs (with the exception of the Mapleview widening) are required to be constructed on 932 Mapleview lands which is consistent with the SIS and subsequent Transportation Master Plan prepared by LEA.

3.0 Water Distribution

Water servicing for the subject lands will be designed in accordance with City of Barrie and the Ministry of the Environment, Conservation and Parks (MECP) Design Guidelines for Drinking Water Systems to ensure that adequate pressures and fire flows are achieved.

Watermain design flows will be based on the following criteria:

- Average Daily Demand: 450 L/cap/day
- Maximum daily demand factor: 2.00
- Peak hourly demand factor: 4.5
- Minimum Fire flow: 57 L/s (@ 20 PSI)

932 Mapleview is currently serviced by an existing well located on the west side of the site. This well will be professionally decommissioned prior to the build-out of 932 Mapleview.

Proposed lots within 932 Mapleview will be serviced by 25 mm water service laterals connecting into the 200 mm diameter watermain which will be constructed on the future Nottingham Road ROW.

The proposed 200 mm diameter watermain will have sufficient capacity to service 932 Mapleview as shown on Figure 2 and described in the approved Water Supply memo prepared for 970 Mapleview Inc. by Schaeffers (Appendix B). Hydrants on Nottingham Road will be spaced per City of Barrie standards to provide adequate coverage. No watermains are required to be constructed on 932 Mapleview lands which is consistent with the SIS.

4.0 Wastewater Servicing

Sanitary servicing for the subject land will be designed in accordance with City of Barrie and the MECP Design Guidelines for Sewage Works.

Sanitary design flows will be based on the following criteria:

- Flow Rate for Average Daily Residential Flow: 225 L/cap/day
- Population (Detached Single units): 3.13 PPU
- Extraneous Flow: 0.10 L/s/ha
- Minimum full flow velocity: 0.6 m/s

932 Mapleview is currently serviced by an on-site septic system located on the northern portion of the site. This septic system will be professionally decommissioned and removed prior to the build-out of 932 Mapleview.

Proposed lots within 932 Mapleview will be serviced by 100 mm dia. sanitary sewer laterals located at the center of the proposed lots and discharging to a 200 mm PVC sanitary sewer on Nottingham Road as shown on Figure 2. The additional flow contributing to the proposed sewer on Nottingham Road is not significant and the pipe capacity (d/D) will remain under 50%. No local sanitary sewers are required to be constructed on 932 Mapleview lands which is consistent with the SIS. A copy of the 970 Mapleview Detailed Design Sanitary Drainage Plan and Design Sheet is appended (Appendix C) to this Report.

5.0 Grading and Storm Drainage

932 Mapleview is within the Hewitt's Creek sub-watershed and currently drains to the ditch on the north side of Mapleview Drive, which outlets to an existing City ditch inlet catchbasin (DICB) located on the Mapleview Drive right of way (ROW) adjacent to the subject site. The site is flat and generally falls from north to south with an elevation difference of approximately 0.5 m.

The existing DICB on Mapleview Drive to which the site currently drains is not located directly at the low point of elevation, causing local ponding to occur during rain events. As part of the 970 Mapleview works, this DICB will be relocated to ensure adequate drainage, and will be constructed with a 3:1 grate. Refer to Figure 2 for the relocation of the existing DICB.

The proposed grading for 932 Mapleview will be designed to match into proposed grades along the future Mapleview Drive and Nottingham Road ROWs as urban cross sections. These lots will be graded as split-draining type lots complete with side-yard swales with slopes between 2% and 5%. The eastern portion of each lot will drain to the storm sewer on Nottingham Road, which ultimately drains to SWMF11, while the western portion of the lot will drain west towards a proposed rear-yard swale and outlet to the aforementioned relocated catchbasin. This relocated catchbasin will drain to the proposed storm sewer on Mapleview Drive East, which ultimately drains to SWMF11. This is consistent with Figure 3: Hewitt's Creek and Sandy Cove Creek Sub-watershed Exchange. A copy of the 970 Mapleview Detailed Design Storm Drainage Plan and Design Sheet is appended (Appendix C) to this Report.

There are existing mature trees along the western property line of the proposed site, which is generally flat and has a natural grade of only 0.5%. To avoid disturbance to this area and maintain adequate drainage of these lots, a proposed rear-yard swale at a slope of 2% will be constructed along the dripline of the existing trees. This swale will be

designed to have a depth of 0.2 m complete with 3:1 maximum side slopes and will discharge to the relocated DICB. The proposed rear-yard grading will tie-in to existing ground in a manner that ensures disturbance to the existing trees is minimized. Refer to Figure 2 for the proposed grading and location of the DICB.

It is recommended that Tree Inventory Survey is completed to asses the health of these trees. Some tree removal will be required within the Mapleview widening block to construct the ultimate ROW and the relocated DICB.

6.0 Stormwater Management

Under existing conditions, 932 Mapleview drains entirely to an existing ditch inlet catchbasin (DICB) which outlets to the existing 750 mm sewer on Mapleview Drive East.

The rear-yards of the proposed lots will drain to the proposed 1,200 mm storm sewer on Mapleview Drive (970 Mapleview works) via the relocated DICB. Runoff from the 932 Mapleview site will therefore ultimately outlet to Stormwater Management Facility 11 (SWMF11).

The eastern portion of the proposed lots will drain to the proposed storm sewer on Nottingham Road. As described in the SIS and 970 Mapleview FSR, the storm sewer on Nottingham will capture 100-year flow at the intersection of Nottingham and Mapleview, and will convey flows across Mapleview Drive and down Street 2 within the Bulut subdivision. These flows will then ultimately discharge into SWMF11. Quantity control, quality control and phosphorus removal for 932 Mapleview will be achieved within SWMF11. The drainage area from 932 Mapleview has been considered in the design of SWMF11 as described in the Stormwater Management Report prepared by Schaeffers. Therefore, the proposed drainage of the 932 Mapleview site conforms to the SIS and is consistent with Figure 3: Hewitt's Creek and Sandy Cove Creek Subwatershed Exchange.

6.1 Water Balance

It is recommended that the 932 Mapleview lands be the subject of an addendum to the existing hydrogeological report prepared by Burnside for 970 Mapleview Inc. Included within the addendum, the additional water balance deficit should be quantified to reflect the development of 932 Mapleview.

The water balance deficit for 932 Mapleview will be mitigated through the infiltration surplus associated with the approved Stormwater Management Facility 15 (SWMF15). To date, a surplus of 28,768 m^3 belongs to 970 Mapleview Inc. associated with SWMF15 as shown in the Stormwater Management Facility 15 Water Balance Ledger in Appendix E. It is assumed that the water balance deficit for 932 Mapleview will be much

less than this surplus amount. Once the deficit is determined, the quantity will be applied, and the ledger will be updated and re-circulated to the City of Barrie and the Lake Simcoe Region Conservation Authority (LSRCA).

7.0 Conclusions & Recommendations

As described throughout this Report, the proposed infrastructure surrounding 932 Mapleview has adequate capacity and has been designed to consider the proposed lots. The redline revision proposed to the 970 Mapleview draft plan to include 932 Mapleview lands is in accordance with the SIS.

It is recommended that the detailed design 932 Mapleview lands be included within the detailed engineering design package for the 970 Mapleview subdivision.

The following additional investigations should be completed:

- Additional tree inventory and survey on 932 Mapleview is recommended to confirm the limits of grading and tree removal required.
- An addendum to the 970 Mapleview hydrogeological investigation be provided to include 932 Mapleview lands including the site water balance deficit.

BURNSIDE
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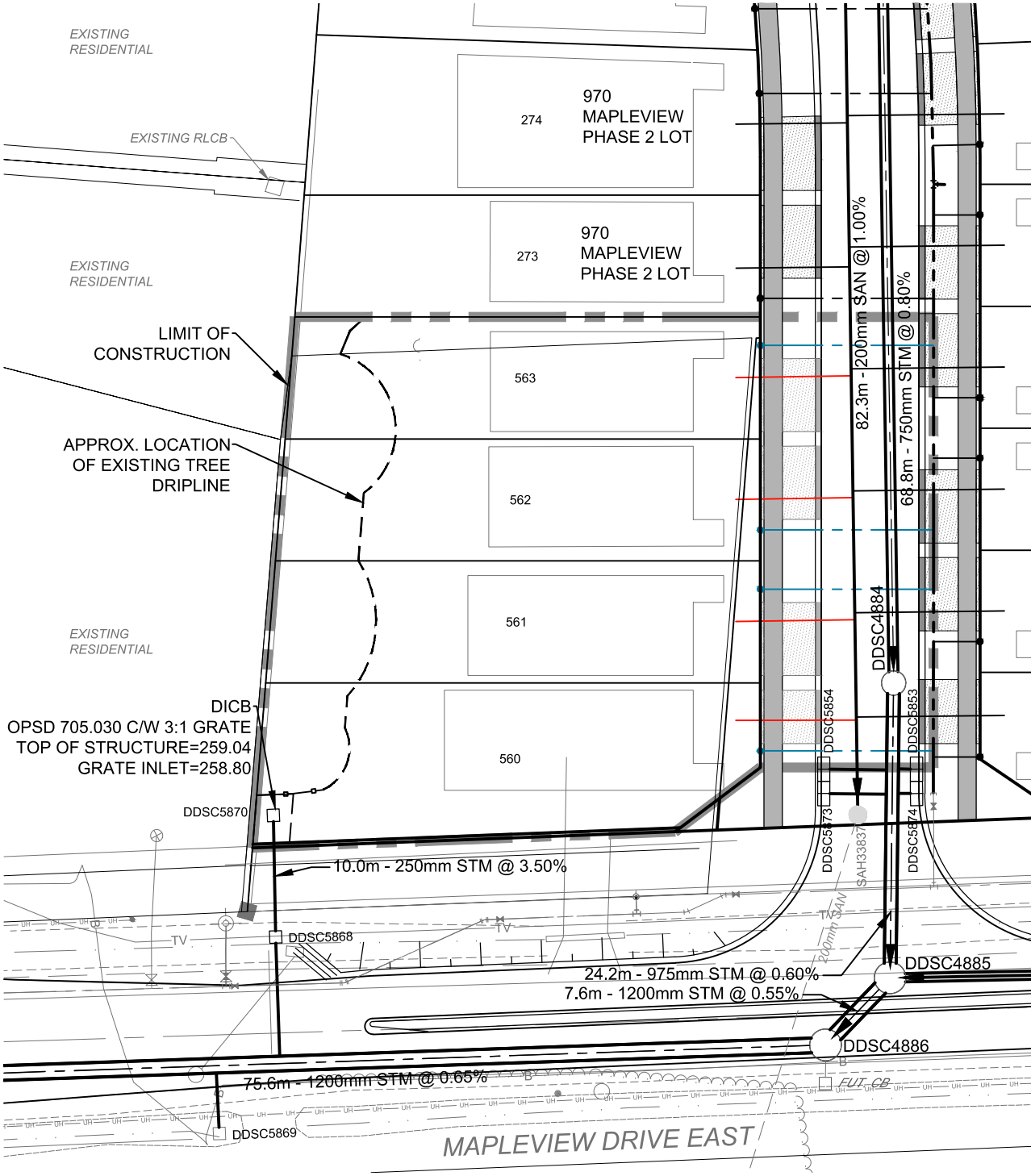
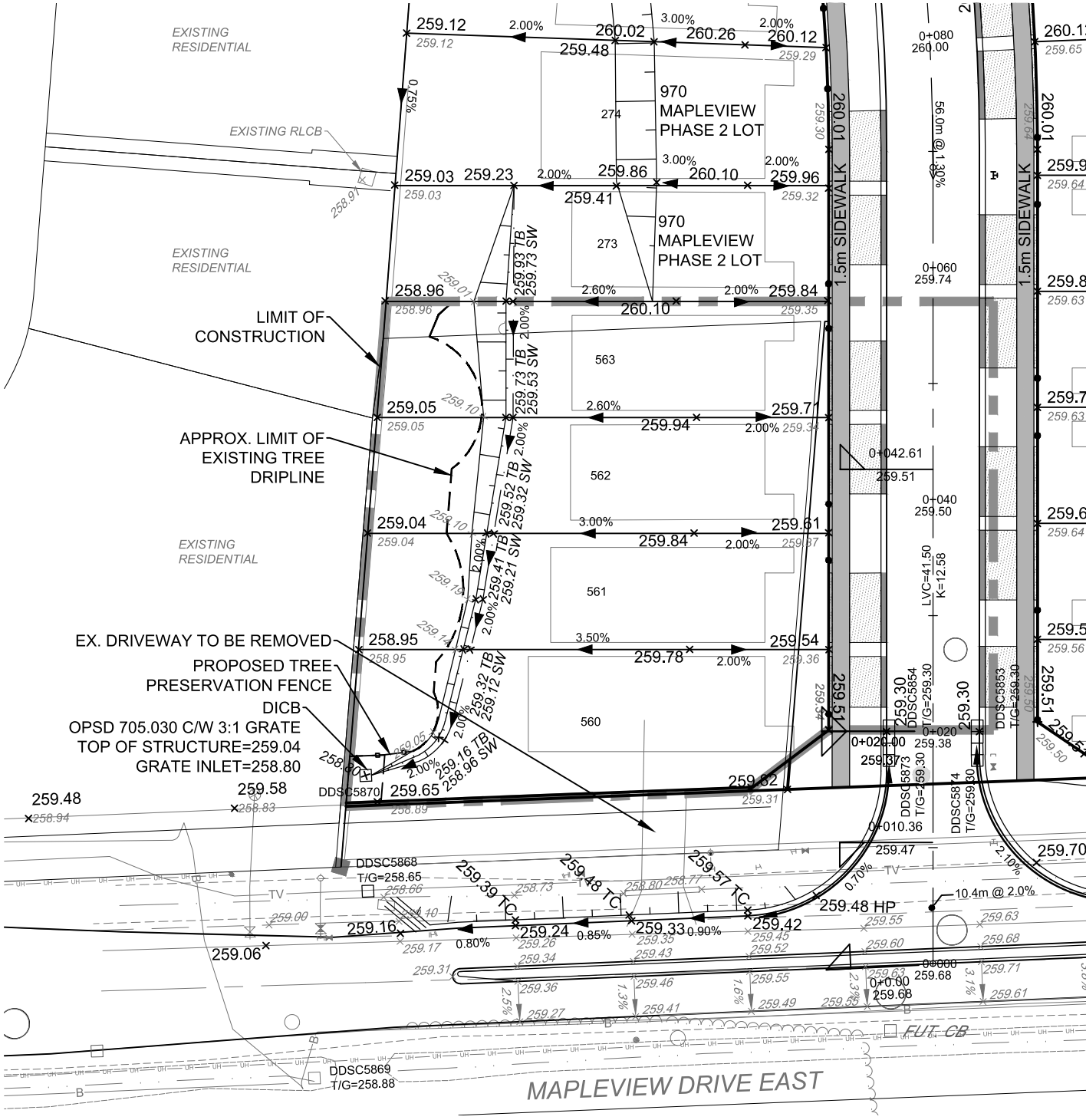
Figures


EXISTING RESIDENTIAL
EXISTING RLCB
EXISTING RESIDENTIAL
EXISTING RESIDENTIAL
274
970 MAPLEVIEW PHASE 2 LOT
273
970 MAPLEVIEW PHASE 2 LOT
563
562
561
560
LIMIT OF CONSTRUCTION
APPROX. LOCATION OF EXISTING TREE DRIPLINE
DICB
OPSD 705.030 C/W 3:1 GRATE
TOP OF STRUCTURE=259.04
GRATE INLET=258.80
DDSC5870
10.0m - 250mm STM @ 3.50%
DDSC5868
82.3m - 200mm SAN @ 1.00%
68.8m - 750mm STM @ 0.80%
DDSC4884
DDSC5854
DDSC5853
DDSC5873
DDSC5874
SAH33837
TV
200mm SAN
DDSC4885
24.2m - 975mm STM @ 0.60%
7.6m - 1200mm STM @ 0.55%
DDSC4886
75.6m - 1200mm STM @ 0.65%
FUT CB
DDSC5869
MAPLEVIEW DRIVE EAST

LEGEND



LEGEND

226.20	PROPOSED LOT CORNER ELEVATION
	HYDRANT & VALVE PER PSD-507

SANDY COVE TO HEWITTS CREEK
AREA 2: 0.47 Ha
HEWITTS CREEK TO SA
AREA 3: 0.34 Ha
SANDY COVE
AREA 4: 0.21
HEWITTS CREEK TO
AREA 5: 0.12 Ha
OPEN SPACE
SANDY COVE TO HEWITTS CREEK

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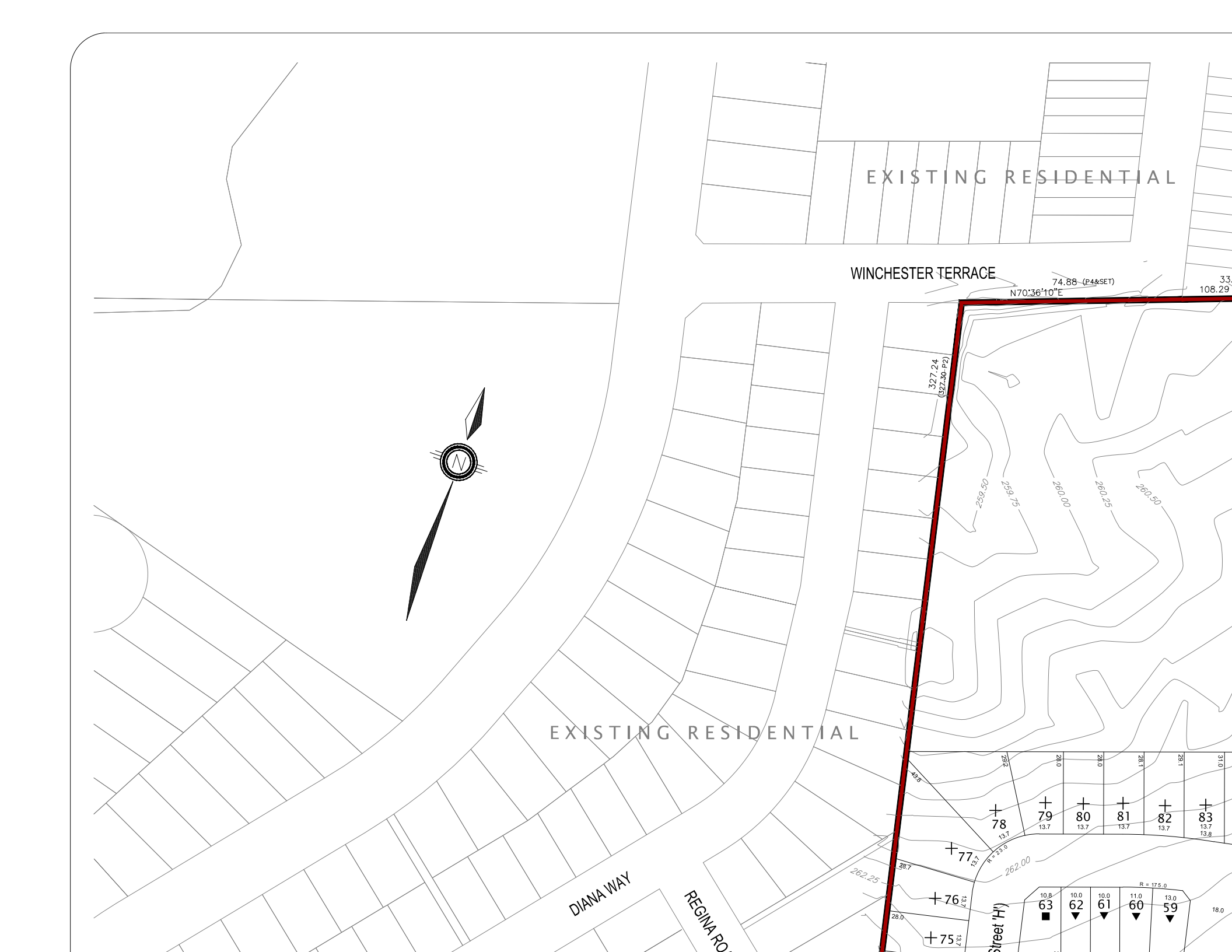
Appendix A

Redline Draft Plan


EXISTING RESIDENTIAL
WINCHESTER TERRACE
74.88 (P4&SET)
N70°36'10"E
108.29
327.24
(327.30 P2)
259.50
259.75
260.00
260.25
260.50
EXISTING RESIDENTIAL
DIANA WAY
REGINA RO
262.25
262.00
78
79
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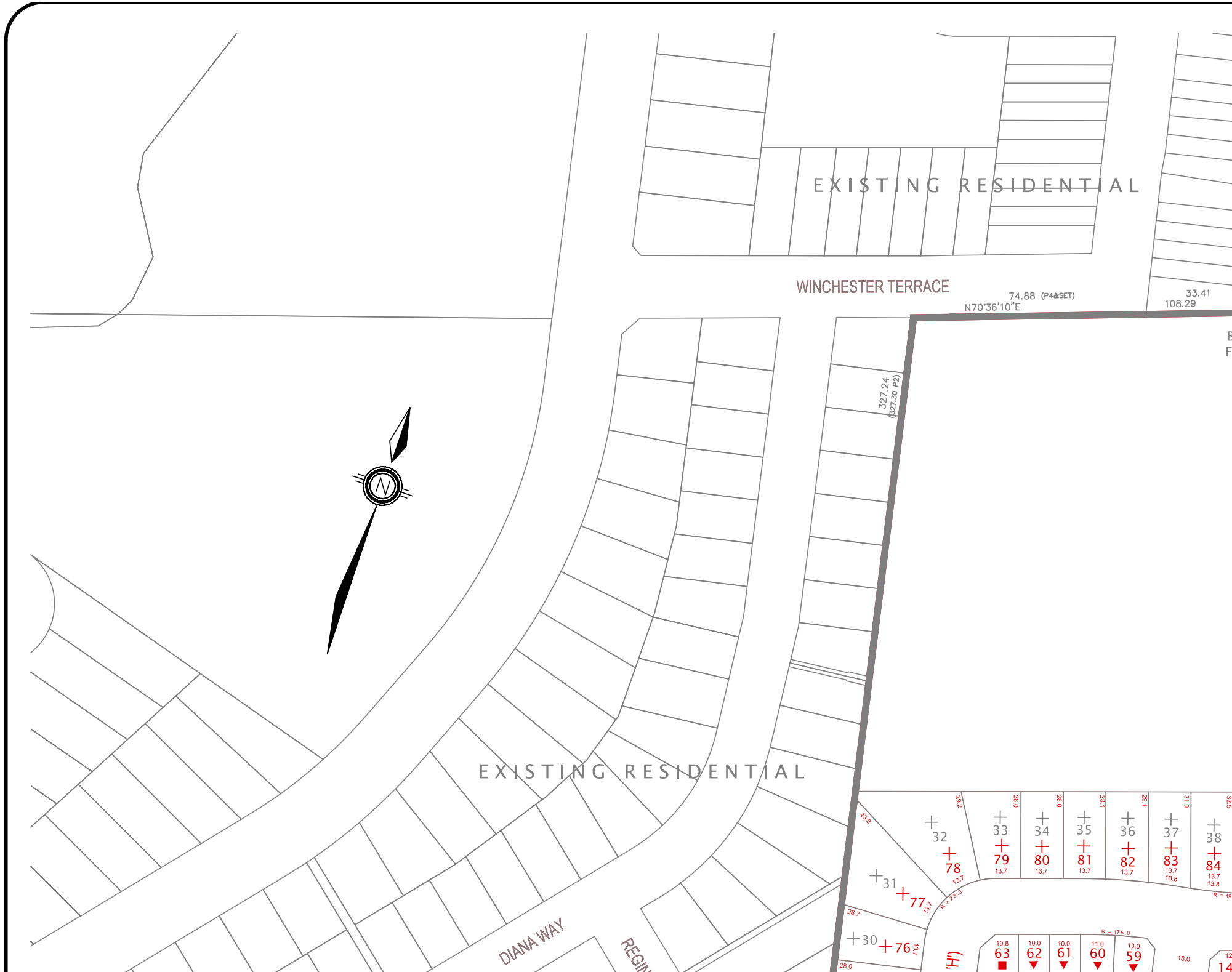
Street 'H')


EXISTING RESIDENTIAL
WINCHESTER TERRACE
74.88 (P4&SET)
N70°36'10"E
33.41
108.29
327.24
(327.30 P2)
EXISTING RESIDENTIAL
DIANA WAY
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Appendix B

Water Supply Memorandum

August 19, 2020

Our File: 2019-4897

R.J. Burnside & Associates Limited
128 Wellington Street West
Barrie, ON L4N 8J6

SCHAEFFERS
CONSULTING ENGINEERS

6 Ronrose Drive, Vaughan, Ontario L4K 4R3
Tel: (905) 738-6100 Fax: (905) 738-6875
Tor. Line: (416) 213-5590 E-mail: general@schaeffers.com

Attention: Mr. Aaron Pettifer, P.Eng.
Project Manager

Dear Mr. Pettifer,

RE: WaterCAD Modeling Brief
Water Supply Scheme for 970 Mapleview Residential Subdivision
Updated Memo addressing City's comments
City of Barrie

1. Introduction

Schaeffer & Associates Ltd. have been retained by the client of 970 Mapleview Drive to provide a water supply analysis for the 970 Mapleview Drive residential subdivision, specifically water demand and fire flow limitations. Subject site is located north of Mapleview Drive East, between Prince William Way and 20th Sideroad, directly east of the existing subdivision on the north side of Mapleview Drive east.

2. Scope of Work

The client has asked Schaeffer & Associates Ltd. to create a model to confirm that the ultimate and the interim connections to the 970 Mapleview Subdivision meet water flow demands for the subdivision. Ultimately the subdivision will have a 300mm connection to Mapleview Drive East, 200mm connection to Regina Road, and a 200mm connection to Unicorn Lane. The Water supply has been modelled to determine the capacity of the water system throughout the stages of the watermain construction.

The latest City of Barrie InfoWater Water Supply Model, provided by the City of Barrie on August 13, has been used provide the design team with the findings. The overall grading plan was provided by R.J. Burnside & Associates Limited, 970 Mapleview, Drawings C201 to C207,

dated 19/10/10. The draft plan from Jones Consulting Group Ltd., LAW-12157-TF-DP-2a, dated March 20, 2019, revised 19.11.28 was used to determine land usage. Site and Grading plans for townhouse blocks 230 to 236 from Hunt Design Associates Inc. were used in the townhouse blocks FUS calculations.

3. Water Supply Design Criteria

The City of Barrie and MOE design criteria were applied to determine the required flows and confirm the required pressures being achieved throughout the water supply system.

- Water demand was calculated using an average daily demand of 225 l/cap/day and population density of 3.13 ppu for low density residential units (single houses), 2.34 ppu for medium density residential units, and 28 m^3/day/ha for commercial areas. City of Barrie Demand Patterns PAT2S-CAL-RES and PAT2S-CAL-NON_RES were applied in the model nodes.

- Peaking factors per MOE for the population of ranging between 2000 and 3000 are: Maximum Daily Flow = 2.25, Minimum Hour Flow = 0.45, Peak Hour Flow = 3.38

- Fire demands: minimum 100 l/s at 20 psi for residential single units, minimum 155 l/s at 20 psi for townhouse units. Fire Underwriters Survey (FUS) fire flow calculations have been performed using detailed townhouse block plans. FUS calculations were performed with the following factors: wood frame construction (factor of 1.5), limited combustible occupancy (-15% credit), no sprinklers, minimum separation of townhouse blocks greater than 3 metres. The FUS calculated fire flows range from 150 l/s to 200 l/s in Phase 1, however, due to the City criteria the required fire flow will range from 155 l/s to 200 l/s in Phase 1. In the ultimate buildout the required fire flows will range from 155 l/s to 200 l/s. The FUS calculations are attached. Minimum 283 l/s at 20 psi for the commercial areas. Velocity needs to remain under 5 m/s for pipe sizes of 300 mm and larger during fire flow conditions.

- Hazen-Williams formula was applied for computing the size of watermain pipes. The actual Hazen-Williams “C” values used in the WaterCAD model are listed in **Table 1.2**.

Table 1.2 Hazen-Williams Coefficients

Pipe Diameter(mm)	Hazen-Williams Coefficient
150	100
200 – 250	110
300 – 450	120
600 and larger	130

- The boundary conditions are the City of Barrie reservoirs and tanks, setup by the City of Barrie in the InfoWater model.

4. Water Supply Analysis and Results

The subject site will be constructed in two phases. Phase 1 consists of 229 single-family houses and 51 townhouses; Phase 2 consists of 216 single-family houses and approximately 349 townhouse units and two mixed use blocks (Block 561 and 542). It is assumed Block 561 will consist of 35 townhouses using the City of Barrie medium density area criteria of 47 units/hectare. Block 542 is assumed to consist of commercial area and townhouses. Block 542 area is assumed to be completely used for commercial land use for water supply demand. Construction phases are shown in the Attachment. InfoWater model 2020ADD and 2020MDD scenarios were used for the analysis.

Phase 1

Phase 1 is bound by subdivision limits to the north and west, Terry Fox Drive to the east and Valleybrook Road to the south. Phase 1 will be connected to the City of Barrie water supply system with two connections. First connection is to the Mapleview Drive East 300mm watermain via the proposed 300mm on Terry Fox Drive, and the second connection is to the 200mm watermain on Regina Road, a watermain in the existing subdivision west of the subject subdivision. Internally the subdivision is serviced by a network of 200mm and 150mm watermains, with Blocks 231, 232, 235, and 236 being serviced by 250mm watermains. Terry Fox Drive and Zaba Road will be serviced by 300mm watermains per the City of Barrie Official Plan and Water Storage and

Distribution Master Plan update in order to service the future lands to the north and east of the subject subdivision.

The water supply scenario of Maximum Day + Fire Flow was simulated and it was found single family house fire flow (100 l/s required), townhouse fire flow (maximum of 200 l/s required), are achieved across the Phase 1. The water supply pressure range in the 2020MDD scenario is 354 kPa to 481 kPa. Phase 1 temporary dead-end street watermains on Alnwick Street, Rochester Drive, Prudhoe Terrace and Durham Avenue are connected with a temporary 50mm watermain and with temporary hydrants. Autoflusher is planned at the Rochester Drive dead-end in order to mitigate the potential water age issues. Phase 1 temporary dead-end street watermains on Durham Avenue (north end), Ludlow Drive, Terry Fox Drive, and Lincoln Drive are connected with a temporary 50mm watermain and with temporary hydrants. Autoflusher is planned at the Terry Fox dead-end in order to mitigate the potential water age issues.

Ultimate Buildout

In the ultimate buildout the subdivision will be connected to the City of Barrie water supply system via the 300mm Mapleview Drive East watermain at two locations, future Terry Fox Drive and Nottingham Road. Subdivision will also be connected to the 200mm watermain on Regina Road, and 200mm on Unicorn Lane. Internally the subdivision will be serviced by a network of 150mm, 200mm, and the before mentioned 250mm watermains. Terry Fox Drive and Zaba Road are serviced with the 300mm watermains. Ultimate buildout temporary dead-end street watermains on Hylton Drive, Valleybrook Road, and Bannister Road are proposed to be connected with a temporary 150mm watermain in order to satisfy the fire flow requirement and mitigate the potential water age issues. All of the residential demands, residential fire flows, and watermain velocity requirements are met as shown in the Attachment. The water supply pressure range in the 2020MDD Scenario is from 349 kPa to 494 kPa. According to the City of Barrie latest set of comments, dated July 13, according to the latest City of Barrie water supply model, the commercial fire flow requirement of 283 l/s is not available on Terry Fox Drive with the proposed water supply servicing until Year 2041 when the future surrounding watermains

are constructed. Specific solutions for the commercial fire flow deficiency will be proposed as a part of a separate site plan application prior to 2041. Some of the solutions include the use of a fire protection tank that can be filled with a low-flow pump (in order to not disrupt the local water supply). The tank and pump would be sized according to the NFPA and the City of Barrie criteria. The tank volume would supplement the available watermain fire flow.

InfoWater model layouts and results for both scenarios are provided in the Attachment for reference.

5. Water Turnover Rate

There are several temporary dead-end watermains in the system, both in Phase 1 and the Ultimate buildout. The water turnover rate was calculated to ensure sufficient renewal of the potable water system. Assuming minimum consumption the turnover rates for the dead-end watermains and phases are calculated as following:

- Phase 1: Alnwick Street, Rochester Drive, Prudhoe Terrace, Durham Avenue and the connecting temporary watermain will turnover every 8.21 days with 10% occupancy and 0.97 days with 100% occupancy. Turnover will be lower than three days (3) after at least 30% occupancy of the residential units in the temporary dead-ends.
- Phase 1: Durham Avenue, Ludlow Drive, Terry Fox Drive, Lincoln Drive and the connecting temporary watermain will turnover every 18.94 days with 10% occupancy and 1.96 days with 100% occupancy. Turnover will be lower than three days (3) after at least 70% occupancy of the residential units in the temporary dead-ends.
- Phase 2: Bannister Road, Valleybrook Road, Hylton Drive and the connecting temporary watermain and the connecting temporary watermain will turnover every 6.98 days with 10% occupancy and 0.73 days with 100% occupancy. Turnover will be lower than three days (3) after at least 30% occupancy of the residential units in the temporary dead-ends.
- Entire Phase 1 turnover based on the occupancy ranges from 14.63 days to 1.48 days.
- The Ultimate buildout of the subdivision the turnover based on the occupancy ranges from 9.87 days to 0.99 days.

As previously mentioned, the temporary dead-end street watermains will be connected with temporary watermains and temporary hydrants to mitigate the potential water age issues.

The City of Barrie recommended turnover rate is 3 to 5 days. Per the City of Barrie Guidelines: Dead end watermain design proposals which are part of an interim phase of a subdivision build-out shall meet water quality requirements by:

i) Demonstrating adequate turnover by use; or

ii) Strategic valve location; and

iii) Installation of a hydrant.

Water demand and turnover calculations are provided in the attachment.

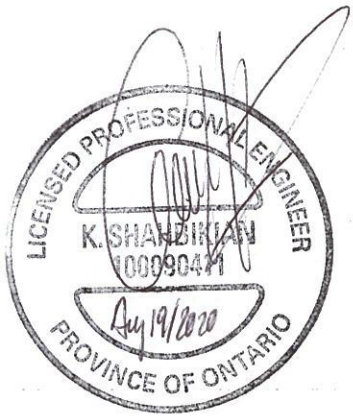
6. Conclusion

The residential water supply and fire flow requirements can be met across the Phase 1 of the 970 Mapleview Residential Subdivision with the proposed connections to Mapleview Drive East and Regina Road. In the planned ultimate build-out residential water supply demands and fire flow requirements are achieved with the proposed connections to the Mapleview Drive East, Regina Road, and Unicorn Lane. Commercial fire flow deficiencies will be addressed as the part of a separate site plan application. The water supply modeling was based on the provided City of Barrie 2016 Water Supply Model, a hydrant test confirms the boundary conditions assumed in the model.

Should you have questions or comments, please do not hesitate to contact the undersigned.

Respectfully Submitted,

SCHAEFFERS CONSULTING ENGINEERS



Bogdan Pavlovic, **MESc., EIT**
Water Resources Analyst

Koryun Shahbikian, **LLM, M.Eng., P.Eng., PMP**
Partner

ATTACHMENT

Background Information

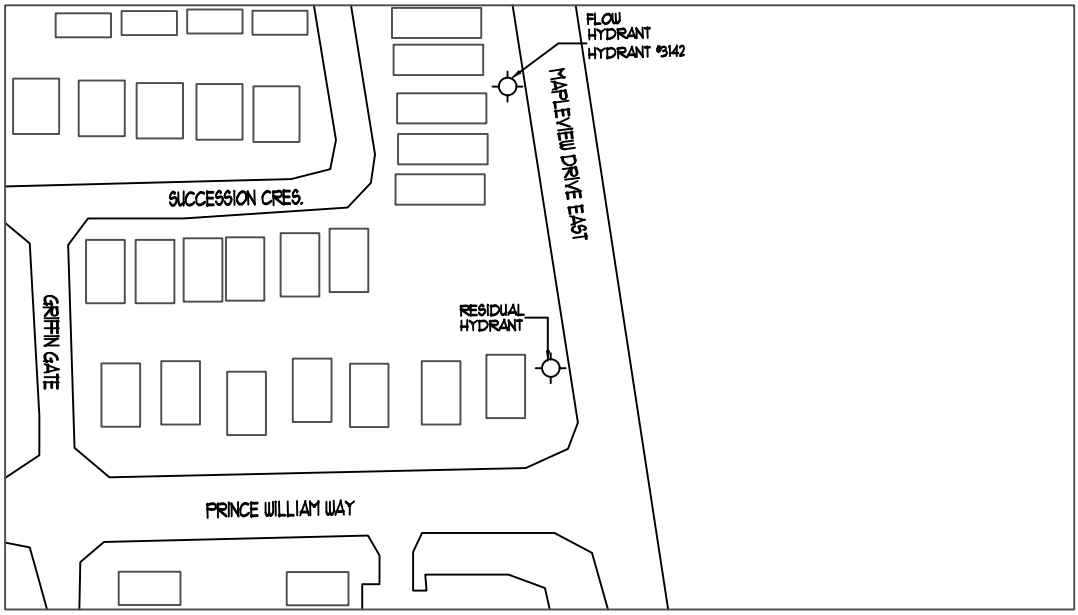
FLOW TEST RESULTS

FIRST FOR FIRE, LIFE SAFETY & SECURITY
VIPOND INC
est. 1945

DATE : AUGUST 30/2019 TIME : 10:00 AM

LOCATION : MAPLEVIEW DRIVE EAST & PRINCE WILLIAM WAY
BARRIE
ONTARIO

TEST BY : VIPOND FIRE PROTECTION AND LOCAL PUC



STATIC PRESSURE : 62 PSI UNDERGROUND TYPE & SIZE : 300mm PVC

TEST NO.	NO. OF NOZZLES	NOZZLE DIAMETER (INCHES)	DISCHARGE CO-EFFICIENT	RESIDUAL PRESSURE (PSI)	PITOT PRESSURE (PSI)	DISCHARGE (U.S.GPM)
1	1	1 3/4"	0.995	57	55	660
2	3	2 1/2"	0.90	57	46	1144
3	4	2 1/2"	0.90	51	42	2186

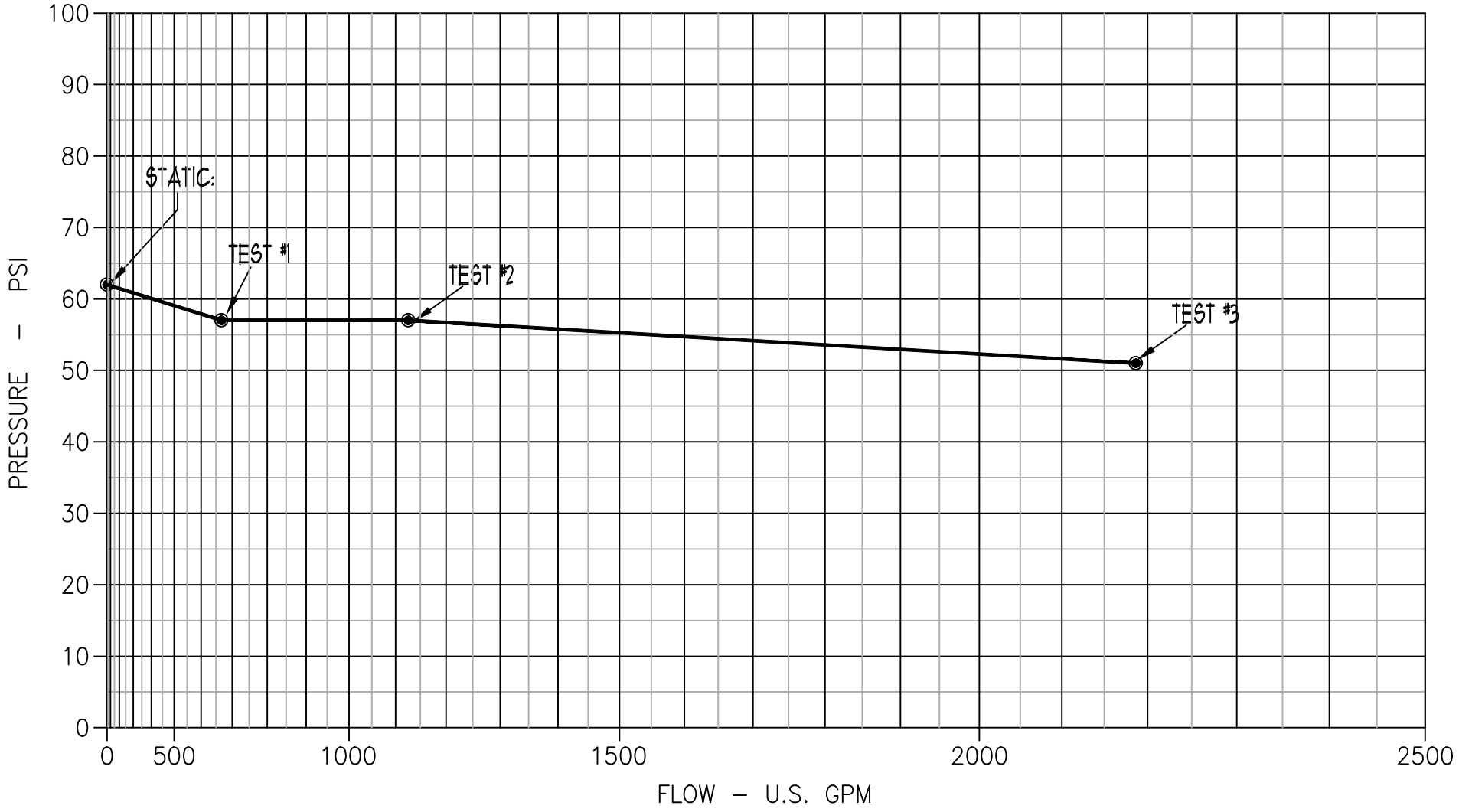
FIRST FOR FIRE, LIFE SAFETY & SECURITY

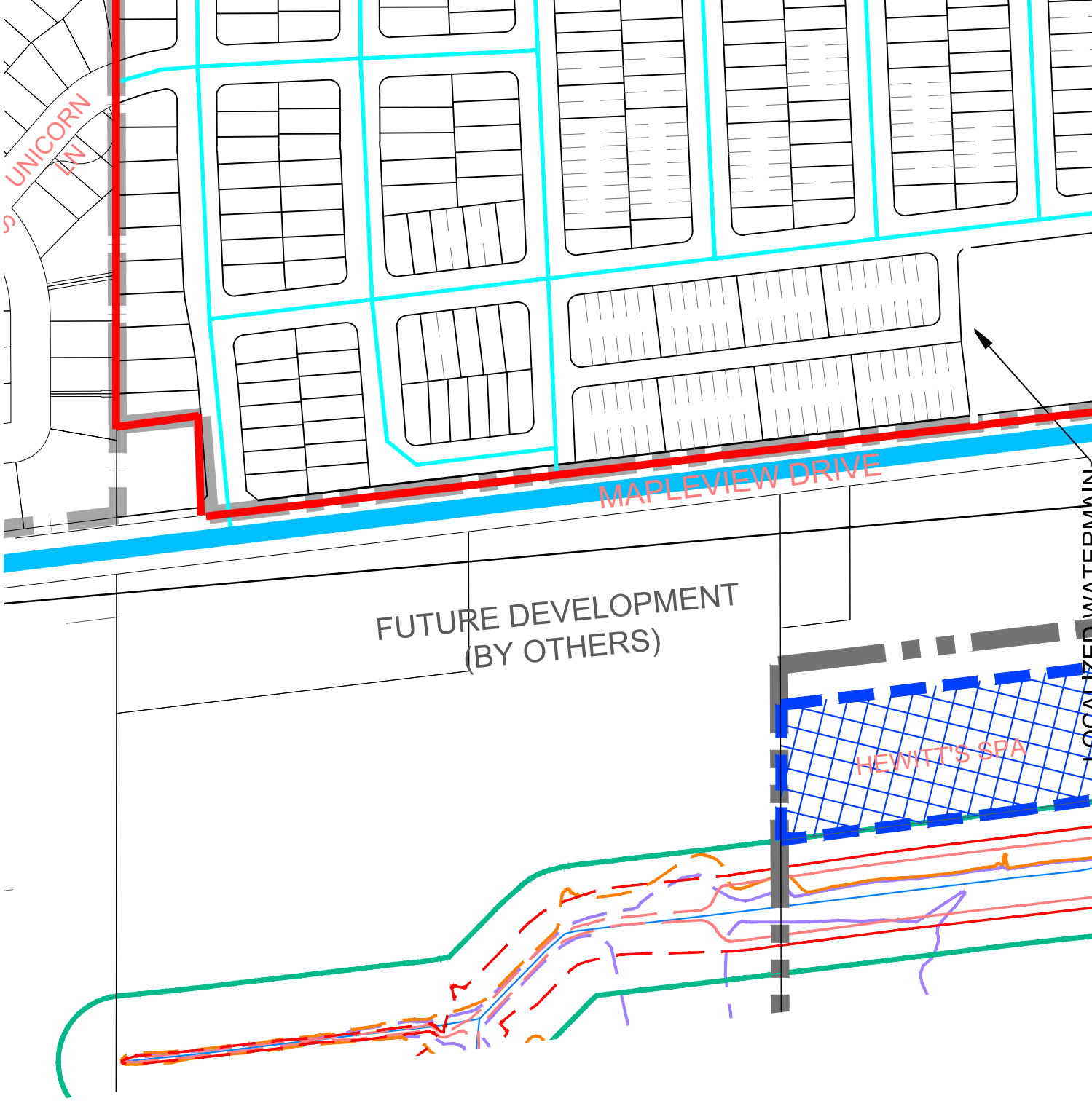
VIPOND INC

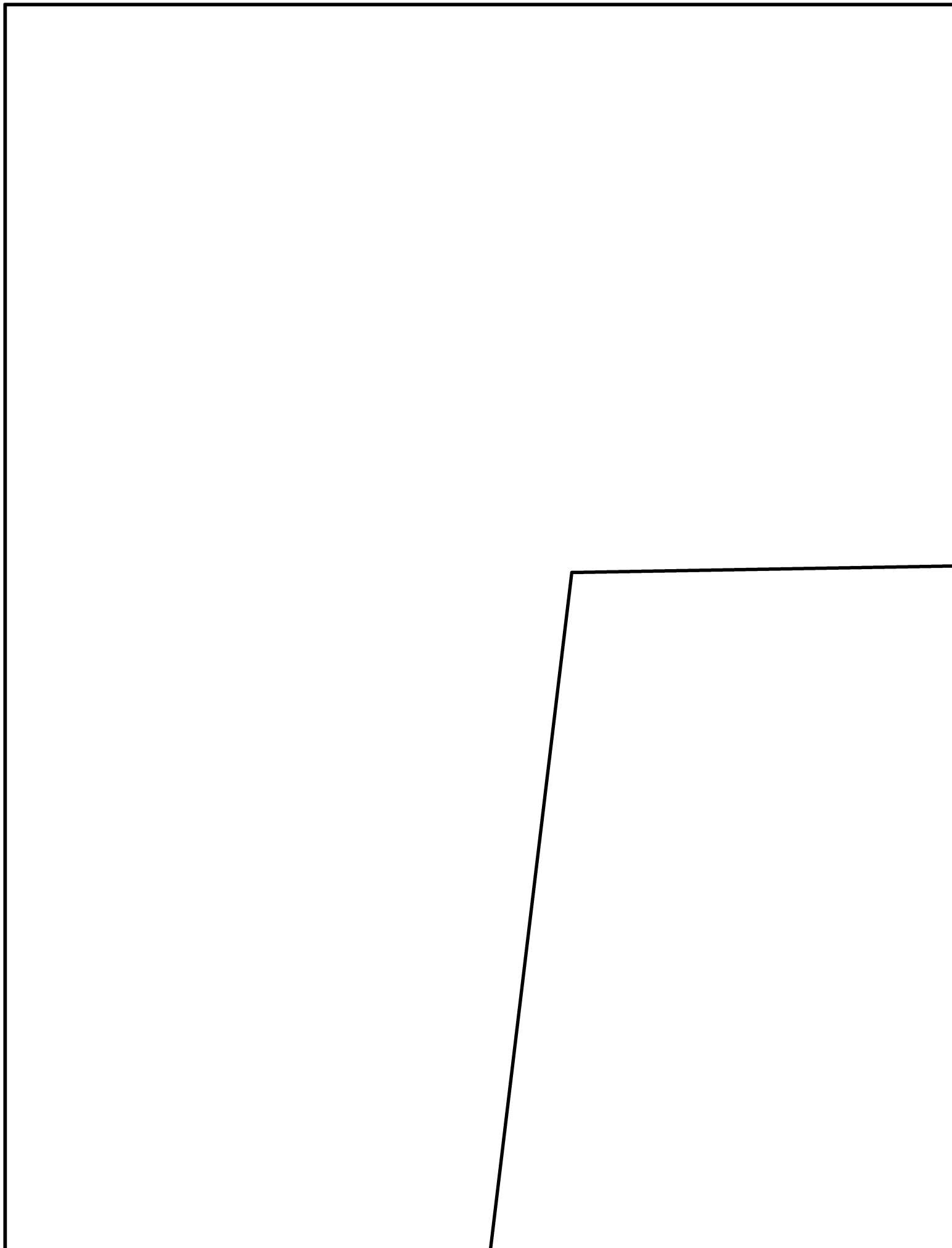
est. 1945

MAPLEVIEW DRIVE EAST & PRINCE WILLIAM WAY		BY :	LEN K.
BARRIE		VIPOND OFFICE :	BARRIE
ONTARIO		TEST BY :	VIPOND & PUC
		DATE :	AUGUST 30,2019

STATIC:		RESIDUAL:		FLOW:
62 PSI	TEST#1	57 PSI	@	660 GPM
	TEST#2	57 PSI	@	1144 GPM
	TEST#3	51 PSI	@	2186 GPM




UNICORN
LN
MAPLEVIEW DRIVE
FUTURE DEVELOPMENT
(BY OTHERS)
HEWITT'S SPA
LOCALIZED WATERMAIN



Bogdan Pavlovic

From: Mark Nywening <mnywening@huntdesign.ca>
Sent: Tuesday, February 11, 2020 11:40 AM
To: Bogdan Pavlovic; Aaron Pettifer
Cc: Koryun Shahbikian; Sal Crimi
Subject: RE: 970 Mapleview Water Supply

Good morning Bogdan,

We will be able to maintain a 1.55m side yard separation from the lot line for the Towns, so the total separation distance between Town blocks will be 3.1m.

Regards,

Mark

Mark Nywening, M.A.A.T.O.
Project Manager // Architectural Technologist

HUNT
DESIGN ASSOCIATES INC.
8966 Woodbine Avenue // Suite 200 // Markham, ON // L3R 0J7
Tel: 905-737-5133 ext: 242
Fax: 905-737-7326
mnywening@huntdesign.ca
www.huntdesign.ca

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From: Bogdan Pavlovic <bpavlovic@schaeffers.com>
Sent: February 7, 2020 4:14 PM
To: Mark Nywening <mnywening@huntdesign.ca>; Aaron Pettifer <Aaron.Pettifer@rjburnside.com>
Cc: Koryun Shahbikian <kshahbikian@schaeffers.com>; Sal Crimi <scland@rogers.com>
Subject: RE: 970 Mapleview Water Supply

Good afternoon Mark,

Can the separation between towns be 3.05m or 3.1m? If you can confirm that in written form (email) we can put it in the water supply report and respond to the City's comments.

Thanks in advance,

Bogdan Pavlovic

From: Lingling He <Lingling.He@barrie.ca>
Sent: Wednesday, July 15, 2020 4:07 PM
To: Bogdan Pavlovic
Subject: RE: D12-430 - 970 Mapleview Drive, Response to Comments

Bogdan,

I have identified locations where flows are generally less than the total demand (MDD + FF) in my email below. For the mixed use block, it is about 50 to 60 L/s less than the required flows. For the townhouse units, where 233 L/s is required, the deficiency is between 20 to 30 L/s.

Barrie's water model has recently gone through a major update that involves with the future scenario demands. I'll clip the model when I get a chance next week or so and send it to you, if you are interested in getting a new copy.

Lingling He, C.E.T., LET
Senior Water Technologist
Corporate Asset Management
Infrastructure and Growth Management Division

The City of Barrie
705-739-4220 x 5291

Please consider the environment before printing this email.

From: Bogdan Pavlovic <bpavlovic@schaeffers.com>
Sent: July 15, 2020 3:49 PM
To: Lingling He <Lingling.He@barrie.ca>
Subject: FW: D12-430 - 970 Mapleview Drive, Response to Comments

Good afternoon Lingling,

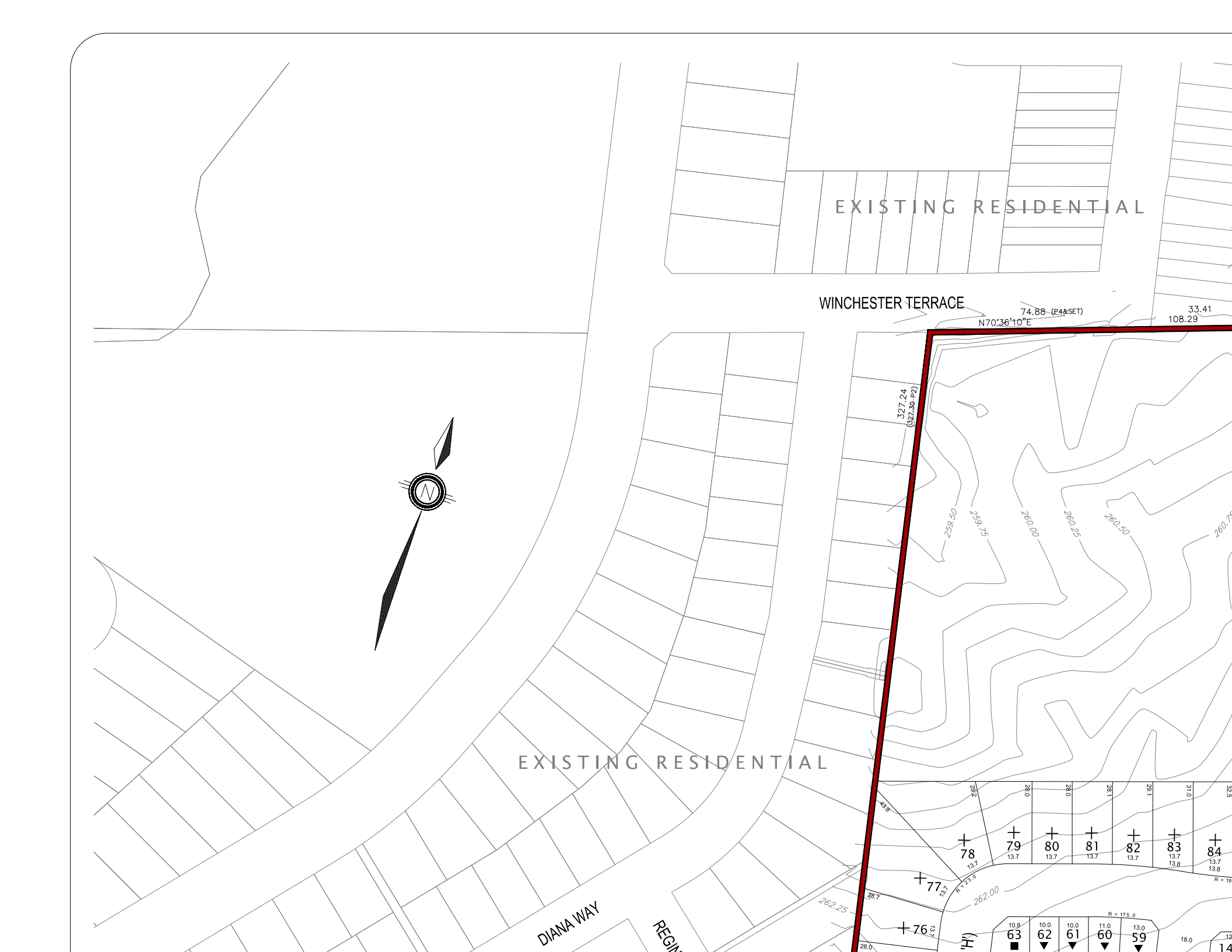
Do you have any updates regarding the email below?

Thanks in advance,

Bogdan Pavlovic, MESc., EIT
Water Resources Analyst
Schaeffers Consulting Engineers
6 Ronrose Drive, Concord
Ontario L4K 4R3
Tel: 905.738.6100 ex. 204
Cell: 519.701.2693

From: Bogdan Pavlovic
Sent: Tuesday, July 14, 2020 3:48 PM
To: 'Lingling He' <Lingling.He@barrie.ca>
Subject: FW: D12-430 - 970 Mapleview Drive, Response to Comments

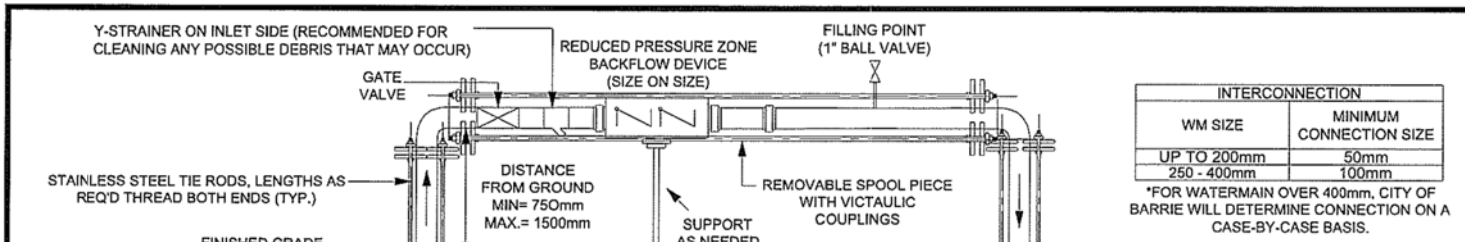
Good afternoon Lingling,


EXISTING RESIDENTIAL
WINCHESTER TERRACE
74.88 (P4&SET)
N70°36'10"E
33.41
108.29
327.24
(327.30-P2)
259.50
259.75
260.00
260.25
260.50
EXISTING RESIDENTIAL
DIANA WAY
262.25
262.00
78
79
80
81
82
83
84
77
76
63
62
61
60
59
R = 175.0
R = 23.0

BLOCK 252
FUTURE LOT
BLOCK 251
FUTURE LOT

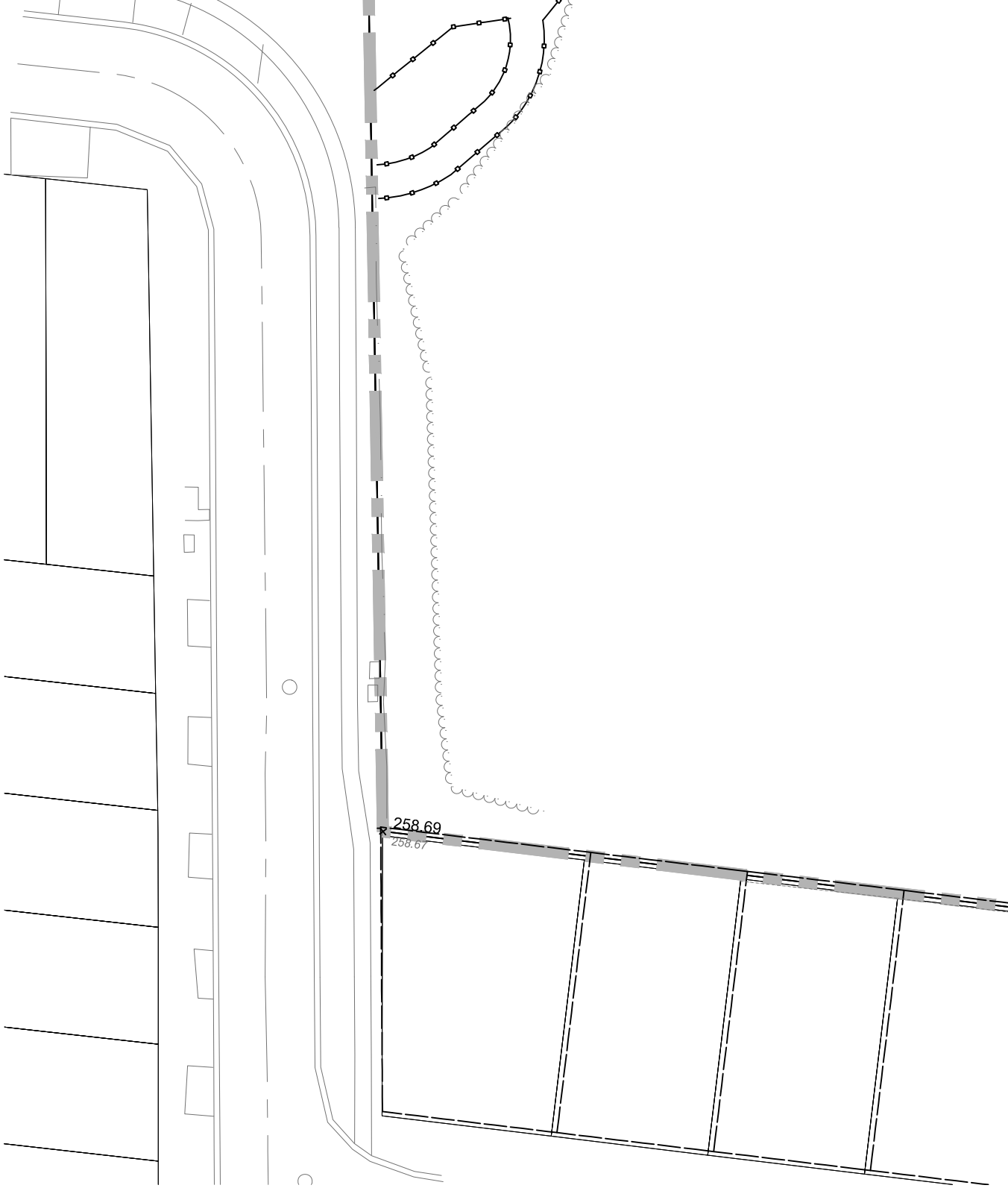
WATERMAIN TESTING AND DISINFECTION NOTES

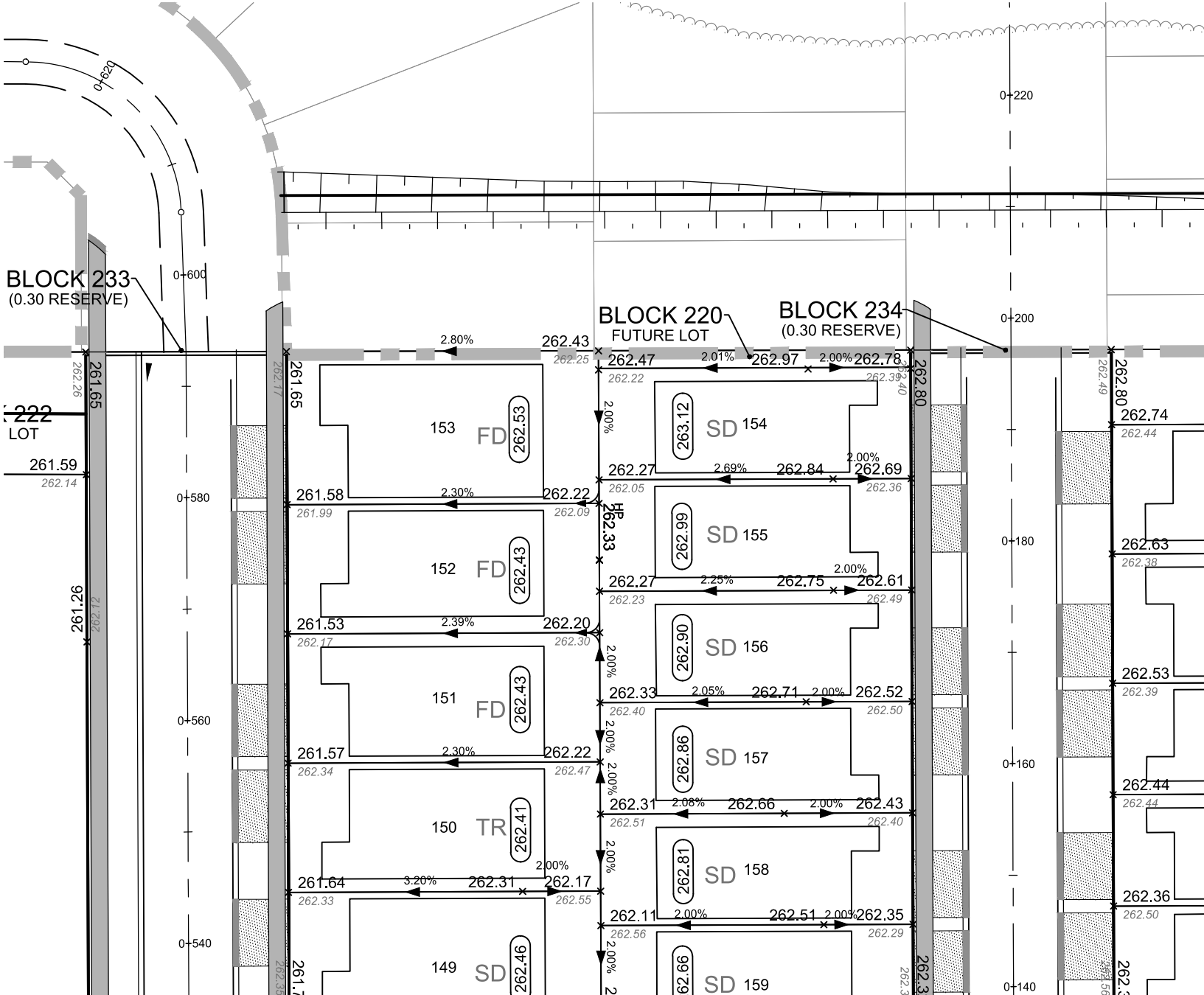
1. THE FOLLOWING SEQUENCE WILL BE UTILIZED IN THE COMMISSIONING OF THE WATER SYSTEM: SWAB AND CHARGE THE WATERMAIN, PRESS CHLORINATE, FLUSH AND SAMPLING.
2. ALL PROCEDURES ARE TO BE COMPLETED THROUGH A BY-PASS CONNECTION TO THE EXISTING WATERMAIN, c/w BACKFLOW PREVENTION VA
3. ALL VALVES ARE TO BE OPERATED BY CITY REPRESENTATIVES ONLY.
4. THE FINAL CONNECTION TO THE EXISTING SYSTEM WILL NOT BE PERMITTED UNTIL ALL COMPONENTS OF THE TESTING AND DISINFECTION PR HAVE BEEN COMPLETED TO THE STRATIFICATION OF THE CITY.
5. HYDROSTATIC TESTING SHALL BE PREFORMED ON THE COMPLETED DISTRIBUTION SYSTEM IN SECTIONS NOT EXCEEDING 500 METERS IN LEN ACCORDANCE WITH AWWA C600. FOR POLYETHYLENE PIPE THE TESTING SHALL BE COMPLETED IN ACCORDANCE WITH OPSS 701. TESTING O THAT CONSIST OF VARYING PIPE MATERIALS WILL NOT BE PERMITTED. ALL SECONDARY MAIN VALVES MUST BE OPEN DURING TESTING WITH EXCEPTION OF THIS BEING USED TO DIVIDE THE SYSTEM INTO SECTIONS FOR THE PURPOSE OF TESTING.
6. THE SYSTEM SHALL BE DISINFECTED USING THE "CONTINUOUS FEED" METHOD IN ACCORDANCE WITH AWWA C652. FOLLOWING THE REQUIRE CONTACT TIME, THE SYSTEM IS TO BE FLUSHED. THE CHLORINATED WATER MUST BE NEUTRALIZED USING AN APPROPRIATE CHEMICAL SUCH THIOSULPHATE. THE DISCHARGED WATER WILL DRAIN TO THE ON-SITE STORM WATER POND.
7. SAMPLES FOR BACTERIOLOGICAL TESTING SHALL BE COLLECTED BY THE CITY A MINIMUM OF 24 HOUR AFTER FLUSHING IS COMPLETED IN AC WITH AWWA C651. SAMPLES SHALL BE COLLECTED FROM EVERY 350 METERS OF NEW WATERMAIN PLUS ONE SAMPLE FROM THE END OF EAC LINES AT LEAST ONE SAMPLE FROM EACH BRANCH (OPSS 441.07.25). FOLLOWING THE RECEIPT OF TWO CONSECUTIVE SETS OF ACCEPTABLE RESULTS THE CITY WILL PROVIDE WRITTEN NOTIFICATION THAT A FINAL CONNECTION VAN BE MADE TO THE EXISTING DISTRIBUTION SYSTEM
8. A CONTINUITY TEST OF THE TRACER WIRE SHALL BE COMPLETED WITH POINT TO POINT READINGS RECORDED AND APPROVED BY THE CITY.
9. THE FINAL CONNECTION SHALL NOT BE MADE UNTIL ALL OF THE ABOVE TESTING REQUIREMENTS HAVE BEEN SATISFACTORILY COMPLETED A CITY HAS PROVIDED WRITTEN NOTIFICATION TO PROCEED. THE LENGTH OF PIPE REQUIRED TO CONNECT THE NEW WATER SYSTEM TO THE E DISTRIBUTION SYSTEM SHALL NOT EXCEED 5.5 METERS AND SHALL BE DISINFECTED PRIOR TO INSTALLATION IN ACCORDANCE WITH AWWA C
10. ALL SWABS TO BE NUMBERED AND WITNESSED BEING INSTALLED BY SITE INSPECTOR.
11. WATERMAINS TO BE SWABBED FROM TEES TO VALVE AND THEN SWABS INSTALLED ON THE OPPOSITE SIDE OF THE CLOSED VALVE.

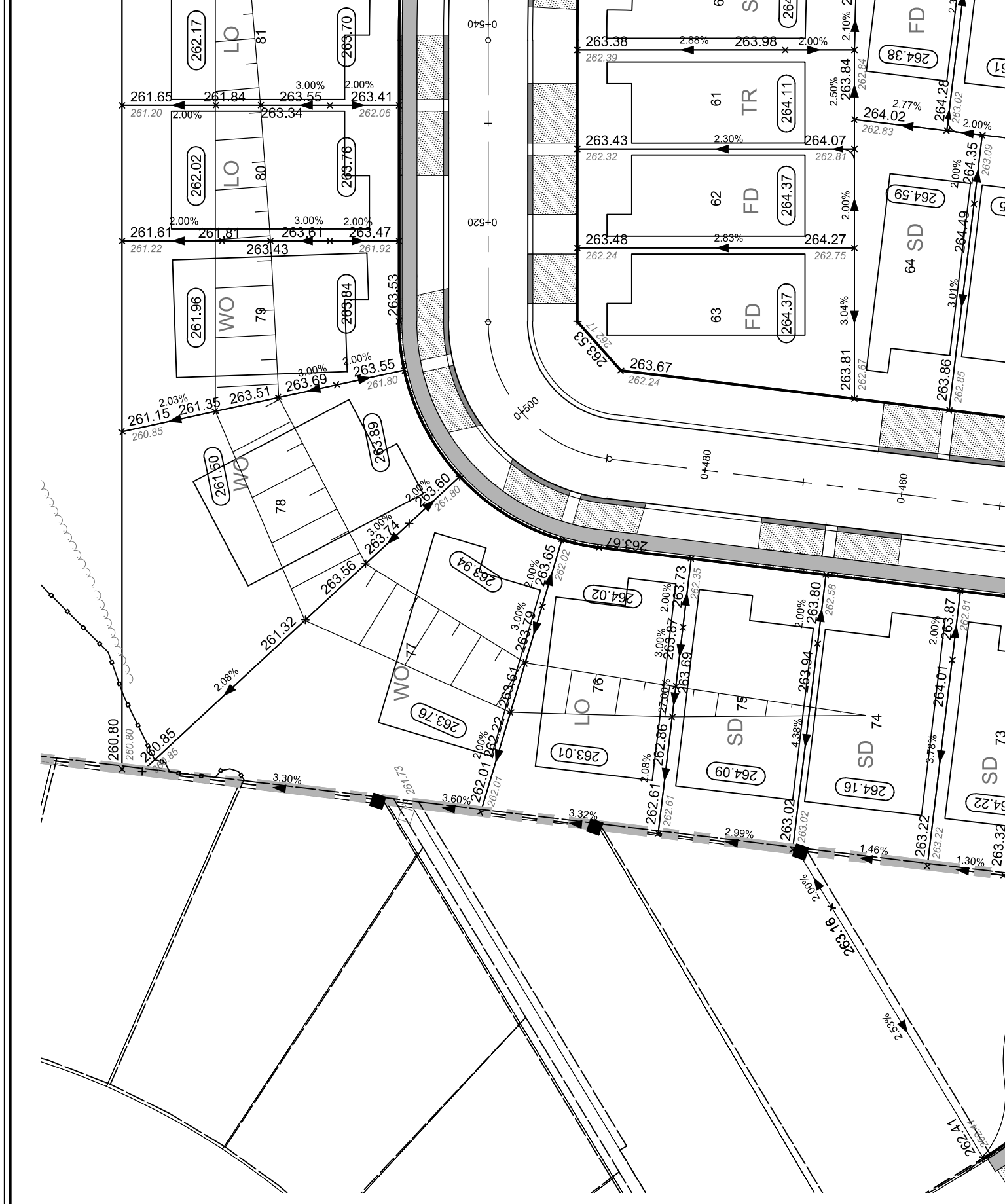


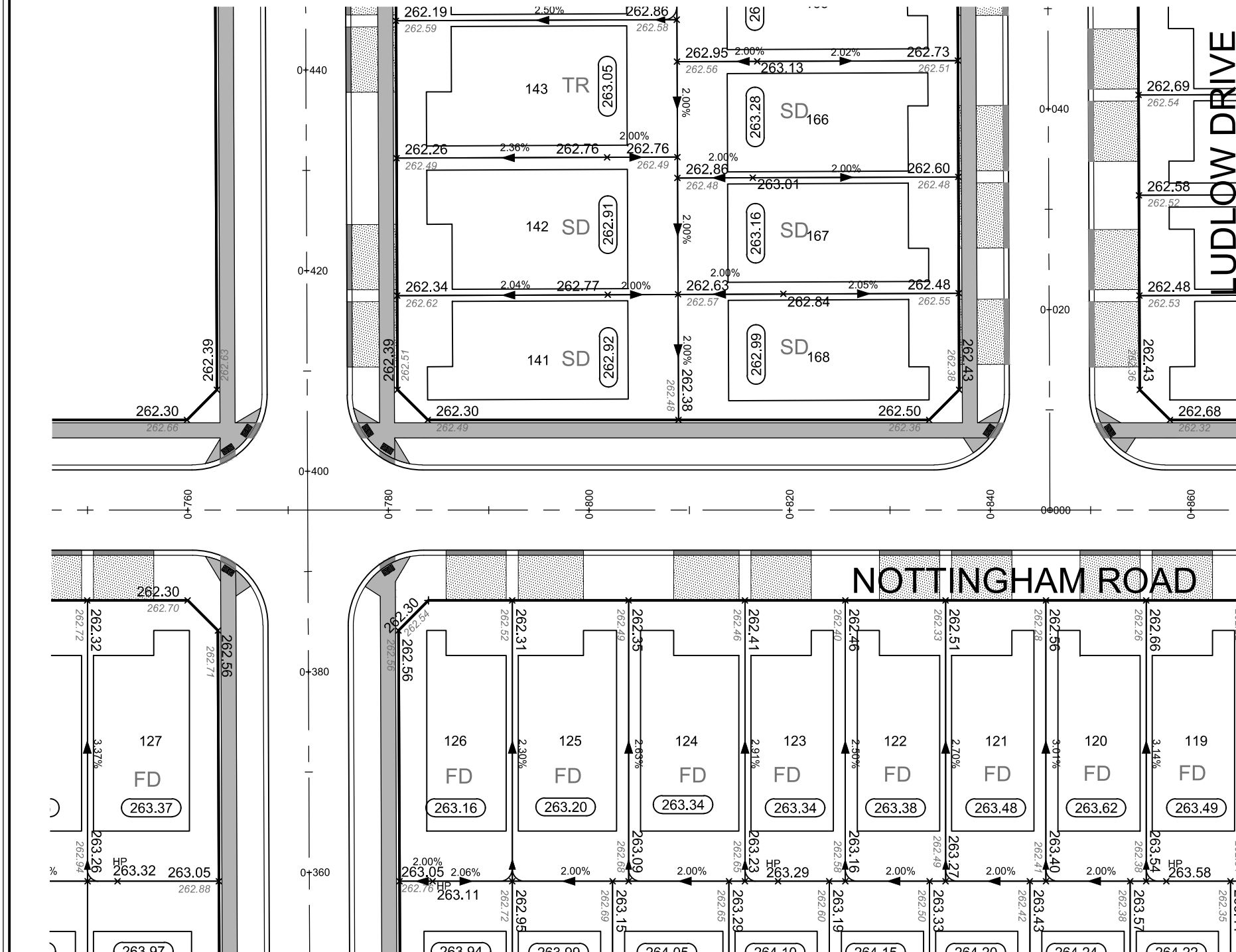
INTERCONNECTION	
WM SIZE	MINIMUM CONNECTION SIZE
UP TO 200mm	50mm
250 - 400mm	100mm

*FOR WATERMAIN OVER 400mm, CITY OF BARRIE WILL DETERMINE CONNECTION ON A CASE-BY-CASE BASIS.


258.69
258.67

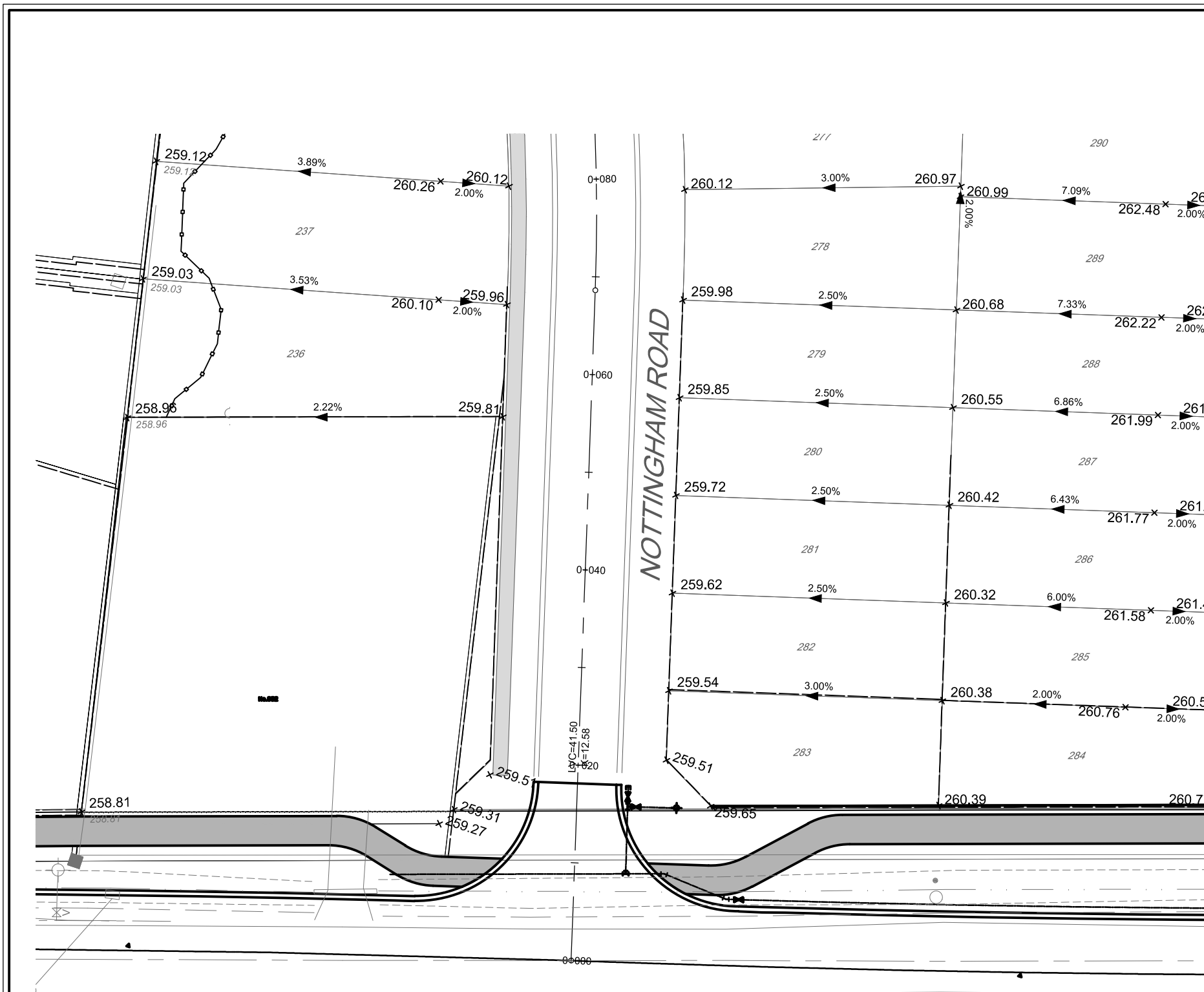

BLOCK 233
(0.30 RESERVE)
BLOCK 220
FUTURE LOT
BLOCK 234
(0.30 RESERVE)
0+620
0+600
0+580
0+560
0+540
0+220
0+200
0+180
0+160
0+140
153 FD 262.53
152 FD 262.43
151 FD 262.43
150 TR 262.41
149 SD 262.46
154 SD 263.12
155 SD 262.99
156 SD 262.90
157 SD 262.86
158 SD 262.81
159 SD 262.66
2.80%
262.43
262.25
262.47
2.01%
262.97
2.00%
262.78
262.22
262.39
262.40
262.49
261.65
262.26
262.17
262.80
262.74
262.44
LOT
261.59
262.14
2.00%
262.27
2.69%
262.84
2.00%
262.69
262.05
262.36
261.58
2.30%
262.22
261.99
262.09
HP
262.33
262.63
262.38
261.26
262.12
261.53
2.39%
262.20
262.17
262.30
262.27
2.25%
262.75
2.00%
262.61
262.23
262.49
262.53
262.39
262.33
2.05%
262.71
2.00%
262.52
262.40
262.50
261.57
2.30%
262.22
262.34
262.47
262.31
2.06%
262.66
2.00%
262.43
262.51
262.40
262.44
262.44
2.00%
261.64
3.20%
262.31
262.17
262.33
262.55
262.11
2.00%
262.51
2.00%
262.35
262.56
262.29
262.36
262.50
261.7
262.3


0+540
0+520
0+500
0+480
0+460
LO 81 262.17 263.70
LO 80 262.02 263.76
WO 79 261.96 263.84
WO 78 261.50 263.89
WO 77 263.94 263.76
LO 76 263.01
SD 75 264.09
SD 74 264.16
SD 73
61 TR 264.11
62 FD 264.37
63 FD 264.37
64 SD 264.59
FD 264.38
263.38 263.98 263.84 264.28 264.02
263.43 264.07 264.35
263.48 264.27 264.49
263.81 263.86
263.67 263.53
261.65 261.84 263.55 263.41 263.34
261.61 261.81 263.61 263.47 263.43
261.15 261.35 263.51 263.69 263.55
263.56 263.74 263.60
263.65 263.79 263.61 263.22
263.73 263.87 263.69 263.61
263.80 263.94 263.87
264.01 263.87
263.67 263.91
263.32
260.80 260.85 261.32
262.01 262.61 263.02 263.22
3.30% 3.60% 3.32% 2.99% 1.46% 1.30%
2.08% 2.00% 2.55%


LUDLOW DRIVE
NOTTINGHAM ROAD
143 TR 263.05
142 SD 262.91
141 SD 262.92
SD166 263.28
SD167 263.16
SD168 262.99
127 FD 263.37
126 FD 263.16
125 FD 263.20
124 FD 263.34
123 FD 263.34
122 FD 263.38
121 FD 263.48
120 FD 263.62
119 FD 263.49
0+440
0+420
0+400
0+380
0+360
0+040
0+020
0+000
0+940
0+880
0+860
0+820
0+840
0+980

NOTTINGHAM ROAD
0+320
0+300
0+280
0+260
0+240
263.42
264.15
1.94%
264.01
254
263.03
263.03
4.42%
263.96
2.07%
263.82
253
262.83
262.83
4.55%
263.79
2.04%
263.65
252
262.75
262.75
4.13%
263.62
263.48
251
262.63
262.63
3.90%
263.45
2.01%
263.31
250
262.47
262.47
3.83%
263.28
1.97%
263.14
249
262.21
262.21
4.28%
263.11
1.94%
262.97
248
262.03
262.03
4.36%
262.95
2.06%
262.81
264.04
3.32%
264.97
264.01
261
263.87
2.49%
264.57
262
263.58
2.66%
264.36
264.32
263
263.53
264.24
264.17
264
263.36
264.07
263.97
265
264.07
263.19
2.50%
263.89
266
263.97
263.02
2.50%
263.72
263.75
267
262.86
2.50%
263.56

BLOCK 55
8 STREET TOWNHO
HYLTON DRIV
396
395
394
393
392
391
390
389
388
400
401
402
403
1
2
3
4
5
407
408
409
410
433
432
431
430
266.27
266.42
2.51%
2.50%
265.87
0.52%
266.30
2.52%
265.70
0.17%
266.19
2.50%
265.49
0.90%
266.10
2.80%
265.32
265.84
2.51%
265.14
265.67
2.52%
264.97
265.49
2.49%
264.79
2.52%
264.62
265.78
265.30
265.13
264.95
265.24
2.00%
264.83
265.01
2.01%
264.73
264.47
265.33
264.88
264.56
265.35
264.31
265.19
2.00%
265.35
264.83
264.80
2.46%
264.11
264.99
2.00%
265.15
2.00%
264.75
264.72
2.69%
263.97
264.79
2.00%
264.95
2.00%
264.55
264.52
2.50%
263.82
264.59
2.00%
264.77
2.00%
264.39
264.36
2.44%
263.68
0+200
0+180
0+160
0+140
0+120
0+000
0+010
0+020
0+040
0+060
0+080


NOTTINGHAM ROAD
259.12
259.12
3.89%
260.26
260.12
2.00%
237
259.03
259.03
3.53%
260.10
259.96
2.00%
236
258.96
258.96
2.22%
259.81
0+080
0+060
0+040
0+000
L=C=41.50
L=T=12.58
259.51
258.81
258.81
259.31
259.27
259.65
260.39
260.12
3.00%
260.97
260.99
7.09%
262.48
2.00%
278
289
259.98
2.50%
260.68
7.33%
262.22
2.00%
279
288
259.85
2.50%
260.55
6.86%
261.99
2.00%
280
287
259.72
2.50%
260.42
6.43%
261.77
2.00%
281
286
259.62
2.50%
260.32
6.00%
261.58
2.00%
282
285
259.54
3.00%
260.38
2.00%
260.76
2.00%
283
284
259.51
290

Water Demand, Turnover and WaterCAD Modeling Results

970 Mapleview Drive East Residential Subdivision

City of Barrie

August 2020

Demands				
Average daily demand			225	L/cap/day
Minimum hour factor			0.45	
Maximum day factor			2.25	
Peak hour factor			3.38	
Fire Flow	Commercial:		283	L/s
	Townhouses:		155	L/s
	Singles:		100	L/s
Population Densities				
Total population			2290	
Persons per unit		Commercial	28	m^3/day/ha
		Singles, semi-detached:	3.13	persons per unit
		Townhouses:	2.34	persons per unit
		High-density residential	1.67	persons per unit

Node	Elevation (m)	Units			Population	Demand			
		Commercial (ha)	Single, semi-detached	Townhouses	Residential	Average Day (l/s)	Maximum Day (l/s)	Peak Hour (l/s)	Minimum Hour (l/s)
Phase 1									
M-240	264.36		5		16	0.04	0.09	0.14	0.02
M-241	265.07		9		29	0.08	0.17	0.26	0.03
M-242	265.98		7		22	0.06	0.13	0.19	0.03
M-243	265.65		4	6	27	0.07	0.16	0.24	0.03
M-244	265.11		7	8	41	0.11	0.24	0.36	0.05
M-245	264.26				0	0.00	0.00	0.00	0.00
M-246	263.89		4		13	0.03	0.08	0.11	0.02
M-247	263.52		11		35	0.09	0.21	0.31	0.04
M-248	263.9		12		38	0.10	0.22	0.33	0.04
M-249	264.12		7		22	0.06	0.13	0.19	0.03
M-250	262.63		9		29	0.08	0.17	0.26	0.03
M-251	261.83		5		16	0.04	0.09	0.14	0.02
M-252	261.65		5		16	0.04	0.09	0.14	0.02
M-253	262.74		11		35	0.09	0.21	0.31	0.04
M-254	262.68		16		51	0.13	0.30	0.45	0.06
M-255	262.3		12		38	0.10	0.22	0.33	0.04
M-256	263.64		12		38	0.10	0.22	0.33	0.04
M-257	264.08		14	6	58	0.15	0.34	0.51	0.07
M-258	264.1		15		47	0.12	0.28	0.41	0.06
M-259	263.21		11		35	0.09	0.21	0.31	0.04
M-260	262.72		9		29	0.08	0.17	0.26	0.03
M-261	263.6		9		29	0.08	0.17	0.26	0.03
M-289	264.91		2		7	0.02	0.04	0.06	0.01
M-290	265.5		2		7	0.02	0.04	0.06	0.01
M-294	264.11		11		35	0.09	0.21	0.31	0.04
M-295	264.69		2		7	0.02	0.04	0.06	0.01
M-296	265.73		2		7	0.02	0.04	0.06	0.01
M-297	265.48		4		13	0.03	0.08	0.11	0.02
M-298	265.37		2		7	0.02	0.04	0.06	0.01
M-328	263.76		6	16	57	0.15	0.33	0.50	0.07
M-329	264.69		4	15	48	0.13	0.28	0.42	0.06
M-330	265.79				0	0.00	0.00	0.00	0.00
Phase 2									
M-262	263.96		2		7	0.02	0.04	0.06	0.01
M-263	261.98	1.6853	6	35	101	0.81	1.82	2.74	0.36
M-265	262.39		21	4	76	0.20	0.45	0.67	0.09
M-266	260.23		20	14	96	0.25	0.56	0.85	0.11
M-268	262.46		4	21	62	0.16	0.36	0.55	0.07
M-269	261.46		6	7	36	0.09	0.21	0.32	0.04
M-270	262.71		0	8	19	0.05	0.11	0.17	0.02
M-271	263.68		0	36	85	0.22	0.50	0.75	0.10
M-272	263.41		2	34	86	0.22	0.50	0.76	0.10
M-273	263.04		1	24	60	0.16	0.35	0.53	0.07
M-274	262.8		0	0	0	0.00	0.00	0.00	0.00
M-275	262.67		4	6	27	0.07	0.16	0.24	0.03
M-276	263.59		17		54	0.14	0.32	0.48	0.06
M-277	264.99		24		76	0.20	0.45	0.67	0.09
M-278	265.07		27		85	0.22	0.50	0.75	0.10
M-279	265.7		10	8	51	0.13	0.30	0.45	0.06
M-280	263.98		7	6	36	0.09	0.21	0.32	0.04
M-281	264.47		10	11	58	0.15	0.34	0.51	0.07
M-282	263.05		0	24	57	0.15	0.33	0.50	0.07
M-283	263.99		2	27	70	0.18	0.41	0.62	0.08
M-284	263.51		2	30	77	0.20	0.45	0.68	0.09
M-285	263.3		4	26	74	0.19	0.43	0.65	0.09
M-286	264.09		22	10	93	0.24	0.54	0.82	0.11
M-287	263.78		5	6	30	0.08	0.18	0.26	0.04
M-288	265.64		7		22	0.06	0.13	0.19	0.03
M-299	261.4				0	0.00	0.00	0.00	0.00
M-300	261.4				0	0.00	0.00	0.00	0.00
M-301	262.07				0	0.00	0.00	0.00	0.00
M-302	262.07				0	0.00	0.00	0.00	0.00
M-303	263.34		6		19	0.05	0.11	0.17	0.02
M-304	263.34				0	0.00	0.00	0.00	0.00
M-327	263.58		7	12	50	0.13	0.29	0.44	0.06

970 Mapleview Drive East, City of Barrie

Aug-20

Turnover Calculation

Minimum Consumption: 0.10 m^3/cap/day

Phase 1: Alnwick Street, Rochester Drive, Prudhoe Terrace, Durham Avenue and the connecting temporary watermain

Occupancy	Length	Diameter	Area	Volume (m^3)	Population	Current Consumption	Day/turnover
(%)	(m)	(mm)	(m^2)	(m^3)	(-)	(m^3)	(Day)
10	228	50	0.002	3.33	4	0.41	8.21
20					7	0.71	4.69
30					11	1.11	2.99
40					14	1.42	2.35
50					17	1.72	1.93
60	106	150	0.02		21	2.13	1.56
70					24	2.43	1.37
80					28	2.84	1.17
90	32	200	0.03		31	3.14	1.06
100					34	3.44	0.97

Phase 1: Durham Avenue, Ludlow Drive, Terry Fox Drive, Lincoln Drive and the connecting temporary watermain

Occupancy	Length	Diameter	Area	Volume (m^3)	Population	Current Consumption	Day/turnover
(%)	(m)	(mm)	(m^2)	(m^3)	(-)	(m^3)	(Day)
10	229	50	0.002	17.26	9	0.91	18.94
20					18	1.82	9.47
30					27	2.73	6.31
40					35	3.54	4.87
50					44	4.46	3.87
60	202	200	0.03		53	5.37	3.22
70					61	6.18	2.79
80					70	7.09	2.43
90	148	300	0.07		79	8.00	2.16
100					87	8.81	1.96

Phase 2: Bannister Road, Valleybrook Road, Hylton Drive and the connecting temporary watermain

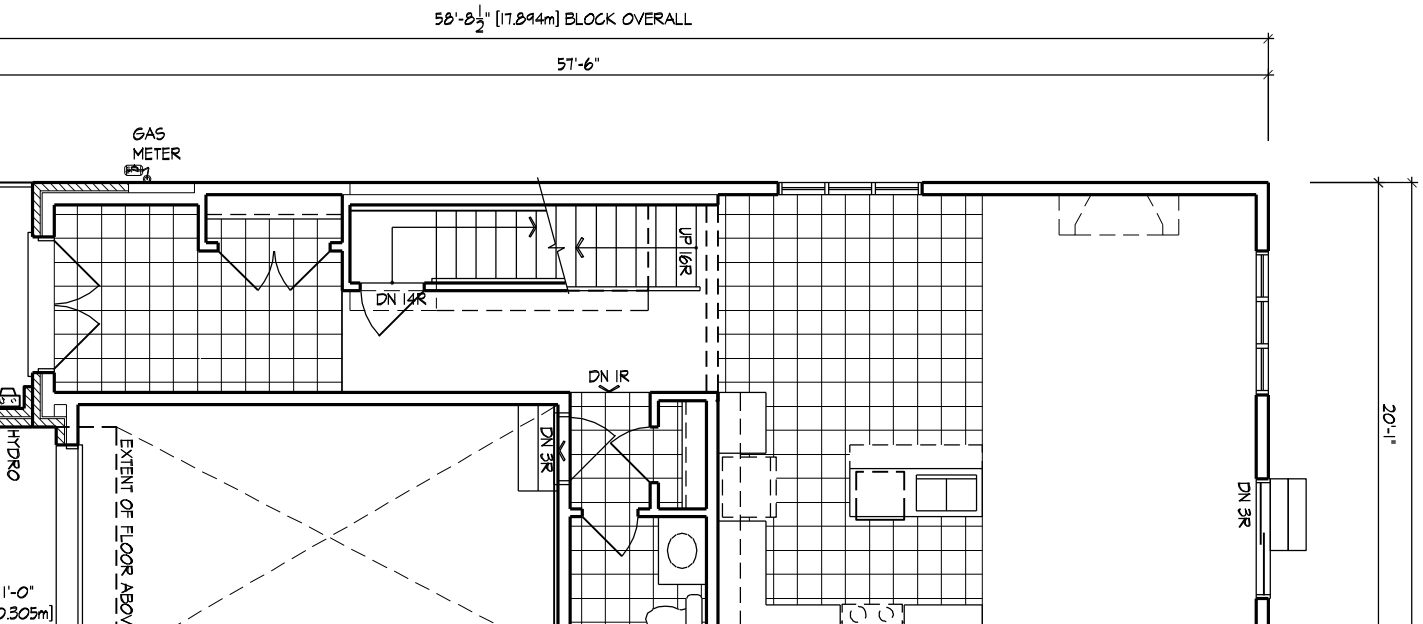
Occupancy	Length	Diameter	Area	Volume (m^3)	Population	Current Consumption	Day/turnover
(%)	(m)	(mm)	(m^2)	(m^3)	(-)	(m^3)	(Day)
10	226	150	0.02	16.25	23	2.33	6.98
20					45	4.56	3.57
30					67	6.78	2.39
40					89	9.01	1.80
50					111	11.24	1.45
60	390	200	0.03		133	13.47	1.21
70					155	15.69	1.04
80					177	17.92	0.91
90					199	20.15	0.81
100					221	22.38	0.73

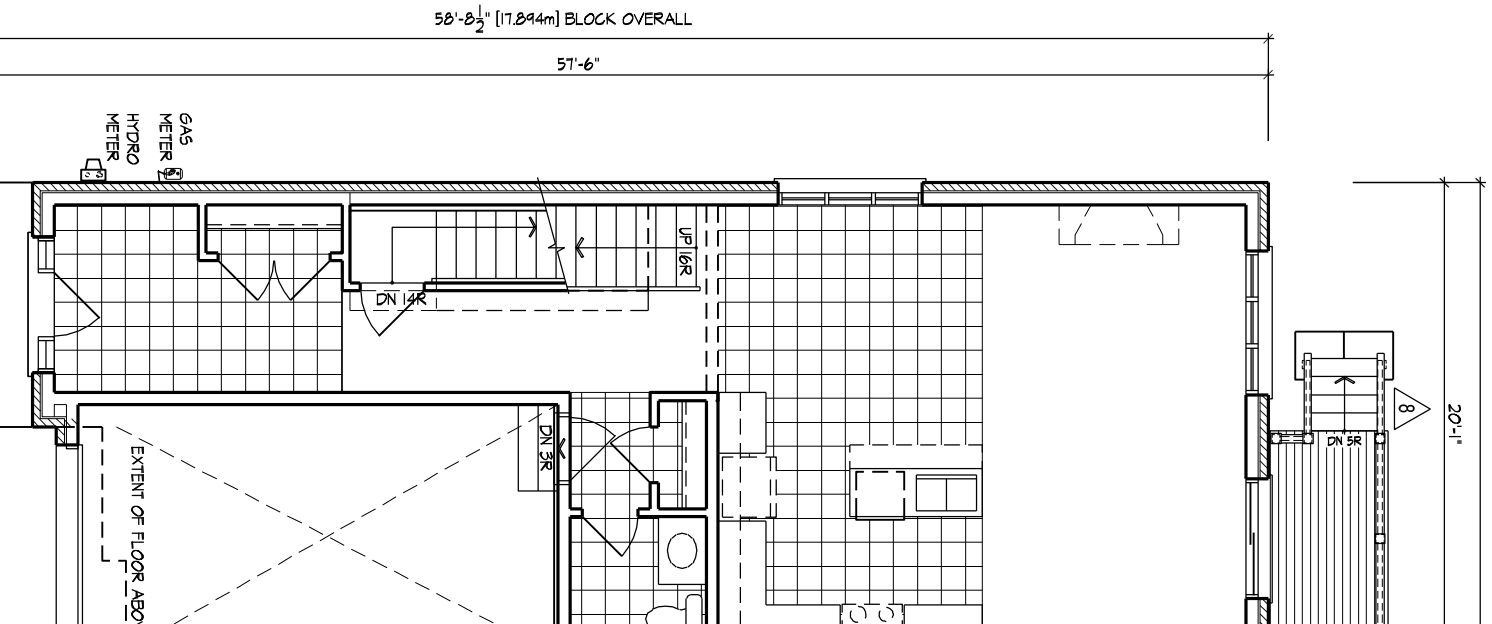
Phase 1

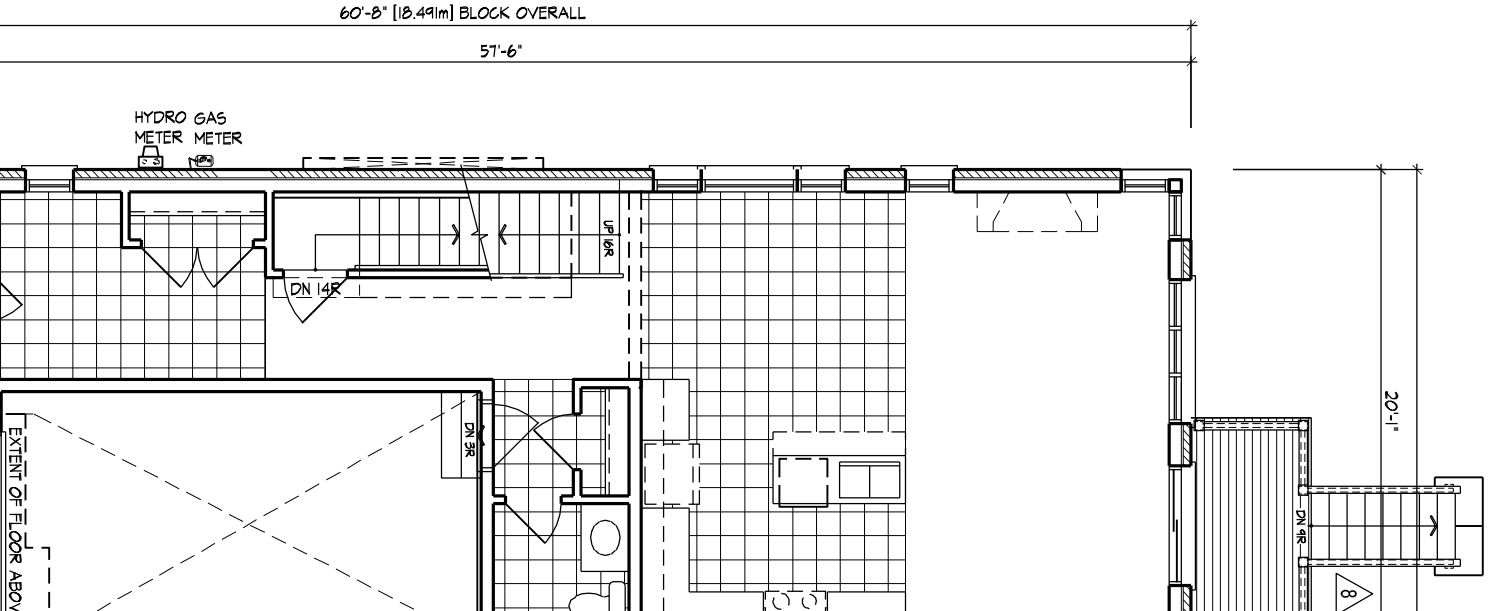
Occupancy	Length	Diameter	Area	Volume (m^3)	Population	Current Consumption	Day/turnover
(%)	(m)	(mm)	(m^2)	(m^3)	(-)	(m^3)	(Day)
10	1028	150	0.018	127.42	86	8.71	14.63
20					171	17.31	7.36
30					256	25.92	4.92
40					341	34.53	3.69
50					426	43.13	2.95
60	1041	200	0.03		512	51.84	2.46
70					597	60.45	2.11
80	373	250	0.05		682	69.05	1.85
90	824	300	0.07		767	77.66	1.64
100					852	86.27	1.48

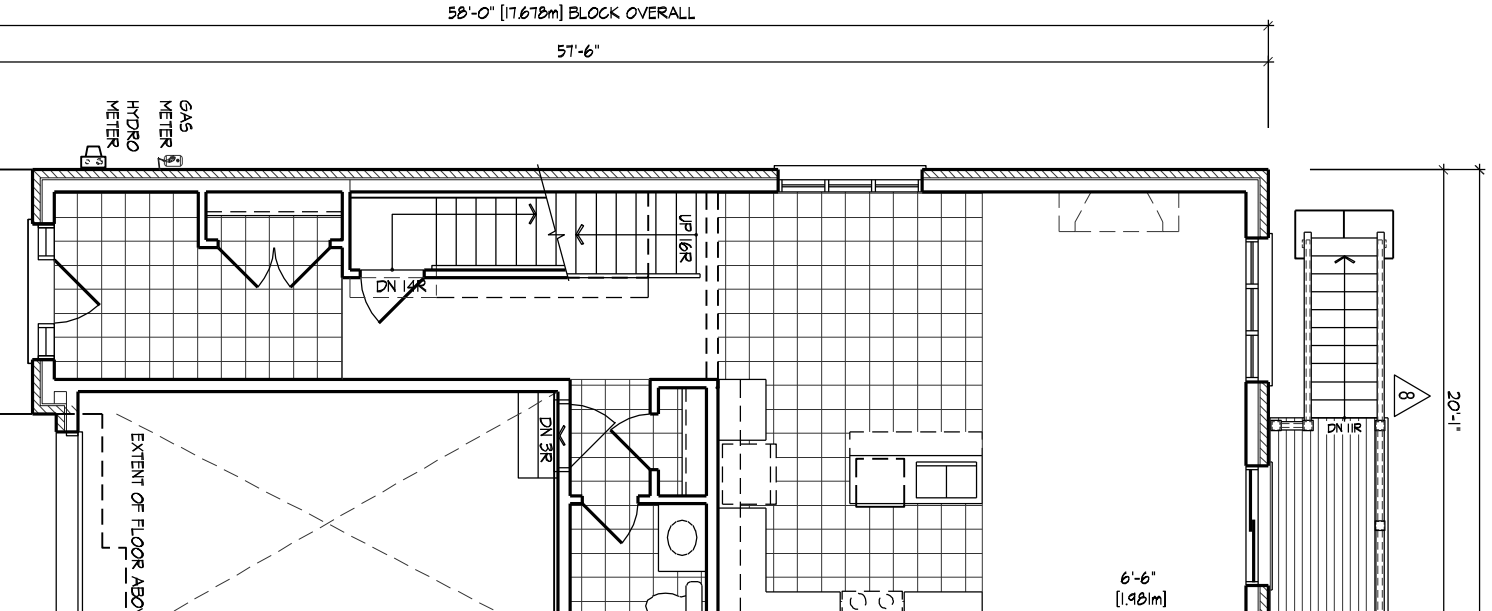
Ultimate Buildout

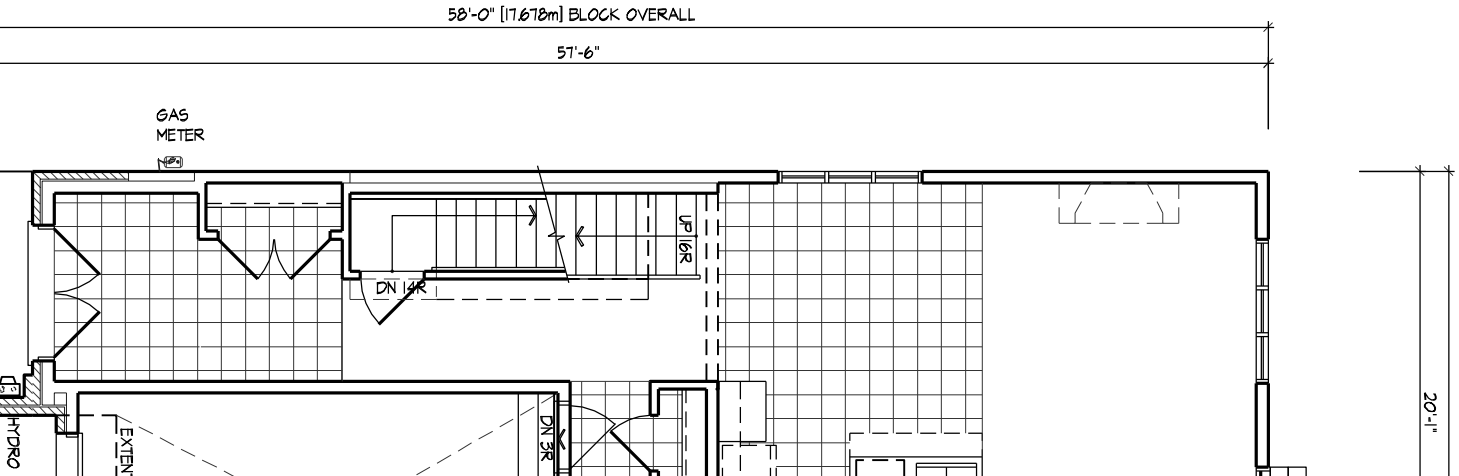
Occupancy	Length	Diameter	Area	Volume (m^3)	Population	Current Consumption	Day/turnover
(%)	(m)	(mm)	(m^2)	(m^3)	(-)	(m^3)	(Day)
10	1926	150	0.018	235.85	236	23.90	9.87
20					472	47.79	4.94
30					708	71.69	3.29
40					944	95.58	2.47
50					1180	119.48	1.97
60	3816	200	0.03		1416	143.37	1.65
70					1652	167.27	1.41
80	373	250	0.05		1888	191.16	1.23
90	900	300	0.07		2124	215.06	1.10
100					2359	238.85	0.99

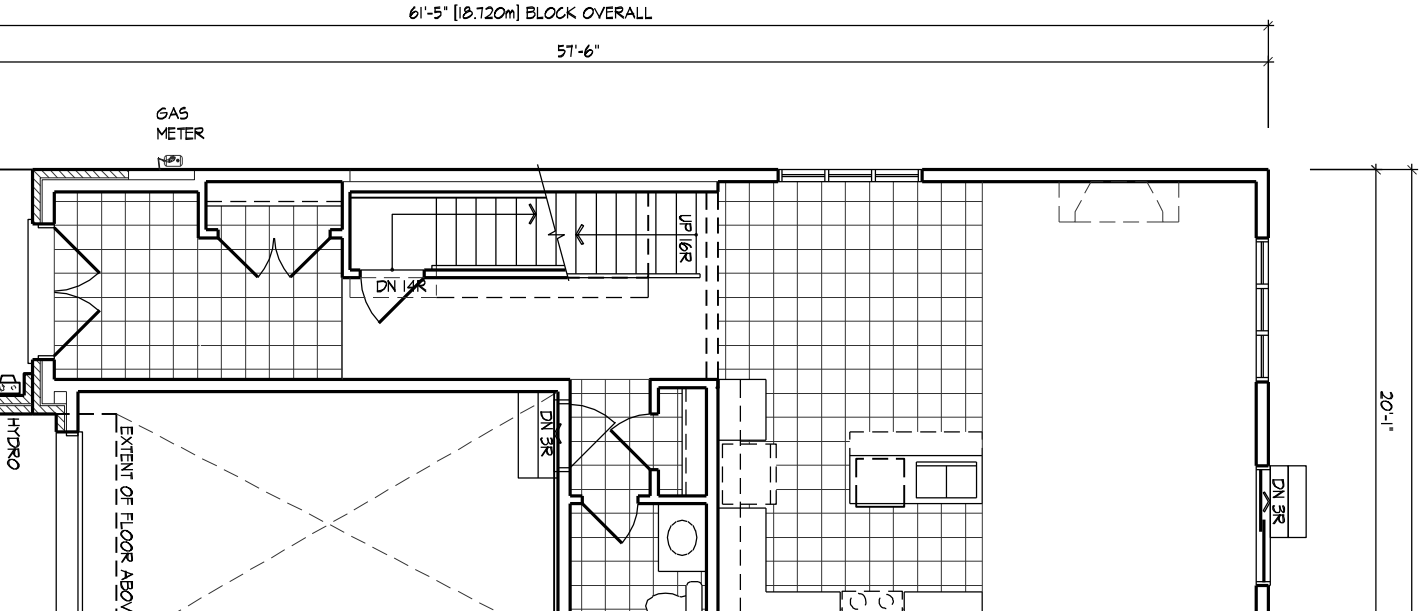

58'-8½" [17.894m] BLOCK OVERALL
57'-6"
GAS METER
UP 16R
DN 14R
DN 1R
DN 3R
HYDRO
EXTENT OF FLOOR ABOV
DN 3R
20'-1"

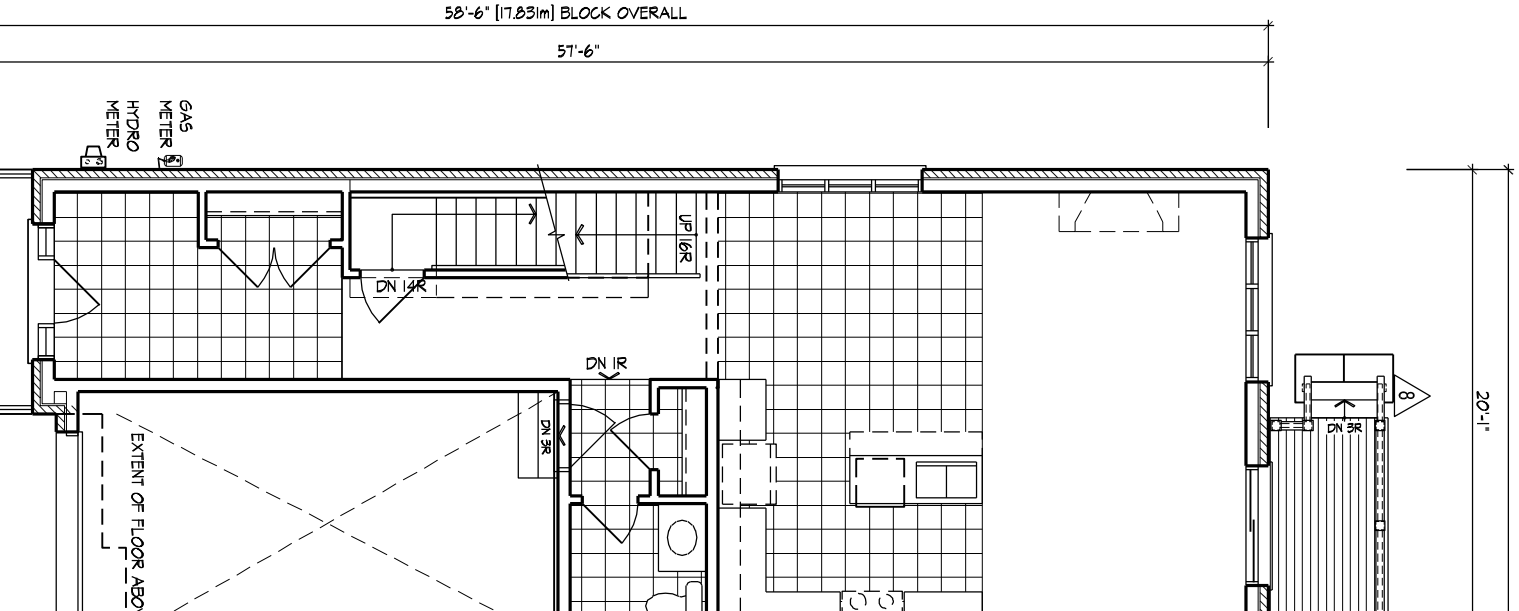

58'-8½" [17.894m] BLOCK OVERALL
57'-6"
GAS METER
HYDRO METER
UP 16R
DN 14R
DN 3R
EXTENT OF FLOOR ABO
DN 5R
8
20'-1"

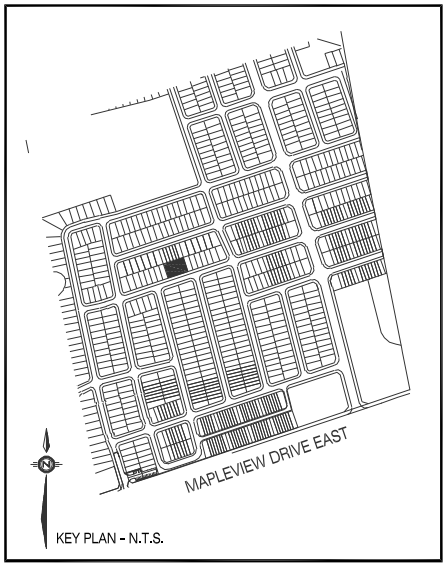

60'-8" [18.491m] BLOCK OVERALL
57'-6"
HYDRO GAS
METER METER
UP 6R
DN 14R
DN 3R
EXTENT OF FLOOR ABOV
20'-1"
DN 4R
8


58'-0" [17.678m] BLOCK OVERALL
57'-6"
GAS METER
HYDRO METER
UP 16R
DN 14R
DN 3R
EXTENT OF FLOOR ABO
DN 11R
8
20'-1"
6'-6"
[1.981m]


58'-0" [17.678m] BLOCK OVERALL
57'-6"
GAS
METER
UP 16R
DN 14R
DN 3R
HYDRO
20'-1"


61'-5" [18.720m] BLOCK OVERALL
57'-6"
GAS METER
UP 16R
DN 14R
DN 3R
HYDRO
EXTENT OF FLOOR ABOVE
DN 3R
20'-1"


58'-6" [17.83Im] BLOCK OVERALL
57'-6"
GAS METER
HYDRO METER
UP 16R
DN 14R
DN 1R
DN 3R
EXTENT OF FLOOR ABO
DN 3R
8
20'-1"



2009-141 ZONING (R5)	TOWNS
MIN. LOT FRONTAGE	
INTERIOR LOT	4.5m
CORNER LOT	N/A
MIN. INT. LOT AREA	N/A
MIN. EXT. LOT AREA	N/A
MAX. DWELLING DEPTH	N/A
MAX. LOT COVERAGE (PORCHES INCLUDED)	70%
MIN. BLDG. SEPERATION	N/A
MIN. FRONT YARD	5.5m
MIN. REAR YARD	5.5m
MIN. INTERIOR SIDE YARD	N/A
MIN. EXTERIOR SIDE YARD	2.0m
DRVWY. SIGHT LINE TRIANGLE	N/A
MIN. PARKING SIZE	2.7m x 5.5m
MIN. DRIVEWAY SETBACK	0.6m
MIN. DRIVEWAY WIDTH	N/A

...219003.FERN\SITE\219003.WSP01.2020.05.13.DWG

BLOCK 234

BLOCK 233

28 1 2 3 4

WATER 1R
2ND SUITE

STURGEON
2007-END
EL 'C'

CAMERON
2004
EL 'C' REV

ERIE
2002
EL 'C'

ERIE
2002
EL 'C' REV

FF 266.64
TFW 266.34
BF 264.03
UF 263.80

2 HOUR FIREWALL

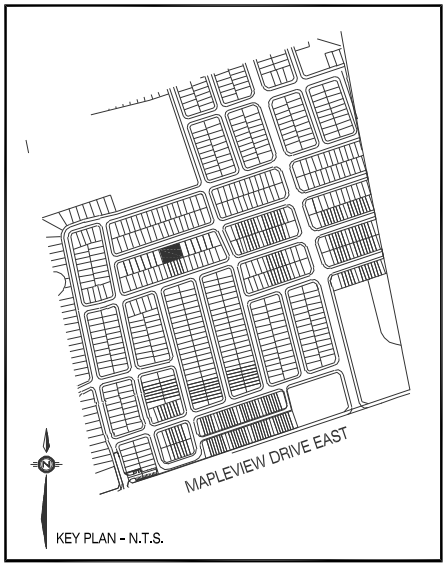
NO SUNKEN

DECK 266.45

DECK 10R 266.45

1.50m CONCRETE SIDEWALK

VALLEYBROOK ROAD



2009-141 ZONING (R5)	TOWNS
MIN. LOT FRONTAGE	
INTERIOR LOT	4.5m
CORNER LOT	N/A
MIN. INT. LOT AREA	N/A
MIN. EXT. LOT AREA	N/A
MAX. DWELLING DEPTH	N/A
MAX. LOT COVERAGE (PORCHES INCLUDED)	70%
MIN. BLDG. SEPERATION	N/A
MIN. FRONT YARD	5.5m
MIN. REAR YARD	5.5m
MIN. INTERIOR SIDE YARD	N/A
MIN. EXTERIOR SIDE YARD	2.0m
DRVWY. SIGHT LINE TRIANGLE	N/A
MIN. PARKING SIZE	2.7m x 5.5m
MIN. DRIVEWAY SETBACK	0.6m
MIN. DRIVEWAY WIDTH	N/A

219003.FERN\SITE\219003.WSP01.2020.05.13.DWG

BLOCK 230
KEMPENFELT
2003
EL 'B' REV
CAMERON
2004
EL 'B'
STURGEON
2007-END
EL 'B'
GEORGIAN
304 W/ SUITE
' 'A' REV
MIN. USF ELEV=262.86
1.5m CONC. SIDEWALK
NO SUNKEN
SUNKEN 1R
265.26
HP 264.97
HP 264.67
265.15
265.00
265.10
265.09
265.08
265.00
264.98
264.89
264.80
264.50
264.33
264.26
264.51
264.65
264.79
264.87
264.91
264.95
264.90
264.82
264.78
264.74
264.66
264.62
264.88
264.84
264.94
264.98
264.96
264.98
265.03
265.05
265.12
265.15
265.09
265.08
265.10
265.05
265.03
265.00
265.15
265.45
265.41
265.26
264.60
264.50
264.44
264.52
264.49
264.40
264.70
264.58
264.55
264.63
264.46
264.47
264.45
264.35
264.32
264.29
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264.57
264.58
264.75
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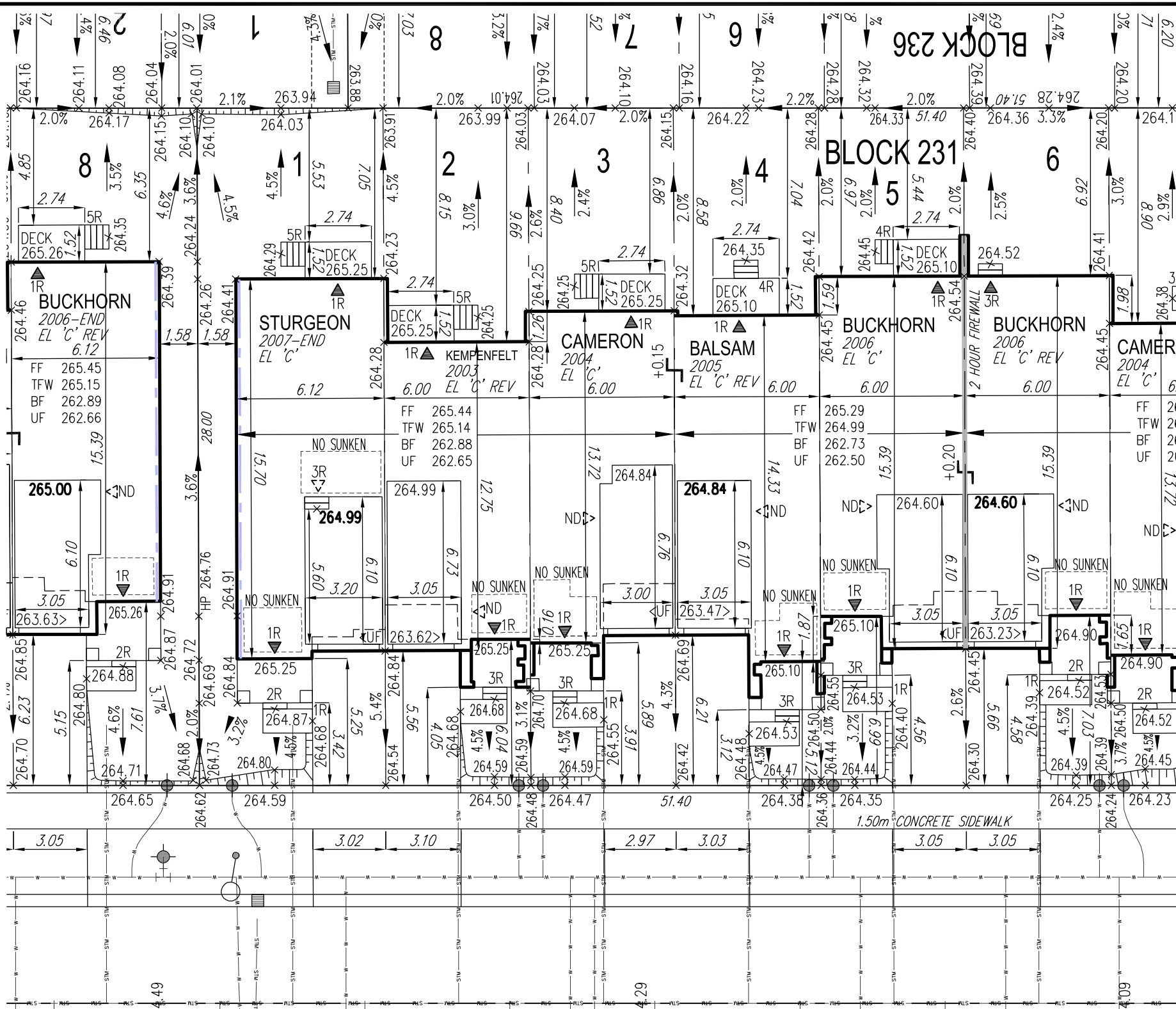
264.65
264.41



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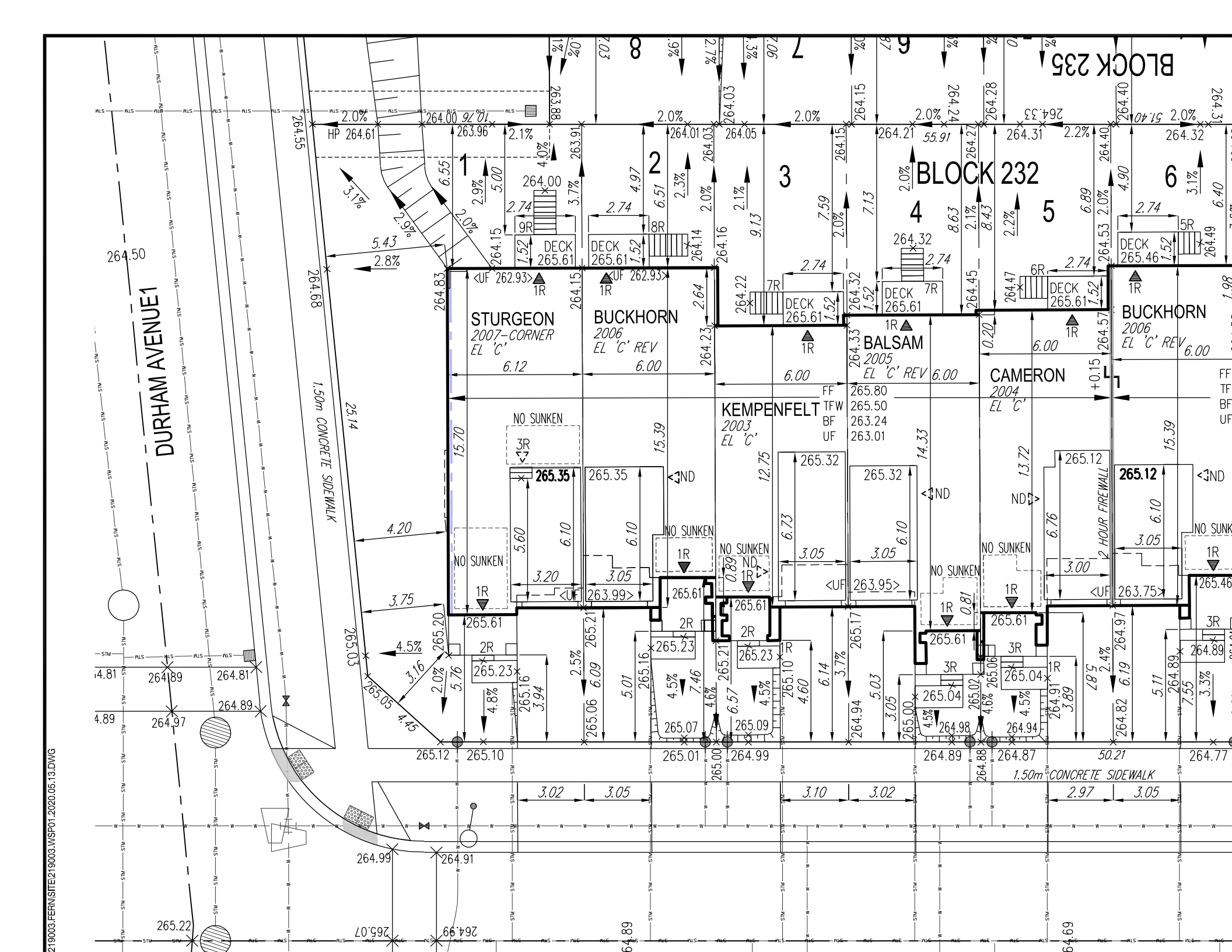
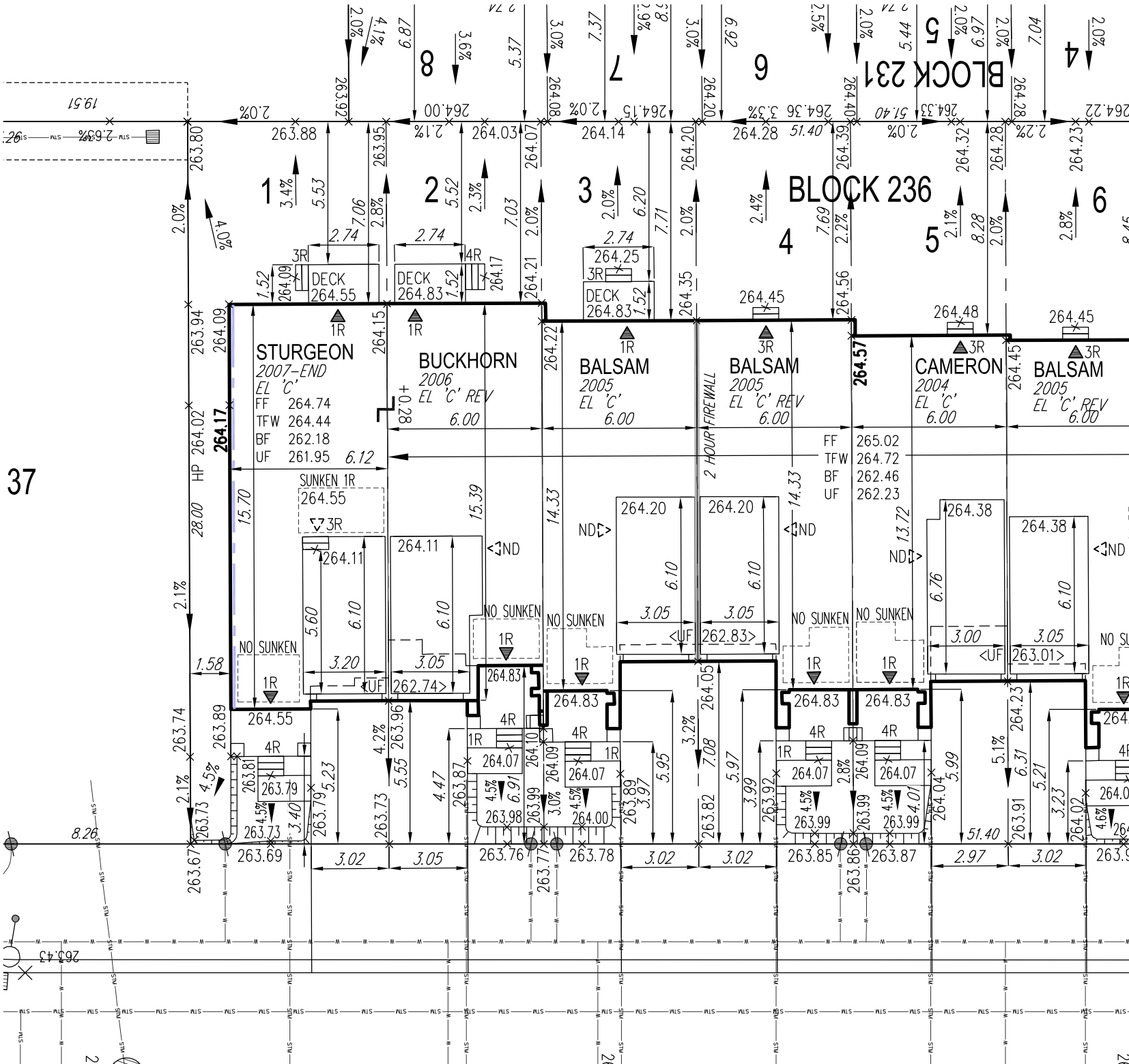

BLOCK 235
BLOCK 232
DURHAM AVENUE1
1.50m CONCRETE SIDEWALK
2 HOUR FIREWALL
STURGEON
2007-CORNER
EL 'C'
BUCKHORN
2006
EL 'C' REV
BALSAM
2005
EL 'C' REV
KEMPENFELT
2003
EL 'C'
CAMERON
2004
EL 'C'
BUCKHORN
2006
EL 'C' REV
FF 265.80
TFW 265.50
BF 263.24
UF 263.01
NO SUNKEN
DECK 265.61
DECK 265.46
1.50m CONCRETE SIDEWALK



19003.FERN\SITE\219003.WSP01.2020.05.13.DWG

Project: 970 Mapleview **Block 230**
Project number: 4897
Municipality: City of Barrie

A = Type of Construction

Type of Construction:	C	Description
Wood Frame	1.5	(essentially all combustible)
Ordinary	1	(brick/masonry walls, combustible interior)
Non-Combustible	0.8	(unprotected metal structure, masonry/metal walls)
Fire-Resistive	0.6	(fully protected frame, roof, floors)

Construction Coefficient:	**1.5**	

B = Largest Floor

Area:	192	square metres (per TH unit)

C = Height (storeys)

Height:	2	Storeys

D = Fire Flow (000's)

GFA	995	square metres
Construction Type	1.5	
Fire Flow	10,409	L/min.

-> Fire Flow	**10,000**	**L/min.**

E = Occupancy Factor

Fire Hazard of Contents	**Charge**
Non-Combustible	-25%
Limited Combustible	-15%
Combustible	0%
Free Burning	15%
Rapid Burning	25%

Occupancy Factor	-15%	
Fire Flow	**8,500**	**L/min.**

F = Sprinkler Factor

Sprinkler System	**Charge**
n/a	0%
NFPA 13 System	-30%
Fully Supervised System	-50%

Sprinkler Factor:	0%	incl 10% Standard Connection Size

G = Exposure Factor

Separation	**Charge**	
0 to 3 m	25%	
3.1 to 10 m	20%	1 side
10.1 to 20 m	15%	1 side
20.1 to 30 m	10%	1 side
30.1 to 45 m	5%	

Exposure Factor	45.00%	(no more than 75%)

H - Net Fire Flow Required

	Charge
F + G Factors	45%

	12325	L/min.
Fire Flow:	12000	L/min.
	200	L/s
	3170	USGPM

Project: 970 Mapleview **Block 231**
Project number: 4897
Municipality: City of Barrie

A = Type of Construction

Type of Construction:	C	Description
Wood Frame	1.5	(essentially all combustible)
Ordinary	1	(brick/masonry walls, combustible interior)
Non-Combustible	0.8	(unprotected metal structure, masonry/metal walls)
Fire-Resistive	0.6	(fully protected frame, roof, floors)

Construction Coefficient:	**1.5**	

B = Largest Floor

Area:	192	square metres (per TH unit)

C = Height (storeys)

Height:	2	Storeys

D = Fire Flow (000's)

GFA	862	square metres
Construction Type	1.5	
Fire Flow	9,689	L/min.

-> Fire Flow	**10,000**	**L/min.**

E = Occupancy Factor

Fire Hazard of Contents	**Charge**
Non-Combustible	-25%
Limited Combustible	-15%
Combustible	0%
Free Burning	15%
Rapid Burning	25%

Occupancy Factor	-15%	
Fire Flow	**8,500**	**L/min.**

F = Sprinkler Factor

Sprinkler System	**Charge**
n/a	0%
NFPA 13 System	-30%
Fully Supervised System	-50%

Sprinkler Factor:	0%	incl 10% Standard Connection Size

G = Exposure Factor

Separation	**Charge**	
0 to 3 m	25%	
3.1 to 10 m	20%	1 side
10.1 to 20 m	15%	1 side
20.1 to 30 m	10%	1 side
30.1 to 45 m	5%	

Exposure Factor	45.00%	(no more than 75%)

H - Net Fire Flow Required

	Charge
F + G Factors	45%

	12325	L/min.
Fire Flow:	12000	L/min.
	200	L/s
	3170	USGPM

Project: 970 Mapleview **Block 232**
Project number: 4897
Municipality: City of Barrie

A = Type of Construction

Type of Construction:	C	Description
Wood Frame	1.5	(essentially all combustible)
Ordinary	1	(brick/masonry walls, combustible interior)
Non-Combustible	0.8	(unprotected metal structure, masonry/metal walls)
Fire-Resistive	0.6	(fully protected frame, roof, floors)

Construction Coefficient:	**1.5**	

B = Largest Floor

Area:	192	square metres (per TH unit)

C = Height (storeys)

Height:	2	Storeys

D = Fire Flow (000's)

GFA	862	square metres
Construction Type	1.5	
Fire Flow	9,689	L/min.

-> Fire Flow	**10,000**	**L/min.**

E = Occupancy Factor

Fire Hazard of Contents	**Charge**
Non-Combustible	-25%
Limited Combustible	-15%
Combustible	0%
Free Burning	15%
Rapid Burning	25%

Occupancy Factor	-15%	
Fire Flow	**8,500**	**L/min.**

F = Sprinkler Factor

Sprinkler System	**Charge**
n/a	0%
NFPA 13 System	-30%
Fully Supervised System	-50%

Sprinkler Factor:	0%	incl 10% Standard Connection Size

G = Exposure Factor

Separation	**Charge**	
0 to 3 m	25%	
3.1 to 10 m	20%	
10.1 to 20 m	15%	1 side
20.1 to 30 m	10%	2 sides
30.1 to 45 m	5%	

Exposure Factor	35.00%	(no more than 75%)

H - Net Fire Flow Required

	Charge
F + G Factors	35%

	11475	L/min.
Fire Flow:	11000	L/min.
	183	L/s
	2906	USGPM

Project: 970 Mapleview **Block 233**
Project number: 4897
Municipality: City of Barrie

A = Type of Construction

Type of Construction:	C	Description
Wood Frame	1.5	(essentially all combustible)
Ordinary	1	(brick/masonry walls, combustible interior)
Non-Combustible	0.8	(unprotected metal structure, masonry/metal walls)
Fire-Resistive	0.6	(fully protected frame, roof, floors)

Construction Coefficient:	**1.5**	

B = Largest Floor

Area:	192	square metres (per TH unit)

C = Height (storeys)

Height:	2	Storeys

D = Fire Flow (000's)

GFA	496	square metres
Construction Type	1.5	
Fire Flow	7,352	L/min.

-> Fire Flow	**7,000**	**L/min.**

E = Occupancy Factor

Fire Hazard of Contents	**Charge**
Non-Combustible	-25%
Limited Combustible	-15%
Combustible	0%
Free Burning	15%
Rapid Burning	25%

Occupancy Factor	-15%	
Fire Flow	**5,950**	**L/min.**

F = Sprinkler Factor

Sprinkler System	**Charge**
n/a	0%
NFPA 13 System	-30%
Fully Supervised System	-50%

Sprinkler Factor:	0%	incl 10% Standard Connection Size

G = Exposure Factor

Separation	**Charge**	
0 to 3 m	25%	
3.1 to 10 m	20%	1 side
10.1 to 20 m	15%	1 side
20.1 to 30 m	10%	1 side
30.1 to 45 m	5%	

Exposure Factor	45.00%	(no more than 75%)

H - Net Fire Flow Required

	Charge
F + G Factors	45%

	8627.5	L/min.
Fire Flow:	9000	L/min.
	150	L/s
	2378	USGPM

Project: 970 Mapleview **Block 234**
Project number: 4897
Municipality: City of Barrie

A = Type of Construction

Type of Construction:	C	Description
Wood Frame	1.5	(essentially all combustible)
Ordinary	1	(brick/masonry walls, combustible interior)
Non-Combustible	0.8	(unprotected metal structure, masonry/metal walls)
Fire-Resistive	0.6	(fully protected frame, roof, floors)

Construction Coefficient:	**1.5**	

B = Largest Floor

Area:	192	square metres (per TH unit)

C = Height (storeys)

Height:	2	Storeys

D = Fire Flow (000's)

GFA	496	square metres
Construction Type	1.5	
Fire Flow	7,352	L/min.

-> Fire Flow	**7,000**	**L/min.**

E = Occupancy Factor

Fire Hazard of Contents	**Charge**
Non-Combustible	-25%
Limited Combustible	-15%
Combustible	0%
Free Burning	15%
Rapid Burning	25%

Occupancy Factor	-15%	
Fire Flow	**5,950**	**L/min.**

F = Sprinkler Factor

Sprinkler System	**Charge**
n/a	0%
NFPA 13 System	-30%
Fully Supervised System	-50%

Sprinkler Factor:	0%	incl 10% Standard Connection Size

G = Exposure Factor

Separation	**Charge**	
0 to 3 m	25%	
3.1 to 10 m	20%	1 side
10.1 to 20 m	15%	1 side
20.1 to 30 m	10%	1 side
30.1 to 45 m	5%	

Exposure Factor	45.00%	(no more than 75%)

H - Net Fire Flow Required

	Charge
F + G Factors	45%

	8627.5	L/min.
Fire Flow:	9000	L/min.
	150	L/s
	2378	USGPM

Project: 970 Mapleview **Block 235**
Project number: 4897
Municipality: City of Barrie

A = Type of Construction

Type of Construction:	C	Description
Wood Frame	1.5	(essentially all combustible)
Ordinary	1	(brick/masonry walls, combustible interior)
Non-Combustible	0.8	(unprotected metal structure, masonry/metal walls)
Fire-Resistive	0.6	(fully protected frame, roof, floors)

Construction Coefficient:	**1.5**	

B = Largest Floor

Area:	192	square metres (per TH unit)

C = Height (storeys)

Height:	2	Storeys

D = Fire Flow (000's)

GFA	837	square metres
Construction Type	1.5	
Fire Flow	9,546	L/min.

-> Fire Flow	**10,000**	**L/min.**

E = Occupancy Factor

Fire Hazard of Contents	**Charge**
Non-Combustible	-25%
Limited Combustible	-15%
Combustible	0%
Free Burning	15%
Rapid Burning	25%

Occupancy Factor	-15%	
Fire Flow	**8,500**	**L/min.**

F = Sprinkler Factor

Sprinkler System	**Charge**
n/a	0%
NFPA 13 System	-30%
Fully Supervised System	-50%

Sprinkler Factor:	0%	incl 10% Standard Connection Size

G = Exposure Factor

Separation	**Charge**	
0 to 3 m	25%	
3.1 to 10 m	20%	1 side
10.1 to 20 m	15%	1 side
20.1 to 30 m	10%	1 side
30.1 to 45 m	5%	

Exposure Factor	45.00%	(no more than 75%)

H - Net Fire Flow Required

	Charge
F + G Factors	45%

	12325	L/min.
Fire Flow:	12000	L/min.
	200	L/s
	3170	USGPM

Project: 970 Mapleview **Block 236**
Project number: 4897
Municipality: City of Barrie

A = Type of Construction

Type of Construction:	C	Description
Wood Frame	1.5	(essentially all combustible)
Ordinary	1	(brick/masonry walls, combustible interior)
Non-Combustible	0.8	(unprotected metal structure, masonry/metal walls)
Fire-Resistive	0.6	(fully protected frame, roof, floors)

Construction Coefficient:	**1.5**	

B = Largest Floor

Area:	192	square metres (per TH unit)

C = Height (storeys)

Height:	2	Storeys

D = Fire Flow (000's)

GFA	857	square metres
Construction Type	1.5	
Fire Flow	9,661	L/min.

-> Fire Flow	**10,000**	**L/min.**

E = Occupancy Factor

Fire Hazard of Contents	**Charge**
Non-Combustible	-25%
Limited Combustible	-15%
Combustible	0%
Free Burning	15%
Rapid Burning	25%

Occupancy Factor	-15%	
Fire Flow	**8,500**	**L/min.**

F = Sprinkler Factor

Sprinkler System	**Charge**
n/a	0%
NFPA 13 System	-30%
Fully Supervised System	-50%

Sprinkler Factor:	0%	incl 10% Standard Connection Size

G = Exposure Factor

Separation	**Charge**	
0 to 3 m	25%	
3.1 to 10 m	20%	1 side
10.1 to 20 m	15%	1 side
20.1 to 30 m	10%	1 side
30.1 to 45 m	5%	

Exposure Factor	45.00%	(no more than 75%)

H - Net Fire Flow Required

	Charge
F + G Factors	45%

	12325	L/min.
Fire Flow:	12000	L/min.
	200	L/s
	3170	USGPM

Project: 970 Mapleview **Block 491**
Project number: 4897
Municipality: City of Barrie

A = Type of Construction

Type of Construction:	C	Description
Wood Frame	1.5	(essentially all combustible)
Ordinary	1	(brick/masonry walls, combustible interior)
Non-Combustible	0.8	(unprotected metal structure, masonry/metal walls)
Fire-Resistive	0.6	(fully protected frame, roof, floors)

Construction Coefficient:	**1.5**	

B = Largest Floor

Area:	192	square metres (per TH unit)

C = Height (storeys)

Height:	2	Storeys

D = Fire Flow (000's)

GFA	496	square metres
Construction Type	1.5	
Fire Flow	7,349	L/min.

-> Fire Flow	**7,000**	**L/min.**

E = Occupancy Factor

Fire Hazard of Contents	**Charge**
Non-Combustible	-25%
Limited Combustible	-15%
Combustible	0%
Free Burning	15%
Rapid Burning	25%

Occupancy Factor	-15%	
Fire Flow	**5,950**	**L/min.**

F = Sprinkler Factor

Sprinkler System	**Charge**
n/a	0%
NFPA 13 System	-30%
Fully Supervised System	-50%

Sprinkler Factor:	0%	incl 10% Standard Connection Size

G = Exposure Factor

Separation	**Charge**	
0 to 3 m	25%	
3.1 to 10 m	20%	1 side
10.1 to 20 m	15%	1 side
20.1 to 30 m	10%	2 sides
30.1 to 45 m	5%	

Exposure Factor	55.00%	(no more than 75%)

H - Net Fire Flow Required

	Charge
F + G Factors	55%

	9222.5	L/min.
Fire Flow:	9000	L/min.
	150	L/s
	2378	USGPM

Project: 970 Mapleview **Block 492**
Project number: 4897
Municipality: City of Barrie

A = Type of Construction

Type of Construction:	C	Description
Wood Frame	1.5	(essentially all combustible)
Ordinary	1	(brick/masonry walls, combustible interior)
Non-Combustible	0.8	(unprotected metal structure, masonry/metal walls)
Fire-Resistive	0.6	(fully protected frame, roof, floors)

Construction Coefficient:	**1.5**	

B = Largest Floor

Area:	192	square metres (per TH unit)

C = Height (storeys)

Height:	2	Storeys

D = Fire Flow (000's)

GFA	995	square metres
Construction Type	1.5	
Fire Flow	10,409	L/min.

-> Fire Flow	**10,000**	**L/min.**

E = Occupancy Factor

Fire Hazard of Contents	**Charge**
Non-Combustible	-25%
Limited Combustible	-15%
Combustible	0%
Free Burning	15%
Rapid Burning	25%

Occupancy Factor	-15%	
Fire Flow	**8,500**	**L/min.**

F = Sprinkler Factor

Sprinkler System	**Charge**
n/a	0%
NFPA 13 System	-30%
Fully Supervised System	-50%

Sprinkler Factor:	0%	incl 10% Standard Connection Size

G = Exposure Factor

Separation	**Charge**	
0 to 3 m	25%	
3.1 to 10 m	20%	
10.1 to 20 m	15%	1 side
20.1 to 30 m	10%	2 sides
30.1 to 45 m	5%	

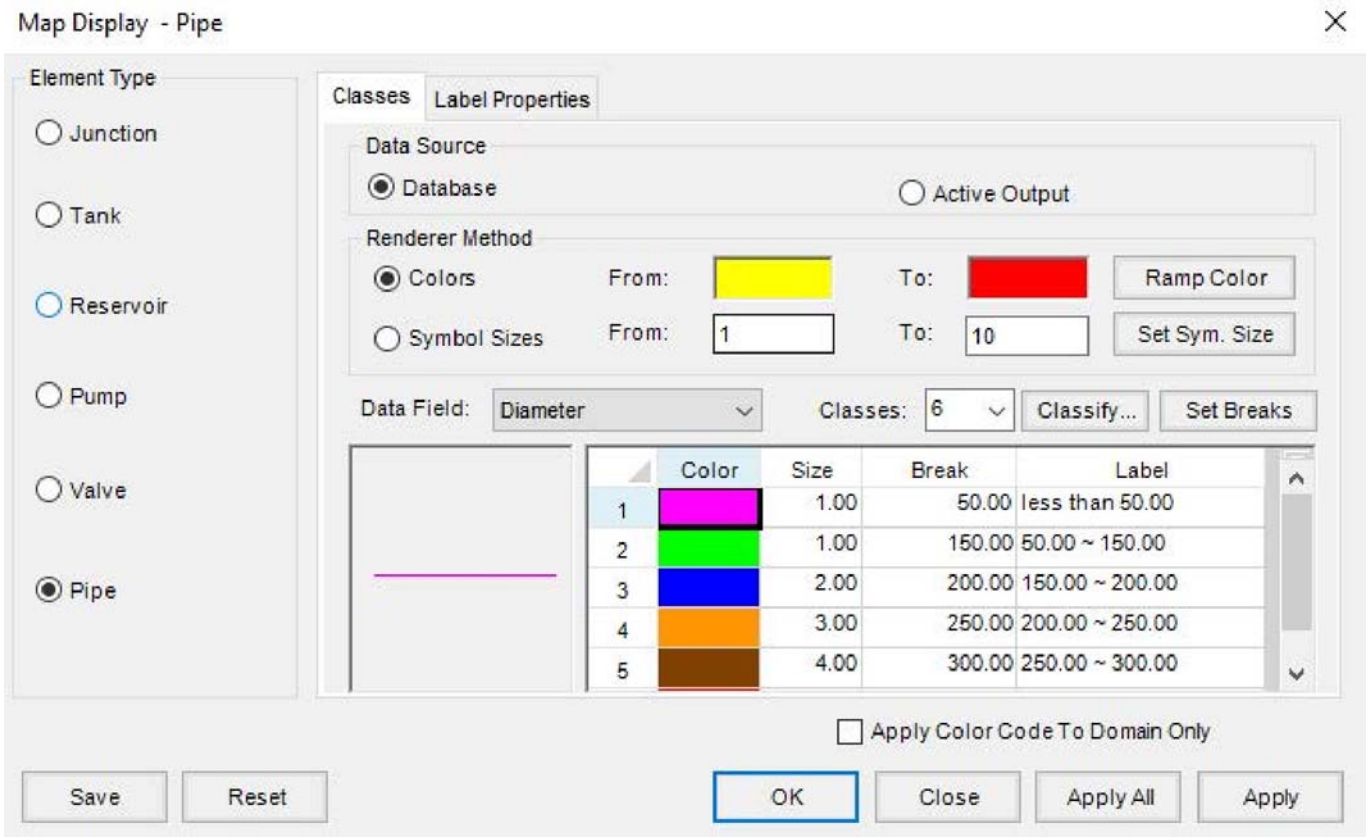
Exposure Factor	35.00%	(no more than 75%)

H - Net Fire Flow Required

	Charge
F + G Factors	35%

	11475	L/min.
Fire Flow:	11000	L/min.
	183	L/s
	2906	USGPM

Phase 1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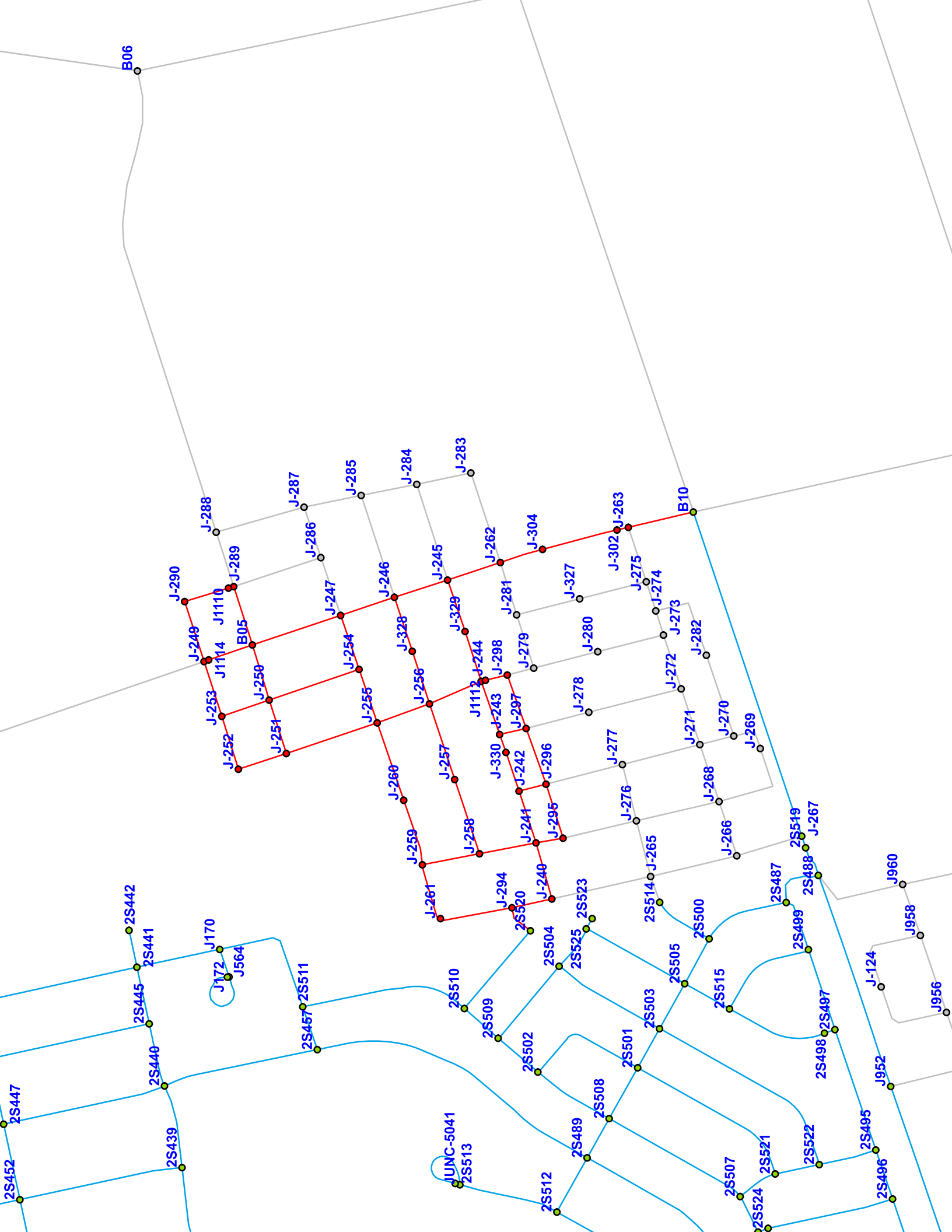
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970 Mapleview Phase 1 2020ADD Scenario Demand

	ID	Max.Value (L/s)	Max.Time (hrs.)	Min.Value (L/s)	Min.Time (hrs.)	Average (L/s)	Difference (L/s)
1	J-242	0.12	20:00	0.02	01:00	0.06	0.10
2	J-330	0.00	00:00	0.00	00:00	0.00	0.00
3	J-296	0.04	20:00	0.01	01:00	0.02	0.03
4	J-243	0.14	20:00	0.02	01:00	0.07	0.11
5	J-290	0.00	00:00	0.00	00:00	0.00	0.00
6	J-297	0.06	20:00	0.01	01:00	0.03	0.05
7	J-298	0.04	20:00	0.01	01:00	0.02	0.03
8	J1112	0.00	00:00	0.00	00:00	0.00	0.00
9	J-244	0.22	20:00	0.04	01:00	0.11	0.18
10	J-241	0.16	20:00	0.03	01:00	0.08	0.13
11	J1110	0.00	00:00	0.00	00:00	0.00	0.00
12	J-289	0.00	00:00	0.00	00:00	0.00	0.00
13	J-295	0.04	20:00	0.01	01:00	0.02	0.03
14	J-329	0.26	20:00	0.04	01:00	0.13	0.21
15	J-240	0.08	20:00	0.01	01:00	0.04	0.07
16	J-245	0.00	00:00	0.00	00:00	0.00	0.00
17	J-249	0.12	20:00	0.02	01:00	0.06	0.10
18	J-294	0.18	20:00	0.03	01:00	0.09	0.15
19	J1114	0.00	00:00	0.00	00:00	0.00	0.00
20	J-258	0.24	20:00	0.04	01:00	0.12	0.20
21	J-257	0.30	20:00	0.05	01:00	0.15	0.25
22	J-262	0.00	00:00	0.00	00:00	0.00	0.00
23	B05	0.20	20:00	0.03	01:00	0.10	0.16
24	J-246	0.06	20:00	0.01	01:00	0.03	0.05
25	J-328	0.30	20:00	0.05	01:00	0.15	0.25
26	J-256	0.20	20:00	0.03	01:00	0.10	0.16
27	J-261	0.16	20:00	0.03	01:00	0.08	0.13
28	J-247	0.18	20:00	0.03	01:00	0.09	0.15
29	J-304	0.00	00:00	0.00	00:00	0.00	0.00
30	J-259	0.18	20:00	0.03	01:00	0.09	0.15
31	J-253	0.18	20:00	0.03	01:00	0.09	0.15
32	J-260	0.16	20:00	0.03	01:00	0.08	0.13
33	J-254	0.26	20:00	0.04	01:00	0.13	0.21
34	J-250	0.16	20:00	0.03	01:00	0.08	0.13
35	J-255	0.20	20:00	0.03	01:00	0.10	0.16
36	J-302	0.00	00:00	0.00	00:00	0.00	0.00
37	J-263	0.00	00:00	0.00	00:00	0.00	0.00
38	J-251	0.08	20:00	0.01	01:00	0.04	0.07
39	J-252	0.08	20:00	0.01	01:00	0.04	0.07

	ID	Max.Value (L/s)	Max.Time (hrs.)	Min.Value (L/s)	Min.Time (hrs.)	Average (L/s)	Difference (L/s)
1	ANNEX_12112A	3.58	20:00	0.57	01:00	1.84	3.01
2	ANNEX_12112F	3.58	20:00	0.57	01:00	1.84	3.01
3	ANNEX_12112G	3.58	20:00	0.57	01:00	1.84	3.01
4	ANNEX_12112B	3.58	20:00	0.57	01:00	1.84	3.01
5	ANNEX_12112C	3.58	20:00	0.57	01:00	1.84	3.01
6	ANNEX_12503	0.00	00:00	0.00	00:00	0.00	0.00
7	ANNEX_12112	0.88	20:00	0.14	01:00	0.45	0.73
8	ANNEX_12112D	2.28	20:00	0.37	01:00	1.17	1.91
9	ANNEX_12112E	1.34	20:00	0.22	01:00	0.69	1.12
10	ANNEX_12111A	0.13	20:00	0.02	01:00	0.07	0.11
11	P2892	0.08	116:00	0.01	265:00	0.04	0.06
12	P2894	0.00	00:00	0.00	00:00	0.00	0.00
13	P2896	0.55	20:00	0.09	01:00	0.28	0.46
14	P2898	0.18	20:00	0.03	01:00	0.09	0.16
15	P2900	0.17	20:00	0.03	01:00	0.09	0.14
16	P2904	0.16	20:00	0.01	01:00	0.08	0.15
17	P2910	0.47	20:00	0.06	01:00	0.24	0.41
18	P2912	1.05	20:00	0.16	01:00	0.54	0.89
19	P2914	0.58	20:00	0.08	01:00	0.30	0.50
20	P2920	0.02	116:00	0.00	265:00	0.01	0.02
21	P2922	0.13	20:00	0.01	01:00	0.07	0.12
22	P2924	0.07	20:00	0.01	01:00	0.03	0.06
23	P2926	0.29	20:00	0.05	01:00	0.15	0.24
24	P2928	0.45	20:00	0.06	01:00	0.23	0.39
25	P2932	0.24	20:00	0.04	01:00	0.12	0.20
26	P2934	0.31	20:00	0.05	49:00	0.16	0.26
27	P2936	0.05	20:00	0.01	01:00	0.03	0.04
28	P2944	0.03	20:00	0.00	01:00	0.01	0.03
29	P2946	0.04	20:00	0.01	01:00	0.02	0.03
30	P3024	0.00	20:00	0.00	00:00	0.00	0.00
31	P3026	0.01	20:00	0.00	01:00	0.01	0.01
32	P3036	0.00	00:00	0.00	00:00	0.00	0.00
33	P3040	0.13	20:00	0.02	01:00	0.07	0.11
34	P4024	0.88	20:00	0.13	01:00	0.45	0.74
35	P4026	1.31	20:00	0.21	01:00	0.67	1.10
36	P3028	0.00	00:00	0.00	00:00	0.00	0.00
37	P2888	0.12	20:00	0.00	01:00	0.06	0.12
38	P2890	0.22	116:00	0.04	265:00	0.11	0.18
39	P2902	0.29	116:00	0.05	265:00	0.15	0.25
40	P2906	0.37	116:00	0.06	265:00	0.19	0.31
41	P2908	0.27	20:00	0.03	01:00	0.14	0.25
42	P2916	0.22	116:00	0.04	265:00	0.11	0.18
43	P2918	0.06	116:00	0.01	265:00	0.03	0.05
44	P2930	0.14	20:00	0.02	01:00	0.07	0.12
45	P2938	0.05	20:00	0.01	01:00	0.03	0.05
46	P2940	0.04	44:00	0.01	25:00	0.02	0.03
47	P2942	0.04	116:00	0.01	265:00	0.02	0.03
48	P3030	0.00	20:00	0.00	00:00	0.00	0.00
49	P3032	0.01	20:00	0.00	00:00	0.00	0.01
50	P3034	0.01	20:00	0.00	01:00	0.01	0.01
51	P3038	0.05	20:00	0.01	01:00	0.03	0.04
52	P4028	0.27	20:00	0.03	01:00	0.14	0.25

970 Mapleview Phase 1 2020ADD Scenario Head

		ID	Max.Value (m)	Max.Time (hrs.)	Min.Value (m)	Min.Time (hrs.)	Average (m)	Difference (m)
1	☐	J-242	311.20	02:00	306.62	09:00	308.03	4.58
2	☐	J-330	311.20	02:00	306.62	09:00	308.03	4.58
3	☐	J-296	311.20	02:00	306.62	09:00	308.03	4.58
4	☐	J-243	311.20	02:00	306.62	09:00	308.03	4.58
5	☐	J-290	311.20	02:00	306.62	09:00	308.03	4.58
6	☐	J-297	311.20	02:00	306.62	09:00	308.03	4.58
7	☐	J-298	311.20	02:00	306.62	09:00	308.03	4.58
8	☐	J1112	311.20	02:00	306.62	09:00	308.03	4.58
9	☐	J-244	311.20	02:00	306.62	09:00	308.03	4.58
10	☐	J-241	311.20	02:00	306.62	09:00	308.03	4.58
11	☐	J1110	311.20	02:00	306.62	09:00	308.03	4.58
12	☐	J-289	311.20	02:00	306.62	09:00	308.03	4.58
13	☐	J-295	311.20	02:00	306.62	09:00	308.03	4.58
14	☐	J-329	311.20	02:00	306.62	09:00	308.03	4.58
15	☐	J-240	311.20	02:00	306.62	09:00	308.03	4.58
16	☐	J-245	311.20	02:00	306.62	09:00	308.03	4.58
17	☐	J-249	311.20	02:00	306.62	09:00	308.03	4.58
18	☐	J-294	311.20	02:00	306.62	09:00	308.03	4.58
19	☐	J1114	311.20	02:00	306.62	09:00	308.03	4.58
20	☐	J-258	311.20	02:00	306.62	09:00	308.03	4.58
21	☐	J-257	311.20	02:00	306.62	09:00	308.03	4.58
22	☐	J-262	311.20	02:00	306.62	09:00	308.03	4.58
23	☐	B05	311.20	02:00	306.62	09:00	308.03	4.58
24	☐	J-246	311.20	02:00	306.62	09:00	308.03	4.58
25	☐	J-328	311.20	02:00	306.62	09:00	308.03	4.58
26	☐	J-256	311.20	02:00	306.62	09:00	308.03	4.58
27	☐	J-261	311.20	02:00	306.62	09:00	308.03	4.58
28	☐	J-247	311.20	02:00	306.62	09:00	308.03	4.58
29	☐	J-304	311.20	02:00	306.62	09:00	308.03	4.58
30	☐	J-259	311.20	02:00	306.62	09:00	308.03	4.58
31	☐	J-253	311.20	02:00	306.62	09:00	308.03	4.58
32	☐	J-260	311.20	02:00	306.62	09:00	308.03	4.58
33	☐	J-254	311.20	02:00	306.62	09:00	308.03	4.58
34	☐	J-250	311.20	02:00	306.62	09:00	308.03	4.58
35	☐	J-255	311.20	02:00	306.62	09:00	308.03	4.58
36	☐	J-302	311.20	02:00	306.62	09:00	308.03	4.58
37	☐	J-263	311.20	02:00	306.62	09:00	308.03	4.58
38	☐	J-251	311.20	02:00	306.62	09:00	308.03	4.58
39	☐	J-252	311.20	02:00	306.62	09:00	308.03	4.58

	ID	Max.Value (m/k-m)	Max.Time (hrs.)	Min.Value (m/k-m)	Min.Time (hrs.)	Average (m/k-m)	Difference (m/k-m)
1	ANNEX_12112A	0.02	20:00	0.00	01:00	0.01	0.02
2	ANNEX_12112F	0.02	164:00	0.00	49:00	0.01	0.02
3	ANNEX_12112G	0.02	68:00	0.00	01:00	0.01	0.02
4	ANNEX_12112B	0.02	20:00	0.00	01:00	0.01	0.02
5	ANNEX_12112C	0.02	20:00	0.00	01:00	0.01	0.02
6	ANNEX_12503	0.00	00:00	0.00	00:00	0.00	0.00
7	ANNEX_12112	0.00	20:00	0.00	01:00	0.00	0.00
8	ANNEX_12112D	0.01	20:00	0.00	01:00	0.00	0.01
9	ANNEX_12112E	0.00	68:00	0.00	49:00	0.00	0.00
10	ANNEX_12111A	0.00	00:00	0.00	00:00	0.00	0.00
11	P2892	0.00	16:00	0.00	00:00	0.00	0.00
12	P2894	0.00	00:00	0.00	00:00	0.00	0.00
13	P2896	0.00	21:00	0.00	01:00	0.00	0.00
14	P2898	0.00	44:00	0.00	00:00	0.00	0.00
15	P2900	0.00	20:00	0.00	00:00	0.00	0.00
16	P2904	0.00	20:00	0.00	00:00	0.00	0.00
17	P2910	0.00	116:00	0.00	00:00	0.00	0.00
18	P2912	0.00	164:00	0.00	73:00	0.00	0.00
19	P2914	0.00	20:00	0.00	01:00	0.00	0.00
20	P2920	0.00	01:00	0.00	00:00	0.00	0.00
21	P2922	0.00	21:00	0.00	02:00	0.00	0.00
22	P2924	0.00	20:00	0.00	00:00	0.00	0.00
23	P2926	0.01	212:00	0.00	01:00	0.00	0.01
24	P2928	0.00	44:00	0.00	01:00	0.00	0.00
25	P2932	0.00	20:00	0.00	01:00	0.00	0.00
26	P2934	0.00	21:00	0.00	00:00	0.00	0.00
27	P2936	0.00	21:00	0.00	00:00	0.00	0.00
28	P2944	0.00	16:00	0.00	00:00	0.00	0.00
29	P2946	0.00	10:00	0.00	00:00	0.00	0.00
30	P3024	0.00	19:00	0.00	00:00	0.00	0.00
31	P3026	0.00	68:00	0.00	01:00	0.00	0.00
32	P3036	0.00	00:00	0.00	00:00	0.00	0.00
33	P3040	0.00	16:00	0.00	00:00	0.00	0.00
34	P4024	0.00	68:00	0.00	73:00	0.00	0.00
35	P4026	0.01	20:00	0.00	01:00	0.00	0.01
36	P3028	0.00	00:00	0.00	00:00	0.00	0.00
37	P2888	0.00	09:00	0.00	00:00	0.00	0.00
38	P2890	0.00	164:00	0.00	00:00	0.00	0.00
39	P2902	0.00	20:00	0.00	01:00	0.00	0.00
40	P2906	0.00	20:00	0.00	24:00	0.00	0.00
41	P2908	0.00	20:00	0.00	00:00	0.00	0.00
42	P2916	0.00	20:00	0.00	73:00	0.00	0.00
43	P2918	0.00	67:00	0.00	01:00	0.00	0.00
44	P2930	0.00	68:00	0.00	01:00	0.00	0.00
45	P2938	0.00	10:00	0.00	00:00	0.00	0.00
46	P2940	0.00	10:00	0.00	00:00	0.00	0.00
47	P2942	0.00	18:00	0.00	00:00	0.00	0.00
48	P3030	0.00	09:00	0.00	00:00	0.00	0.00
49	P3032	0.00	20:00	0.00	00:00	0.00	0.00
50	P3034	0.00	44:00	0.00	00:00	0.00	0.00
51	P3038	0.00	87:00	0.00	00:00	0.00	0.00
52	P4028	0.00	19:00	0.00	01:00	0.00	0.00

970 Mapleview Phase 1 2020ADD Scenario Pressure

		ID	Max.Value (kPa)	Max.Time (hrs.)	Min.Value (kPa)	Min.Time (hrs.)	Average (kPa)	Difference (kPa)
1	☐	J-242	443.11	02:00	398.24	09:00	412.05	44.87
2	☐	J-330	444.97	02:00	400.10	09:00	413.91	44.87
3	☐	J-296	445.56	02:00	400.69	09:00	414.50	44.87
4	☐	J-243	446.34	02:00	401.47	09:00	415.29	44.87
5	☐	J-290	447.81	02:00	402.94	09:00	416.76	44.87
6	☐	J-297	448.01	02:00	403.14	09:00	416.95	44.87
7	☐	J-298	449.09	02:00	404.21	09:00	418.03	44.87
8	☐	J1112	451.24	02:00	406.37	09:00	420.19	44.87
9	☐	J-244	451.63	02:00	406.76	09:00	420.58	44.87
10	☐	J-241	452.02	02:00	407.15	09:00	420.97	44.87
11	☐	J1110	453.00	02:00	408.13	09:00	421.95	44.87
12	☐	J-289	453.59	02:00	408.72	09:00	422.54	44.87
13	☐	J-295	455.75	02:00	410.88	09:00	424.69	44.87
14	☐	J-329	455.75	02:00	410.88	09:00	424.70	44.87
15	☐	J-240	458.98	02:00	414.11	09:00	427.93	44.87
16	☐	J-245	459.96	02:00	415.09	09:00	428.91	44.87
17	☐	J-249	461.33	02:00	416.46	09:00	430.28	44.87
18	☐	J-294	461.43	02:00	416.56	09:00	430.38	44.87
19	☐	J1114	461.53	02:00	416.66	09:00	430.48	44.87
20	☐	J-258	461.53	02:00	416.66	09:00	430.47	44.87
21	☐	J-257	461.73	02:00	416.85	09:00	430.67	44.87
22	☐	J-262	462.90	02:00	418.04	09:00	431.85	44.86
23	☐	B05	463.49	02:00	418.62	09:00	432.44	44.87
24	☐	J-246	463.59	02:00	418.72	09:00	432.54	44.87
25	☐	J-328	464.86	02:00	419.99	09:00	433.81	44.87
26	☐	J-256	466.04	02:00	421.17	09:00	434.98	44.87
27	☐	J-261	466.43	02:00	421.56	09:00	435.37	44.87
28	☐	J-247	467.21	02:00	422.34	09:00	436.16	44.87
29	☐	J-304	468.98	02:00	424.12	09:00	437.93	44.86
30	☐	J-259	470.25	02:00	425.38	09:00	439.20	44.87
31	☐	J-253	474.86	02:00	429.99	09:00	443.80	44.87
32	☐	J-260	475.05	02:00	430.18	09:00	444.00	44.87
33	☐	J-254	475.44	02:00	430.57	09:00	444.39	44.87
34	☐	J-250	475.93	02:00	431.06	09:00	444.88	44.87
35	☐	J-255	479.17	02:00	434.30	09:00	448.11	44.87
36	☐	J-302	481.42	02:00	436.57	09:00	450.38	44.86
37	☐	J-263	482.31	02:00	437.45	09:00	451.27	44.86
38	☐	J-251	483.77	02:00	438.90	09:00	452.72	44.87
39	☐	J-252	485.54	02:00	440.67	09:00	454.48	44.87

		ID	Max.Value (m/s)	Max.Time (hrs.)	Min.Value (m/s)	Min.Time (hrs.)	Average (m/s)	Difference (m/s)
1	☐	ANNEX_12112A	0.05	20:00	0.01	01:00	0.03	0.04
2	☐	ANNEX_12112F	0.05	20:00	0.01	01:00	0.03	0.04
3	☐	ANNEX_12112G	0.05	20:00	0.01	01:00	0.03	0.04
4	☐	ANNEX_12112B	0.05	20:00	0.01	01:00	0.03	0.04
5	☐	ANNEX_12112C	0.05	20:00	0.01	01:00	0.03	0.04
6	☐	ANNEX_12503	0.00	00:00	0.00	00:00	0.00	0.00
7	☐	ANNEX_12112	0.01	20:00	0.00	01:00	0.01	0.01
8	☐	ANNEX_12112D	0.03	20:00	0.01	01:00	0.02	0.03
9	☐	ANNEX_12112E	0.02	20:00	0.00	01:00	0.01	0.02
10	☐	ANNEX_12111A	0.00	20:00	0.00	01:00	0.00	0.00
11	☐	P2892	0.00	116:00	0.00	25:00	0.00	0.00
12	☐	P2894	0.00	00:00	0.00	00:00	0.00	0.00
13	☐	P2896	0.02	20:00	0.00	01:00	0.01	0.01
14	☐	P2898	0.01	20:00	0.00	01:00	0.00	0.00
15	☐	P2900	0.01	20:00	0.00	01:00	0.00	0.00
16	☐	P2904	0.01	20:00	0.00	01:00	0.00	0.00
17	☐	P2910	0.01	20:00	0.00	01:00	0.01	0.01
18	☐	P2912	0.02	20:00	0.00	01:00	0.01	0.02
19	☐	P2914	0.01	20:00	0.00	01:00	0.01	0.01
20	☐	P2920	0.00	116:00	0.00	265:00	0.00	0.00
21	☐	P2922	0.01	20:00	0.00	01:00	0.00	0.01
22	☐	P2924	0.00	20:00	0.00	01:00	0.00	0.00
23	☐	P2926	0.02	20:00	0.00	01:00	0.01	0.01
24	☐	P2928	0.01	20:00	0.00	01:00	0.01	0.01
25	☐	P2932	0.01	20:00	0.00	01:00	0.01	0.01
26	☐	P2934	0.01	20:00	0.00	49:00	0.00	0.01
27	☐	P2936	0.00	20:00	0.00	01:00	0.00	0.00
28	☐	P2944	0.00	20:00	0.00	01:00	0.00	0.00
29	☐	P2946	0.00	20:00	0.00	01:00	0.00	0.00
30	☐	P3024	0.00	20:00	0.00	00:00	0.00	0.00
31	☐	P3026	0.01	20:00	0.00	01:00	0.00	0.01
32	☐	P3036	0.00	00:00	0.00	00:00	0.00	0.00
33	☐	P3040	0.00	20:00	0.00	01:00	0.00	0.00
34	☐	P4024	0.02	20:00	0.00	01:00	0.01	0.02
35	☐	P4026	0.03	20:00	0.00	01:00	0.01	0.02
36	☐	P3028	0.00	00:00	0.00	00:00	0.00	0.00
37	☐	P2888	0.00	20:00	0.00	01:00	0.00	0.00
38	☐	P2890	0.01	116:00	0.00	265:00	0.00	0.01
39	☐	P2902	0.01	116:00	0.00	265:00	0.00	0.01
40	☐	P2906	0.01	116:00	0.00	265:00	0.01	0.01
41	☐	P2908	0.01	20:00	0.00	01:00	0.00	0.01
42	☐	P2916	0.01	116:00	0.00	265:00	0.01	0.01
43	☐	P2918	0.00	116:00	0.00	265:00	0.00	0.00
44	☐	P2930	0.01	20:00	0.00	01:00	0.00	0.01
45	☐	P2938	0.00	20:00	0.00	01:00	0.00	0.00
46	☐	P2940	0.00	44:00	0.00	25:00	0.00	0.00
47	☐	P2942	0.00	116:00	0.00	265:00	0.00	0.00
48	☐	P3030	0.00	20:00	0.00	00:00	0.00	0.00
49	☐	P3032	0.00	20:00	0.00	00:00	0.00	0.00
50	☐	P3034	0.01	20:00	0.00	01:00	0.00	0.01
51	☐	P3038	0.00	20:00	0.00	01:00	0.00	0.00
52	☐	P4028	0.01	20:00	0.00	01:00	0.00	0.01

970 Mapleview Phase 1 2020MDD Scenario Demand

		ID	Max.Value (L/s)	Max.Time (hrs.)	Min.Value (L/s)	Min.Time (hrs.)	Average (L/s)	Difference (L/s)
1	☐	B05	0.20	20:00	0.03	01:00	0.10	0.16
2	☐	J-263	0.00	00:00	0.00	00:00	0.00	0.00
3	☐	J-262	0.00	00:00	0.00	00:00	0.00	0.00
4	☐	J-245	0.00	00:00	0.00	00:00	0.00	0.00
5	☐	J-246	0.08	20:00	0.01	01:00	0.04	0.07
6	☐	J-247	0.16	20:00	0.03	01:00	0.08	0.13
7	☐	J-249	0.12	20:00	0.02	01:00	0.06	0.10
8	☐	J-252	0.14	20:00	0.02	01:00	0.07	0.11
9	☐	J-253	0.22	20:00	0.04	01:00	0.11	0.18
10	☐	J-290	0.00	00:00	0.00	00:00	0.00	0.00
11	☐	J-289	0.06	20:00	0.01	01:00	0.03	0.05
12	☐	J-250	0.18	20:00	0.03	01:00	0.09	0.15
13	☐	J-251	0.12	20:00	0.02	01:00	0.06	0.10
14	☐	J-242	0.16	20:00	0.03	01:00	0.08	0.13
15	☐	J-243	0.08	20:00	0.01	01:00	0.04	0.07
16	☐	J-244	0.08	20:00	0.01	01:00	0.04	0.07
17	☐	J-256	0.18	20:00	0.03	01:00	0.09	0.15
18	☐	J-260	0.26	20:00	0.04	01:00	0.13	0.21
19	☐	J-255	0.20	20:00	0.03	01:00	0.10	0.16
20	☐	J-254	0.20	20:00	0.03	01:00	0.10	0.16
21	☐	J-257	0.30	20:00	0.05	01:00	0.15	0.25
22	☐	J-296	0.24	20:00	0.04	01:00	0.12	0.20
23	☐	J-297	0.18	20:00	0.03	01:00	0.09	0.15
24	☐	J-298	0.16	20:00	0.03	01:00	0.08	0.13
25	☐	J-302	0.16	20:00	0.03	01:00	0.08	0.13
26	☐	J-304	0.00	00:00	0.00	00:00	0.00	0.00
27	☐	J1110	0.00	00:00	0.00	00:00	0.00	0.00
28	☐	J1112	0.00	00:00	0.00	00:00	0.00	0.00
29	☐	J1114	0.00	00:00	0.00	00:00	0.00	0.00
30	☐	J-328	0.09	00:00	0.09	00:00	0.09	0.00
31	☐	J-329	0.02	00:00	0.02	00:00	0.02	0.00
32	☐	J-330	0.02	00:00	0.02	00:00	0.02	0.00
33	☐	J-241	0.06	20:00	0.01	01:00	0.03	0.05
34	☐	J-240	0.04	20:00	0.01	01:00	0.02	0.03
35	☐	J-258	0.00	00:00	0.00	00:00	0.00	0.00
36	☐	J-294	0.00	00:00	0.00	00:00	0.00	0.00
37	☐	J-261	0.30	20:00	0.05	01:00	0.15	0.25
38	☐	J-259	0.26	20:00	0.04	01:00	0.13	0.21
39	☐	J-295	0.00	00:00	0.00	00:00	0.00	0.00

	ID	Max.Value (L/s)	Max.Time (hrs.)	Min.Value (L/s)	Min.Time (hrs.)	Average (L/s)	Difference (L/s)
1	ANNEX_12503	0.06	260:00	0.01	217:00	0.03	0.05
2	ANNEX_12112	1.15	44:00	0.19	73:00	0.59	0.96
3	ANNEX_12112A	4.73	44:00	0.79	73:00	2.45	3.93
4	ANNEX_12112B	4.57	44:00	0.77	73:00	2.37	3.80
5	ANNEX_12112C	4.57	44:00	0.77	73:00	2.37	3.80
6	ANNEX_12112D	2.92	44:00	0.49	73:00	1.51	2.42
7	ANNEX_12112E	1.69	44:00	0.27	73:00	0.86	1.41
8	ANNEX_12111A	0.13	44:00	0.02	73:00	0.07	0.11
9	P2888	0.38	44:00	0.01	73:00	0.17	0.37
10	P2892	0.13	140:00	0.02	01:00	0.07	0.11
11	P2894	0.00	00:00	0.00	00:00	0.00	0.00
12	P2896	0.75	44:00	0.12	73:00	0.38	0.64
13	P2898	0.35	44:00	0.05	73:00	0.18	0.30
14	P2900	0.21	140:00	0.04	49:00	0.11	0.17
15	P2904	0.60	44:00	0.06	73:00	0.29	0.54
16	P2908	0.76	44:00	0.07	73:00	0.37	0.69
17	P2910	1.03	44:00	0.14	73:00	0.52	0.90
18	P2912	1.63	44:00	0.25	73:00	0.83	1.38
19	P2914	1.06	44:00	0.12	73:00	0.52	0.94
20	P2920	0.17	44:00	0.01	73:00	0.08	0.16
21	P2922	0.43	44:00	0.05	73:00	0.21	0.38
22	P2924	0.20	44:00	0.03	73:00	0.10	0.18
23	P2926	0.38	44:00	0.06	73:00	0.20	0.32
24	P2928	0.90	44:00	0.11	73:00	0.45	0.79
25	P2932	0.32	44:00	0.05	265:00	0.16	0.27
26	P2934	0.34	44:00	0.07	265:00	0.18	0.27
27	P2936	0.18	44:00	0.03	73:00	0.09	0.15
28	P2938	0.17	44:00	0.03	265:00	0.09	0.14
29	P2940	0.22	44:00	0.04	01:00	0.11	0.18
30	P2944	0.10	44:00	0.01	73:00	0.05	0.09
31	P2946	0.02	44:00	0.00	01:00	0.01	0.02
32	ANNEX_12112F	4.73	44:00	0.79	73:00	2.45	3.93
33	ANNEX_12112G	4.57	44:00	0.77	73:00	2.37	3.80
34	P3024	0.01	44:00	0.00	01:00	0.00	0.01
35	P3026	0.02	44:00	0.00	73:00	0.01	0.01
36	P3028	0.00	00:00	0.00	00:00	0.00	0.00
37	P3030	0.00	69:00	0.00	01:00	0.00	0.00
38	P3032	0.02	44:00	0.00	73:00	0.01	0.02
39	P3034	0.02	44:00	0.00	73:00	0.01	0.02
40	P3036	0.00	00:00	0.00	00:00	0.00	0.00
41	P3038	0.18	44:00	0.03	73:00	0.09	0.15
42	P3040	0.13	44:00	0.02	73:00	0.07	0.11
43	P4024	1.15	44:00	0.21	73:00	0.61	0.94
44	P4026	1.65	44:00	0.27	73:00	0.85	1.38
45	P4028	0.78	44:00	0.09	73:00	0.39	0.69
46	P2890	0.30	44:00	0.01	73:00	0.14	0.28
47	P2902	0.62	44:00	0.01	73:00	0.28	0.61
48	P2906	0.58	44:00	0.00	73:00	0.26	0.58
49	P2916	0.08	140:00	0.03	150:00	0.05	0.05
50	P2918	0.22	44:00	0.01	73:00	0.10	0.21
51	P2930	0.31	44:00	0.05	265:00	0.15	0.26
52	P2942	0.00	69:00	0.00	01:00	0.00	0.00

970 Mapleview Phase 1 2020MDD Scenario Head

		ID	Max.Value (m)	Max.Time (hrs.)	Min.Value (m)	Min.Time (hrs.)	Average (m)	Difference (m)
1	☐	B05	310.74	02:00	302.11	141:00	308.03	8.63
2	☐	J-263	310.74	02:00	302.12	141:00	308.03	8.62
3	☐	J-262	310.74	02:00	302.11	141:00	308.03	8.62
4	☐	J-245	310.74	02:00	302.11	141:00	308.03	8.63
5	☐	J-246	310.74	02:00	302.11	141:00	308.03	8.63
6	☐	J-247	310.74	02:00	302.11	141:00	308.03	8.63
7	☐	J-249	310.74	02:00	302.11	141:00	308.03	8.63
8	☐	J-252	310.74	02:00	302.11	141:00	308.03	8.63
9	☐	J-253	310.74	02:00	302.11	141:00	308.03	8.63
10	☐	J-290	310.74	02:00	302.11	141:00	308.03	8.63
11	☐	J-289	310.74	02:00	302.11	141:00	308.03	8.63
12	☐	J-250	310.74	02:00	302.11	141:00	308.03	8.63
13	☐	J-251	310.74	02:00	302.11	141:00	308.03	8.63
14	☐	J-242	310.74	02:00	302.11	141:00	308.03	8.63
15	☐	J-243	310.74	02:00	302.11	141:00	308.03	8.63
16	☐	J-244	310.74	02:00	302.11	141:00	308.03	8.63
17	☐	J-256	310.74	02:00	302.11	141:00	308.03	8.63
18	☐	J-260	310.74	02:00	302.11	141:00	308.03	8.63
19	☐	J-255	310.74	02:00	302.11	141:00	308.03	8.63
20	☐	J-254	310.74	02:00	302.11	141:00	308.03	8.63
21	☐	J-257	310.74	02:00	302.11	141:00	308.03	8.63
22	☐	J-296	310.74	02:00	302.11	141:00	308.03	8.63
23	☐	J-297	310.74	02:00	302.11	141:00	308.03	8.63
24	☐	J-298	310.74	02:00	302.11	141:00	308.03	8.63
25	☐	J-302	310.74	02:00	302.12	141:00	308.03	8.62
26	☐	J-304	310.74	02:00	302.11	141:00	308.03	8.62
27	☐	J1110	310.74	02:00	302.11	141:00	308.03	8.63
28	☐	J1112	310.74	02:00	302.11	141:00	308.03	8.63
29	☐	J1114	310.74	02:00	302.11	141:00	308.03	8.63
30	☐	J-328	310.74	02:00	302.11	141:00	308.03	8.63
31	☐	J-329	310.74	02:00	302.11	141:00	308.03	8.63
32	☐	J-330	310.74	02:00	302.11	141:00	308.03	8.63
33	☐	J-241	310.74	02:00	302.11	141:00	308.03	8.63
34	☐	J-240	310.74	02:00	302.11	141:00	308.03	8.63
35	☐	J-258	310.74	02:00	302.11	141:00	308.03	8.63
36	☐	J-294	310.74	02:00	302.11	141:00	308.03	8.63
37	☐	J-261	310.74	02:00	302.11	141:00	308.03	8.63
38	☐	J-259	310.74	02:00	302.11	141:00	308.03	8.63
39	☐	J-295	310.74	02:00	302.11	141:00	308.03	8.63

	ID	Max.Value (m/k-m)	Max.Time (hrs.)	Min.Value (m/k-m)	Min.Time (hrs.)	Average (m/k-m)	Difference (m/k-m)
1	ANNEX_12503	0.00	13:00	0.00	00:00	0.00	0.00
2	ANNEX_12112	0.00	20:00	0.00	00:00	0.00	0.00
3	ANNEX_12112A	0.03	20:00	0.00	49:00	0.01	0.03
4	ANNEX_12112B	0.02	20:00	0.00	01:00	0.01	0.02
5	ANNEX_12112C	0.02	20:00	0.00	145:00	0.01	0.02
6	ANNEX_12112D	0.01	44:00	0.00	25:00	0.00	0.01
7	ANNEX_12112E	0.00	20:00	0.00	01:00	0.00	0.00
8	ANNEX_12111A	0.00	279:00	0.00	00:00	0.00	0.00
9	P2888	0.00	20:00	0.00	01:00	0.00	0.00
10	P2892	0.00	09:00	0.00	00:00	0.00	0.00
11	P2894	0.00	00:00	0.00	00:00	0.00	0.00
12	P2896	0.01	212:00	0.00	01:00	0.00	0.01
13	P2898	0.00	44:00	0.00	01:00	0.00	0.00
14	P2900	0.00	20:00	0.00	00:00	0.00	0.00
15	P2904	0.00	20:00	0.00	01:00	0.00	0.00
16	P2908	0.01	20:00	0.00	01:00	0.00	0.01
17	P2910	0.01	44:00	0.00	01:00	0.00	0.01
18	P2912	0.01	20:00	0.00	02:00	0.00	0.01
19	P2914	0.00	20:00	0.00	01:00	0.00	0.00
20	P2920	0.00	20:00	0.00	00:00	0.00	0.00
21	P2922	0.01	44:00	0.00	01:00	0.00	0.01
22	P2924	0.00	20:00	0.00	01:00	0.00	0.00
23	P2926	0.01	44:00	0.00	02:00	0.00	0.01
24	P2928	0.01	44:00	0.00	01:00	0.00	0.01
25	P2932	0.01	92:00	0.00	121:00	0.00	0.01
26	P2934	0.00	19:00	0.00	01:00	0.00	0.00
27	P2936	0.00	19:00	0.00	00:00	0.00	0.00
28	P2938	0.00	20:00	0.00	01:00	0.00	0.00
29	P2940	0.00	92:00	0.00	02:00	0.00	0.00
30	P2944	0.00	20:00	0.00	00:00	0.00	0.00
31	P2946	0.00	14:00	0.00	00:00	0.00	0.00
32	ANNEX_12112F	0.03	44:00	0.00	25:00	0.01	0.03
33	ANNEX_12112G	0.02	20:00	0.00	01:00	0.01	0.02
34	P3024	0.00	21:00	0.00	01:00	0.00	0.00
35	P3026	0.01	20:00	0.00	01:00	0.00	0.01
36	P3028	0.00	00:00	0.00	00:00	0.00	0.00
37	P3030	0.00	20:00	0.00	00:00	0.00	0.00
38	P3032	0.01	212:00	0.00	25:00	0.00	0.01
39	P3034	0.01	20:00	0.00	01:00	0.00	0.01
40	P3036	0.00	00:00	0.00	00:00	0.00	0.00
41	P3038	0.00	10:00	0.00	00:00	0.00	0.00
42	P3040	0.00	04:00	0.00	00:00	0.00	0.00
43	P4024	0.01	20:00	0.00	01:00	0.00	0.01
44	P4026	0.01	20:00	0.00	01:00	0.00	0.01
45	P4028	0.01	20:00	0.00	01:00	0.00	0.01
46	P2890	0.00	20:00	0.00	01:00	0.00	0.00
47	P2902	0.01	20:00	0.00	00:00	0.00	0.01
48	P2906	0.00	20:00	0.00	01:00	0.00	0.00
49	P2916	0.00	21:00	0.00	04:00	0.00	0.00
50	P2918	0.00	44:00	0.00	01:00	0.00	0.00
51	P2930	0.01	20:00	0.00	193:00	0.00	0.01
52	P2942	0.00	00:00	0.00	00:00	0.00	0.00

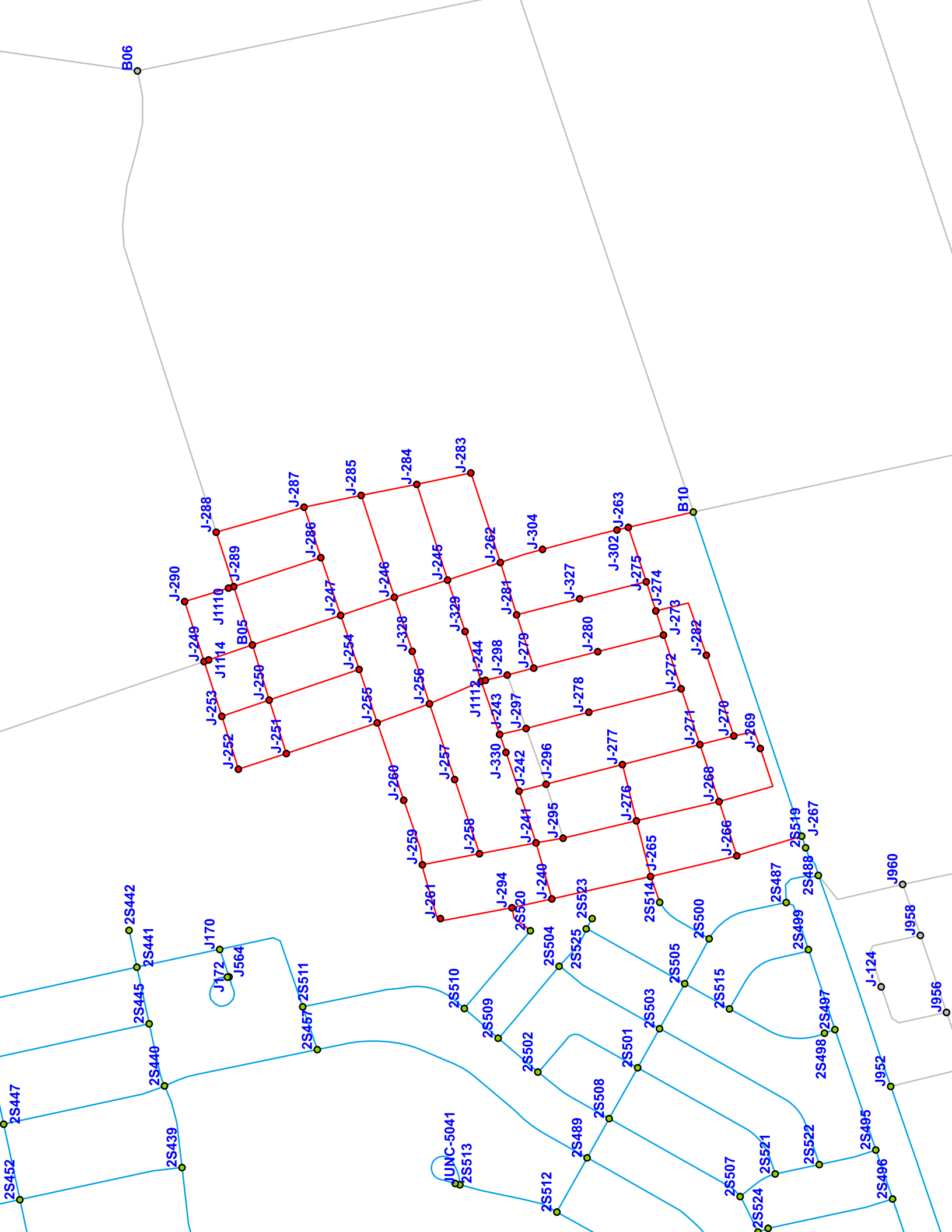
970 Mapleview Phase 1 2020MDD Scenario Pressure

		ID	Max.Value (kPa)	Max.Time (hrs.)	Min.Value (kPa)	Min.Time (hrs.)	Average (kPa)	Difference (kPa)
1	☐	J-242	438.57	02:00	354.02	141:00	412.05	84.55
2	☐	J-330	440.44	02:00	355.89	141:00	413.91	84.55
3	☐	J-296	441.02	02:00	356.47	141:00	414.50	84.56
4	☐	J-243	441.81	02:00	357.26	141:00	415.28	84.55
5	☐	J-290	443.28	02:00	358.74	141:00	416.76	84.54
6	☐	J-297	443.47	02:00	358.92	141:00	416.95	84.55
7	☐	J-298	444.55	02:00	360.01	141:00	418.03	84.54
8	☐	J1112	446.71	02:00	362.17	141:00	420.19	84.54
9	☐	J-244	447.10	02:00	362.56	141:00	420.58	84.54
10	☐	J-241	447.49	02:00	362.94	141:00	420.96	84.56
11	☐	J1110	448.47	02:00	363.93	141:00	421.95	84.54
12	☐	J-289	449.06	02:00	364.52	141:00	422.54	84.54
13	☐	J-295	451.21	02:00	366.66	141:00	424.69	84.56
14	☐	J-329	451.22	02:00	366.68	141:00	424.70	84.53
15	☐	J-240	454.45	02:00	369.89	141:00	427.92	84.56
16	☐	J-245	455.43	02:00	370.90	141:00	428.91	84.53
17	☐	J-249	456.80	02:00	372.26	141:00	430.28	84.54
18	☐	J-294	456.90	02:00	372.34	141:00	430.37	84.56
19	☐	J-258	457.00	02:00	372.44	141:00	430.47	84.55
20	☐	J1114	457.00	02:00	372.46	141:00	430.48	84.54
21	☐	J-257	457.19	02:00	372.64	141:00	430.67	84.55
22	☐	J-262	458.37	02:00	373.86	141:00	431.86	84.51
23	☐	B05	458.96	02:00	374.42	141:00	432.44	84.54
24	☐	J-246	459.06	02:00	374.52	141:00	432.53	84.53
25	☐	J-328	460.33	02:00	375.79	141:00	433.81	84.54
26	☐	J-256	461.50	02:00	376.96	141:00	434.98	84.54
27	☐	J-261	461.90	02:00	377.33	141:00	435.37	84.56
28	☐	J-247	462.68	02:00	378.14	141:00	436.16	84.54
29	☐	J-304	464.45	02:00	379.95	141:00	437.94	84.50
30	☐	J-259	465.72	02:00	381.16	141:00	439.19	84.56
31	☐	J-253	470.32	02:00	385.78	141:00	443.80	84.54
32	☐	J-260	470.52	02:00	385.96	141:00	443.99	84.56
33	☐	J-254	470.91	02:00	386.37	141:00	444.39	84.54
34	☐	J-250	471.40	02:00	386.86	141:00	444.88	84.54
35	☐	J-255	474.64	02:00	390.09	141:00	448.11	84.54
36	☐	J-302	476.89	02:00	392.42	141:00	450.39	84.47
37	☐	J-263	477.77	02:00	393.31	141:00	451.27	84.47
38	☐	J-251	479.24	02:00	394.70	141:00	452.72	84.54
39	☐	J-252	481.00	02:00	396.46	141:00	454.48	84.54

	ID	Max.Value (m/s)	Max.Time (hrs.)	Min.Value (m/s)	Min.Time (hrs.)	Average (m/s)	Difference (m/s)
1	ANNEX_12503	0.00	260:00	0.00	217:00	0.00	0.00
2	ANNEX_12112	0.02	44:00	0.00	73:00	0.01	0.01
3	ANNEX_12112A	0.07	44:00	0.01	73:00	0.03	0.06
4	ANNEX_12112B	0.06	44:00	0.01	73:00	0.03	0.05
5	ANNEX_12112C	0.06	44:00	0.01	73:00	0.03	0.05
6	ANNEX_12112D	0.04	44:00	0.01	73:00	0.02	0.03
7	ANNEX_12112E	0.02	44:00	0.00	73:00	0.01	0.02
8	ANNEX_12111A	0.00	44:00	0.00	73:00	0.00	0.00
9	P2888	0.01	44:00	0.00	73:00	0.01	0.01
10	P2892	0.00	140:00	0.00	01:00	0.00	0.00
11	P2894	0.00	00:00	0.00	00:00	0.00	0.00
12	P2896	0.02	44:00	0.00	73:00	0.01	0.02
13	P2898	0.01	44:00	0.00	73:00	0.01	0.01
14	P2900	0.01	140:00	0.00	49:00	0.00	0.01
15	P2904	0.02	44:00	0.00	73:00	0.01	0.02
16	P2908	0.02	44:00	0.00	73:00	0.01	0.02
17	P2910	0.03	44:00	0.00	73:00	0.02	0.03
18	P2912	0.03	44:00	0.01	73:00	0.02	0.03
19	P2914	0.02	44:00	0.00	73:00	0.01	0.02
20	P2920	0.01	44:00	0.00	73:00	0.00	0.01
21	P2922	0.02	44:00	0.00	73:00	0.01	0.02
22	P2924	0.01	44:00	0.00	73:00	0.01	0.01
23	P2926	0.02	44:00	0.00	73:00	0.01	0.02
24	P2928	0.03	44:00	0.00	73:00	0.01	0.03
25	P2932	0.02	44:00	0.00	265:00	0.01	0.02
26	P2934	0.01	44:00	0.00	265:00	0.00	0.01
27	P2936	0.01	44:00	0.00	73:00	0.00	0.00
28	P2938	0.01	44:00	0.00	265:00	0.01	0.01
29	P2940	0.01	44:00	0.00	01:00	0.01	0.01
30	P2944	0.01	44:00	0.00	73:00	0.00	0.01
31	P2946	0.00	44:00	0.00	01:00	0.00	0.00
32	ANNEX_12112F	0.07	44:00	0.01	73:00	0.03	0.06
33	ANNEX_12112G	0.06	44:00	0.01	73:00	0.03	0.05
34	P3024	0.00	44:00	0.00	01:00	0.00	0.00
35	P3026	0.01	44:00	0.00	73:00	0.00	0.01
36	P3028	0.00	00:00	0.00	00:00	0.00	0.00
37	P3030	0.00	69:00	0.00	01:00	0.00	0.00
38	P3032	0.01	44:00	0.00	73:00	0.00	0.01
39	P3034	0.01	44:00	0.00	73:00	0.01	0.01
40	P3036	0.00	00:00	0.00	00:00	0.00	0.00
41	P3038	0.01	44:00	0.00	73:00	0.00	0.00
42	P3040	0.00	44:00	0.00	73:00	0.00	0.00
43	P4024	0.02	44:00	0.00	73:00	0.01	0.02
44	P4026	0.03	44:00	0.01	73:00	0.02	0.03
45	P4028	0.02	44:00	0.00	73:00	0.01	0.02
46	P2890	0.01	44:00	0.00	73:00	0.00	0.01
47	P2902	0.02	44:00	0.00	73:00	0.01	0.02
48	P2906	0.02	44:00	0.00	73:00	0.01	0.02
49	P2916	0.00	140:00	0.00	150:00	0.00	0.00
50	P2918	0.01	44:00	0.00	73:00	0.01	0.01
51	P2930	0.02	44:00	0.00	49:00	0.01	0.01
52	P2942	0.00	69:00	0.00	01:00	0.00	0.00

		ID	Static Demand (L/s)	Static Pressure (kPa)	Static Head (m)	Fire-Flow Demand (L/s)	Residual Pressure (kPa)	Hydrant Available Flow (L/s)	Hydrant Pressure at Available Flow (kPa)	Critical Pipe ID at Available Flow	Critical Pipe Velocity at Available Flow (m/s)
1	☐	B05	0.22	402.78	305.00	100.00	321.87	196.40	137.86	ANNEX_12112	2.29
2	☐	J-240	0.09	398.27	305.00	100.00	302.55	176.08	137.86	P2902	3.10
3	☐	J-241	0.17	391.31	305.00	100.00	304.50	183.81	137.86	P2890	2.07
4	☐	J-242	0.13	382.39	305.00	155.00	180.97	172.88	137.86	P2888	2.85
5	☐	J-243	0.16	385.63	305.00	155.00	190.91	177.52	137.86	P2910	3.39
6	☐	J-244	0.24	390.92	305.00	183.00	175.31	200.40	137.86	P2912	1.80
7	☐	J-245	0.00	399.26	305.00	200.00	166.22	213.26	137.86	ANNEX_12112C	2.33
8	☐	J-246	0.08	402.88	305.00	200.00	160.86	210.49	137.86	ANNEX_12112D	2.08
9	☐	J-247	0.21	406.50	305.00	100.00	330.73	205.74	137.86	ANNEX_12112E	2.50
10	☐	J-249	0.13	400.62	305.00	100.00	314.91	188.87	137.86	ANNEX_12111A	2.64
11	☐	J-250	0.17	415.22	305.00	100.00	318.47	181.44	137.86	P2896	3.53
12	☐	J-251	0.09	423.06	305.00	100.00	306.60	165.45	137.86	P2898	3.71
13	☐	J-252	0.09	424.82	305.00	100.00	269.55	140.93	137.86	P2892	4.37
14	☐	J-253	0.21	414.14	305.00	100.00	279.87	149.98	137.86	P2900	4.57
15	☐	J-254	0.30	414.73	305.00	100.00	302.06	166.08	137.86	P2926	3.63
16	☐	J-255	0.22	418.45	305.00	100.00	317.97	178.67	137.86	P2932	3.43
17	☐	J-256	0.22	405.33	305.00	200.00	153.77	207.19	137.86	P2934	1.59
18	☐	J-257	0.34	401.01	305.00	155.00	198.21	179.62	137.86	P2928	3.17
19	☐	J-258	0.28	400.81	305.00	100.00	310.97	184.01	137.86	P2890	2.61
20	☐	J-259	0.21	409.53	305.00	100.00	282.14	153.12	137.86	P2930	3.77
21	☐	J-260	0.17	414.33	305.00	100.00	242.95	130.68	137.86	P2922	3.70
22	☐	J-261	0.17	405.71	305.00	100.00	242.54	131.99	137.86	P2916	3.77
23	☐	J-262	0.00	402.22	305.01	155.00	259.66	219.35	137.86	ANNEX_12112B	2.42
24	☐	J-263	0.00	421.66	305.01	283.00	45.74	242.12	137.86	ANNEX_12112A	2.74
25	☐	J-289	0.04	392.88	305.00	100.00	306.15	184.37	137.86	ANNEX_12503	2.59
26	☐	J-290	0.04	387.10	305.00	100.00	260.09	145.98	137.86	P3036	4.55
27	☐	J-294	0.21	400.72	305.00	100.00	304.18	176.19	137.86	P2906	2.69
28	☐	J-295	0.04	395.03	305.00	100.00	206.44	91.43	234.51	P2942	5.00
29	☐	J-296	0.04	384.84	305.00	100.00	195.94	94.68	213.68	P2940	5.00
30	☐	J-297	0.08	387.29	305.00	100.00	203.17	94.63	220.74	P2938	5.00
31	☐	J-298	0.04	388.37	305.00	100.00	292.13	159.39	169.12	P3038	5.00
32	☐	J-302	0.00	420.77	305.01	283.00	40.97	240.32	137.86	ANNEX_12112F	2.71
33	☐	J-304	0.00	408.31	305.01	283.00	3.80	226.30	137.86	ANNEX_12112G	2.52
34	☐	J-328	0.33	404.15	305.00	200.00	148.60	204.98	137.86	P4024	2.25
35	☐	J-329	0.28	395.04	305.00	200.00	143.45	202.75	137.86	P4026	2.44
36	☐	J-330	0.00	384.25	305.00	155.00	184.35	174.22	137.86	P4028	3.15

Ultimate Buildout


B06
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970 Mapleview Ultimate Buildout 2020ADD Scenario Demand

		ID	Max.Value (L/s)	Max.Time (hrs.)	Min.Value (L/s)	Min.Time (hrs.)	Average (L/s)	Difference (L/s)
1	☐	J-263	1.61	20:00	0.28	01:00	0.82	1.33
2	☐	J-302	0.00	00:00	0.00	00:00	0.00	0.00
3	☐	J-262	0.04	20:00	0.01	01:00	0.02	0.03
4	☐	J-304	0.10	20:00	0.02	01:00	0.05	0.08
5	☐	B05	0.20	20:00	0.03	01:00	0.10	0.16
6	☐	J-245	0.00	00:00	0.00	00:00	0.00	0.00
7	☐	J-246	0.06	20:00	0.01	01:00	0.03	0.05
8	☐	J-247	0.18	20:00	0.03	01:00	0.09	0.15
9	☐	J-252	0.08	20:00	0.01	01:00	0.04	0.07
10	☐	J-253	0.18	20:00	0.03	01:00	0.09	0.15
11	☐	J-289	0.04	20:00	0.01	01:00	0.02	0.03
12	☐	J-250	0.16	20:00	0.03	01:00	0.08	0.13
13	☐	J-251	0.08	20:00	0.01	01:00	0.04	0.07
14	☐	J-244	0.22	20:00	0.04	01:00	0.11	0.18
15	☐	J-256	0.20	20:00	0.03	01:00	0.10	0.16
16	☐	J-260	0.16	20:00	0.03	01:00	0.08	0.13
17	☐	J-255	0.20	20:00	0.03	01:00	0.10	0.16
18	☐	J-254	0.26	20:00	0.04	01:00	0.13	0.21
19	☐	J-257	0.30	20:00	0.05	01:00	0.15	0.25
20	☐	J1110	0.00	00:00	0.00	00:00	0.00	0.00
21	☐	J1114	0.00	00:00	0.00	00:00	0.00	0.00
22	☐	J-328	0.30	20:00	0.05	01:00	0.15	0.25
23	☐	J-329	0.26	20:00	0.04	01:00	0.13	0.21
24	☐	J-249	0.12	20:00	0.02	01:00	0.06	0.10
25	☐	J-290	0.04	20:00	0.01	01:00	0.02	0.03
26	☐	J-241	0.16	20:00	0.03	01:00	0.08	0.13
27	☐	J-240	0.08	20:00	0.01	01:00	0.04	0.07
28	☐	J-258	0.24	20:00	0.04	01:00	0.12	0.20
29	☐	J-294	0.18	20:00	0.03	01:00	0.09	0.15
30	☐	J-242	0.12	20:00	0.02	01:00	0.06	0.10
31	☐	J-243	0.14	20:00	0.02	01:00	0.07	0.11
32	☐	J-261	0.16	20:00	0.03	01:00	0.08	0.13
33	☐	J-259	0.18	20:00	0.03	01:00	0.09	0.15
34	☐	J-295	0.04	20:00	0.01	01:00	0.02	0.03
35	☐	J-296	0.04	20:00	0.01	01:00	0.02	0.03
36	☐	J-297	0.06	20:00	0.01	01:00	0.03	0.05
37	☐	J-298	0.04	20:00	0.01	01:00	0.02	0.03
38	☐	J1112	0.00	00:00	0.00	00:00	0.00	0.00
39	☐	J-330	0.00	00:00	0.00	00:00	0.00	0.00
40	☐	J-286	0.48	20:00	0.08	01:00	0.24	0.39
41	☐	J-283	0.36	20:00	0.06	01:00	0.18	0.30
42	☐	J-284	0.40	20:00	0.07	01:00	0.20	0.33
43	☐	J-285	0.38	20:00	0.06	01:00	0.19	0.31
44	☐	J-287	0.16	20:00	0.03	01:00	0.08	0.13
45	☐	J-288	0.12	20:00	0.02	01:00	0.06	0.10
46	☐	J-279	0.26	20:00	0.04	01:00	0.13	0.21
47	☐	J-281	0.30	20:00	0.05	01:00	0.15	0.25
48	☐	J-280	0.18	20:00	0.03	01:00	0.09	0.15
49	☐	J-327	0.13	00:00	0.13	00:00	0.13	0.00
50	☐	J-274	0.00	00:00	0.00	00:00	0.00	0.00

970 Mapleview Ultimate Buildout 2020ADD Scenario Demand

		ID	Max.Value (L/s)	Max.Time (hrs.)	Min.Value (L/s)	Min.Time (hrs.)	Average (L/s)	Difference (L/s)
51	☐	J-273	0.32	20:00	0.05	01:00	0.16	0.26
52	☐	J-275	0.14	20:00	0.02	01:00	0.07	0.11
53	☐	J-265	0.40	20:00	0.07	01:00	0.20	0.33
54	☐	J-277	0.40	20:00	0.07	01:00	0.20	0.33
55	☐	J-276	0.28	20:00	0.05	01:00	0.14	0.23
56	☐	J-278	0.44	20:00	0.07	01:00	0.22	0.36
57	☐	J-266	0.49	20:00	0.08	01:00	0.25	0.41
58	☐	J-271	0.44	20:00	0.07	01:00	0.22	0.36
59	☐	J-270	0.10	20:00	0.02	01:00	0.05	0.08
60	☐	J-268	0.32	20:00	0.05	01:00	0.16	0.26
61	☐	J-272	0.44	20:00	0.07	01:00	0.22	0.36
62	☐	J-282	0.30	20:00	0.05	01:00	0.15	0.25
63	☐	J-269	0.18	20:00	0.03	01:00	0.09	0.15

970 Mapleview Ultimate Buildout 2020ADD Scenario Flow

		ID	Max.Value (L/s)	Max.Time (hrs.)	Min.Value (L/s)	Min.Time (hrs.)	Average (L/s)	Difference (L/s)
1	☐	ANNEX_12112A	5.23	20:00	0.92	01:00	2.72	4.31
2	☐	ANNEX_12112F	2.71	20:00	0.48	01:00	1.41	2.22
3	☐	ANNEX_12112G	2.71	20:00	0.48	01:00	1.41	2.22
4	☐	ANNEX_12112B	2.61	20:00	0.46	01:00	1.36	2.14
5	☐	ANNEX_12112C	1.95	20:00	0.31	01:00	0.99	1.63
6	☐	ANNEX_12503	0.29	68:00	0.05	25:00	0.15	0.24
7	☐	ANNEX_12112	0.87	20:00	0.15	01:00	0.45	0.73
8	☐	ANNEX_12112D	1.64	20:00	0.27	01:00	0.84	1.37
9	☐	ANNEX_12112E	1.58	20:00	0.27	01:00	0.81	1.31
10	☐	ANNEX_12111A	0.13	20:00	0.02	01:00	0.07	0.11
11	☐	P2892	0.08	20:00	0.01	73:00	0.04	0.07
12	☐	P2894	0.04	44:00	0.01	01:00	0.02	0.03
13	☐	P2896	0.26	20:00	0.04	01:00	0.13	0.22
14	☐	P2898	0.01	20:00	0.00	00:00	0.00	0.01
15	☐	P2900	0.17	44:00	0.03	25:00	0.09	0.14
16	☐	P2904	0.82	92:00	0.15	265:00	0.43	0.66
17	☐	P2910	0.72	236:00	0.14	265:00	0.38	0.58
18	☐	P2912	0.36	236:00	0.07	25:00	0.19	0.29
19	☐	P2914	0.64	92:00	0.11	25:00	0.33	0.53
20	☐	P2920	0.42	92:00	0.08	265:00	0.22	0.35
21	☐	P2922	0.26	92:00	0.05	265:00	0.14	0.21
22	☐	P2924	0.18	92:00	0.03	265:00	0.09	0.15
23	☐	P2926	0.15	20:00	0.02	01:00	0.08	0.13
24	☐	P2928	0.52	92:00	0.10	265:00	0.27	0.42
25	☐	P2932	0.27	20:00	0.04	01:00	0.14	0.23
26	☐	P2934	0.59	20:00	0.09	01:00	0.30	0.50
27	☐	P2936	0.45	20:00	0.06	01:00	0.22	0.39
28	☐	P2944	0.16	92:00	0.03	265:00	0.08	0.13
29	☐	P2946	0.07	236:00	0.01	265:00	0.04	0.06
30	☐	P3024	0.00	68:00	0.00	00:00	0.00	0.00
31	☐	P3026	0.01	20:00	0.00	01:00	0.00	0.01
32	☐	P3036	0.04	20:00	0.01	01:00	0.02	0.03
33	☐	P3040	0.13	68:00	0.02	01:00	0.07	0.11
34	☐	P4024	0.35	92:00	0.06	25:00	0.18	0.28
35	☐	P4026	0.10	236:00	0.02	25:00	0.06	0.08
36	☐	P3028	0.00	92:00	0.00	00:00	0.00	0.00
37	☐	P2888	0.89	92:00	0.16	265:00	0.46	0.73
38	☐	P2890	1.12	236:00	0.20	265:00	0.58	0.91
39	☐	P2902	1.79	92:00	0.33	265:00	0.93	1.47
40	☐	P2906	0.80	332:00	0.15	265:00	0.42	0.66
41	☐	P2908	1.05	92:00	0.19	265:00	0.55	0.85
42	☐	P2916	0.70	92:00	0.13	265:00	0.36	0.57
43	☐	P2918	0.54	332:00	0.10	265:00	0.28	0.44
44	☐	P2930	0.06	20:00	0.01	01:00	0.03	0.06
45	☐	P2938	0.19	92:00	0.03	25:00	0.10	0.16
46	☐	P2940	0.28	20:00	0.05	01:00	0.14	0.23
47	☐	P2942	0.37	20:00	0.06	01:00	0.19	0.30
48	☐	P3038	0.45	20:00	0.06	01:00	0.22	0.39
49	☐	P4028	1.05	92:00	0.19	265:00	0.55	0.85
50	☐	P3010	0.37	20:00	0.06	25:00	0.19	0.31

		ID	Max.Value (L/s)	Max.Time (hrs.)	Min.Value (L/s)	Min.Time (hrs.)	Average (L/s)	Difference (L/s)
51	☐	P3012	0.05	20:00	0.01	01:00	0.03	0.04
52	☐	P3014	0.05	92:00	0.01	25:00	0.03	0.04
53	☐	P3870	0.17	20:00	0.03	01:00	0.08	0.14
54	☐	P3872	0.18	20:00	0.03	01:00	0.09	0.15
55	☐	P3874	0.19	20:00	0.03	01:00	0.10	0.16
56	☐	P2994	0.08	309:00	0.05	01:00	0.07	0.03
57	☐	P3016	0.04	92:00	0.01	25:00	0.02	0.04
58	☐	P3018	0.35	68:00	0.06	25:00	0.18	0.29
59	☐	P3020	0.41	44:00	0.07	25:00	0.21	0.34
60	☐	P3022	0.54	20:00	0.09	01:00	0.28	0.45
61	☐	ANNEX_12503A	0.16	68:00	0.03	25:00	0.08	0.13
62	☐	P2980	0.92	20:00	0.17	01:00	0.48	0.75
63	☐	P2982	0.49	20:00	0.06	01:00	0.24	0.43
64	☐	P2990	0.45	20:00	0.08	01:00	0.24	0.37
65	☐	P2992	0.29	20:00	0.02	01:00	0.14	0.27
66	☐	P2996	0.51	20:00	0.02	01:00	0.23	0.49
67	☐	P3008	0.63	20:00	0.12	01:00	0.33	0.52
68	☐	P4030	0.64	20:00	0.15	01:00	0.36	0.49
69	☐	P2962	0.14	20:00	0.00	25:00	0.06	0.14
70	☐	P2964	0.58	20:00	0.09	01:00	0.29	0.50
71	☐	P2966	0.36	236:00	0.08	25:00	0.20	0.28
72	☐	P2972	0.44	92:00	0.09	25:00	0.24	0.35
73	☐	P2950	1.07	20:00	0.18	01:00	0.55	0.89
74	☐	P2952	0.91	20:00	0.14	01:00	0.47	0.76
75	☐	P2954	2.50	236:00	0.45	265:00	1.30	2.05
76	☐	P2984	0.13	332:00	0.02	25:00	0.07	0.11
77	☐	P2986	0.32	20:00	0.06	01:00	0.16	0.26
78	☐	P2988	0.41	20:00	0.07	01:00	0.21	0.34
79	☐	P2998	0.44	92:00	0.08	25:00	0.23	0.35
80	☐	P3000	1.95	236:00	0.35	265:00	1.01	1.59
81	☐	P3002	0.11	236:00	0.02	25:00	0.06	0.09
82	☐	P3004	1.15	92:00	0.21	265:00	0.60	0.94
83	☐	P3006	0.30	20:00	0.05	01:00	0.15	0.25
84	☐	P2956	3.73	20:00	0.64	01:00	1.93	3.08
85	☐	P2958	2.33	20:00	0.41	01:00	1.21	1.91
86	☐	P2960	1.10	92:00	0.21	25:00	0.58	0.90
87	☐	P2968	0.15	92:00	0.03	25:00	0.08	0.12
88	☐	P2970	0.74	236:00	0.14	25:00	0.39	0.60
89	☐	P2974	1.25	68:00	0.23	25:00	0.65	1.02
90	☐	P2976	0.86	236:00	0.16	25:00	0.45	0.71
91	☐	P2978	0.69	92:00	0.13	25:00	0.36	0.56
92	☐	P2886	1.68	332:00	0.30	265:00	0.87	1.38

970 Mapleview Ultimate Buildout 2020ADD Scenario Head

		ID	Max.Value (m)	Max.Time (hrs.)	Min.Value (m)	Min.Time (hrs.)	Average (m)	Difference (m)
1	☐	J-263	311.17	02:00	306.58	09:00	307.99	4.59
2	☐	J-302	311.17	02:00	306.58	09:00	307.99	4.59
3	☐	J-262	311.17	02:00	306.58	09:00	307.99	4.59
4	☐	J-304	311.17	02:00	306.58	09:00	307.99	4.59
5	☐	B05	311.17	02:00	306.58	09:00	307.99	4.59
6	☐	J-245	311.17	02:00	306.58	09:00	307.99	4.59
7	☐	J-246	311.17	02:00	306.58	09:00	307.99	4.59
8	☐	J-247	311.17	02:00	306.58	09:00	307.99	4.59
9	☐	J-252	311.17	02:00	306.58	09:00	307.99	4.59
10	☐	J-253	311.17	02:00	306.58	09:00	307.99	4.59
11	☐	J-289	311.17	02:00	306.58	09:00	307.99	4.59
12	☐	J-250	311.17	02:00	306.58	09:00	307.99	4.59
13	☐	J-251	311.17	02:00	306.58	09:00	307.99	4.59
14	☐	J-244	311.17	02:00	306.58	09:00	307.99	4.59
15	☐	J-256	311.17	02:00	306.58	09:00	307.99	4.59
16	☐	J-260	311.17	02:00	306.58	09:00	307.99	4.59
17	☐	J-255	311.17	02:00	306.58	09:00	307.99	4.59
18	☐	J-254	311.17	02:00	306.58	09:00	307.99	4.59
19	☐	J-257	311.17	02:00	306.58	09:00	307.99	4.59
20	☐	J1110	311.17	02:00	306.58	09:00	307.99	4.59
21	☐	J1114	311.17	02:00	306.58	09:00	307.99	4.59
22	☐	J-328	311.17	02:00	306.58	09:00	307.99	4.59
23	☐	J-329	311.17	02:00	306.58	09:00	307.99	4.59
24	☐	J-249	311.17	02:00	306.58	09:00	307.99	4.59
25	☐	J-290	311.17	02:00	306.58	09:00	307.99	4.59
26	☐	J-241	311.17	02:00	306.58	09:00	308.00	4.59
27	☐	J-240	311.17	02:00	306.58	09:00	308.00	4.59
28	☐	J-258	311.17	02:00	306.58	09:00	307.99	4.59
29	☐	J-294	311.17	02:00	306.58	09:00	308.00	4.59
30	☐	J-242	311.17	02:00	306.58	09:00	307.99	4.59
31	☐	J-243	311.17	02:00	306.58	09:00	307.99	4.59
32	☐	J-261	311.17	02:00	306.58	09:00	308.00	4.59
33	☐	J-259	311.17	02:00	306.58	09:00	307.99	4.59
34	☐	J-295	311.17	02:00	306.58	09:00	308.00	4.59
35	☐	J-296	311.17	02:00	306.58	09:00	307.99	4.59
36	☐	J-297	311.17	02:00	306.58	09:00	307.99	4.59
37	☐	J-298	311.17	02:00	306.58	09:00	307.99	4.59
38	☐	J1112	311.17	02:00	306.58	09:00	307.99	4.59
39	☐	J-330	311.17	02:00	306.58	09:00	307.99	4.59
40	☐	J-286	311.17	02:00	306.58	09:00	307.99	4.59
41	☐	J-283	311.17	02:00	306.58	09:00	307.99	4.59
42	☐	J-284	311.17	02:00	306.58	09:00	307.99	4.59
43	☐	J-285	311.17	02:00	306.58	09:00	307.99	4.59
44	☐	J-287	311.17	02:00	306.58	09:00	307.99	4.59
45	☐	J-288	311.17	02:00	306.58	09:00	307.99	4.59
46	☐	J-279	311.17	02:00	306.58	09:00	307.99	4.59
47	☐	J-281	311.17	02:00	306.58	09:00	307.99	4.59
48	☐	J-280	311.17	02:00	306.58	09:00	307.99	4.59
49	☐	J-327	311.17	02:00	306.58	09:00	307.99	4.59
50	☐	J-274	311.17	02:00	306.58	09:00	307.99	4.59

970 Mapleview Ultimate Buildout 2020ADD Scenario Head

		ID	Max.Value (m)	Max.Time (hrs.)	Min.Value (m)	Min.Time (hrs.)	Average (m)	Difference (m)
51	☐	J-273	311.17	02:00	306.58	09:00	307.99	4.59
52	☐	J-275	311.17	02:00	306.58	09:00	307.99	4.59
53	☐	J-265	311.17	02:00	306.58	09:00	308.00	4.59
54	☐	J-277	311.17	02:00	306.58	09:00	308.00	4.59
55	☐	J-276	311.17	02:00	306.58	09:00	308.00	4.59
56	☐	J-278	311.17	02:00	306.58	09:00	307.99	4.59
57	☐	J-266	311.17	02:00	306.58	09:00	308.00	4.59
58	☐	J-271	311.17	02:00	306.58	09:00	307.99	4.59
59	☐	J-270	311.17	02:00	306.58	09:00	307.99	4.59
60	☐	J-268	311.17	02:00	306.58	09:00	308.00	4.59
61	☐	J-272	311.17	02:00	306.58	09:00	307.99	4.59
62	☐	J-282	311.17	02:00	306.58	09:00	307.99	4.59
63	☐	J-269	311.17	02:00	306.58	09:00	308.00	4.59

970 Mapleview Ultimate Buildout 2020ADD Scenario Headloss/1km

	ID	Max.Value (m/k-m)	Max.Time (hrs.)	Min.Value (m/k-m)	Min.Time (hrs.)	Average (m/k-m)	Difference (m/k-m)
1	ANNEX_12112A	0.03	44:00	0.00	01:00	0.01	0.03
2	ANNEX_12112F	0.01	20:00	0.00	01:00	0.00	0.01
3	ANNEX_12112G	0.01	44:00	0.00	01:00	0.00	0.01
4	ANNEX_12112B	0.01	20:00	0.00	01:00	0.00	0.01
5	ANNEX_12112C	0.01	20:00	0.00	74:00	0.00	0.01
6	ANNEX_12503	0.00	22:00	0.00	00:00	0.00	0.00
7	ANNEX_12112	0.00	20:00	0.00	01:00	0.00	0.00
8	ANNEX_12112D	0.00	21:00	0.00	49:00	0.00	0.00
9	ANNEX_12112E	0.00	20:00	0.00	01:00	0.00	0.00
10	ANNEX_12111A	0.00	116:00	0.00	00:00	0.00	0.00
11	P2892	0.00	03:00	0.00	00:00	0.00	0.00
12	P2894	0.00	174:00	0.00	00:00	0.00	0.00
13	P2896	0.00	44:00	0.00	00:00	0.00	0.00
14	P2898	0.00	00:00	0.00	00:00	0.00	0.00
15	P2900	0.00	68:00	0.00	00:00	0.00	0.00
16	P2904	0.01	20:00	0.00	01:00	0.00	0.01
17	P2910	0.01	20:00	0.00	01:00	0.00	0.01
18	P2912	0.00	92:00	0.00	00:00	0.00	0.00
19	P2914	0.00	44:00	0.00	00:00	0.00	0.00
20	P2920	0.01	44:00	0.00	01:00	0.00	0.01
21	P2922	0.01	20:00	0.00	02:00	0.00	0.01
22	P2924	0.00	20:00	0.00	01:00	0.00	0.00
23	P2926	0.00	20:00	0.00	01:00	0.00	0.00
24	P2928	0.00	20:00	0.00	01:00	0.00	0.00
25	P2932	0.01	20:00	0.00	193:00	0.00	0.01
26	P2934	0.00	20:00	0.00	01:00	0.00	0.00
27	P2936	0.00	07:00	0.00	00:00	0.00	0.00
28	P2944	0.00	44:00	0.00	01:00	0.00	0.00
29	P2946	0.00	44:00	0.00	00:00	0.00	0.00
30	P3024	0.00	93:00	0.00	00:00	0.00	0.00
31	P3026	0.00	68:00	0.00	00:00	0.00	0.00
32	P3036	0.00	17:00	0.00	00:00	0.00	0.00
33	P3040	0.00	44:00	0.00	00:00	0.00	0.00
34	P4024	0.00	21:00	0.00	02:00	0.00	0.00
35	P4026	0.00	04:00	0.00	00:00	0.00	0.00
36	P3028	0.00	19:00	0.00	00:00	0.00	0.00
37	P2888	0.01	68:00	0.00	25:00	0.00	0.01
38	P2890	0.02	68:00	0.00	25:00	0.01	0.01
39	P2902	0.04	20:00	0.00	49:00	0.01	0.04
40	P2906	0.01	44:00	0.00	01:00	0.00	0.01
41	P2908	0.01	20:00	0.00	193:00	0.00	0.01
42	P2916	0.03	20:00	0.00	73:00	0.01	0.03
43	P2918	0.02	164:00	0.00	25:00	0.01	0.02
44	P2930	0.00	20:00	0.00	00:00	0.00	0.00
45	P2938	0.00	20:00	0.00	01:00	0.00	0.00
46	P2940	0.01	140:00	0.00	02:00	0.00	0.01
47	P2942	0.01	20:00	0.00	49:00	0.00	0.01
48	P3038	0.00	21:00	0.00	00:00	0.00	0.00
49	P4028	0.01	92:00	0.00	73:00	0.00	0.01
50	P3010	0.00	20:00	0.00	01:00	0.00	0.00

	ID	Max.Value (m/k-m)	Max.Time (hrs.)	Min.Value (m/k-m)	Min.Time (hrs.)	Average (m/k-m)	Difference (m/k-m)
51	P3012	0.00	15:00	0.00	00:00	0.00	0.00
52	P3014	0.00	19:00	0.00	00:00	0.00	0.00
53	P3870	0.00	20:00	0.00	01:00	0.00	0.00
54	P3872	0.00	92:00	0.00	02:00	0.00	0.00
55	P3874	0.00	20:00	0.00	01:00	0.00	0.00
56	P2994	0.00	01:00	0.00	00:00	0.00	0.00
57	P3016	0.00	20:00	0.00	00:00	0.00	0.00
58	P3018	0.00	20:00	0.00	01:00	0.00	0.00
59	P3020	0.00	21:00	0.00	73:00	0.00	0.00
60	P3022	0.00	44:00	0.00	01:00	0.00	0.00
61	ANNEX_12503A	0.00	17:00	0.00	00:00	0.00	0.00
62	P2980	0.01	68:00	0.00	01:00	0.00	0.01
63	P2982	0.00	20:00	0.00	01:00	0.00	0.00
64	P2990	0.00	44:00	0.00	73:00	0.00	0.00
65	P2992	0.00	92:00	0.00	00:00	0.00	0.00
66	P2996	0.00	44:00	0.00	02:00	0.00	0.00
67	P3008	0.01	20:00	0.00	01:00	0.00	0.01
68	P4030	0.01	20:00	0.00	01:00	0.00	0.01
69	P2962	0.00	12:00	0.00	00:00	0.00	0.00
70	P2964	0.01	68:00	0.00	00:00	0.00	0.01
71	P2966	0.00	20:00	0.00	24:00	0.00	0.00
72	P2972	0.00	20:00	0.00	97:00	0.00	0.00
73	P2950	0.01	20:00	0.00	01:00	0.00	0.01
74	P2952	0.01	44:00	0.00	01:00	0.00	0.01
75	P2954	0.07	68:00	0.00	73:00	0.02	0.07
76	P2984	0.00	20:00	0.00	00:00	0.00	0.00
77	P2986	0.01	68:00	0.00	01:00	0.00	0.01
78	P2988	0.01	92:00	0.00	01:00	0.00	0.01
79	P2998	0.00	68:00	0.00	73:00	0.00	0.00
80	P3000	0.04	20:00	0.00	25:00	0.01	0.04
81	P3002	0.00	69:00	0.00	00:00	0.00	0.00
82	P3004	0.02	20:00	0.00	193:00	0.01	0.02
83	P3006	0.01	20:00	0.00	25:00	0.00	0.01
84	P2956	0.14	20:00	0.01	01:00	0.05	0.14
85	P2958	0.06	44:00	0.00	01:00	0.02	0.06
86	P2960	0.02	92:00	0.00	01:00	0.01	0.01
87	P2968	0.00	07:00	0.00	00:00	0.00	0.00
88	P2970	0.01	92:00	0.00	01:00	0.00	0.01
89	P2974	0.02	20:00	0.00	73:00	0.01	0.02
90	P2976	0.01	20:00	0.00	313:00	0.00	0.01
91	P2978	0.01	236:00	0.00	73:00	0.00	0.01
92	P2886	0.03	20:00	0.00	25:00	0.01	0.03

970 Mapleview Ultimate Buildout 2020ADD Scenario Pressure

	ID	Max.Value (kPa)	Max.Time (hrs.)	Min.Value (kPa)	Min.Time (hrs.)	Average (kPa)	Difference (kPa)
1	J-242	442.83	02:00	397.84	09:00	411.71	44.99
2	J-330	444.69	02:00	399.70	09:00	413.57	44.99
3	J-296	445.28	02:00	400.29	09:00	414.16	44.99
4	J-279	445.58	02:00	400.58	09:00	414.45	45.00
5	J-243	446.07	02:00	401.07	09:00	414.94	45.00
6	J-288	446.16	02:00	401.16	09:00	415.04	45.00
7	J-290	447.53	02:00	402.54	09:00	416.41	45.00
8	J-297	447.73	02:00	402.74	09:00	416.61	45.00
9	J-298	448.81	02:00	403.81	09:00	417.68	45.00
10	J1112	450.96	02:00	405.97	09:00	419.84	45.00
11	J-244	451.36	02:00	406.36	09:00	420.23	45.00
12	J-278	451.75	02:00	406.75	09:00	420.62	45.00
13	J-241	451.75	02:00	406.76	09:00	420.63	44.99
14	J-277	452.53	02:00	407.54	09:00	421.42	44.99
15	J1110	452.73	02:00	407.73	09:00	421.60	45.00
16	J-289	453.32	02:00	408.32	09:00	422.19	45.00
17	J-329	455.47	02:00	410.48	09:00	424.35	45.00
18	J-295	455.47	02:00	410.48	09:00	424.36	44.99
19	J-281	457.63	02:00	412.63	09:00	426.50	45.00
20	J-240	458.71	02:00	413.73	09:00	427.60	44.98
21	J-245	459.69	02:00	414.69	09:00	428.56	45.00
22	J-249	461.06	02:00	416.06	09:00	429.93	45.00
23	J-294	461.16	02:00	416.18	09:00	430.05	44.98
24	J1114	461.25	02:00	416.25	09:00	430.13	45.00
25	J-258	461.25	02:00	416.26	09:00	430.13	44.99
26	J-286	461.35	02:00	416.35	09:00	430.22	45.00
27	J-257	461.45	02:00	416.45	09:00	430.33	45.00
28	J-283	462.33	02:00	417.33	09:00	431.21	45.00
29	J-280	462.43	02:00	417.43	09:00	431.31	45.00
30	J-262	462.63	02:00	417.63	09:00	431.50	45.00
31	B05	463.21	02:00	418.21	09:00	432.09	45.00
32	J-246	463.31	02:00	418.31	09:00	432.19	45.00
33	J-287	464.39	02:00	419.39	09:00	433.26	45.00
34	J-328	464.59	02:00	419.59	09:00	433.46	45.00
35	J-271	465.37	02:00	420.38	09:00	434.25	44.99
36	J-256	465.76	02:00	420.76	09:00	434.64	45.00
37	J-261	466.15	02:00	421.16	09:00	435.04	44.99
38	J-276	466.25	02:00	421.27	09:00	435.14	44.99
39	J-327	466.35	02:00	421.35	09:00	435.23	45.00
40	J-247	466.94	02:00	421.94	09:00	435.81	45.00
41	J-284	467.04	02:00	422.04	09:00	435.91	45.00
42	J-272	468.02	02:00	423.02	09:00	436.89	44.99
43	J-304	468.70	02:00	423.71	09:00	437.58	44.99
44	J-285	469.09	02:00	424.09	09:00	437.97	45.00
45	J-259	469.98	02:00	424.98	09:00	438.85	44.99
46	J-282	471.54	02:00	426.55	09:00	440.42	44.99
47	J-273	471.64	02:00	426.65	09:00	440.52	44.99
48	J-274	473.99	02:00	429.00	09:00	442.87	44.99
49	J-253	474.58	02:00	429.58	09:00	443.45	45.00
50	J-260	474.78	02:00	429.78	09:00	443.65	45.00

970 Mapleview Ultimate Buildout 2020ADD Scenario Pressure

		ID	Max.Value (kPa)	Max.Time (hrs.)	Min.Value (kPa)	Min.Time (hrs.)	Average (kPa)	Difference (kPa)
51	☐	J-270	474.88	02:00	429.88	09:00	443.76	44.99
52	☐	J-254	475.17	02:00	430.17	09:00	444.04	45.00
53	☐	J-275	475.27	02:00	430.27	09:00	444.15	44.99
54	☐	J-250	475.66	02:00	430.66	09:00	444.53	45.00
55	☐	J-268	477.33	02:00	432.34	09:00	446.21	44.99
56	☐	J-265	478.01	02:00	433.04	09:00	446.91	44.98
57	☐	J-255	478.89	02:00	433.89	09:00	447.77	45.00
58	☐	J-302	481.15	02:00	436.15	09:00	450.03	44.99
59	☐	J-263	482.03	02:00	437.04	09:00	450.91	44.99
60	☐	J-251	483.50	02:00	438.50	09:00	452.37	45.00
61	☐	J-252	485.26	02:00	440.26	09:00	454.13	45.00
62	☐	J-269	487.12	02:00	442.13	09:00	456.01	44.99
63	☐	J-266	499.18	02:00	454.21	09:00	468.08	44.98

970 Mapleview Ultimate Buildout 2020ADD Scenario Velocity

	ID	Max.Value (m/s)	Max.Time (hrs.)	Min.Value (m/s)	Min.Time (hrs.)	Average (m/s)	Difference (m/s)
1	ANNEX_12112A	0.07	20:00	0.01	01:00	0.04	0.06
2	ANNEX_12112F	0.04	20:00	0.01	01:00	0.02	0.03
3	ANNEX_12112G	0.04	20:00	0.01	01:00	0.02	0.03
4	ANNEX_12112B	0.04	20:00	0.01	01:00	0.02	0.03
5	ANNEX_12112C	0.03	20:00	0.00	01:00	0.01	0.02
6	ANNEX_12503	0.00	68:00	0.00	25:00	0.00	0.00
7	ANNEX_12112	0.01	20:00	0.00	01:00	0.01	0.01
8	ANNEX_12112D	0.02	20:00	0.00	01:00	0.01	0.02
9	ANNEX_12112E	0.02	20:00	0.00	01:00	0.01	0.02
10	ANNEX_12111A	0.00	20:00	0.00	01:00	0.00	0.00
11	P2892	0.00	20:00	0.00	73:00	0.00	0.00
12	P2894	0.00	44:00	0.00	01:00	0.00	0.00
13	P2896	0.01	20:00	0.00	01:00	0.00	0.01
14	P2898	0.00	20:00	0.00	00:00	0.00	0.00
15	P2900	0.01	44:00	0.00	25:00	0.00	0.00
16	P2904	0.03	92:00	0.00	265:00	0.01	0.02
17	P2910	0.02	236:00	0.00	265:00	0.01	0.02
18	P2912	0.01	236:00	0.00	25:00	0.00	0.01
19	P2914	0.01	92:00	0.00	25:00	0.01	0.01
20	P2920	0.02	68:00	0.00	265:00	0.01	0.02
21	P2922	0.01	92:00	0.00	265:00	0.01	0.01
22	P2924	0.01	92:00	0.00	265:00	0.01	0.01
23	P2926	0.01	20:00	0.00	01:00	0.00	0.01
24	P2928	0.02	92:00	0.00	265:00	0.01	0.01
25	P2932	0.02	20:00	0.00	01:00	0.01	0.01
26	P2934	0.01	20:00	0.00	01:00	0.01	0.01
27	P2936	0.01	20:00	0.00	01:00	0.01	0.01
28	P2944	0.01	92:00	0.00	265:00	0.00	0.01
29	P2946	0.00	236:00	0.00	265:00	0.00	0.00
30	P3024	0.00	68:00	0.00	00:00	0.00	0.00
31	P3026	0.00	20:00	0.00	01:00	0.00	0.00
32	P3036	0.00	20:00	0.00	01:00	0.00	0.00
33	P3040	0.00	68:00	0.00	01:00	0.00	0.00
34	P4024	0.01	92:00	0.00	25:00	0.00	0.01
35	P4026	0.00	236:00	0.00	25:00	0.00	0.00
36	P3028	0.00	92:00	0.00	00:00	0.00	0.00
37	P2888	0.03	92:00	0.01	265:00	0.01	0.02
38	P2890	0.04	236:00	0.01	265:00	0.02	0.03
39	P2902	0.06	92:00	0.01	265:00	0.03	0.05
40	P2906	0.03	332:00	0.00	265:00	0.01	0.02
41	P2908	0.03	92:00	0.01	265:00	0.02	0.03
42	P2916	0.04	92:00	0.01	265:00	0.02	0.03
43	P2918	0.03	332:00	0.01	265:00	0.02	0.02
44	P2930	0.00	20:00	0.00	01:00	0.00	0.00
45	P2938	0.01	92:00	0.00	25:00	0.01	0.01
46	P2940	0.02	20:00	0.00	01:00	0.01	0.01
47	P2942	0.02	20:00	0.00	01:00	0.01	0.02
48	P3038	0.01	20:00	0.00	01:00	0.01	0.01
49	P4028	0.03	92:00	0.01	265:00	0.02	0.03
50	P3010	0.01	20:00	0.00	25:00	0.01	0.01

970 Mapleview Ultimate Buildout 2020ADD Scenario Velocity

		ID	Max.Value (m/s)	Max.Time (hrs.)	Min.Value (m/s)	Min.Time (hrs.)	Average (m/s)	Difference (m/s)
51	☐	P3012	0.00	20:00	0.00	01:00	0.00	0.00
52	☐	P3014	0.00	92:00	0.00	25:00	0.00	0.00
53	☐	P3870	0.01	20:00	0.00	01:00	0.00	0.01
54	☐	P3872	0.01	20:00	0.00	01:00	0.01	0.01
55	☐	P3874	0.01	20:00	0.00	01:00	0.01	0.01
56	☐	P2994	0.00	309:00	0.00	01:00	0.00	0.00
57	☐	P3016	0.00	92:00	0.00	25:00	0.00	0.00
58	☐	P3018	0.01	44:00	0.00	25:00	0.01	0.01
59	☐	P3020	0.01	44:00	0.00	25:00	0.01	0.01
60	☐	P3022	0.02	20:00	0.00	01:00	0.01	0.01
61	☐	ANNEX_12503A	0.00	68:00	0.00	25:00	0.00	0.00
62	☐	P2980	0.03	20:00	0.01	01:00	0.02	0.02
63	☐	P2982	0.02	20:00	0.00	01:00	0.01	0.01
64	☐	P2990	0.01	20:00	0.00	01:00	0.01	0.01
65	☐	P2992	0.01	20:00	0.00	01:00	0.00	0.01
66	☐	P2996	0.02	20:00	0.00	01:00	0.01	0.02
67	☐	P3008	0.02	20:00	0.00	01:00	0.01	0.02
68	☐	P4030	0.02	20:00	0.00	01:00	0.01	0.02
69	☐	P2962	0.00	20:00	0.00	25:00	0.00	0.00
70	☐	P2964	0.02	20:00	0.00	01:00	0.01	0.02
71	☐	P2966	0.01	236:00	0.00	25:00	0.01	0.01
72	☐	P2972	0.01	92:00	0.00	25:00	0.01	0.01
73	☐	P2950	0.03	20:00	0.01	01:00	0.02	0.03
74	☐	P2952	0.03	20:00	0.00	01:00	0.01	0.02
75	☐	P2954	0.08	236:00	0.01	265:00	0.04	0.07
76	☐	P2984	0.01	332:00	0.00	25:00	0.00	0.01
77	☐	P2986	0.02	20:00	0.00	01:00	0.01	0.01
78	☐	P2988	0.02	20:00	0.00	01:00	0.01	0.02
79	☐	P2998	0.01	92:00	0.00	25:00	0.01	0.01
80	☐	P3000	0.06	236:00	0.01	265:00	0.03	0.05
81	☐	P3002	0.00	236:00	0.00	25:00	0.00	0.00
82	☐	P3004	0.04	92:00	0.01	265:00	0.02	0.03
83	☐	P3006	0.02	20:00	0.00	01:00	0.01	0.01
84	☐	P2956	0.12	20:00	0.02	01:00	0.06	0.10
85	☐	P2958	0.07	20:00	0.01	01:00	0.04	0.06
86	☐	P2960	0.04	92:00	0.01	25:00	0.02	0.03
87	☐	P2968	0.00	92:00	0.00	25:00	0.00	0.00
88	☐	P2970	0.02	236:00	0.00	25:00	0.01	0.02
89	☐	P2974	0.04	68:00	0.01	25:00	0.02	0.03
90	☐	P2976	0.03	236:00	0.01	25:00	0.01	0.02
91	☐	P2978	0.02	92:00	0.00	25:00	0.01	0.02
92	☐	P2886	0.05	332:00	0.01	265:00	0.03	0.04

970 Mapleview Ultimate Buildout 2020MDD Scenario Demand

		ID	Max.Value (L/s)	Max.Time (hrs.)	Min.Value (L/s)	Min.Time (hrs.)	Average (L/s)	Difference (L/s)
1	☐	B05	0.20	20:00	0.03	01:00	0.10	0.16
2	☐	J-247	0.18	20:00	0.03	01:00	0.09	0.15
3	☐	J-249	0.12	20:00	0.02	01:00	0.06	0.10
4	☐	J-252	0.08	20:00	0.01	01:00	0.04	0.07
5	☐	J-253	0.18	20:00	0.03	01:00	0.09	0.15
6	☐	J-290	0.04	20:00	0.01	01:00	0.02	0.03
7	☐	J-289	0.04	20:00	0.01	01:00	0.02	0.03
8	☐	J-288	0.12	20:00	0.02	01:00	0.06	0.10
9	☐	J-250	0.16	20:00	0.03	01:00	0.08	0.13
10	☐	J-251	0.08	20:00	0.01	01:00	0.04	0.07
11	☐	J-255	0.20	20:00	0.03	01:00	0.10	0.16
12	☐	J-254	0.26	20:00	0.04	01:00	0.13	0.21
13	☐	J-285	0.38	20:00	0.06	01:00	0.19	0.31
14	☐	J-287	0.16	20:00	0.03	01:00	0.08	0.13
15	☐	J-286	0.48	20:00	0.08	01:00	0.24	0.39
16	☐	J1110	0.00	00:00	0.00	00:00	0.00	0.00
17	☐	J1114	0.00	00:00	0.00	00:00	0.00	0.00
18	☐	2S514	0.00	00:00	0.00	00:00	0.00	0.00
19	☐	J-263	1.61	20:00	0.28	01:00	0.82	1.33
20	☐	J-262	0.04	20:00	0.01	01:00	0.02	0.03
21	☐	J-245	0.00	00:00	0.00	00:00	0.00	0.00
22	☐	J-246	0.06	20:00	0.01	01:00	0.03	0.05
23	☐	J-241	0.16	20:00	0.03	01:00	0.08	0.13
24	☐	J-240	0.08	20:00	0.01	01:00	0.04	0.07
25	☐	J-258	0.24	20:00	0.04	01:00	0.12	0.20
26	☐	J-294	0.18	20:00	0.03	01:00	0.09	0.15
27	☐	J-242	0.12	20:00	0.02	01:00	0.06	0.10
28	☐	J-243	0.14	20:00	0.02	01:00	0.07	0.11
29	☐	J-244	0.22	20:00	0.04	01:00	0.11	0.18
30	☐	J-256	0.20	20:00	0.03	01:00	0.10	0.16
31	☐	J-259	0.18	20:00	0.03	01:00	0.09	0.15
32	☐	J-260	0.16	20:00	0.03	01:00	0.08	0.13
33	☐	J-257	0.30	20:00	0.05	01:00	0.15	0.25
34	☐	J-295	0.04	20:00	0.01	01:00	0.02	0.03
35	☐	J-296	0.04	20:00	0.01	01:00	0.02	0.03
36	☐	J-297	0.06	20:00	0.01	01:00	0.03	0.05
37	☐	J-298	0.04	20:00	0.01	01:00	0.02	0.03
38	☐	J-302	0.00	00:00	0.00	00:00	0.00	0.00
39	☐	J-304	0.10	20:00	0.02	01:00	0.05	0.08
40	☐	J-265	0.40	20:00	0.07	01:00	0.20	0.33
41	☐	J-274	0.00	00:00	0.00	00:00	0.00	0.00
42	☐	J-275	0.14	20:00	0.02	01:00	0.07	0.11
43	☐	J-279	0.26	20:00	0.04	01:00	0.13	0.21
44	☐	J-281	0.30	20:00	0.05	01:00	0.15	0.25
45	☐	J-277	0.40	20:00	0.07	01:00	0.20	0.33
46	☐	J-276	0.28	20:00	0.05	01:00	0.14	0.23
47	☐	J-278	0.44	20:00	0.07	01:00	0.22	0.36
48	☐	J-280	0.18	20:00	0.03	01:00	0.09	0.15
49	☐	J-283	0.36	20:00	0.06	01:00	0.18	0.30
50	☐	J-284	0.40	20:00	0.07	01:00	0.20	0.33

970 Mapleview Ultimate Buildout 2020MDD Scenario Demand

		ID	Max.Value (L/s)	Max.Time (hrs.)	Min.Value (L/s)	Min.Time (hrs.)	Average (L/s)	Difference (L/s)
51	☐	J1112	0.00	00:00	0.00	00:00	0.00	0.00
52	☐	J-328	0.15	00:00	0.15	00:00	0.15	0.00
53	☐	J-329	0.13	00:00	0.13	00:00	0.13	0.00
54	☐	J-330	0.00	00:00	0.00	00:00	0.00	0.00
55	☐	J-327	0.13	00:00	0.13	00:00	0.13	0.00
56	☐	J-271	0.44	20:00	0.07	01:00	0.22	0.36
57	☐	J-273	0.32	20:00	0.05	01:00	0.16	0.26
58	☐	J-272	0.44	20:00	0.07	01:00	0.22	0.36
59	☐	J-282	0.30	20:00	0.05	01:00	0.15	0.25
60	☐	J-270	0.10	20:00	0.02	01:00	0.05	0.08
61	☐	J-268	0.32	20:00	0.05	01:00	0.16	0.26
62	☐	J-269	0.18	20:00	0.03	01:00	0.09	0.15
63	☐	J-266	0.49	20:00	0.08	01:00	0.25	0.41

970 Mapleview Ultimate Buildout 2020MDD Flow

	ID	Max.Value (L/s)	Max.Time (hrs.)	Min.Value (L/s)	Min.Time (hrs.)	Average (L/s)	Difference (L/s)
1	P3870	0.17	92:00	0.03	97:00	0.09	0.14
2	ANNEX_12503	0.28	116:00	0.05	01:00	0.15	0.23
3	ANNEX_12112	0.89	92:00	0.14	97:00	0.45	0.75
4	P3874	0.20	92:00	0.04	97:00	0.10	0.16
5	ANNEX_12112E	1.62	92:00	0.26	97:00	0.82	1.35
6	ANNEX_12111A	0.13	92:00	0.02	97:00	0.07	0.11
7	P2892	0.08	116:00	0.01	121:00	0.04	0.07
8	ANNEX_12503A	0.16	116:00	0.03	01:00	0.08	0.13
9	P2894	0.04	188:00	0.01	97:00	0.02	0.03
10	P2896	0.28	92:00	0.04	97:00	0.14	0.24
11	P2898	0.02	92:00	0.00	00:00	0.01	0.02
12	P2900	0.17	116:00	0.03	01:00	0.09	0.14
13	P2922	0.21	116:00	0.06	01:00	0.12	0.15
14	P2924	0.16	116:00	0.04	121:00	0.08	0.12
15	P2926	0.17	92:00	0.02	97:00	0.08	0.15
16	P2932	0.29	92:00	0.04	97:00	0.14	0.24
17	P2944	0.14	116:00	0.03	121:00	0.07	0.11
18	P2946	0.07	116:00	0.01	01:00	0.04	0.05
19	P3010	0.38	116:00	0.06	01:00	0.19	0.31
20	P3012	0.05	92:00	0.01	97:00	0.03	0.04
21	P3014	0.05	116:00	0.01	01:00	0.02	0.04
22	P3016	0.04	116:00	0.01	01:00	0.02	0.03
23	P3018	0.35	116:00	0.06	01:00	0.18	0.29
24	P3024	0.00	116:00	0.00	00:00	0.00	0.00
25	P3026	0.01	92:00	0.00	01:00	0.00	0.01
26	P3028	0.00	116:00	0.00	00:00	0.00	0.00
27	P3036	0.04	92:00	0.01	97:00	0.02	0.03
28	P3040	0.13	92:00	0.02	97:00	0.07	0.11
29	P3872	0.19	92:00	0.04	97:00	0.10	0.15
30	ANNEX_12112A	5.37	92:00	1.03	97:00	2.83	4.35
31	ANNEX_12112B	2.68	92:00	0.55	97:00	1.44	2.13
32	ANNEX_12112C	1.98	92:00	0.41	97:00	1.06	1.58
33	ANNEX_12112D	1.66	92:00	0.32	97:00	0.87	1.34
34	P2888	0.72	116:00	0.17	01:00	0.39	0.55
35	P2890	1.02	116:00	0.22	01:00	0.55	0.80
36	P2902	1.48	116:00	0.34	01:00	0.81	1.14
37	P2904	0.67	116:00	0.17	01:00	0.38	0.50
38	P2906	0.36	116:00	0.10	122:00	0.21	0.26
39	P2908	0.91	116:00	0.22	01:00	0.50	0.69
40	P2910	0.59	116:00	0.17	01:00	0.34	0.42
41	P2912	0.21	116:00	0.10	122:00	0.15	0.11
42	P2914	0.52	116:00	0.16	01:00	0.31	0.36
43	P2916	0.59	116:00	0.13	01:00	0.32	0.46
44	P2918	0.43	116:00	0.10	01:00	0.24	0.33
45	P2920	0.36	116:00	0.08	01:00	0.20	0.28
46	P2928	0.37	116:00	0.12	122:00	0.22	0.26
47	P2930	0.11	92:00	0.01	97:00	0.05	0.10
48	P2934	0.63	92:00	0.12	97:00	0.33	0.51
49	P2936	0.47	92:00	0.09	97:00	0.25	0.37
50	P2938	0.18	116:00	0.02	01:00	0.09	0.16

970 Mapleview Ultimate Buildout 2020MDD Flow

		ID	Max.Value (L/s)	Max.Time (hrs.)	Min.Value (L/s)	Min.Time (hrs.)	Average (L/s)	Difference (L/s)
51	☐	P2940	0.31	92:00	0.07	97:00	0.17	0.25
52	☐	P2942	0.42	92:00	0.08	97:00	0.22	0.34
53	☐	ANNEX_12112F	2.78	92:00	0.57	97:00	1.49	2.21
54	☐	ANNEX_12112G	2.78	92:00	0.57	97:00	1.49	2.21
55	☐	P2950	1.20	92:00	0.23	97:00	0.63	0.97
56	☐	P2952	1.51	92:00	0.25	97:00	0.78	1.26
57	☐	P2962	0.22	92:00	0.00	122:00	0.08	0.21
58	☐	P2964	0.62	92:00	0.09	97:00	0.31	0.53
59	☐	P2972	0.41	116:00	0.11	01:00	0.23	0.29
60	☐	P2980	0.99	92:00	0.18	97:00	0.52	0.80
61	☐	P2982	0.50	92:00	0.10	97:00	0.27	0.40
62	☐	P2984	0.12	116:00	0.01	01:00	0.06	0.11
63	☐	P2986	0.35	92:00	0.07	97:00	0.19	0.28
64	☐	P2988	0.46	92:00	0.09	97:00	0.24	0.37
65	☐	P2990	0.44	260:00	0.11	121:00	0.25	0.33
66	☐	P2992	0.32	92:00	0.04	97:00	0.16	0.29
67	☐	P2994	0.12	92:00	0.04	97:00	0.07	0.08
68	☐	P2996	0.50	92:00	0.05	97:00	0.24	0.45
69	☐	P2998	0.38	116:00	0.09	01:00	0.21	0.29
70	☐	P3000	1.68	116:00	0.36	01:00	0.90	1.31
71	☐	P3002	0.19	92:00	0.01	97:00	0.09	0.18
72	☐	P3004	1.13	116:00	0.23	01:00	0.60	0.90
73	☐	P3006	0.31	92:00	0.06	97:00	0.17	0.25
74	☐	P3008	0.62	260:00	0.14	121:00	0.34	0.48
75	☐	P3020	0.41	116:00	0.07	01:00	0.21	0.34
76	☐	P3022	0.54	92:00	0.10	97:00	0.28	0.44
77	☐	P3038	0.47	92:00	0.09	97:00	0.25	0.37
78	☐	P4024	0.37	116:00	0.01	01:00	0.16	0.36
79	☐	P4026	0.08	116:00	0.00	28:00	0.03	0.08
80	☐	P4028	0.91	116:00	0.22	01:00	0.50	0.69
81	☐	P4030	0.63	92:00	0.18	97:00	0.37	0.45
82	☐	P2960	1.06	116:00	0.24	01:00	0.58	0.82
83	☐	P2966	0.31	116:00	0.10	122:00	0.19	0.21
84	☐	P2968	0.13	116:00	0.04	122:00	0.07	0.09
85	☐	P2970	0.70	116:00	0.16	01:00	0.39	0.54
86	☐	P2974	1.24	116:00	0.26	01:00	0.66	0.99
87	☐	P2958	2.60	92:00	0.49	97:00	1.37	2.11
88	☐	P2976	0.85	116:00	0.18	01:00	0.46	0.68
89	☐	P2978	0.68	116:00	0.14	01:00	0.36	0.53
90	☐	P2956	4.61	92:00	0.83	97:00	2.40	3.78

970 Mapleview Ultimate Buildout 2020MDD Scenario Head

		ID	Max.Value (m)	Max.Time (hrs.)	Min.Value (m)	Min.Time (hrs.)	Average (m)	Difference (m)
1	☐	B05	310.70	02:00	301.64	165:00	307.86	9.05
2	☐	J-247	310.70	02:00	301.64	69:00	307.86	9.05
3	☐	J-249	310.70	02:00	301.64	165:00	307.86	9.05
4	☐	J-252	310.70	02:00	301.64	69:00	307.86	9.05
5	☐	J-253	310.70	02:00	301.64	69:00	307.86	9.05
6	☐	J-290	310.70	02:00	301.64	69:00	307.86	9.05
7	☐	J-289	310.70	02:00	301.64	69:00	307.86	9.05
8	☐	J-288	310.70	02:00	301.64	69:00	307.86	9.05
9	☐	J-250	310.70	02:00	301.64	69:00	307.86	9.05
10	☐	J-251	310.70	02:00	301.64	165:00	307.86	9.05
11	☐	J-255	310.70	02:00	301.64	69:00	307.86	9.05
12	☐	J-254	310.70	02:00	301.64	69:00	307.86	9.05
13	☐	J-285	310.70	02:00	301.64	69:00	307.86	9.05
14	☐	J-287	310.70	02:00	301.64	69:00	307.86	9.05
15	☐	J-286	310.70	02:00	301.64	165:00	307.86	9.05
16	☐	J1110	310.70	02:00	301.64	69:00	307.86	9.05
17	☐	J1114	310.70	02:00	301.64	165:00	307.86	9.05
18	☐	2S514	310.70	02:00	301.65	69:00	307.86	9.05
19	☐	J-263	310.70	02:00	301.65	69:00	307.86	9.05
20	☐	J-262	310.70	02:00	301.64	69:00	307.86	9.05
21	☐	J-245	310.70	02:00	301.64	69:00	307.86	9.05
22	☐	J-246	310.70	02:00	301.64	165:00	307.86	9.05
23	☐	J-241	310.70	02:00	301.65	165:00	307.86	9.05
24	☐	J-240	310.70	02:00	301.65	69:00	307.86	9.05
25	☐	J-258	310.70	02:00	301.64	165:00	307.86	9.05
26	☐	J-294	310.70	02:00	301.65	69:00	307.86	9.05
27	☐	J-242	310.70	02:00	301.64	69:00	307.86	9.05
28	☐	J-243	310.70	02:00	301.64	69:00	307.86	9.05
29	☐	J-244	310.70	02:00	301.64	69:00	307.86	9.05
30	☐	J-256	310.70	02:00	301.64	69:00	307.86	9.05
31	☐	J-259	310.70	02:00	301.64	69:00	307.86	9.05
32	☐	J-260	310.70	02:00	301.64	165:00	307.86	9.05
33	☐	J-257	310.70	02:00	301.64	69:00	307.86	9.05
34	☐	J-295	310.70	02:00	301.65	69:00	307.86	9.05
35	☐	J-296	310.70	02:00	301.65	165:00	307.86	9.05
36	☐	J-297	310.70	02:00	301.64	165:00	307.86	9.05
37	☐	J-298	310.70	02:00	301.64	69:00	307.86	9.05
38	☐	J-302	310.70	02:00	301.65	69:00	307.86	9.05
39	☐	J-304	310.70	02:00	301.64	165:00	307.86	9.05
40	☐	J-265	310.70	02:00	301.65	165:00	307.86	9.05
41	☐	J-274	310.70	02:00	301.64	69:00	307.86	9.05
42	☐	J-275	310.70	02:00	301.64	165:00	307.86	9.05
43	☐	J-279	310.70	02:00	301.64	165:00	307.86	9.05
44	☐	J-281	310.70	02:00	301.64	165:00	307.86	9.05
45	☐	J-277	310.70	02:00	301.65	69:00	307.86	9.05
46	☐	J-276	310.70	02:00	301.65	69:00	307.86	9.05
47	☐	J-278	310.70	02:00	301.64	69:00	307.86	9.05
48	☐	J-280	310.70	02:00	301.64	69:00	307.86	9.05
49	☐	J-283	310.70	02:00	301.64	69:00	307.86	9.05
50	☐	J-284	310.70	02:00	301.64	165:00	307.86	9.05

970 Mapleview Ultimate Buildout 2020MDD Scenario Head

		ID	Max.Value (m)	Max.Time (hrs.)	Min.Value (m)	Min.Time (hrs.)	Average (m)	Difference (m)
51	☐	J1112	310.70	02:00	301.64	69:00	307.86	9.05
52	☐	J-328	310.70	02:00	301.64	69:00	307.86	9.05
53	☐	J-329	310.70	02:00	301.64	69:00	307.86	9.05
54	☐	J-330	310.70	02:00	301.64	69:00	307.86	9.05
55	☐	J-327	310.70	02:00	301.64	69:00	307.86	9.05
56	☐	J-271	310.70	02:00	301.65	69:00	307.86	9.05
57	☐	J-273	310.70	02:00	301.64	69:00	307.86	9.05
58	☐	J-272	310.70	02:00	301.64	69:00	307.86	9.05
59	☐	J-282	310.70	02:00	301.65	165:00	307.86	9.05
60	☐	J-270	310.70	02:00	301.65	69:00	307.86	9.05
61	☐	J-268	310.70	02:00	301.65	165:00	307.86	9.05
62	☐	J-269	310.70	02:00	301.65	165:00	307.86	9.05
63	☐	J-266	310.70	02:00	301.65	165:00	307.87	9.04

970 Mapleview Ultimate Buildout 2020MDD Headloss/1km

		ID	Max.Value (m/k-m)	Max.Time (hrs.)	Min.Value (m/k-m)	Min.Time (hrs.)	Average (m/k-m)	Difference (m/k-m)
1	☐	P3870	0.00	93:00	0.00	00:00	0.00	0.00
2	☐	ANNEX_12503	0.00	12:00	0.00	00:00	0.00	0.00
3	☐	ANNEX_12112	0.00	44:00	0.00	00:00	0.00	0.00
4	☐	P3874	0.00	20:00	0.00	25:00	0.00	0.00
5	☐	ANNEX_12112E	0.00	20:00	0.00	25:00	0.00	0.00
6	☐	ANNEX_12111A	0.00	00:00	0.00	00:00	0.00	0.00
7	☐	P2892	0.00	09:00	0.00	00:00	0.00	0.00
8	☐	ANNEX_12503A	0.00	19:00	0.00	00:00	0.00	0.00
9	☐	P2894	0.00	19:00	0.00	00:00	0.00	0.00
10	☐	P2896	0.00	20:00	0.00	01:00	0.00	0.00
11	☐	P2898	0.00	46:00	0.00	00:00	0.00	0.00
12	☐	P2900	0.00	20:00	0.00	00:00	0.00	0.00
13	☐	P2922	0.00	20:00	0.00	73:00	0.00	0.00
14	☐	P2924	0.00	20:00	0.00	01:00	0.00	0.00
15	☐	P2926	0.00	236:00	0.00	00:00	0.00	0.00
16	☐	P2932	0.01	68:00	0.00	73:00	0.00	0.01
17	☐	P2944	0.00	44:00	0.00	01:00	0.00	0.00
18	☐	P2946	0.00	21:00	0.00	01:00	0.00	0.00
19	☐	P3010	0.00	44:00	0.00	00:00	0.00	0.00
20	☐	P3012	0.00	04:00	0.00	00:00	0.00	0.00
21	☐	P3014	0.00	19:00	0.00	00:00	0.00	0.00
22	☐	P3016	0.00	05:00	0.00	00:00	0.00	0.00
23	☐	P3018	0.00	20:00	0.00	25:00	0.00	0.00
24	☐	P3024	0.00	261:00	0.00	00:00	0.00	0.00
25	☐	P3026	0.00	20:00	0.00	01:00	0.00	0.00
26	☐	P3028	0.00	19:00	0.00	00:00	0.00	0.00
27	☐	P3036	0.00	93:00	0.00	00:00	0.00	0.00
28	☐	P3040	0.00	35:00	0.00	00:00	0.00	0.00
29	☐	P3872	0.00	20:00	0.00	01:00	0.00	0.00
30	☐	ANNEX_12112A	0.03	20:00	0.00	25:00	0.01	0.03
31	☐	ANNEX_12112B	0.01	20:00	0.00	02:00	0.00	0.01
32	☐	ANNEX_12112C	0.01	21:00	0.00	01:00	0.00	0.01
33	☐	ANNEX_12112D	0.00	20:00	0.00	01:00	0.00	0.00
34	☐	P2888	0.01	20:00	0.00	01:00	0.00	0.01
35	☐	P2890	0.01	164:00	0.00	01:00	0.00	0.01
36	☐	P2902	0.03	68:00	0.00	73:00	0.01	0.02
37	☐	P2904	0.01	260:00	0.00	01:00	0.00	0.01
38	☐	P2906	0.00	20:00	0.00	25:00	0.00	0.00
39	☐	P2908	0.01	44:00	0.00	02:00	0.00	0.01
40	☐	P2910	0.00	21:00	0.00	01:00	0.00	0.00
41	☐	P2912	0.00	00:00	0.00	04:00	0.00	0.00
42	☐	P2914	0.00	21:00	0.00	01:00	0.00	0.00
43	☐	P2916	0.02	20:00	0.00	01:00	0.01	0.02
44	☐	P2918	0.01	20:00	0.00	25:00	0.00	0.01
45	☐	P2920	0.01	68:00	0.00	01:00	0.00	0.01
46	☐	P2928	0.00	20:00	0.00	25:00	0.00	0.00
47	☐	P2930	0.00	20:00	0.00	01:00	0.00	0.00
48	☐	P2934	0.00	20:00	0.00	25:00	0.00	0.00
49	☐	P2936	0.00	09:00	0.00	00:00	0.00	0.00
50	☐	P2938	0.00	21:00	0.00	01:00	0.00	0.00

970 Mapleview Ultimate Buildout 2020MDD Headloss/1km

		ID	Max.Value (m/k-m)	Max.Time (hrs.)	Min.Value (m/k-m)	Min.Time (hrs.)	Average (m/k-m)	Difference (m/k-m)
51	☐	P2940	0.01	20:00	0.00	01:00	0.00	0.01
52	☐	P2942	0.01	20:00	0.00	25:00	0.00	0.01
53	☐	ANNEX_12112F	0.01	44:00	0.00	01:00	0.00	0.01
54	☐	ANNEX_12112G	0.01	20:00	0.00	49:00	0.00	0.01
55	☐	P2950	0.02	188:00	0.00	241:00	0.01	0.02
56	☐	P2952	0.03	20:00	0.00	25:00	0.01	0.03
57	☐	P2962	0.00	21:00	0.00	00:00	0.00	0.00
58	☐	P2964	0.01	44:00	0.00	01:00	0.00	0.01
59	☐	P2972	0.00	20:00	0.00	01:00	0.00	0.00
60	☐	P2980	0.01	20:00	0.00	01:00	0.00	0.01
61	☐	P2982	0.00	21:00	0.00	01:00	0.00	0.00
62	☐	P2984	0.00	20:00	0.00	00:00	0.00	0.00
63	☐	P2986	0.01	68:00	0.00	25:00	0.00	0.01
64	☐	P2988	0.01	20:00	0.00	01:00	0.01	0.01
65	☐	P2990	0.00	20:00	0.00	01:00	0.00	0.00
66	☐	P2992	0.00	236:00	0.00	00:00	0.00	0.00
67	☐	P2994	0.00	00:00	0.00	01:00	0.00	0.00
68	☐	P2996	0.00	20:00	0.00	01:00	0.00	0.00
69	☐	P2998	0.00	21:00	0.00	25:00	0.00	0.00
70	☐	P3000	0.03	44:00	0.00	73:00	0.01	0.03
71	☐	P3002	0.00	44:00	0.00	00:00	0.00	0.00
72	☐	P3004	0.02	20:00	0.00	01:00	0.01	0.02
73	☐	P3006	0.01	68:00	0.00	01:00	0.00	0.01
74	☐	P3008	0.01	20:00	0.00	25:00	0.00	0.00
75	☐	P3020	0.00	20:00	0.00	01:00	0.00	0.00
76	☐	P3022	0.00	21:00	0.00	01:00	0.00	0.00
77	☐	P3038	0.00	20:00	0.00	00:00	0.00	0.00
78	☐	P4024	0.00	20:00	0.00	00:00	0.00	0.00
79	☐	P4026	0.00	43:00	0.00	00:00	0.00	0.00
80	☐	P4028	0.01	20:00	0.00	01:00	0.00	0.01
81	☐	P4030	0.01	21:00	0.00	25:00	0.00	0.00
82	☐	P2960	0.01	20:00	0.00	73:00	0.01	0.01
83	☐	P2966	0.00	21:00	0.00	01:00	0.00	0.00
84	☐	P2968	0.00	07:00	0.00	00:00	0.00	0.00
85	☐	P2970	0.01	44:00	0.00	25:00	0.00	0.01
86	☐	P2974	0.02	44:00	0.00	01:00	0.01	0.02
87	☐	P2958	0.07	68:00	0.00	25:00	0.03	0.07
88	☐	P2976	0.01	44:00	0.00	01:00	0.00	0.01
89	☐	P2978	0.01	20:00	0.00	01:00	0.00	0.01
90	☐	P2956	0.21	20:00	0.01	01:00	0.07	0.20

970 Mapleview Ultimate Buildout 2020MDD Scenario Pressure

		ID	Max.Value (kPa)	Max.Time (hrs.)	Min.Value (kPa)	Min.Time (hrs.)	Average (kPa)	Difference (kPa)
1	☐	J-242	438.19	02:00	349.49	69:00	410.42	88.70
2	☐	J-330	440.05	02:00	351.35	69:00	412.27	88.71
3	☐	J-296	440.64	02:00	351.94	165:00	412.87	88.70
4	☐	J-279	440.93	02:00	352.22	165:00	413.16	88.71
5	☐	J-243	441.42	02:00	352.71	69:00	413.65	88.71
6	☐	J-288	441.52	02:00	352.80	69:00	413.74	88.72
7	☐	J-290	442.89	02:00	354.17	69:00	415.11	88.72
8	☐	J-297	443.09	02:00	354.38	165:00	415.31	88.71
9	☐	J-298	444.17	02:00	355.46	69:00	416.39	88.71
10	☐	J1112	446.32	02:00	357.61	69:00	418.54	88.71
11	☐	J-244	446.72	02:00	358.00	69:00	418.94	88.71
12	☐	J-278	447.11	02:00	358.40	69:00	419.33	88.71
13	☐	J-241	447.11	02:00	358.41	165:00	419.33	88.70
14	☐	J-277	447.89	02:00	359.20	69:00	420.12	88.69
15	☐	J1110	448.09	02:00	359.37	69:00	420.31	88.72
16	☐	J-289	448.68	02:00	359.96	69:00	420.89	88.72
17	☐	J-329	450.83	02:00	362.12	69:00	423.05	88.71
18	☐	J-295	450.83	02:00	362.14	69:00	423.06	88.69
19	☐	J-281	452.99	02:00	364.28	165:00	425.21	88.71
20	☐	J-240	454.07	02:00	365.39	69:00	426.30	88.68
21	☐	J-245	455.05	02:00	366.33	69:00	427.27	88.71
22	☐	J-249	456.42	02:00	367.70	165:00	428.63	88.72
23	☐	J-294	456.52	02:00	367.84	69:00	428.75	88.68
24	☐	J1114	456.61	02:00	367.89	165:00	428.83	88.72
25	☐	J-258	456.61	02:00	367.91	165:00	428.84	88.71
26	☐	J-286	456.71	02:00	367.99	165:00	428.93	88.72
27	☐	J-257	456.81	02:00	368.10	69:00	429.03	88.71
28	☐	J-283	457.69	02:00	368.98	69:00	429.91	88.71
29	☐	J-280	457.79	02:00	369.08	69:00	430.01	88.71
30	☐	J-262	457.99	02:00	369.28	69:00	430.21	88.71
31	☐	B05	458.57	02:00	369.85	165:00	430.79	88.72
32	☐	J-246	458.67	02:00	369.95	165:00	430.89	88.72
33	☐	J-287	459.75	02:00	371.03	69:00	431.97	88.72
34	☐	J-328	459.94	02:00	371.23	69:00	432.16	88.72
35	☐	J-271	460.73	02:00	372.04	69:00	432.96	88.69
36	☐	J-256	461.12	02:00	372.41	69:00	433.34	88.71
37	☐	J-276	461.61	02:00	372.93	69:00	433.84	88.68
38	☐	J-327	461.71	02:00	373.00	69:00	433.93	88.71
39	☐	J-247	462.30	02:00	373.58	69:00	434.51	88.72
40	☐	J-284	462.39	02:00	373.68	165:00	434.61	88.72
41	☐	J-272	463.38	02:00	374.67	69:00	435.60	88.70
42	☐	J-304	464.06	02:00	375.36	165:00	436.28	88.70
43	☐	J-285	464.45	02:00	375.73	69:00	436.67	88.72
44	☐	J-259	465.34	02:00	376.63	69:00	437.56	88.71
45	☐	J-282	466.90	02:00	378.20	165:00	439.13	88.70
46	☐	J-273	467.00	02:00	378.30	69:00	439.22	88.70
47	☐	J-274	469.35	02:00	380.65	69:00	441.58	88.70
48	☐	J-253	469.94	02:00	381.22	69:00	442.16	88.72
49	☐	J-260	470.14	02:00	381.42	165:00	442.36	88.72
50	☐	J-270	470.24	02:00	381.54	69:00	442.46	88.69

970 Mapleview Ultimate Buildout 2020MDD Scenario Pressure

		ID	Max.Value (kPa)	Max.Time (hrs.)	Min.Value (kPa)	Min.Time (hrs.)	Average (kPa)	Difference (kPa)
51	☐	J-254	470.53	02:00	381.81	69:00	442.75	88.72
52	☐	J-275	470.63	02:00	381.92	165:00	442.85	88.70
53	☐	J-250	471.02	02:00	382.30	69:00	443.24	88.72
54	☐	J-268	472.69	02:00	384.01	165:00	444.92	88.68
55	☐	J-265	473.37	02:00	384.71	165:00	445.61	88.66
56	☐	J-255	474.25	02:00	385.53	69:00	446.47	88.72
57	☐	J-302	476.51	02:00	387.81	69:00	448.73	88.70
58	☐	2S514	477.20	02:00	388.55	69:00	449.44	88.65
59	☐	J-263	477.39	02:00	388.69	69:00	449.61	88.69
60	☐	J-251	478.86	02:00	390.14	165:00	451.07	88.72
61	☐	J-252	480.62	02:00	391.90	69:00	452.84	88.72
62	☐	J-269	482.48	02:00	393.79	165:00	454.71	88.69
63	☐	J-266	494.54	02:00	405.91	165:00	466.79	88.63

970 Mapleview Ultimate Buildout 2020MDD Velocity

	ID	Max.Value (m/s)	Max.Time (hrs.)	Min.Value (m/s)	Min.Time (hrs.)	Average (m/s)	Difference (m/s)
1	P3870	0.01	92:00	0.00	97:00	0.00	0.01
2	ANNEX_12503	0.00	116:00	0.00	01:00	0.00	0.00
3	ANNEX_12112	0.01	92:00	0.00	97:00	0.01	0.01
4	P3874	0.01	92:00	0.00	97:00	0.01	0.01
5	ANNEX_12112E	0.02	92:00	0.00	97:00	0.01	0.02
6	ANNEX_12111A	0.00	92:00	0.00	97:00	0.00	0.00
7	P2892	0.00	116:00	0.00	121:00	0.00	0.00
8	ANNEX_12503A	0.00	116:00	0.00	01:00	0.00	0.00
9	P2894	0.00	188:00	0.00	97:00	0.00	0.00
10	P2896	0.01	92:00	0.00	97:00	0.00	0.01
11	P2898	0.00	92:00	0.00	00:00	0.00	0.00
12	P2900	0.01	116:00	0.00	01:00	0.00	0.00
13	P2922	0.01	116:00	0.00	01:00	0.01	0.01
14	P2924	0.01	116:00	0.00	121:00	0.00	0.01
15	P2926	0.01	92:00	0.00	97:00	0.00	0.01
16	P2932	0.02	92:00	0.00	97:00	0.01	0.01
17	P2944	0.01	116:00	0.00	121:00	0.00	0.01
18	P2946	0.00	116:00	0.00	01:00	0.00	0.00
19	P3010	0.01	116:00	0.00	01:00	0.01	0.01
20	P3012	0.00	92:00	0.00	97:00	0.00	0.00
21	P3014	0.00	116:00	0.00	01:00	0.00	0.00
22	P3016	0.00	116:00	0.00	01:00	0.00	0.00
23	P3018	0.01	116:00	0.00	01:00	0.01	0.01
24	P3024	0.00	116:00	0.00	00:00	0.00	0.00
25	P3026	0.00	92:00	0.00	01:00	0.00	0.00
26	P3028	0.00	116:00	0.00	00:00	0.00	0.00
27	P3036	0.00	92:00	0.00	97:00	0.00	0.00
28	P3040	0.00	92:00	0.00	97:00	0.00	0.00
29	P3872	0.01	92:00	0.00	97:00	0.01	0.01
30	ANNEX_12112A	0.08	92:00	0.01	97:00	0.04	0.06
31	ANNEX_12112B	0.04	92:00	0.01	97:00	0.02	0.03
32	ANNEX_12112C	0.03	92:00	0.01	97:00	0.01	0.02
33	ANNEX_12112D	0.02	92:00	0.00	97:00	0.01	0.02
34	P2888	0.02	116:00	0.01	01:00	0.01	0.02
35	P2890	0.03	116:00	0.01	01:00	0.02	0.03
36	P2902	0.05	116:00	0.01	01:00	0.03	0.04
37	P2904	0.02	116:00	0.01	01:00	0.01	0.02
38	P2906	0.01	116:00	0.00	122:00	0.01	0.01
39	P2908	0.03	116:00	0.01	01:00	0.02	0.02
40	P2910	0.02	116:00	0.01	01:00	0.01	0.01
41	P2912	0.00	116:00	0.00	122:00	0.00	0.00
42	P2914	0.01	116:00	0.00	01:00	0.01	0.01
43	P2916	0.03	116:00	0.01	01:00	0.02	0.03
44	P2918	0.02	116:00	0.01	01:00	0.01	0.02
45	P2920	0.02	116:00	0.00	01:00	0.01	0.02
46	P2928	0.01	116:00	0.00	122:00	0.01	0.01
47	P2930	0.01	92:00	0.00	97:00	0.00	0.01
48	P2934	0.01	92:00	0.00	97:00	0.01	0.01
49	P2936	0.01	92:00	0.00	97:00	0.01	0.01
50	P2938	0.01	116:00	0.00	01:00	0.01	0.01

970 Mapleview Ultimate Buildout 2020MDD Velocity

		ID	Max.Value (m/s)	Max.Time (hrs.)	Min.Value (m/s)	Min.Time (hrs.)	Average (m/s)	Difference (m/s)
51	☐	P2940	0.02	92:00	0.00	97:00	0.01	0.01
52	☐	P2942	0.02	92:00	0.00	97:00	0.01	0.02
53	☐	ANNEX_12112F	0.04	92:00	0.01	97:00	0.02	0.03
54	☐	ANNEX_12112G	0.04	92:00	0.01	97:00	0.02	0.03
55	☐	P2950	0.04	92:00	0.01	97:00	0.02	0.03
56	☐	P2952	0.05	92:00	0.01	97:00	0.02	0.04
57	☐	P2962	0.01	92:00	0.00	122:00	0.00	0.01
58	☐	P2964	0.02	92:00	0.00	97:00	0.01	0.02
59	☐	P2972	0.01	116:00	0.00	01:00	0.01	0.01
60	☐	P2980	0.03	92:00	0.01	97:00	0.02	0.03
61	☐	P2982	0.02	92:00	0.00	97:00	0.01	0.01
62	☐	P2984	0.01	116:00	0.00	01:00	0.00	0.01
63	☐	P2986	0.02	92:00	0.00	97:00	0.01	0.02
64	☐	P2988	0.03	92:00	0.01	97:00	0.01	0.02
65	☐	P2990	0.01	260:00	0.00	121:00	0.01	0.01
66	☐	P2992	0.01	92:00	0.00	97:00	0.01	0.01
67	☐	P2994	0.00	92:00	0.00	97:00	0.00	0.00
68	☐	P2996	0.02	92:00	0.00	97:00	0.01	0.01
69	☐	P2998	0.01	116:00	0.00	01:00	0.01	0.01
70	☐	P3000	0.05	116:00	0.01	01:00	0.03	0.04
71	☐	P3002	0.01	92:00	0.00	97:00	0.00	0.01
72	☐	P3004	0.04	116:00	0.01	01:00	0.02	0.03
73	☐	P3006	0.02	92:00	0.00	97:00	0.01	0.01
74	☐	P3008	0.02	260:00	0.00	121:00	0.01	0.02
75	☐	P3020	0.01	116:00	0.00	01:00	0.01	0.01
76	☐	P3022	0.02	92:00	0.00	97:00	0.01	0.01
77	☐	P3038	0.01	92:00	0.00	97:00	0.01	0.01
78	☐	P4024	0.01	116:00	0.00	01:00	0.00	0.01
79	☐	P4026	0.00	116:00	0.00	28:00	0.00	0.00
80	☐	P4028	0.03	116:00	0.01	01:00	0.02	0.02
81	☐	P4030	0.02	92:00	0.01	97:00	0.01	0.01
82	☐	P2960	0.03	116:00	0.01	01:00	0.02	0.03
83	☐	P2966	0.01	116:00	0.00	122:00	0.01	0.01
84	☐	P2968	0.00	116:00	0.00	122:00	0.00	0.00
85	☐	P2970	0.02	116:00	0.01	01:00	0.01	0.02
86	☐	P2974	0.04	116:00	0.01	01:00	0.02	0.03
87	☐	P2958	0.08	92:00	0.02	97:00	0.04	0.07
88	☐	P2976	0.03	116:00	0.01	01:00	0.01	0.02
89	☐	P2978	0.02	116:00	0.00	01:00	0.01	0.02
90	☐	P2956	0.15	92:00	0.03	97:00	0.08	0.12

970 Mapleview Ultimate Buildout 2020MDD_FF Scenario, Maximum Day Demand + Fire Flow

		ID	Static Demand (L/s)	Static Pressure (kPa)	Static Head (m)	Fire-Flow Demand (L/s)	Residual Pressure (kPa)	Hydrant Available Flow (L/s)	Hydrant Pressure at Available Flow (kPa)	Critical Pipe ID at Available Flow	Critical Pipe Velocity at Available Flow (m/s)
1	☐	B05	0.22	401.32	304.85	100.00	340.89	238.47	137.86	ANNEX_12112	2.32
2	☐	J-240	0.09	396.88	304.86	100.00	340.80	246.04	137.86	P2902	2.93
3	☐	J-241	0.17	389.89	304.86	100.00	334.92	246.08	137.86	P2902	2.63
4	☐	J-242	0.13	380.97	304.86	155.00	254.08	225.65	137.86	P2888	3.35
5	☐	J-243	0.16	384.19	304.86	155.00	255.56	225.61	137.86	P2910	3.51
6	☐	J-244	0.24	389.47	304.86	183.00	245.21	252.71	137.86	P2910	1.81
7	☐	J-245	0.00	397.80	304.86	200.00	232.41	259.61	137.86	ANNEX_12112C	1.82
8	☐	J-246	0.08	401.42	304.85	200.00	230.87	257.10	137.86	ANNEX_12112D	2.14
9	☐	J-247	0.21	405.05	304.85	100.00	348.16	250.00	137.86	ANNEX_12112E	2.71
10	☐	J-249	0.13	399.17	304.85	100.00	333.93	225.82	137.86	ANNEX_12111A	3.15
11	☐	J-250	0.17	413.77	304.85	100.00	336.75	209.90	137.86	P2896	4.11
12	☐	J-251	0.09	421.61	304.85	100.00	324.78	185.33	137.86	P2898	4.16
13	☐	J-252	0.09	423.37	304.85	100.00	287.73	152.44	137.86	P2892	4.73
14	☐	J-253	0.21	412.69	304.85	100.00	298.16	164.21	139.82	P2900	5.00
15	☐	J-254	0.30	413.28	304.85	100.00	319.84	186.39	137.86	P2926	4.06
16	☐	J-255	0.22	417.00	304.85	100.00	336.09	204.84	137.86	P2932	3.91
17	☐	J-256	0.22	403.88	304.86	200.00	229.77	255.46	137.86	P2934	2.18
18	☐	J-257	0.34	399.57	304.86	155.00	249.04	213.06	137.86	P2928	3.62
19	☐	J-258	0.28	399.38	304.86	100.00	335.25	227.91	137.86	P2890	3.67
20	☐	J-259	0.21	408.10	304.86	100.00	304.99	173.55	137.86	P2930	4.31
21	☐	J-260	0.17	412.89	304.86	100.00	262.75	140.83	137.86	P2920	4.01
22	☐	J-261	0.17	404.30	304.86	100.00	267.73	146.01	137.86	P2916	4.22
23	☐	J-262	0.04	400.75	304.86	155.00	294.99	263.48	137.86	ANNEX_12112B	1.75
24	☐	J-263	1.82	420.17	304.86	283.00	131.77	281.39	137.86	ANNEX_12112A	2.02
25	☐	J-265	0.45	416.21	304.86	183.00	281.77	278.79	137.86	P2954	2.53
26	☐	J-266	0.56	437.39	304.86	155.00	333.52	286.29	137.86	P2956	3.84
27	☐	J-268	0.36	415.48	304.86	155.00	306.90	267.30	137.86	P2958	3.12
28	☐	J-269	0.21	425.27	304.86	183.00	239.31	234.69	137.86	P2978	4.28
29	☐	J-270	0.11	413.02	304.86	183.00	250.61	247.67	137.86	P2968	3.90
30	☐	J-271	0.50	403.51	304.86	183.00	256.64	257.99	137.86	P2974	2.26
31	☐	J-272	0.50	406.14	304.86	183.00	236.15	238.17	137.86	P2960	3.46
32	☐	J-273	0.35	409.77	304.86	183.00	252.23	250.77	137.86	P2964	3.58
33	☐	J-274	0.00	412.12	304.86	183.00	257.79	254.71	137.86	P2962	3.31
34	☐	J-275	0.16	413.40	304.86	183.00	259.57	256.04	137.86	P2962	3.25

		ID	Static Demand (L/s)	Static Pressure (kPa)	Static Head (m)	Fire-Flow Demand (L/s)	Residual Pressure (kPa)	Hydrant Available Flow (L/s)	Hydrant Pressure at Available Flow (kPa)	Critical Pipe ID at Available Flow	Critical Pipe Velocity at Available Flow (m/s)
35	☐	J-276	0.32	404.41	304.86	200.00	234.23	259.06	137.86	P3000	3.11
36	☐	J-277	0.45	390.68	304.86	200.00	194.98	231.96	137.86	P3004	3.36
37	☐	J-278	0.50	389.87	304.86	100.00	234.19	131.74	137.86	P2984	3.76
38	☐	J-279	0.30	383.69	304.86	200.00	197.08	234.58	137.86	P2982	3.00
39	☐	J-280	0.21	400.55	304.86	200.00	178.80	220.45	137.86	P3008	3.51
40	☐	J-281	0.34	395.75	304.86	155.00	275.45	241.27	137.86	P2994	3.12
41	☐	J-282	0.33	409.68	304.86	200.00	173.24	216.79	137.86	P2972	3.49
42	☐	J-283	0.41	400.45	304.86	183.00	152.92	189.62	137.86	P3022	3.97
43	☐	J-284	0.45	405.15	304.85	183.00	197.54	211.75	137.86	P3020	3.31
44	☐	J-285	0.43	407.20	304.85	155.00	249.10	210.61	137.86	P3874	3.22
45	☐	J-286	0.54	399.46	304.85	155.00	251.04	215.12	137.86	P3010	3.51
46	☐	J-287	0.18	402.50	304.85	155.00	239.23	204.43	137.86	P3012	3.36
47	☐	J-288	0.13	384.27	304.85	100.00	316.97	214.10	137.86	ANNEX_12503A	2.60
48	☐	J-289	0.04	391.42	304.85	100.00	327.87	225.64	137.86	ANNEX_12503	2.48
49	☐	J-290	0.04	385.64	304.85	100.00	281.73	160.23	149.09	P3036	5.00
50	☐	J-294	0.21	399.33	304.86	100.00	334.56	225.32	137.86	P2906	4.36
51	☐	J-295	0.04	393.62	304.86	100.00	297.66	141.58	218.16	P2942	5.00
52	☐	J-296	0.04	383.42	304.86	100.00	282.85	141.64	199.14	P2940	5.00
53	☐	J-297	0.08	385.85	304.86	100.00	271.72	124.55	218.67	P2938	5.00
54	☐	J-298	0.04	386.93	304.86	100.00	328.22	234.61	137.86	P3038	4.22
55	☐	J-302	0.00	419.29	304.86	283.00	128.79	277.92	137.86	ANNEX_12112F	2.59
56	☐	J-304	0.11	406.83	304.86	283.00	108.83	267.03	137.86	ANNEX_12112G	2.03
57	☐	J-327	0.29	404.47	304.86	155.00	262.55	222.78	137.86	P4030	3.56
58	☐	J-328	0.33	402.70	304.86	200.00	220.78	248.48	137.86	P4024	2.60
59	☐	J-329	0.28	393.59	304.86	200.00	216.57	247.41	137.86	P4026	2.56
60	☐	J-330	0.00	382.82	304.86	155.00	250.40	220.87	137.86	P4028	3.73

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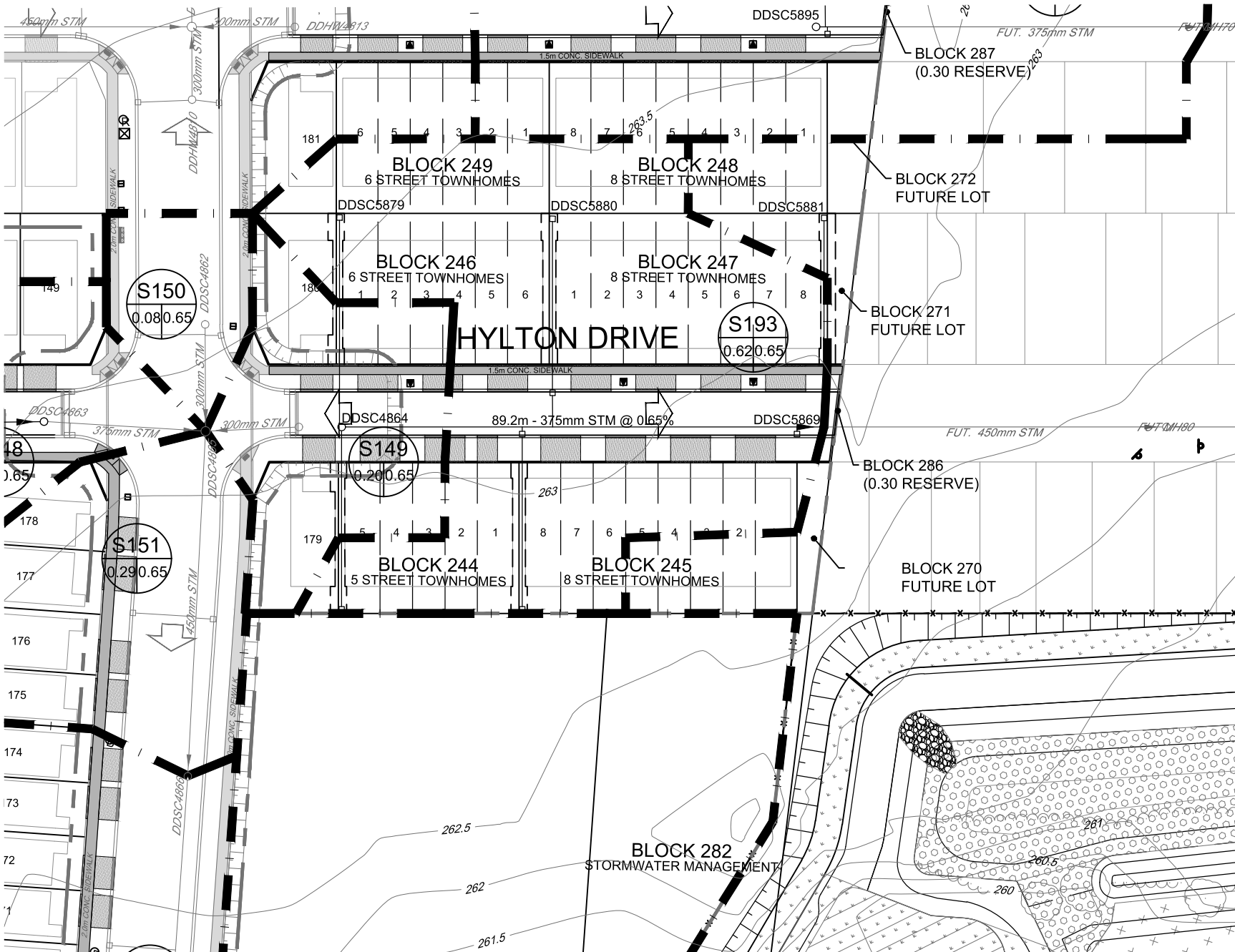
Appendix C

970 Mapleview Phase 2 and 3 Detailed Design: Storm Sewer and Sanitary Sewer Design

NOTTINGHAM ROAD
NOTTINGHAM ROAD
DDHW4833
DDHW4832
DDHW4824
DDHW4825
DDSC5742
DDSC5737
S101
0.740.65
1.5m CONC. SIDEWALK
1.5m CONC. SIDEWALK
1.5m CONC. SIDEWALK


HYLTON DRIVE
BLOCK 249
6 STREET TOWNHOMES
BLOCK 248
8 STREET TOWNHOMES
BLOCK 246
6 STREET TOWNHOMES
BLOCK 247
8 STREET TOWNHOMES
BLOCK 244
5 STREET TOWNHOMES
BLOCK 245
8 STREET TOWNHOMES
BLOCK 282
STORMWATER MANAGEMENT
BLOCK 287
(0.30 RESERVE)
BLOCK 272
FUTURE LOT
BLOCK 271
FUTURE LOT
BLOCK 286
(0.30 RESERVE)
BLOCK 270
FUTURE LOT
S150
0.08 0.65
S149
0.20 0.65
S193
0.62 0.65
S151
0.29 0.65
DDSC5895
DDSC5879
DDSC5880
DDSC5881
DDSC4864
DDSC5869
89.2m - 375mm STM @ 0.65%
450mm STM
300mm STM
375mm STM
FUT. 375mm STM
FUT. 450mm STM
1.5m CONC. SIDEWALK
263.5
263
262.5
262
261.5
261
260.5
260

SERVICING
PACKAGE 1
LUDLOW DRIVE
OXFORD ROAD
DURHAM AVENUE
675mm STM
825mm STM
450mm STM
1200mm STM
1.5m CONC. SIDEWALK
1.8m CONC. SIDEWALK

NOTTINGHAM ROAD
SA101
0.44
38
SA102
SAH33831
SAH33832
SAH33587
52.8m - 200mm PVC SAN @ 2.00%
200mm SAN
1.5m CONC. SIDEWALK
1.5m CONC. SIDEWALK
1.5m CONC. SIDEWALK
1.5m CONC. SIDEWALK
1.5m CONC. SIDEWALK
1.5m CONC. SIDEWALK
60
59
58
57
56
30
31
32
33
34
35
36
37
38
29
28
27
26
25
24
23
22
21

ZABA ROAD
2.0m CONC. SIDEWALK
200mm SAN
SAH33614
SAH33606
SAH3361
19
19
19
19
19
19
19

Barrie

n ≥ 0.013
M = 5/P^0.2 Babbit

$Q_p = P*q*M/86.4$

$Q_i = I*A$

$Q_{tot} = Q_p + Q_i + Q_C$

STREET	AREA
NOTTINGHAM	SA1
NOTTINGHAM	SA1
ALNWICK	SA1
UNICORN	SA1
UNICORN	SA1
NOTTINGHAM	SA1
NOTTINGHAM	SA1
ALNWICK	SA1
RICHMOND	SA1
RICHMOND	SA1

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Appendix D

Stormwater Management Report: SWMF 11

STORMWATER MANAGEMENT REPORT

883 MAPLEVIEW DRIVE EAST
PROPOSED RESIDENTIAL SUBDIVISION

CITY OF BARRIE

PROJECT: 2018-4692

APRIL 2019
REVISED: OCTOBER 2019
REVISED: MARCH 2020

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Appendix B: Calculations
Appendix C: Visual OTTHYMO and EPA SWMM Modelling Results
Appendix D: Supporting Documents
Appendix E: Engineering Drawings

1. INTRODUCTION

1.1 Objective and Location

This Stormwater Management Report is prepared in support of the detail design for the East Annexation Lands, 883 Mapleview Drive East proposed residential development, within Hewitt's Secondary Plan Area, in the City of Barrie. The Hewitt's Secondary Plan Area has been described in Amendment 39 to the City of Barrie Official Plan as *"the 2010 Annexed Lands East which have an area of approximately 860 hectares, bounded by Big Bay Point Road and Mapleview Drive East to the north, 20th Sideroad to the east, Lockhart Road to the south and the former City boundary east of Huronia Road on the west"* (see Figure 1 in Appendix D, excerpted from Hewitt's Secondary Plan Area Subwatershed Impact Study, by R.J Burnside and Associates Limited, dated September 2016). The proposed development, as shown in Figure 1.1 is located south of the Mapleview Drive East and bounded by future developments on all other three sides.

This report will establish how the subject site can be serviced by stormwater infrastructure. The following sections present proposed stormwater management servicing plan for the proposed development, tributary to the SWM Pond 11.

1.2 Existing Conditions

Under existing conditions, the 883 Mapleview Drive East proposed development, referred to as subject site, covers a total area of 30.254 ha and is located partially in Sandy Cove and Hewitt's Creeks Subwatersheds (See Figure 2-1, Drawing SWM-1 in Appendix E, and Figure 5 in Appendix D, excerpted from Subwatershed Impact Study). As shown on Figure 2-1, the topography of the 24.8 ha area, tributary to Sandy Cove Creek, declines from the northwest to the southeast. The remaining 5.5 ha area, located immediately south of the Mapleview Drive East, drain northerly and ultimately discharge to Hewitt's Creek. The subject site has been used as agriculture land.

1.3 Proposed Development Plan

According to the *"Hewitt's Secondary Plan Area Subwatershed Impact Study (SIS), by Burnside and Associates Ltd, dated September 2016 and Addendum No. 1, dated November 2017"* the subject site will be developed as part of the Phase 1 development lands (see Figure 3 in Appendix D, excerpted from the Subwatershed Impact Study by Burnside). Phase 1 roughly encompasses south of Mapleview Drive East and the western half of the site north of Mapleview Drive to Big Bay Point Road. The *"Hewitt's Secondary Plan Area, Subwatershed Impact Study, Lover's, Hewitt's and Sandy Cove Creeks, by R.J Burnside & Associates Limited in partnership with Azimuth Environmental Consulting Inc., dated September 2016 and Addendum No. 1, dated November 2017"*, identifies the municipal servicing plan for the Hewitt's Secondary Plan Area including Phase 1 and the subject site (see Figure 10 and Figure 11, provided in Appendix D, excerpted from Addendum No. 1, dated November 2017).

The legal description for the subject site is *'"North half of Lot 18, Concession 11, Geographic Township of Innisfil, City of Barrie, County of Simcoe"*. According to the Subdivision Draft Plan, prepared by KLM Planning Partners Inc., dated September 19, 2017, the subject site will be developed as a residential subdivision. The proposed subdivision will include 457 detached units, 113 townhouses and a stormwater management pond (see Draft Plan of Subdivision in Appendix A).

1.4 Background Information

The subject site will be developed as part of the Hewitt's Secondary Plan which was passed in June 2014. The Hewitt's Secondary Plan emphasized on need for a Subwatershed Impact Study (SIS). The following reports and technical documents were reviewed in the preparation of this report:

1 *City of Barrie Secondary Plan, Background Studies & Infrastructure Master Plan, Intensification & Annexed Lands, Drainage and Stormwater Management Master Plan (DSWMMP), October 2013, prepared by AMEC*;

2 *Hewitt's Secondary Plan Area, Subwatershed Impact Study (SIS), Lover's, Hewitt's and Sandy Cove Creeks, by R.J. Burnside & Associates Limited in partnership with Azimuth Environmental Consulting Inc., dated September 2016 and Addendum No. 1, dated November 2017*;

3 *MOECC Stormwater Management Planning and Design Manual (March 2003);*

4 *LSRCA Technical Guidelines for Stormwater Management Submissions (June 2016)*;

5 *Lake Simcoe Protection Plan (July 2009);*

6 *The City of Barrie Storm Drainage and Stormwater Management Policies and Design Guidelines 2017.*

EAST ANNEXATION LANDS
MAPLEVIEW DRIVE EAST

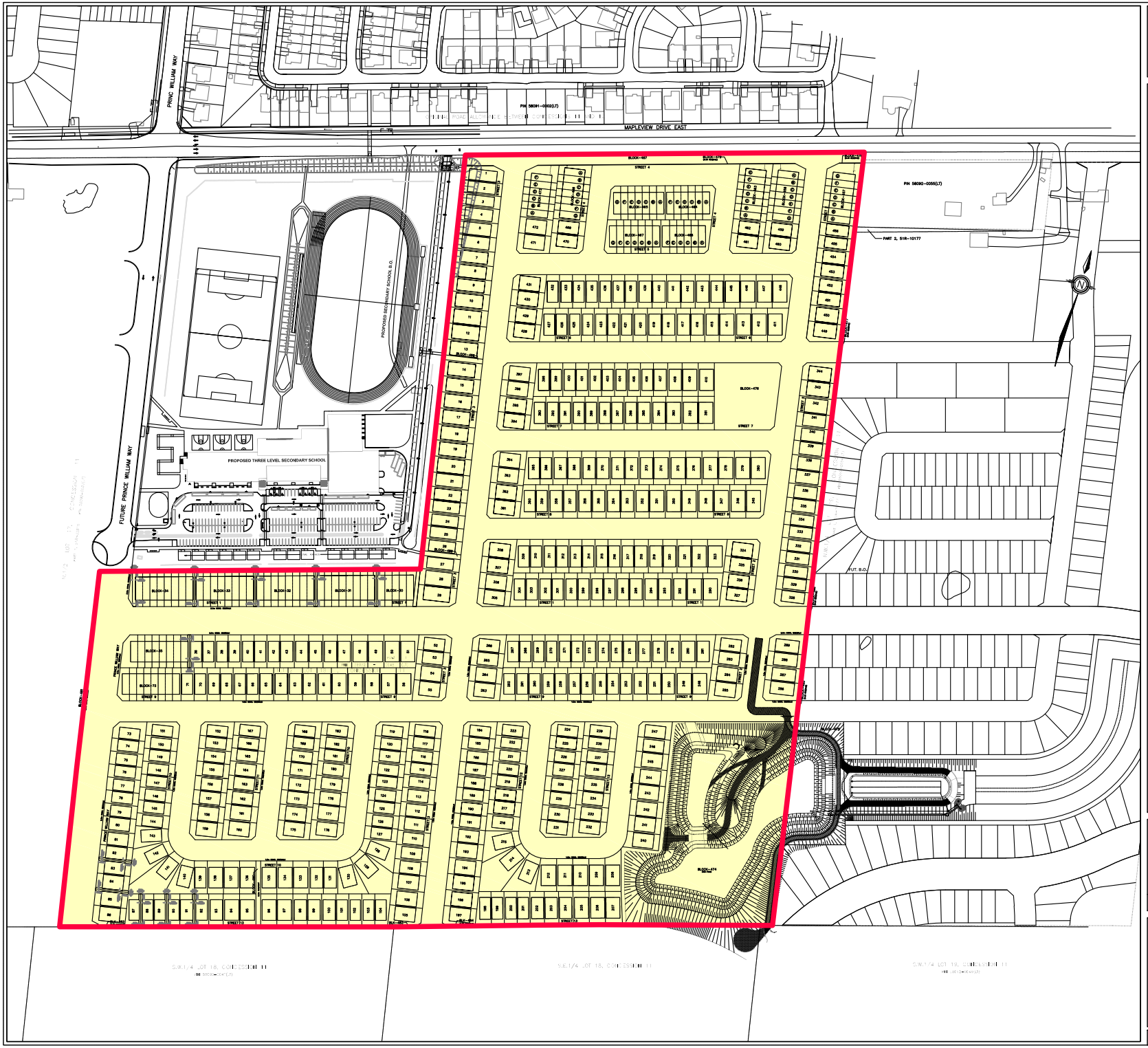
LEGEND

SUBJECT SITE\

SCHAEFFERS
CONSULTING ENGINEERS
6 Ronrose Drive, Concord, Ontario L4K 4R3
Tel: (905) 738-6100 Email: general@schaeffers.com
www.schaeffers.com

FIGURE 1.1
LOCATION PLAN

2018-4692	MARCH 2020	SCALE: N.T.S.



EAST ANNEXATION LANDS
MAPLEVIEW DRIVE EAST

LEGEND

SUBJECT SITE

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www.schaeffers.com

FIGURE 1.2
SITE PLAN

2018-4692	MARCH 2020	SCALE: N.T.S.

2.0 STORMWATER MANAGEMENT

Major part of the subject site is located within the Sandy Cove Creek Subwatershed. The "*Hewitt's Secondary Plan Area, Subwatershed Impact Study (SIS), Lover's, Hewitt's and Sandy Cove Creeks, by R.J. Burnside & Associates Limited in partnership with Azimuth Environmental Consulting Inc., dated September 2016 and Addendum No. 1, dated November 2017"* identified the stormwater management requirements for the Sandy Cove Creek Subwatershed (see excerpts from the SIS in Appendix D). The proposed development will drain mainly into a tributary of the Sandy Cove Creek (see Figures 5 and Figure 10 in Appendix D).

2.1 Existing Infrastructure

The subject site has been used as a farmland. Under existing conditions, the subject site is draining partially to the north towards Mapleview Drive and to the southeast towards an existing tributary of the Sandy Cove Creek As shown on Figure 2.1 and Pre-development Storm Drainage Plan (Drawing STM-1), provided in Appendix E, 5.5 ha drainage area, located at north part of the subject site and immediately south of the Mapleview Drive, drains northerly towards Mapleview Drive and the remaining 24.8 ha area of the subject site drains easterly into tributaries of the Sandy Cove Creek. There is no storm sewer connection in vicinity of the proposed development to service the subject site.

2.2 Stormwater Management Design Criteria

The stormwater quality and quantity control criteria for the subject site is based on the Ministry of Environment 2003 Stormwater Management Practices Planning and Design manual. Additional SWM design criteria as recommended by the City of Barrie and the Lake Simcoe Region Conservation Authority (LSRCA) have been integrated into the overall design. A summary of the stormwater management design criteria is provided as follows:

- Enhanced water quality protection is required. The permanent pool required storage volume, to be calculated using Table 3.2, from the 2003 MOE SWMP Manual;
- According to SIS, the erosion analysis results, presented in Table 4.4.15, provided in

Appendix D, to be matched at detailed design stage;

- Water quantity control for the development is required to control the post-development runoff from the 2-year to 100-year storm events, to pre-development target release rates;
- Storm sewers to be provided on all roads with a curb and gutter. Storm sewers to be designed, to convey the 1:5 year design storm, as a minimum;
- For the quantity control modelling, design storms SCS Type II (6 hours, 12 hours and 24 hours duration) and City of Barrie 4-hour Chicago design storm should be used;
- In order to determine the critical design storms, the SCS Type II (6-hour, 12-hour, and 24-hour durations), as well as 4-hour Chicago storm distributions for the 1:2 year through the 1: 100 year return periods to be applied.;
- All storm sewers to be designed according to the Rational Formula where:

  $Q = (C)(I)(A)/360$, where:

  Q = the design flow in (m^3/s)

  C = the site specific runoff coefficient

  A = the drainage area (ha)

  The rainfall intensity shall be calculated in accordance with the "*Table 3.1: Barrie WPCC IDF Curve Parameters - Adjusted to Account for Climate Change"* and the following equation:

  $I = A/(t + B)^C$

  I = the rainfall intensity (mm/hr)

  t = the time of concentration (minutes)

  A, B, C = function of the local intensity-duration data.

- For Medium Density Residential (1/10 to ¼ acre lot) total imperviousness 35% - 60% and directly connected imperviousness 20% - 45% (Table 7.6 of City Design

Guidelines);

- For High Density Residential (<1/10 acre lot) total imperviousness 60% - 75% and directly connected imperviousness 35% - 60% (Table 7.6 of City Design Guidelines);
- Curve No. (AMC II) for residential area with Soil Group BC is = 68 (see Table 7.4 of City Design Guidelines and LSRCA Comment No. E2, dated May 28, 2019 in Appendix D)

2.3 Proposed Stormwater Management Plan

The proposed stormwater management plan for the subject site is consistent with the "*Hewitt's Secondary Plan Area, Subwatershed Impact Study (SIS), Lover's, Hewitt's and Sandy Cove Creeks, by R.J. Burnside & Associates Limited in partnership with Azimuth Environmental Consulting Inc., dated September 2016 and Addendum No.1, dated November 2017"*. The SIS was prepared based on "*City of Barrie Secondary Plan, Background Studies & Infrastructure Master Plan, Intensification & Annexed Lands, Drainage and Stormwater Management Master Plan, October 2013, prepared by AMEC"* and provided additional information. The SIS identified stormwater management requirements for the Hewitt's Secondary Plan Area, including the subject site. An off-line SWM wet pond, referred to as SWM Pond 11, located at southeast corner of the subject site, was proposed to provide erosion, quality and quantity controls for the stormwater runoff from its drainage area (see Figure 7 and Figure 10 in Appendix D). According to Figure 3, excerpted from SIS and provided in Appendix D, the subject site will be developed as part of the Phase 1 development plan. Due to grading constraints, as shown on Figure 2-3, the runoff from 3.63 ha drainage area of the subject site, located at southwest part of the site, will be accommodated by future stormwater infrastructure in neighboring properties. As such, the full servicing of the subject site will depend upon construction of the municipal infrastructure in neighboring properties.

The proposed drainage plan for the subject site consists of a dual drainage system designed in accordance with the Ministry of Environment and Climate Change (MOECC), Lake Simcoe

Region Conservation Authority (LSRCA) and City of Barrie design criteria and guidelines. Flows generated by storms up to and including the 5 year storm event will be captured and conveyed by the minor system, which will be comprised of storm sewers and catchbasins. The major system will convey all runoff that is not captured by the minor system (up to and including the 100 year storm event) and will consist of roadways and overland flow routes (see Figure 2.2 and Figure 2.3).

2.3.1 SWM Pond Drainage Area

Figure 10 and Figure 11, excerpted from SIS and provided in Appendix D, show the drainage area to SWM Pond 11 as Catchment 11 and Catchment 11B. In Table 13 of SIS, provided in Appendix D, the allowable release rates for the proposed SWM Pond 11 have been calculated based on total tributary area of 36.3 ha to the pond.

As shown on Figure 2.3, a small area at south part of the subject site, tributary to SWM Pond 11 and Sandy Cove Creek, according to SIS, has been directed to Future SWM Pond in neighbouring property, which will drain into Hewitt's Creek. In return, an area at southeast part of the site, tributary to Hewitt's Creek, according to SIS has been partially directed to the proposed SWM Pond 11 and ultimately to Sandy Cove Creek.

The proposed SWM Pond 11 has been sized to accommodate flows from total of 42.08 ha drainage area, consisting of:

- 26.52 ha subject site (883 Mapleview Drive East Subdivision drainage area), with weighted runoff coefficient, C = 0.63;
- 7.07 ha external residential drainage area (C = 0.67), north of the subject site (Mapleview Drive East Road Widening and residential Subdivision);
- 7.53 ha (including pond area) external residential area (C = 0.68), east of the subject (Reino Mapleview South Development) and
- 0.99 ha external drainage area (C = 0.76), northeast of the subject site (AWAN Group Residential Development).

The pond has been expanded towards east to provide quality, erosion and quantity controls for the increased drainage area. A summary of the SWM Pond 11 tributary areas is provided in Table 2-1 as follows:

Table 2-1: Drainage Areas to SWM Pond 11

No.	Location of Drainage Area	Area (ha)	Runoff Coefficient., C	Imperviousness
1	Subject Site (Internal)	26.52	0.63	0.61
2	External from North	7.07	0.67	0.67
3	External from East	7.53	0.68	0.68
4	External from Northeast	0.99	0.76	0.81
Total		42.11	0.65	0.64

Note: the subject site and External from East drainage areas include the SWM portions.

The site specific, 5-year storm event runoff coefficients for the subject site have been calculated, based on "*Composite Runoff Coefficient Calculation"* sheet, provided in Appendix B. The calculated runoff coefficients are consistent with Table 3.2 of the City of Barrie Design Criteria (Residential – Hydrologic Soil Group B – BC). Please refer to Appendix B for copies of runoff coefficient calculations and Table 3.2 of the City of Barrie Design Criteria. Storm tributary area plans are provided in Appendix E.

2.3.2 Water Quality Control –Treatment Train

Degradation of water quality can result in a decline in plant and animal diversity. It may also affect drinking waterer supplies and recreational uses of water such as swimming (MOE, 2013). Only end of pipe treatment may not be sufficient to provide enhance quality control for the flows from urbanized areas, therefore, treatment train, including LID measures are proposed to provide the required protection.

As part of the treatment train, clean water from roof, directed to the perforated pipe infiltration system is proposed to enhance infiltration, reduce runoff and provide quality control. The proposed SWM Pond, which has been designed as a wet pond, includes a filtration bed amended with phosphorus sorbtive media, is the final quality control LID measures. It will retain stormwater and provide quality control through filtration. The following sections will provide more details of the treatment train and quality control.

2.3.2.1 Water Quality Control Storage Volume (Permanent Pool)

The required suspended solids removal treatment is based on MOECC Enhanced Protection Level (Level 1). This corresponds to a long-term average removal of 80% of suspended solids. Consistent with SIS, the proposed SWM Pond will provide Enhanced water quality control as per the MOECC Stormwater Management Planning and Design (SWMP) Manual (March 2003). The proposed treatment train mentioned in Section 2.3.1 will have the capacity to capture more than 80% total suspended solids (TSS). Please note that only the proposed SWM Pond, designed based on MOECC guidelines will have the capacity to capture 80% of the TSS and the other proposed LID measures will provide additional quality control for the stormwater runoff from the proposed developments.

According to the Table 7.6 of the City of Barrie Storm Drainage and Stormwater Management Policies and Guidelines, 2017, the total imperviousness percentage for medium density residential ranges from 35% to 60%. Site specific runoff coefficients for detached and townhouse units have been calculated and provided in Appendix B The calculated runoff coefficient for detached unit is 0.62 and for townhouse unit is 0.73. According to the Average Runoff Coefficient Calculation, provided in Appendix B, the overall Average Runoff Coefficient is 0.65. The corresponding imperviousness ratio based on I = (C – 0.2)/0.7 = (0.65 – 0.20)/0.70 is = 0.64, which has been used for permanent pool storage volume calculation.

The water quality control volumes (permanent pool) for the proposed SWM Pond are summarized in Table 2-1. Detailed calculations are provided in Appendix B for reference.

Table 2-2: Permanent Pool Requirements – SWM Pond 11

Type of Facility	Wet Pond
Level of Protection	Enhanced
Drainage Area	42.11 ha
Weighted Imperviousness	64 %
Total Storage Volume Requirement	211 m^3/ha
Minimum Extended Detention Storage Volume Requirement	40 m^3/ha = 1,684 m^3
Permanent Pool Requirement	171 m^3/ha
Required Permanent Pool Storage Volume	7,201 m^3
Provided Permanent Pool Storage Volume	11,010 m^3

Table 2-2 shows that the provided permanent pool storage volume (11,010 m^3) is more than the required permanent pool storage volume (7,201 m^3), therefore, permanent pool capacity concerns will not be expected. The calculations provided in Appendix B shows that forebay area is 26.0% of the total permanent pool area and forebay volume is 24% of the total permanent pool volume.

According to an email of August 12, 2019 from Tatham Engineering Ltd. (The consultant for designing the channel), provided in Appendix D, the 100-year storm event water level at most upstream cross-section of the Sandy Cove Creek Natural Channel, immediately downstream of SWM Pond is 252.65 m, while the permanent pool elevation is at 253.00 m.

2.3.2.2 Erosion Control

The "*City of Barrie Secondary Plan, Background Studies & Infrastructure Master Plan, Intensification & Annexed Lands, Drainage and Stormwater Management Master Plan (DSWMMP), October 2013, prepared by AMEC"* developed erosion threshold unitary discharge rates and volumes for the Sandy Cove Creek Subwatershed, utilizing QUALHYMO and 30-year continuous simulation data set. Please refer to Table 4.4.15 of the DSWMMP (reprinted in Section 5.4.2 of the SIS) for the previously developed erosion

threshold unitary discharge rate. According to this table the unitary erosion release rate is = 0.0010 m^3/s/ha and release rate for the SWM Pond with 42.11 ha drainage area is:
Q = 0.0010 x 42.11 = 0.042 m^3/s and the required storage volume according to the same table (unitary storage rate of 310 m^3/Imp. ha, and average imperviousness of 0.64) is:
= 310 x 42.11 x 0.64 = 8355 m^3, while the provided storage is 8,700 m^3. The detention time = 8355/ (0.042 x 60 x 60) = 55 hour.

2.3.3 Water Quantity Control and Storage Requirements

2.3.3.1 Target Release Rates

The proposed SWM Pond 11 drainage area is located within Sandy Cove Creek Subwatershed. The DSWMMP identified unitary storage and discharge rates for the Hewitt's Secondary Plan Area (SPA), based on traditional mitigation of post development peak discharge to existing conditions peak release rates for discrete storm events. The DSWMMP also provided erosion threshold unitary discharge rates and storage volumes based primarily on mitigation to a minimum of 95% of the excess shear impact for the receiving stream on the flow, anticipated by the proposed development. The erosion threshold unitary discharge rates were developed using a continuous simulation model (see Table 4.4.15 in Appendix D). The composite unitary discharge rates for the Sandy Cove Creek Subwatershed from Table 4.4.15 of the DSWMMP and the calculated release rates for the subject site, based on 36.3ha drainage area, used in SIS, are summarized in Table 2-3 as follows:

Table 2-3: End-of-Pipe Stormwater Management Requirements from DSWMMP

Storm Event	Erosion	5-year	25-year	100-year
Unitary Discharge Rate (m^3/s/ha)	0.0010	0.010	0.02	0.04
Discharge Rates for 36.3 ha area (m^3/s)	0.040	0.36	0.73	1.46

The SIS used PCSWMM modelling software and identified the post-development 2-year up to 100-year storm event allowable release rates from the proposed SWM Pond, referred to as SWM Pond 11. Based on 36.3 ha drainage area used in SIS, the post-development flows from

the SWM Pond 11, shown on Table 13 of the SIS, provided in Appendix D, are summarized in Table 2-4 as follows:

Table 2-4: Target Release Rates for SWM Pond 11, from Table 13 of SIS (36.3 ha Area)

Storm Event	2-year	5-year	10-year	25-year	50-year	100-year
Unitary Release Rate (m^3/s/ha)	0.002	0.008	0.015	0.024	0.032	0.040
Allowable Release Rate (m^3/s)	0.07	0.29	0.54	0.87	1.16	1.45

As mentioned in Section 3.2.1, the total drainage area to the proposed SWM Pond has increased to 42.11 ha. The allowable release rates, based on 42.11 ha drainage area have been calculated and summarized in Table 2-4 as follows:

Table 2-5: Target Release Rates for SWM Pond 11 Proposed to Service 42.11 ha Area

Storm Event	2-year	5-year	10-year	25-year	50-year	100-year
Unitary Release Rate (m^3/s/ha)	0.002	0.008	0.015	0.024	0.032	0.040
Allowable Release Rate (m^3/s)	0.08	0.34	0.63	1.01	1.35	1.68

The proposed SWM Pond 11 has been sized to control post development flows from 42.11 ha drainage area, to allowable release rates shown in Table 2-5.

2.3.4 Proposed SWM Pond 11

Consistent with the SIS, a stormwater management block is proposed at the southeast corner of the subject site. In order to provide enough capacity, to accommodate the flows from increased drainage area, the pond has been expanded towards east, within Reino Mapleview South Proposed Development. The proposed SWM Pond which will provide quality, erosion and quantity control for the 2-year up to and including 100-year storm event flows from 42.11 ha drainage area, will discharge into a tributary of the Sandy Cove Creek. The proposed SWM Pond has been sized according to MOECC, LSRCA and City of Barry design criteria for wet ponds, to provide enhanced quality control (80% TSS removal) and attenuate post-development flows, from its drainage area, to flows less than target release rates, provided in

Table 2-5. The proposed pond consists of a forebay a wet cells and a sand filtration bed. Due to high groundwater elevation, Bentofix Geosynthetic liner is proposed in forebay and wet cells. Subdrains are provided to convey the groundwater during maintenance of the pond to the proposed dewatering sump as shown on Drawing SWM-1. According to the *"Hydrogeological Review, Stormwater Management Pond",* by EXP, dated October 4, 2019, provided in Appendix D, the maximum flow into subdrain system, during maintenance of the pond is = 1,100 m^3/day (12.73 l/s). Six 150 mm diameter PVC perforated pipes at 0.5% slope are proposed. The conveyance capacity of each proposed perforated pipe is = 1/0.013 x $(0.15/4)^{2/3}$ x $(0.005)^{0.5}$ x π x $0.15^2/4$ = 10.8 l/s. The total capacity of the proposed six 150 mm pipes is = 6 x 10.8 = 64.8 l/s, which indicates a safety factory of 5. The conveyance capacity of the proposed 300 mm diameter pipe is = 1/0.013 x $(0.30/4)^{2/3}$ x $(0.005)^{0.5}$ x π x $0.30^2/4$ = 68.32 l/s.

As part of the treatment train, a Sand Filtration Bed, amended with the phosphorus sorbtive media, is proposed downstream of the wet cell. The extended detention flow will discharge at the surface of the sand filter bed, at permanent pool elevation (253.0 m) and after filtration will discharge to the outlet through proposed perforated pipes (see drawings in Appendix E).

In response to LSRCA concerns, regarding long-term compaction of the filtration bed due to weight of water on top of it, the geotechnical consultant (EXP), prepared a report *"Geotechnical Considerations, Stormwater Management Pond Filtration Media, dated October 4, 2019"* (see Appendix D for a copy of the report).

2.3.4.1 SWM Pond Quantity Control Sizing (Stage –Storage –Discharge)

According to the City of Barrie Design Criteria, Visual OTTHYMO hydrological modelling, 4-hour Chicago storm distribution and SCS Type II (6-hour, 12-hour and 24-hour durations) design storms were used to size the proposed pond. Based on Geotechnical Report for the subject site, the type of soil is mainly Sandy Silt, belonging to Group B/ BC. Based on Table 7.4 of the "*City of Barrie Storm Drainage and Stormwater Management Policies and Guidelines, 2017"*and LSRCA comment of May 2019, the curve numbers (AMC II) for lawn

with soil type B and BC are 61 and 68, respectively. The CN* has been calculated conservatively based on CN 68. The calculations provided in Appendix C shows that the CN* (AMC II) is = 64. The Visual OTTHYMO modelling results are provided in Appendix C and pond drawings can be found in Appendix E. The storage volumes and release rates are summarized in Table 2-6 as follows:

Table 2-6: Summary of Stage – Storage – Discharge Relationship for SWM Pond 11

Storm Event	Stage (m)	Target flows	Flows from SWM Pond (m^3/s) and Required Storage Volumes (m^3)								Provided storage volume
			4-hr Chicago		6-hr SCS		12-hr SCS		24-hr SCS		
			Flow	Storage	Flow	Storage	Flow	Storage	Flow	Storage	
P. Pool	253.00	**0.00**	0.00	7,201	0.00	7,201	0.00	7,201	**0.00**	**7,201**	**11,010**
Erosion	253.80	**0.04**	0.032	8,355	0.022	8,355	0.022	8,355	**0.022**	**8,355**	**8700**
2-yr	254.10	**0.08**	0.058	8,660	0.057	10,251	0.064	10,917	**0.076**	**11,882**	**12,250**
5-yr	254.35	**0.34**	0.164	12,378	0.218	14,426	0.214	14,362	**0.276**	**15,376**	**15,850**
10-yr	254.50	**0.63**	0.306	14,315	0.392	16,784	0.376	16,606	**0.480**	**17,764**	**17,950**
25-yr	254.75	**1.01**	0.525	16,438	0.680	19,700	0.648	19,396	**0.826**	**21,099**	**21,550**
50-yr	254.90	**1.35**	0.703	17,940	0.928	22,018	0.886	21,658	**1.116**	**23,641**	**23,800**
100-yr	255.05	**1.68**	0.895	19,503	1.191	24,380	1.150	23,964	**1.374**	**26,299**	**26,700**

Table 2-6 shows that the 24-hour SCS Type II Design Storm requires more storage volumes. The maximum storage volume used during a 100-year storm event is 26,299 m^3, while the provided 100-year storm event storage volume is 26,700 m^3, which is greater than the maximum storage volume used, therefore, SWM Pond capacity constraints will not be expected. Additionally, the expected actual flows from the SWM Pond are less than the allowable release rates, therefore, the proposed SWM Pond will provide the required quantity control for the stormwater flows from its drainage area.

A summary of the total controlled flows from SWM Pond 11 and uncontrolled flows from backyard in Reino Mapleview South Proposed Development, discharging directly to the water course, is provided in Table 2-7 as follows:

Table 2-7: Controlled plus Uncontrolled Flows to the Watercourse (NASHYD # 7)

Storm Event	Elevation (m)	Controlled Plus Uncontrolled Flows to the Watercourse (m^3/s)				
		Target	4-hr Chicago	6-hr SCS	12-hr SCS	24-hr-SCS
Erosion	253.80	**0.04**	0.033	0.023	0.023	**0.023**
2-year	254.10	**0.08**	0.060	0.058	0.065	**0.077**
5-year	254.35	**0.34**	0.166	0.220	0.216	**0.280**
10-year	254.50	**0.63**	0.310	0.398	0.382	**0.488**
25-year	254.75	**1.01**	0.532	0.690	0.658	**0.839**
50-year	254.90	**1.35**	0.713	0.942	0.900	**1.136**
100-year	255.05	**1.68**	0.908	1.215	1.173	**1.404**

Table 2-7 shows that the controlled flows from the SWM pond plus the uncontrolled flows from the backyards, discharging to the watercourse will not exceed the allowable release rates, therefore, the development of the SWM Pond 11 drainage area will not have an adverse impact on erosion and level of flows in receiving watercourse.

2.3.4.2 SWM Pond Quantity Control Structure

The proposed SWM facility will provide a combination of enhanced water quality, erosion and quantity control for all storm events up to and including the 100-year storm event. In order to achieve the target release rates provided in Table 2-5, the following structure is proposed:

As part of the outlet control structure, a 300 mm diameter pipe controlled by a 135 mm diameter orifice plate, at invert elevation of 253.0 m, is proposed to provide water quantity control. As shown on drawings, provided in Appendix E, the extended detention flows will discharge at the surface of the proposed Sand Filtration Bed and after passing through sand filter media, will discharge to the outlet through proposed perforated pipes, at the bottom of the filter bed. Each of the three proposed 150 mm diameter perforated pipes with 1800 (25 mm diameter) holes, at 100 mm spacing and perforated length of 60 m, surrounded with a gravel jacket will have the required capacity to capture the flows and convey them to the

outlet. Based on City of Barrie requirements, a separate storm sewer, equipped with a valve to facilitate drainage of forebay for maintenance has been provided (see drawings in Appendix E).

The Stage-Storage-Discharge Calculation sheet, provided in Appendix B, shows that a 0.69 m wide and 1.05 m high weir, at invert elevation of 254.0 m will control the 2-year up to and including the 100-year storm event flows, from the proposed SWM Pond to flows less than the allowable release rates. As shown on drawings, provided in Appendix E, a 900 mm diameter storm sewer at upstream invert elevation of 252.44, will convey the 2-year up to and including the 100-year storm event flows to the outlet.

Table 2-8 provides the details of each component of the outlet structure for the proposed SWM Pond as follow:

Table 2-8: SWM Pond 11 Outlet Control Structure Details

Component	Aperture Description	Size	Invert Elevation (m)
Extended Detention	Orifice Plate	135 mm Φ	253.00
2-year – 100 - year Storm	Weir	0.69 m x 1.05 m	254.00
All Storm Events	Outlet Pipe	900 mm Φ	252.44

The maximum 100-year storm event discharge from the proposed pond is = 1.374 m^3/s. The CulvertMaster calculation, provided in Appendix B, which considers the tailwater elevation at 252.65 m (100-year storm water level in receiving watercourse), shows that the calculated headwaer elevation for the 100-year storm, expected release rate of 1.374 m^3/s, is at 253.60 m which is lower than the invert of the proposed weir at 254.0 m, therefore the flow through the proposed weir will not be affected by the tailwater in outlet storm sewer.

2.3.4.3 SWM Pond Sediment Forebay

The function of the sediment forebay is to facilitate maintenance and improve pollutant removal by trapping larger particles from stormwater runoff near the inlet of the pond. The sizing of the sediment forebay is based on the settling length and dispersion length

calculations, provided in the MOE SWMPD Manual (March 2003). The forebay length should be greater than or equal to the larger of the settling and dispersion lengths.

Sediment forebay sizing calculations for the forebay is provided in Appendix B and summarized in Table 2-9. Please refer to Drawing SWM-1, provided in Appendix E for forebay length (88 m, measured from forebay inlet to forebay outlet) and width (33 m). Table 2-9 demonstrates that the proposed forebay has sufficient length, with length to width ratios of at least 2.7:1 and permanent pool depth of 1.6 m.

Table 2-9: SWM Pond Sediment Forebay Details

Description	Forebay Size
Provided Length-to-Width Ratio	2.7:1
Provided Permanent Pool Depth	1.6
Required Settling Length	18 m
Required Dispersion Length	81 m
Provided Forebay Length	88 m
Provided Forebay Width	33 m

2.3.4.4 SWM Pond Emergency Spillway

SWM Pond 11 has been designed with an emergency spillway to allow storm drainage to safely exit the facility in the event that the outlet fails to function or the storm event is greater than the facility design (100-year return period). The emergency spillway invert is placed at the proposed 100-year water elevation of 255.05 m. It will convey flows out of the pond should water elevation in the pond rise above the proposed 100-year water elevation. The maximum 100-year storm event inflow, from the 6-hour SCS Type II Storm VO modelling results, provided in Appendix C is 13.75 m^3/s, while the maximum conveyance capacity of the proposed spillway is 16.77 m^3/s (see Table 2-10 below and calculations in Appendix B). Detail of the emergency spillway is shown on Drawings SWM-1 provided in Appendix C.

Table 2-10: SWM Pond 11 Emergency Spillway Design

Top width (m)	Bottom width (m)	Average width (m)	Depth (m)	Side slope	100-year Inflow (m^3/s)	Capacity (m^3/s)
31	21	26	0.50	10:1	13.75	16.77

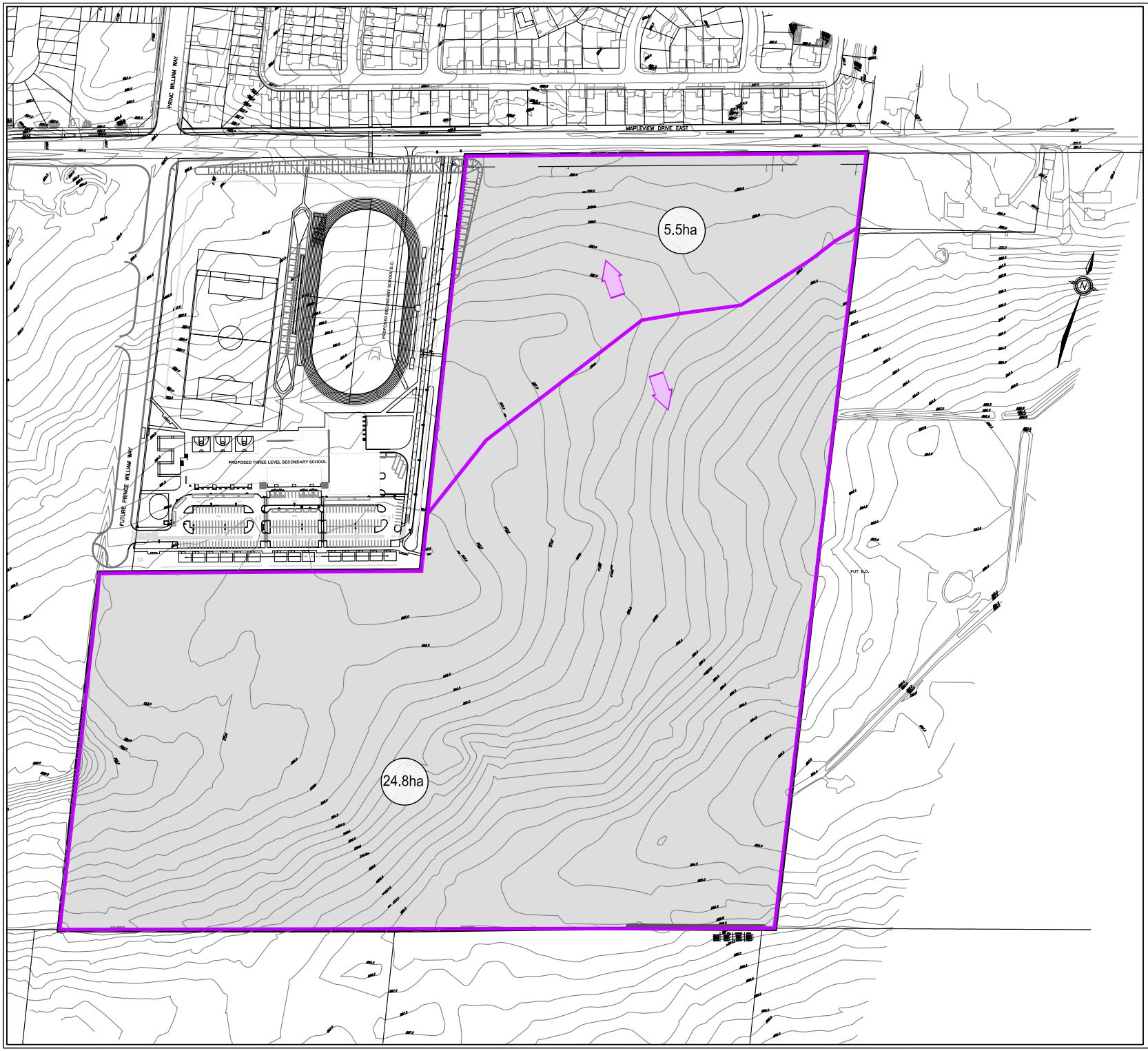
2.3.4.5 Thermal Mitigation

Thermal considerations are implemented in the proposed SWM Pond 11 design in order to minimize the thermal impact of the flows from the SWM facility on the cold water receiving watercourse. Thermal impacts from the SWM facility are mitigated through landscaping of the SWM facility and appropriate outlet structure design.

Landscaping of the SWM facility (i.e. high density planting of trees and shrubs) will provide shade and protection from the sun. The proposed outlet design thermal measure is a reverse slope pipe and Hickenbottom pipe. The thermal mitigation has been considered in configuration of the proposed SWM Pond, such that the forebay and wet cell have narrow layouts and will receive shading from all sides.

2.3.4.6 Groundwater Consideration

A copy of the "*Preliminary Hydrogeological Investigation, 883 Mapleview Drive East, Barrie, ON –December 21, 2017"*, by exp which includes detail information is provided in Appendix D.



EAST ANNEXATION LANDS
MAPLEVIEW DRIVE EAST

LEGEND

SUBJECT SITE

STROM DRAINAGE AREA

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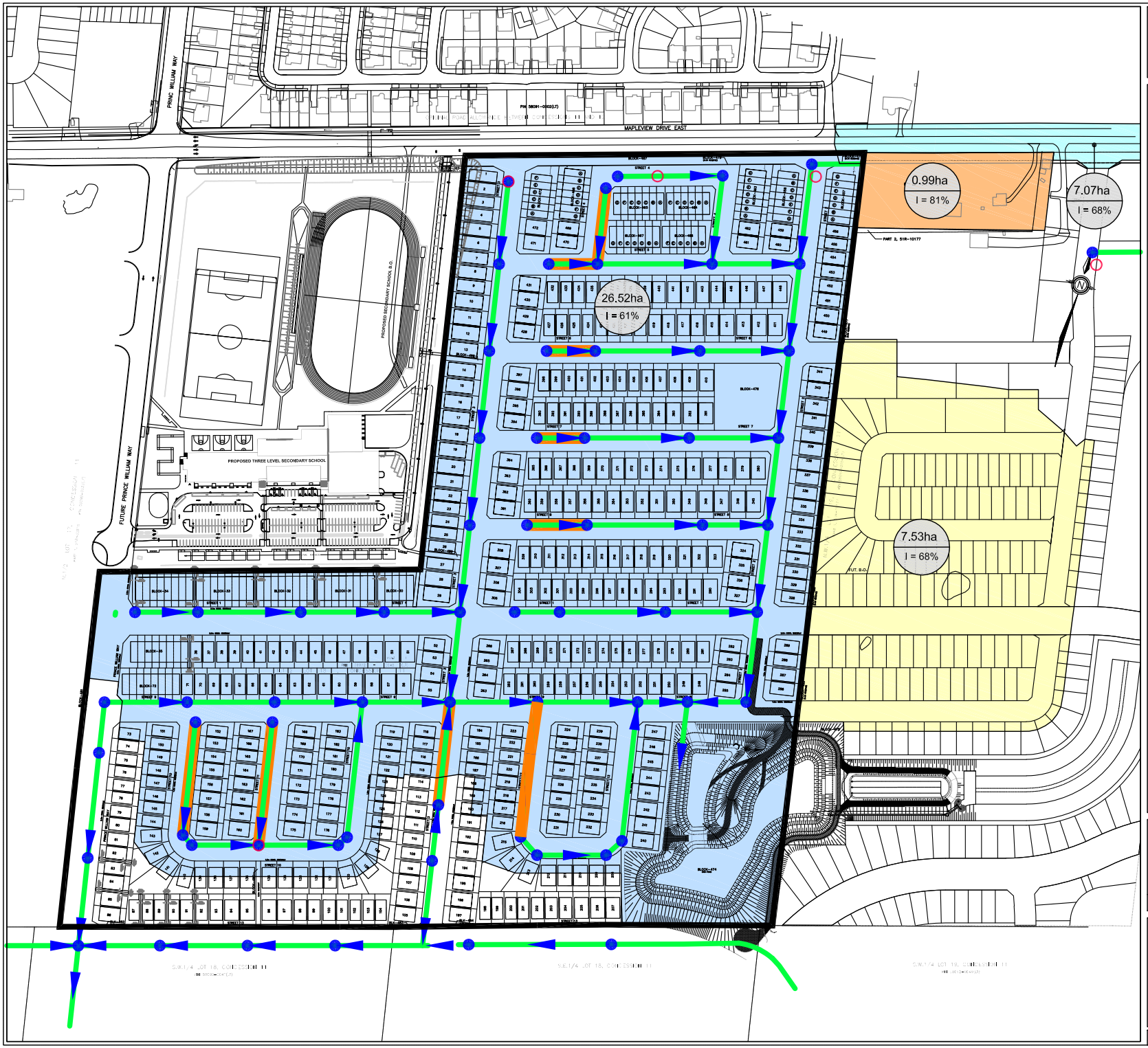
www.schaeffers.com

FIGURE 2.1
PRE-DEVELOPMENT
STORM DRAINAGE PLAN

2018-4692	MARCH 2020	SCALE: N.T.S.



EAST ANNEXATION LANDS
MAPLEVIEW DRIVE EAST

LEGEND

- SUBJECT SITE
- PROPOSED STORM SEWERS
- PERFORATED PIPE
- MINOR SYSTEM DRAINAGE AREA
- 28.0ha, I = 60% — DRAINAGE AREA IMPERVIOUSNESS
- DENOTES 100-YEAR MAJOR SYSTEM FULL CAPTURE
- 7.53ha EXTERNAL DRAINAGE AREA FROM REINO MAPLEVIEW SOUTH DEVELOPMENT
- 0.99ha EXTERNAL DRAINAGE AREA FROM AWAN GROUP RESIDENTIAL DEVELOPMENT
- 7.07ha EXTERNAL DRAINAGE AREA FROM MAPLEVIEW DR E RAOD WIDENING AND RESIDENTIAL SUBDIVISION NORTH OF MAPLEVIEW DR E

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FIGURE 2.2
MINOR SYSTEM
STORM SERVICING PLAN

2018-4692	MARCH 2020	SCALE: N.T.S.

EAST ANNEXATION LANDS
MAPLEVIEW DRIVE EAST

LEGEND

- SUBJECT SITE
- PROPOSED STORM SEWERS
- DENOTES 100-YEAR MAJOR SYSTEM FULL CAPTURE
- 28.0ha, I = 60% — DRAINAGE AREA IMPERVIOUSNESS
- 26.52ha FROM 883 MAPLEVIEW DRIVE EAST PROPOSED SUBDIVISION
- 3.63ha OF EXISTING SANDY COVE CREEK TO DRAIN TO HEWITT'S CREEK DUE TO GRADING CONSTRAINTS
- 7.53ha EXTERNAL DRAINAGE AREA FROM REINO MAPLEVIEW SOUTH DEVELOPMENT
- 0.91ha UNCONTROLLED BACKYARD TO WATERCOURSE
- 0.99ha EXTERNAL DRAINAGE AREA FROM AWAN GROUP RESIDENTIAL DEVELOPMENT
- 7.07ha EXTERNAL DRAINAGE AREA FROM MAPLEVIEW DR E RAOD WIDENING AND RESIDENTIAL SUBDIVISION NORTH OF MAPLEVIEW DR E

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FIGURE 2.3
MAJOR SYSTEM
STORM SERVICING PLAN

2018-4692	MARCH 2020	SCALE: N.T.S.

3.0 STORMWATER CONVEYANCE SYSTEM

The proposed stormwater management plan for the subject site consists of a dual drainage system designed in accordance with the City of Barrie design criteria. Up to and including the 5-year storm event runoff from the subject site and external drainage area will be captured and conveyed by the minor system, which will be comprised of storm sewers and catchbasins. The major system will convey all runoff which are not captured by the minor system (up to and including the 100-year storm event) and will consist of roadways and overland flow paths.

3.1 Minor System

As per the City of Barrie Design Criteria, all minor system pipes were designed to capture and convey the 5-year Design Storm flows under un-surcharged conditions (flows in sewers/full flow capacity < 1). Please refer to the storm sewer design sheets provided in Appendix B. Hydraulic Grade Line (HGL) analysis, using EPA SWMM software, was completed for the proposed storm sewers and details are provided under Section 7.0.

3.2 Major System

As per the City of Barrie design criteria, the major system has been designed to safely convey flows in excess of the minor system. The result of the EPA SWMM modelling, provided in Appendix C shows that the major system flow routes have the required capacity to convey the flows not captured by the minor system. There are four locations where the 100-yeaer storm event full capture is proposed. The location and drainage areas of the full capture are shown on Drawing STM – 1 and Drawing STM – 2, provided in Appendix E.

4.0 WATER BALANCE

As per Policy # 4.8-DP of the Lake Simcoe Protection Plan, a water balance was prepared for the proposed development area to determine the characteristics of water movement, including runoff and groundwater recharge under pre and post-development conditions. It is part of the assessment of potential impact of the proposed development on surface water and groundwater conditions on the site. The main goal of this water balance is to ensure the level of post-development infiltration within the subdivision meets the pre-development levels.

The *"Proposed Residential Development, 883 Mapleview Drive East, Barrie, Ontario, Infiltration Water Balance Assessment",* by EXP, dated October 24, 2019, provides detailed water balance information for the subject site. A copy of the report is provided in Appendix B for reference.

4.1 Pre-development Infiltration

According to the report by EXP, the pre-development annual infiltration has been calculated to be 44,102 m^3/year which is 16% of the annual precipitation volume on subject site. Table 4-1, provides a summary of pre-development water balance analysis for the subject site, as calculated in EXP report, provided in Appendix B.

Table 4-1: Summary of Overall Pre-development Water Balance Results

Location	Total Site Area (m^2)	Area Available for Infiltration (m^2)	Precipitation (m^3/year)	Actual Evapo-transpiration (m^3/year)	Run-off (m^3/year)	Uncorrected infiltration (m^3/year)	corrected infiltration (m^3/year)
Entire site	302,539	302,539	282,275	168,318	62,677	51,281	44,102
Percentage of total precipitation			100%	60%	22%	18%	16

Note: See Table 5.3 in *"Pre and Post-development Site Specific Water Balance Assessment"* in Appendix B

4.2 Post-development Infiltration with No Mitigation

According to the Water Balance Assessment by EXP, provided in Appendix B, the total area of impervious surfaces under the post-development conditions is approximately 187,747 m^2, representing approximately 62% of the subject site area (302,539 m^2). The remaining 114,792

m^2 (38% of the total subject site area) is available to contribute to infiltration under post-development conditions.

The post-development water balance calculations included in Water Balance Assessment by EXP, show that the expected corrected post-development annual infiltration is = 17,427 m^3/year, which forms 6% of the annual precipitation on subject site. Table 4-2 provides a summary of the post-development water balance assessment as calculated in EXP report, provided in Appendix B

Table 4-2: Summary of Post-development Water Balance with No Mitigation

Location	Total Site Area (m^2)	Area Available for Infiltration (m^2)	Precipitation (m^3/year	Actual Evapo-transpiration (m^3/year)	Run-off (m^3/year)	Uncorrected infiltration (m^3/year)	corrected infiltration (m^3/year)
Entire site	302,539	114,792	282,275	63,865	199,871	18,540	17,427
Percentage of total precipitation			100%	23%	70%	7%	6%

Note: See Table 6.1 in *"Pre and Post-development Site Specific Water Balance Assessment"* in Appendix B

4.3 Post-development Infiltration with Mitigation Measures (LID)

In order to meet water balance requirements, Clean Water Collector System, receiving clean water from roof area and discharging into perforated pipe infiltration system has been proposed for the subject site. Detail calculations for clean water collector system, provided in Appendix B, show that 298.9 m^3 clean water from the 12465 m^2 roof area will be stored in proposed infiltration system and infiltrate during each storm event. The infiltration trenches are proposed in areas where more than one metre separation between the bottom of the trench and high groundwater elevation can me maintained (see Plan and Profile drawings in Appendix E). As shown on Plan and Profile and Detail Drawing in Appendix E, the proposed perforated pipes will discharge to the catchbasins when the inflow is in excess of the trench storage capacity.

Comparing Table 4-1 and Table 4-2, the annual post-development infiltration deficit is = 44102 – 17,427 = 26675 m^3/year. Assuming infiltration will take place only during 9 months of the year and there will be average of 10 precipitation events per month, the total annual

volume of water that can be infiltrated is = 9 months/year x 10 events/month x 298.9 m^3/event = 26,901 m^3/year, which is greater than the annual infiltration deficit of 26675 m^3. The total post-development annual infiltration is = 26,901 + 17,427 = 44,328 m^3/year, which is greater than the pre-development annual infiltration of 44,102 m^3/year. As such, the water balance requirements are met and the development of the subject site will not have an adverse impact on groundwater recharge.

5.0 VOLUMETRIC CONTROL

The LSRCA requires the retention of 25 mm of runoff from Major Developments as per the Lake Simcoe Protection Plan (LSPP), dated July 2009. A major development is defined by the LSPP as; the creation of four or more lots, the construction of a building or buildings within a ground floor area of 500 m^2 or more, or the establishment of a major recreational use, further defined in the LSRCA SWM Guidelines as; compliance with the definition of the LSPP or a development that results in new construction or reconstruction of at least 0.5 ha of impervious area. In order to meet this criterion, water must be retained on site to be infiltrated/filtrated, evaporated or re-used whilst still able to capture the next rainfall event.

The hydrogeological studies for the subject site reveal favorable soils for onsite retention and infiltration. High groundwater prevents the implementation of subsurface facilities at some locations. Due to concerns with maintenance, City of Barrie has limited the application of LID's, most notably within backyards. Respecting City's limitations, Schaeffers does not propose infiltration galleries in the backyards. In order to meet LSRCA volumetric control requirements, perforated pipe infiltration system, receiving clean water from the roof and sand filtration bed adjacent to the SWM Pond are proposed. In accordance with the factors listed at the end of *Section 2.2.2.2* of the LSRCA SWM Guidelines, best efforts were made to retain the 25 mm, on site.

As shown on drawings provided in Appendix E, the extended detention flow from the SWM Pond 11 is proposed to discharge on surface of the Sand Filtration Bed and after passing through the filter media will discharge to the outlet. A depth of 0.50 m of sand filter, amended with phosphorus sorbtive media is proposed to provide the required filtration and reduce phosphorus load, leaving the subject site. The proposed Sand Filtration Bed is equipped with perforated pipes, within washed gravel, wrapped with a filter fabric at the bottom of the sand filter, to convey the flows to the outlet after filtration. Fused high density polyethylene sheets are proposed at the bottom of the sand filter to prevent groundwater contamination. Filter sizing calculation is based on Darcy Equation (Equation 4.12: Surface Area of Filter from

MOE Manual, 2003). Maximum depth of ponding on filtration bed is 0.40 m which is less than the maximum allowable depth of 1.0 m, as per MOE Manual (March 2003, Page 4-94), therefore, compaction of the sand filter, due to water load will not be expected. A layer of topsoil is not proposed, because vegetation at the surface of the filtration bed is not intended.

Since the Sand Filtration Bed is proposed downstream of the SWM Pond 11 and will receive treated stormwater from the pond, the total retention target has been calculated based on total drainage area to the proposed SWM Pond 11. According to Section 2.3.1 and imperviousness calculations in Appendix B, the total drainage area to SWM Pond 11, including the external drainage areas, as shown on Figure 2.3 is 42.11 ha with weighted imperviousness of 64%. Total volume of water to be retained per storm event is = 42.11 x 0.64 x 25 x 10 = 6738 m^3/event. Detailed calculation is provided in Appendix B and summarized as follows:

Given:

- Depth of rainfall/impervious area to be retained = 25 mm/event
- Total drainage area to the proposed SWM Pond 11 = 42.11 ha
- Weighted imperviousness of the SWM Pond drainage area = 64%
- Total impervious area is = 26.95 ha
- Total volume of water required to be retained (26.95 x 25 x 10) = 6,738 m^3/event
- Required Extended Detention Volume (see Appendix B) = 8,355 m^3
- Expected Extended detention flow as per Stage-Storage-Discharge Spreadsheet in Appendix B = 0.032 m^3/s
- Detention time based on expected detention flow = 72.5 hours
- Operating head of water on the filter (depth of ponding) = 0.40 m

Calculation:

Darcy Equation:

A =1,000Vd/k (h + d) t "Equation 4.12: Surface Area of filter MOE Manual (March 2003)"

Where:

- A = surface area of the filter in m^2

- V = design volume (m^3)
- d = depth (m) of the controlling filter medium
- k = coefficient of permeability of the controlling filter media (mm/hr)
- h = operating head of water on the filter (m)
- t = design drawdown time in hours

Typical values for k is:

- Sand: 45 mm/hr (MOE Manual March 2003)

The total extended detention volume of 8,355 m^3, which is greater than the 25 mm required volume of 6,738 m^3 is proposed to be infiltrated

Required Surface area of the Filter Bed, A = 1000 x 8355 x 0.50/45 x (0.40 + 0.50) x 72 = 1422 m^2

Provided Surface Area of the Filtration Bed = 1,500 m^2

Expected drawdown time based on provided surface area of 1,500 m^2 is:

t = 1000 x V x d/k x (h + d) x A = 1000 x 8355 x 0.50/45 x (0.40 + 0.50) x 1500 = 69 hours

Total volume of water retained on site = Infiltration Volume + Filtration Volume

= 298.9 + 8355 = 8,654 m^3

Depth of rainfall retained = 8654/26.95 x 10 = 32 mm > 25 mm (required)

6.0 PHOSPHORUS LOADING ANALYSIS

According to "*LSRCA Technical Guidelines for Stormwater Management Submission, September 1, 2016*", an application for major development shall be accompanied by a stormwater management plan that demonstrates through an evaluation of anticipated changes in phosphorus loadings, between pre-development and post-development, how the loadings from the proposed development shall be minimized. In addition to the above, the removal of 80% of the annual Total Phosphorus (TP) load from all major development areas will be required. The phosphorus removal rates recommended in the MOECC's Lake Simcoe Phosphorus loading Development Tool, January 2012 have been used in calculations.

6.1 Pre-development Phosphorus Loading

The proposed development is located within the Sandy Cove Creek Subwatershed and has been used as farmland. According to the SIS, the total phosphorus removal rates provided in the *"MOECC Lake Simcoe Phosphorus Loading Development Tool"* (January 2012) are to be used unless additional evidence can be provided to support alternative removal rates. The MOECC phosphorus loading rate of 0.19 kg/ha/year for cropland has been used to calculate the pre-development phosphorus loading from the subject site. Based on 42.11 ha drainage area of the proposed SWM Pond, the pre-development phosphorus loading from the proposed development is:

TP = 42.11 ha x 0.19 kg /yr /ha = 8.0 kg/year.

6.2 Post-development Phosphorus Loading

Based on the MOECC Phosphorous Tool, a post-development phosphorus loading rate of 1.32 kg/yr/ha was used to calculate the annual phosphorous load for the subject site. Detailed calculations based on 42.11 ha SWM Pond drainage area and loading coefficient of 1.32 kg/ha/year are provide in Appendix B and summarized as follows:

42.11 ha x 1.32 kg/ha/year = 55.59 kg/year

6.3 Post-development Mitigation Measures

Treatment train quality control approach has been proposed to minimize the discharge of the phosphorus from the total drainage area of the proposed SWM Pond 11, including the internal and external drainage areas. The proposed LID measures, as part of the proposed treatment train are highlighted as follows:

- Clean water collector system, receiving clean water from roof areas and discharging into perforated pipe infiltration system;
- Stormwater Management (SWM) Wet Pond;
- Sand Filtration Bed, amended with phosphorus sorbtive media, proposed downstream of the SWM Pond.

The total roof area discharging into proposed perforated pipe infiltration system, calculated as part of the water balance calculation, provided in Appendix B is = 1.25 ha. The flows in excess of the capacity of the proposed perforated pipe infiltration system will discharge into SWM Pond and will receive treatment. The extended detention flow, treated in SWM Pond, will discharge to the proposed Sand Filtration Bed, located immediately downstream of the wet cell of the pond. The LIDs, proposed for the 1.25 ha area consist of perforated pipe infiltration system (reduction factor 87%), SWM Pond (reduction factor 63%) and Sand Filtration Media, amended with sorbtive media (reduction factor 79%). The combined reduction factor for the three measures has been calculated to be 99% (0.87 + 0.63 – 0.87 x 0.63 = 0.95, and 0.95 + 0.79 -0.95 x 0.79 = 0.99). The remaining 40.86 ha drainage area will discharge to the pond and the extended detention volume (8355 m^3) will discharge to the filtration bed and pass through the sorbtive media (reduction factor 79%). The proposed LID measures for this area, consist of SWM wet pond and sorbtive media in filtration bed. The combined factor for the 40.86 ha area, tributary to the SWM Pond has been calculated to be 92% (0.63 + 0.79 – 0.63 x 0.79 = 0.92

The calculations provided in Appendix B shows that the proposed LID measures will reduce the post-development annual phosphorus loading from the SWM Pond drainage area from 55.59 kg/year to 4.33 kg/year which is less than the pre-development load by 3.67 kg/year.

6.4 Phosphorus Offsetting Calculation

According to Lake Simcoe Region Conservation Phosphorus Offsetting Policy, September 2017, the phosphorus load to be reduced to zero.

- The Offsetting Ratio = 2.5
- Post-development Phosphorus annual load = 55.59 kg/year
- Post-development load removed by proposed LIDs = 51.23 kg/year
- Post-development annual load leaving the pond = 4.36 kg/year
- Required reduction to achieve net zero loading = 4.36 kg/year

Proposed Offsetting Cost:

4.36 x 2.5 x $35000 = $381,500

7.0 HGL MODELLING VIA EPA SWMM

To assess the capacity of the proposed storm sewer network and to assess the HGL during major events, an EPA SWMM model was created to simulate 100-year return period storm conditions. Tables and figures presenting the model inputs is presented in Appendix C, digital copy of the model is presented on a CD at the back cover to the report.

The model consisted of minor system drainage pipes, major system overland flow routes, drainage subcatchments (including full capture and overland runoff), and catch basin links between major and minor networks. The sewer pipe network was established directly from the Civil 3D sewer files that were used to create plan and profile drawings for the subject site. The overland flow routes were created based on the proposed grading in the Civil 3D files. The shape of the ROW was characterized from the City of Barrie standard drawings. Drainage subcatchments were established in a way to separate full capture subcatchments and overland drainage subcatchments. Catchbasin links were established based on the storm sewer plan drawings, with the number of catchbasins increased at full capture locations for the purpose of simulation only.

The major and minor system within the model have been created systematically. The pipe network, with inverts and manholes, is based on the Civil 3D network. The major system exists above the minor system, with catch basin connections linking the two systems as outlets. The major system is, where possible, labeled to be consistent with the minor system beneath it (i.e. nodes in the major system use the same name as the Manhole ID, but with "SN" appended to the front, and likewise with Link ID and "SL".) Where required, additional nodes and links were added to better simulate the proposed geometry and/or flow directions.
Subcatchments parameters were determined based on the land use, drainage pattern, and catchment geometry. The land uses considered were single detached dwellings, townhouses, and where appropriate, roads. With imperviousness for each catchment outlined in the Table 2-10 as follows:

Table 7-1: Subcatchment imperviousness by land use

Land Use	Imperviousness
Detached Houses	60
Townhouse	76
Road	99 (assumed fully impervious)

Table 2-11 outlines the parameters used as a default based on the conditions of the subcatchments. The values for percent routed were estimated lower than proposed conditions to be conservative since a lower percent routed leads to a higher runoff.

Table 7-2: Subcatchment Width and Percent Routed

Condition	Width	Percent Routed
One-Sided Drainage	Road Length	50
Two-Sided Drainage	2x Road Length	60
Rear lot full capture	Area [m2] / 20[m]	100

The drainage pattern determined the directly connected impervious percentage and whether the EPA SWMM width parameter was calculated based on one-sided drainage or two-sided drainage. The drainage node of the various subcatchments determines whether the subcatchment is fully captured or has overland runoff to the ROW. If the subcatchment drains to a surface node, it represents overland runoff. Conversely, if the subcatchment drains to a sewer node, then it is a fully captured subcatchment.

Minor losses were added to manholes with the simplifying assumption that upstream and downstream velocity are the same using the Exit Loss parameter on each sewer link. Minor losses were not added to surface links, and where dummy links were added, the dummy link was set to zero minor losses.

The sewer network has external drainage from the North and East. To simulate this, the northern external areas were considered as full capture, and the east was considered to drain to the subject site via major and minor system connections. To simulate the eastern external area, three dummy subcatchments were created, and parameters were estimated conservatively based on land use. Dummy sewers, road surfaces, were created at 0.5% slope and sized to accommodate the flow. Catch basin links were created, and an estimated number of catch basins was assigned based on plans provided by Jones Engineering. The layout of this external area is conceptual only and does not relate to any proposed sewer layout.

The simulation results from the model were used to create the HGL in the sewer profiles where the HGL is above the obvert of the pipe.

8.0 EROSION AND SEDIMENT CONTROL DURING CONSTRUCTION PHASE

Sediment and erosion control measures are generally used to minimize the soil particle detachment, transport and deposit of the detached soil particles. Construction activities commonly alter the landscapes where they are located, exacerbating these natural process. One of the most significant alterations encountered during construction is the removal of the trees and vegetation that stabilize the subsoil. Efforts are required to minimize the extent of the disturbance and stabilize the disturbed areas as soon as possible. The following procedures and control measures will be used:

- Erosion protection at source, which will minimize sediment detachment
- Phasing construction work and minimizing the extent of the disturbance;
- Erosion protection and stabilization of the critical areas and topsoil stockpiles;
- Using rock check dams and DitchChexx to reduce flow velocities in conveyance swales and channel and create ponding opportunities;
- Stabilizing the conveyance swales and channels before directing flows to these channels;
- Using environmental fences to isolate the work area and create upstream ponding, which allows soil particles to settle down, thereby reducing the amount of soil particles leaving a disturbed area ;
- Construction of temporary siltation control pond during construction phase;
- Regular inspection and monitoring;
- Updating the erosion and sediment control measures according to site conditions; and
- Repair/replacement of deficient parts within 24 hours after detected through inspections;

The following discussion provides a summary of potential sediment and erosion control measures that can be implemented during the construction stages of the project. The watercourses and associated valley lands adjacent to the site are the most critical features that are to be protected. Some of the proposed erosion and sediment control measures are explained in more details as follows:

Phasing

In terms of sediment and erosion control, phasing is advantageous as it reduces the limits of construction at a given point and time, as opposed to developing the entire area at once. As a result, disturbed or bare earth areas, which are a large source of sediment and erosion, are also reduced.

Topsoil Stockpiles

Grading for construction requires the top layer of soil (topsoil), which contains nutrients and organic matter, necessary for plant growth, to be removed. The topsoil is put into piles and stored for later use on site. Measures will be taken to prevent erosion of stockpiles, keeping sediment, nutrients and organic matter from entering the waterways.

To ensure the stockpile is effective, it is proposed to stabilize stockpiles immediately. Seeding or mulching can be used to stabilize the stockpile. Another option is to cover it with erosion control blankets to protect it from rainfall. Given the size of the site, topsoil will likely be removed from site.

Rock Check Dams

Rock check dams (RCD) provide ponding opportunities and slow down the flow velocity. They maintain sheet flow and promote sediment settling. Some storage capacity is created on the upstream side of the RCD. During construction activities, RCDs are anticipated to be used within stormwater drainage ditches as part of the sediment and erosion control plan.

Environmental Fencing

Environmental fencing is a type of barrier used to physically separate construction areas from the adjacent properties. In general, environmental fencing should be placed around the limits of construction and topsoil stockpiles. Double row environment fence with straw bales in between are recommended in areas adjacent to the areas of environmental significance, such as watercourses, wetlands, woodlots and other environmental features. It is proposed that all sediment control fences be inspected on a weekly basis and after significant rainfall events. The subject site is located immediately upstream of the Sandy Cove Creek, therefore, intensive erosion and sediment control measures are required. Double row sediment control fence with straw bales are required along east property limits. Regular inspections to be

scheduled to ensure that sediment from the subject site will not be released to the receiving watercourse (Sandy Cove Creek).

Monitoring

It is essential to ensure that the sediment and erosion control measures are properly installed and well maintained. They should be monitored on daily basis to ensure that they function as intended. The ESC plan should provide the framework for the inspection, maintenance, and record-keeping procedures for all stages of construction. The deficient parts to be repaired/replaced as soon as they are detected.

9.0 SUMMARY AND CLOSING REMARKS

This report provides a stormwater management plan for the proposed residential subdivision at 883 Mapleview Drive East and associated external drainage areas, in the City of Barrie. The report demonstrates that the proposed stormwater management plan provides required water quality, erosion control, and water quantity control for the proposed development within drainage area of the proposed SWM Pond 11. Furthermore, it has been demonstrated that the proposed SWM Pond 11, has been adequately sized to accommodate flows from external drainage areas, located north and east of the subject site. A summary of the report has been highlighted as follows:

- SWM Pond 11 has been sized to provide quantity control, quality control and erosion control for the flows from the total of 42.11 ha drainage area, consisting of 26.52 ha drainage area in 883 Mapleview Drive East proposed subdivision and 15.59 ha external drainage area, located north and east of the subject site. The pond was sized in SIS to accommodate flows from 36.3 ha drainage area. In order to provide additional storage volume, the pond has been expanded towards east, in Reino Mapleview South Development lands;
- Water balance analysis conducted by exp identified the post to pre-development deficit of 26,675 m^3/year. Clean water collector, receiving clean water from 1.25 ha roof area, discharging into perforated pipe infiltration system has been proposed to mitigate the annual infiltration deficit. The calculations provided in Appendix B, show that the proposed perforated pipe infiltration system has the capacity to infiltrate 298.9 m^3 water per rainfall event. The post-development annual infiltration has been calculated based on the assumption that infiltration will take place only during nine months of the year and there will be minimum of 10 rainfall events per month. Based on this assumption the post-development annual infiltration is =
  298.9 m^3/event x 10 events/month x 9 months/year = 26,901 m^3/year, which is greater than the annual deficit volume of 26,675 m^3/year.
- Efforts have been made to retain 25 mm rain event as part of the volumetric control requirements. In addition to the perforated pipe infiltration system, a Sand Filtration

Bed, has been proposed, immediately east of the SWM Pond 11. The extended detention flow from the pond, pretreated in the pond, will discharge to the surface of the filtration bed, and after passing through sand filter, amended with phosphorus sorbtive, will discharge to the outlet via perforated pipes, proposed at the bottom of the Filtration Bed. The required extended detention volume, calculated to be 8,355 m^3 is proposed to be filtered in proposed filtration bed. The maximum ponding depth of 0.40 m was used in Equation 4.12: Surface Area of Filter from MOECC Manual (March 2003), to calculate the required surface area of the filter. The calculations provided in Appendix B show that the required surface area is = 1422 m^2, while the provided surface area is = 1500 m^2. The drawdown time based on provided surface area of 1500 m^2, ponding depth of 0.40 m and filtration volume of 8,355 m^3, has been calculated to be 69 hours. Please note that the extended detention volume (8,355 m^3), which will be filtrated, is greater than the required 25 mm volume of 6,738 m^3 and the depth of precipitation, which will be filtered in proposed Filtration Bed has been calculated to be 32 mm.

- The minor system has been designed to convey up to and including the 5 year flow and the major system to convey the flows not captured by the minor system and generated by storm events up to and including the 100-year storm event. For HGL analysis, EPA SWMM software was used to analyse the capacity of the proposed minor and major systems. The results of the modelling shows that the proposed minor and major systems have the required capacity to convey the flows from the subject site, safely.
- The phosphorus loading analysis shows that the annual pre and post-development loadings are 8.00 kg/year and 55.59 kg/year, respectively. The calculations show that the post-development phosphorus load, leaving the site is 4.33 kg/year, which is less than the predevelopment loading by 3.67 kg/year. According to Lake Simcoe Region Conservation Authority, post-development phosphorus loading to be reduced to net zero. The offsetting cost has been calculated to be 4.33 x 2.5 x $35,000 = $378,875

We trust that you will find the contents of this report satisfactory. Please contact us if you have any questions or concerns.

Respectfully Submitted,

SCHAEFFERS CONSULTING ENGINEERS

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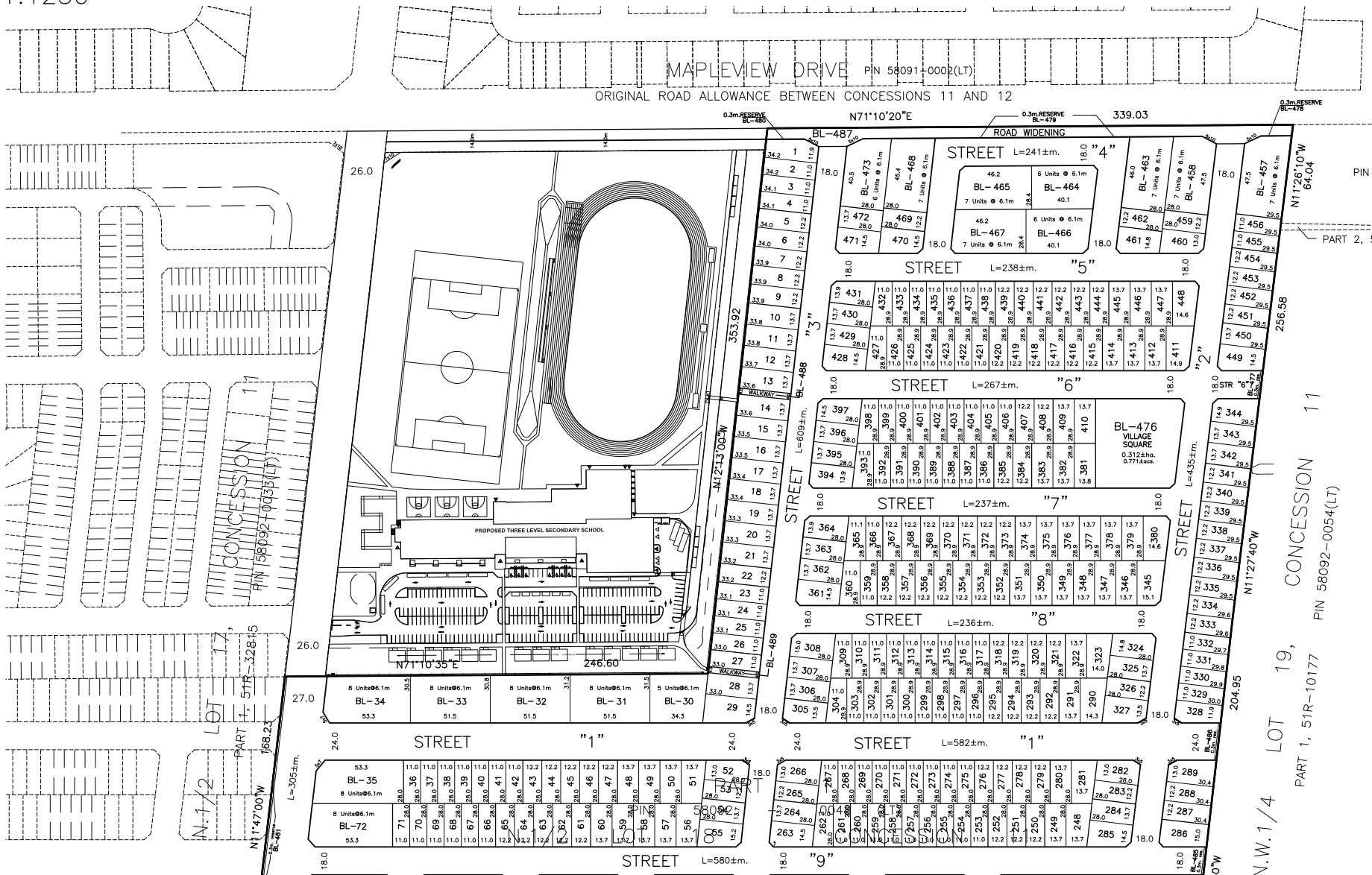
Appendix A:
Draft Plan of Subdivision

DRAFT PLAN OF SUBDIVISION
NORTH HALF OF LOT 18, CONCESSION 11
(GEOGRAPHIC TOWNSHIP OF INNISFIL)
CITY OF BARRIE
COUNTY OF SIMCOE

1:1250

SECTION 51, PL
ADDITIONAL INFO

A. AS SHOWN ON DRAFT PLAN
B. AS SHOWN ON DRAFT PLAN
C. AS SHOWN ON DRAFT PLAN
D. SEE SCHEDULE OF LAND USE
E. AS SHOWN ON DRAFT PLAN
F. AS SHOWN ON DRAFT PLAN
G. AS SHOWN ON DRAFT PLAN
H. MUNICIPAL PIPED WATER AVAILABL
I. CLAY–LOAM
J. AS SHOWN ON DRAFT PLAN
K. SANITARY AND STORM SEWERS, GA
L. AS SHOWN ON DRAFT PLAN


MAPLEVIEW DRIVE
PIN 58091-0002(LT)
ORIGINAL ROAD ALLOWANCE BETWEEN CONCESSIONS 11 AND 12
N71°10'20"E
339.03
ROAD WIDENING
0.3m RESERVE BL-480
0.3m RESERVE BL-479
0.3m RESERVE BL-478
BL-487
STREET L=241±m. "4"
STREET L=238±m. "5"
STREET L=267±m. "6"
STREET L=237±m. "7"
STREET L=236±m. "8"
STREET L=582±m. "1"
STREET L=580±m. "9"
STREET "1"
STREET "2"
STREET "3"
STREET L=609±m.
STREET L=435±m.
BL-473
BL-468
BL-465
BL-464
BL-467
BL-466
BL-463
BL-458
BL-457
BL-476
VILLAGE SQUARE
0.312±ha.
0.771±acs.
PROPOSED THREE LEVEL SECONDARY SCHOOL
BL-34
BL-33
BL-32
BL-31
BL-30
BL-35
BL-72
N71°10'35"E
246.60
N12°13'00"W
353.92
N11°26'10"W
64.04
N11°27'40"W
256.58
N11°27'40"W
204.95
N11°47'00"W
168.23
N11°47'00"W
305±m.
PART 2, 51R-10177
PIN 58092-0054(LT)
PIN 58092-0055(LT)
PIN 58092-0056(LT)
PIN 58092-0057(LT)
PIN 58092-0058(LT)
PIN 58092-0059(LT)
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PIN 58092-0062(LT)
PIN 58092-0063(LT)
PIN 58092-0064(LT)
PIN 58092-0065(LT)
PIN 58092-0066(LT)
PIN 58092-0067(LT)
PIN 58092-0068(LT)
PIN 58092-0069(LT)
PIN 58092-0070(LT)
PIN 58092-0071(LT)
PIN 58092-0072(LT)
PIN 58092-0073(LT)
PIN

Appendix B:
Calculations

Filter Surface Area Calculation Based on Equation 4.12 of MOE Manual		
A = 1000 x V x d/k(h + d) x t		
Volume to be filtered =	8355	m^3
Depth of Filter (d) =	0.50	m
Permeability Coef. (K) =	45	mm/hr
Head of water =	0.4	m
Extended Detention Flow =	0.032	m^3/s
Drawdwon Time (t) =	73	hrs
Filtration Bed Area Required =	1422	m^2
Filtration Bed Area Provided =	1500	m^3
Actual Drawdown Time =	69	hours

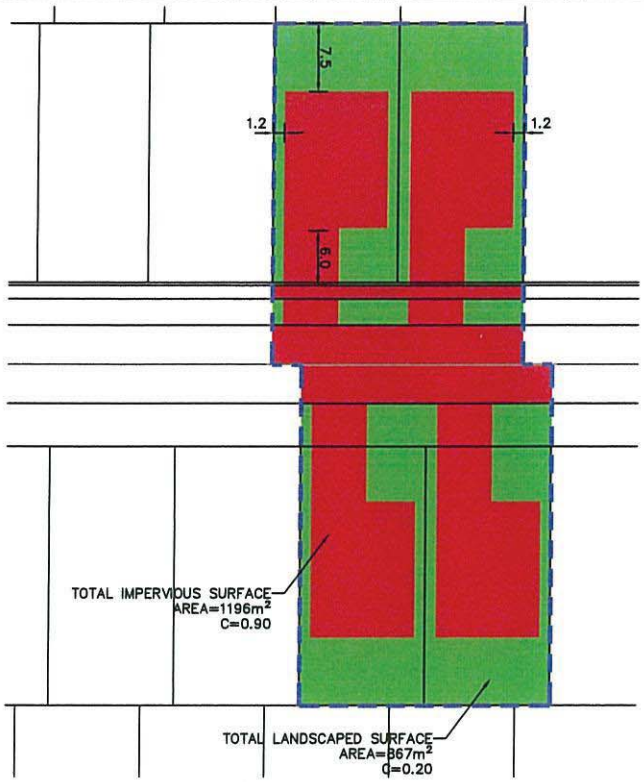
WATER BALANCE CALCULATION
883 MAPLEVIEW DRIVE EAST PROPOSED RESIDENTIAL SUBDIVISION - CITY OF

Projec # 2018 - 4692
Date: March 2020

Roof Tributary Area to the Proposed Infiltration Trench								Provided Storage Volume						
			Roof dimensions					Volume of infiltration Trench (m^3)				Volume of Water in Perfo		
Infiltration ID	# of Roofs	Type of Unit	Length (m)	Width (m)	Area (m^2)	total Area (m^2)	% of Roof Area Tributary	Length (m)	Width (m)	Depth (m)	Volume (m^3)	Diameter (mm)	Length (m)	Ar (m
1	4	Single	15.0	9.1	136.5	546	100%	42	1.75	0.72	52.9	300	42.0	0.0
	2	Single	14.5	11.8	171.1	342.2	100%							
2	7	Town H	16.0	6.8	54.4	380.8	50%	52	1.75	0.88	80.1	300	52.0	0.0
3	8	Single	15.0	9.0	135	1080	100%	39	1.75	0.88	60.1	375	39.0	0.1
4	8	Single	15.0	9.3	139.5	1116	100%	44	1.75	0.88	67.8	375	44.0	0.1
5	8	Single	15.0	9.1	136.5	1092	100%	45	1.75	0.88	69.3	375	45.0	0.1
7	12	Single	15.0	9.5	142.5	1710	100%	66	1.75	0.88	101.6	300	66.0	0.0
8	14	Single	15.0	9.5	142.5	1995	100%	77	1.75	0.88	118.6	300	77.0	0.0
9	14	Single	15.0	9.5	142.5	1995	100%	91.5	1.75	0.88	140.9	300	91.5	0.0
Total						10257		456.5	1.75	0.88	691.3		456.5	

Drawdown Time Calculation				
According to Infiltration Rate Assessment, Low Impact Development for 25 mm Retention, by EXP, Average Infiltration Rate =			46	mm/hr
Safety Factor =			2.5	
Infiltration rate =			**18.4**	**mm/hr**
Depth of Trench =			883.2	mm
Drawdown Time =			48	hrs

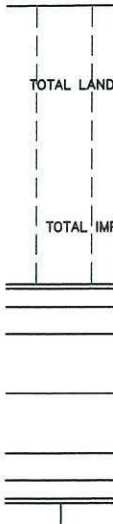
Assuming infiltration will take place during 9 months of a year with minimum of 10 storm
The total volume of water which will be infiltrated per storm event is = 298.9 m^3/storm ev
298.9 m^3/storm event x 90 storm events/year = 26901 m^3/year which greater than the po
EXP (Please refer to Section 2.3.2.4.3 of the Stormwater Management Report, by Scha



PROPORTION OF HARD SURFACE AREA = 58%
PROPORTION OF LANDSCAPED AREA = 42%
COMPOSITE 'C' = 0.9 x 0.58 + 0.2 x 0.42 = 0.61

SINGLE DETACHED LOT (WIDE)

PROPORTION OF HARD SURFACE ARE
PROPORTION OF LANDSCAPED AREA =
COMPOSITE 'C' = 0.9 x 0.60 + 0.2 x 0.40 =



Imperviousness Calculation (External Drainage Area)

Location	Area (A) (ha)	Runoff Coefficient (C)	A x C	Average C	Average I
883-Maplview Drive East (Internal)	26.52	0.63	16.71	0.63	0.61
External Drainage Area from North, Mapleview Drive East Road Widdening (see Drawng STM2 in Appendix E)	4.15	0.65	2.70		
	1.52	0.65	0.99		
	0.55	0.76	0.42		
	0.28	0.76	0.21		
	0.29	0.76	0.22		
	0.28	0.76	0.21		
Subtotal	7.07	0.67	4.75	0.67	0.67
External Drainage Area from East, Reino Mapleview South Development (See Drawing STM-1, Project REI - 17055 in Appendix E	0.21	0.70	0.15		
	0.09	0.70	0.06		
	0.14	0.70	0.10		
	0.12	0.70	0.08		
	0.08	0.70	0.06		
	0.78	0.70	0.55		
	0.46	0.70	0.32		
	0.57	0.70	0.40		
	0.35	0.70	0.25		
	0.33	0.70	0.23		
	0.23	0.70	0.16		
	0.65	0.70	0.46		
	0.66	0.70	0.46		
	0.64	0.70	0.45		
	0.29	0.70	0.20		
	0.32	0.70	0.22		
	0.39	0.70	0.27		
	0.37	0.70	0.26		
Portion of the SWM Pond in Reino Development	0.85	0.50	0.43		
Subtotal	7.53	0.68	5.10	0.68	0.68
External Drainage Area from Northeast, AWAN Group Residential Development	0.13	0.40	0.05		
	0.34	0.88	0.30		
	0.41	0.91	0.37		
	0.11	0.29	0.03		
Subtotal	0.99	0.76	0.76		
Total	42.11	0.65	27.31	0.65	0.64
Total Internal Area (ha)	26.52	0.63	16.71	0.63	0.61
Total External Area (ha)	15.59	0.68	10.61	0.68	0.69

Average Runoff Coefficient Calculation (883 Mapleview Drive East)

ID	Area (ha)	C	A X C		ID	Area (ha)	C	A X C
1	0.69	0.66	0.46		37	0.89	0.7	0.62
2	0.23	0.73	0.17		38	0.28	0.62	0.17
3	0.39	0.73	0.28		39	0.31	0.62	0.19
4	0.06	0.73	0.04		40	0.47	0.62	0.29
5	0.23	0.73	0.17		41	0.44	0.62	0.27
6	0.67	0.68	0.46		42	0.46	0.62	0.29
7	0.32	0.62	0.20		43	0.06	0.62	0.04
8	0.3	0.62	0.19		44	0.07	0.62	0.04
9	0.89	0.66	0.59		45	0.21	0.62	0.13
10	0.39	0.62	0.24		46	0.51	0.62	0.32
11	0.47	0.62	0.29		47	0.66	0.62	0.41
12	0.38	0.62	0.24		48	0.01	0.73	0.01
13	0.44	0.62	0.27		49	0.36	0.62	0.22
14	0.35	0.62	0.22		50	0.16	0.62	0.10
15	0.06	0.62	0.04		51	0.33	0.62	0.20
16	0.01	0.62	0.01		52	0.37	0.62	0.23
17	0.33	0.62	0.20		53	0.29	0.73	0.21
18	0.77	0.62	0.48		54	0.59	0.62	0.37
19	0.76	0.62	0.47		55	0.71	0.62	0.44
20	0.52	0.62	0.32		56	0.31	0.62	0.19
21	0.42	0.62	0.26		57	0.09	0.62	0.06
22	0.44	0.62	0.27		58	0.23	0.62	0.14
23	0.51	0.62	0.32		59	0.21	0.62	0.13
24	0.68	0.62	0.42		60	0.18	0.62	0.11
25	0.47	0.62	0.29		61	0.09	0.62	0.06
26	0.37	0.62	0.23		62	0.13	0.62	0.08
27	0.42	0.62	0.26		63	0.18	0.62	0.11
28	0.01	0.62	0.01		64	0.16	0.62	0.10
29	0.08	0.62	0.05		65	0.46	0.62	0.29
30	0.03	0.62	0.02		66	0.21	0.62	0.13
31	0.35	0.62	0.22		67	0.07	0.62	0.04
32	0.61	0.62	0.38		68	0.03	0.62	0.02
33	0.45	0.62	0.28		69	0.09	0.62	0.06
34	0.42	0.62	0.26	Pond	70	1.97	0.50	0.99
35	0.55	0.68	0.37		Total	11.59	0.61	7.05
36	0.86	0.68	0.58	Average Runoff Coefficient			0.63	
Total	14.93	0.64	9.54	Average Imperviousness			0.61	

For details, please refer to Storm Drainage Plans in Appendix E

PROJECT NO: 2019-04-24-883 Mapleview Drive East
DESCRIPTION: SWM Pond 11
DATE: 10-Mar-20 PREPARED BY: Noor Kamran

SCHAEFFERS
CONSULTING ENGINEERS

FOREBAY

FOREBAY SETTLING LENGTH

ref: SWM Planning & Design Manual (MOE, March 2003)

$Dist = (rQ_p / V_s)^{1/2}$, where

Dist = forebay length (m)
r = Length to width ratio of forebay (>2:1)
Q_p = peak flowrate from the pond during design quality storm (m^3/s)
V_s = settling velocity in the forebay (m/s)

r =	2.4		(2.1:1)
Q_p =	0.042	m^3/s	(required erosion outflow rate)
V_s =	0.0003	m	(based on 150µm particles)

Dist = 18 metres

DISPERSION LENGTH

ref: SWM Planning & Design Manual (MOE, March 2003)

$D = 8Q / dV_f$, where

D = length of dispersion (m)
Q = 10 year inlet flowrate (m^3/s)
d = depth of permanent pool in forebay (m)
V_f = desired velocity in the forebay (m/s)

Q =	8.100	m^3/s	(Max. 10-year flow to the pond from hydrologic model)
d =	1.60	m	
V_f =	0.5	m/s	(MOEE empirical value)

D = 81 m

Forebay Length Required: 81 metres
Forebay Length Provided: 88 metres

883 Mapleview Drive East
City of Barrie

PROJECT NO. 2018 - 4692
DATE: March 2020

SWM Pond 11 - Emergency Spillway

Weir Parameters

Weir Length (L)	8 m	
Weir Width (B)	26 m	
MAX Qinlet (100-year Peak Flow)	**13.75** m^3/s	(From 6-hour SCS Type II Storm Diistribution)
Crest Elevation	255.05 m	
Top of Weir Elevation	255.55 m	
Depth of Weir	0.50 m	

Weir Calculations ($Q = Cd * b * H^{3/2}$)

Water Level (H)	H/L	Cd	**Q**	b (m)
0.05	0.006	1.40	**0.41**	26.50
0.10	0.013	1.40	**1.20**	27.00
0.15	0.019	1.40	**2.24**	27.50
0.20	0.025	1.40	**3.51**	28.00
0.25	0.031	1.45	**5.17**	28.50
0.30	0.038	1.48	**7.05**	29.00
0.35	0.044	1.51	**9.22**	29.50
0.40	0.050	1.52	**11.54**	30.00
0.45	0.056	1.52	**13.99**	30.50
0.50	0.063	1.53	**16.77**	31.00

Therefore, maximum capacity of spillway is 16.77 m^3/s, which is greater than the 100-year strom event inflow to the pond (13.75 m^3/s)

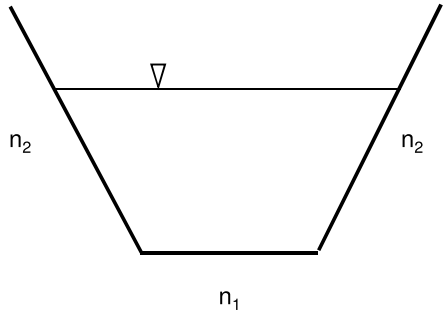
Prject No.: 2018 - 4692
SWM Pond 11
883 Mapleview Drive East
City of Barrie
Date: March 2020

SWM Pond 11 - Emergency Spillway Erosion Protection

Determine Shear Stress Based on Outflow Velocity

Input:

Bottom Width =	21.00	m
Bottom 'n_1' =	0.035	
Side Slope =	10	:1
Side 'n_2' =	0.035	
Long. Slope =	0.33	m/m
Depth =	0.14	m



Output:

Flow =	13.75	m^3/s	100-year storm flow from VO2 model 6 hr SCS
Velocity =	4.35	m/s	
Top Width=	23.82	m	
Area A =	3.16	m^2	
Wetted Perimeter P =	21.28	m	
Hydraulic Radius R =	0.15	m	
1/R =	6.73		
Tractive force, τ =	43.74	kg/m^2	(From MTO Design Chart 2.24)

According to the University of Minnesota Testing Result, excerpted form the International Erosion Control Systems Inc. (IECS) products catalogue, the blocks were tested to shear stresses up to 38.5 lbs./sq.ft and velocities up to 19.0 ft/sec. The test blocks remained stable under all of the test conditions

Test Results				**Calculated based on Site Info.**	
Velocity		Shear Stress		Velocity	Shear Stress
(ft/sec)	(m/s)	(lbs/sq.ft	(kg/m^2)	(m/s)	(kg/m^2)
19	5.79	38.5	188	4.35	43.74

The table shows that the flow velocity and the shear stress at the spillway are less than the resistance capacities of the concrete cable

The testing clearly demonstrated that the blocks were more stable with the broad face resting on the channel bed. For all overtopping tests, success was achieved by ensuring that the block maintained contact with the bed at all flows.

Test data also resulted in information related to Manning's n (roughness co-efficient) as the depth of the overtopping changed.

Wave impact testing was conducted in the 50 foot long, 2.0 foot wide, 3.6 foot deep wave flume at the University of Windsor Hydraulics Laboratory. For the wave impact tests, 1:4 scale model revetment blocks of the CC20 and CC70 blocks were conducted. Bed slopes of 1.5H:1V, 2.0H:1V and 3.0H:1V were tested. As in the overtopping tests, testing with and without the geotextile filter cloth was conducted. Wave heights ranged from 0.67 to 3.0 feet (prototype) and wave periods ranged from 1.3 to 1.7 seconds.

The wave impact testing resulted in developing a series of curves relating to wave steepness and uplift coefficients which are functions of the wave height, wave length, block height and revetment angle.

3. University of Minnesota Testing – 1999

Testing of full size CC35 and CC45 oversized revetment blocks was conducted at the University of Minnesota St. Anthony Falls Laboratory. The test flume measured 253 feet long, 9 feet wide and 6 feet deep.

In this series of tests, geotextile filter cloth was attached to the base of the blocks for all tests. Overtopping flow depths ranged from 1.0 to 3.0 feet. Bed slopes tested included a horizontal level bed and 2.0H:1V.

The blocks were tested to shear stresses up to 38.5 lbs./sq.ft. and velocities up to 19.0 ft./sec. The test blocks remained stable under all of the test conditions.

4. University of Windsor Testing – 2004

In this series of tests, 1:6.5 scale model revetment blocks were tested for wave impact performance. CC65 open cell, CC95 closed cell and CC90 closed cell oversized blocks were evaluated at the University of Windsor Hydraulics laboratory wave flume facility.

For this series of tests, blocks were evaluated with and without geotextile filter cloth attached to the base of the blocks. Impact wave heights ranged from 3.7 feet to 5.2 feet and wave periods ranged from 3.2 to 5.7 seconds. The blocks were

City of Barrie
883 Mapleview Drive East Residential Subdivision
Project No: 2018-4692
DATE: March 2020

Allowable Release Rates From Table 13 of the SIS

Given in SIS:

Total drainage area to the SWM Pond 11 36.30 ha

Erosion Control Unit Rate = 0.0010 $m^3/s/ha$

Erosion Control Required Storage 310 $m^3/imp.ha$

Storm Event	2-year	5-year	10-year	25-year	50-year	100-year
Unitary Discharge Rate (m3/s/ha)	0.002	0.008	0.015	0.024	0.032	0.04
Allowable Release Rate (m3/s)	0.07	0.29	0.54	0.87	1.16	1.45

Extended Detention/Erosion Control Flow = 0.04 m^3/s

Required Erosion Control Storage = 6977 m^3

Allowable Release Rates Calculation Based on Internal Plus External Drainage Area

Proposed SWM Pond 11

Drainage Area from Bulut Lands (internal) 26.52 ha

External Drainage Area from North 7.07 ha

External Drainage Area from East 7.53 ha

Mapleview Drive East ROW 0.99 ha

Total Proposed Drainage Area 42.11 ha

Average Imperviousness for 36.57 ha area 64% %

Storm Event	2-year	5-year	10-year	25-year	50-year	100-year
Unitary Discharge Rate (m3/s/ha)	0.002	0.008	0.015	0.024	0.032	0.04
Allowable Release Rate (m3/s)	0.08	0.34	0.63	1.01	1.35	1.68

Extended Detention/Erosion Control Flow = 0.04 m^3/s

Required Erosion Control Storage = 8355 m^3

Provided Erosion Control Storage = 8700 m^3

STAGE - STORAGE - DISCHARGE CALCULATION
883 MAPLEVIEW DRIVE EAST PROPOSED SUBDIVISION
CITY OF BARRIE
SWM POND 11

	Extended Detention	WEIR DETAIL		EMERGENCY SPILLWAY	
Invert Elevation / Top of Weir	253.00	253.76	254.00	255.05	255.05
Diameter (mm) / Thickness of Weir/Length (m)	135	N/A		6	-
Area of Orifice / Number of Weirs	0.014	N/A	1	N/A	-
Discharge Coefficient/Slope	0.62	Vertical	-	0.42	-
Starting Flow Elevation.(m)/Length of Weir (m)	253.00	254.00	0.69	255.05	26.00
Top Elevation (m)/Top of Weir	255.35	255.35	255.05	255.55	255.55

Stage-Storage-Discharge:

Stage		Extended Detention		Weir			EMERGENCY SPILLWAY			Pond Provided Storage	Total Flow	SWM Pond Expected (Actual) Flow From VO Mo			
Water Elevation (m)	Water Elevation Above Perm. Pool (m)	Head (m)	Q (m^3/s)	Head (m)	C (d) Discharge coefficient	Q (m^3/s)	Head (m)	C(d)	Q (m^3/s)	(m^3)	(m^3/s)	4-hr Chicago Storm (m^3/s)	6-hr SCS Type II Storm (m^3/s)	12-hr SCS Type II Storm (m^3/s)	24-hr Type II (m^3
253.00	0.00	na	0.000	na	na	na	na	na	na	0	0.000				
253.05	0.05	na	0.005	na	na	na	na	na	na	544	0.005				
253.10	0.10	0.03	0.011	na	na	na	na	na	na	1,087	0.011				
253.15	0.15	0.08	0.011	na	na	na	na	na	na	1,631	0.011				
253.20	0.20	0.13	0.014	na	na	na	na	na	na	2,175	0.014				
253.25	0.25	0.18	0.017	na	na	na	na	na	na	2,719	0.017				
253.30	0.30	0.23	0.019	na	na	na	na	na	na	3,263	0.019				
253.35	0.35	0.28	0.021	na	na	na	na	na	na	3,806	0.021				
253.40	**0.40**	0.33	0.023	na	na	na	**na**	**na**	**na**	4,350	0.023				
253.45	**0.45**	0.38	0.024	na	na	na	na	na	na	4,894	0.024				
253.50	**0.50**	0.43	0.026	na	na	na	na	na	na	5,437	0.026				
253.55	**0.55**	0.48	0.027	na	na	na	na	na	na	5,981	0.027				
253.60	**0.60**	0.53	0.029	na	na	na	**na**	**na**	**na**	6,525	0.029				
253.65	**0.65**	0.58	0.030	na	1.84	na	na	na	na	7,069	0.030				
253.70	**0.70**	0.63	0.031	na	1.84	na	na	na	na	7,612	0.031				
253.76	**0.76**	0.69	0.033	na	1.84	na	**na**	**na**	**na**	8,265	0.033				
253.80	**0.80**	0.73	0.034	na	1.84	na	na	na	na	**8,700**	**0.034**	**0.032**	**0.022**	**0.022**	**0.0**
253.85	**0.85**	0.78	0.035	na	1.84	na	na	na	na	9,292	0.035				
253.90	**0.90**	0.83	0.036	na	1.84	na	na	na	na	9,883	0.036				
253.95	**0.95**	0.88	0.037	na	1.84	na	na	na	na	10,475	0.037				
254.00	**1.00**	0.93	0.038	na	1.84	na	**na**	**na**	**na**	11,067	0.038				
254.05	**1.05**	0.98	0.039	0.05	1.84	0.014	na	na	na	11,658	0.053				
254.10	**1.10**	1.03	0.040	0.10	1.84	0.040	na	na	na	**12,250**	**0.080**	0.058	0.057	0.064	**0.0**
254.15	**1.15**	1.08	0.041	0.15	1.84	0.074	**na**	**na**	**na**	12,970	0.115				
254.20	**1.20**	1.13	0.042	0.20	1.84	0.113	na	**na**	**na**	13,690	0.155				
254.35	**1.35**	1.28	0.045	0.35	1.84	0.262	na	**na**	na	**15,850**	**0.307**	0.164	0.218	0.214	**0.2**
254.40	**1.40**	1.33	0.045	0.40	1.84	0.321	na	**na**	na	16,550	0.366				
254.45	**1.45**	1.38	0.046	0.45	1.84	0.383	**na**	**na**	**na**	17,250	0.429				
254.50	**1.50**	1.43	0.047	0.50	1.84	0.448	**na**	**na**	**na**	**17,950**	**0.495**	**0.306**	**0.392**	**0.376**	**0.4**
254.55	**1.55**	1.48	0.048	0.55	1.84	0.517	**na**	**na**	**na**	18,670	0.565				
254.60	**1.60**	1.53	0.049	0.60	1.84	0.589	**na**	**na**	**na**	19,390	0.638				
254.65	**1.65**	1.58	0.049	0.65	1.84	0.664	**na**	**na**	**na**	20,110	0.714				
254.70	**1.70**	1.63	0.050	0.70	1.84	0.742	**na**	**na**	**na**	20,830	0.793				
254.75	**1.75**	1.68	0.051	0.75	1.84	0.823	**na**	**na**	**na**	**21,550**	**0.874**	**0.525**	**0.680**	**0.648**	**0.8**
254.80	**1.80**	1.73	0.052	0.80	1.84	0.907	**na**	**na**	**na**	22,300	0.959				
254.85	**1.85**	1.78	0.052	0.85	1.84	0.993	**na**	**na**	**na**	23,050	1.046				
254.90	**1.90**	1.83	0.053	0.90	1.84	1.082	**na**	**na**	**na**	**23,800**	**1.135**	**0.703**	**0.928**	**0.886**	**1.1**
254.95	**1.95**	1.88	0.054	0.95	1.84	1.174	**na**	**na**	**na**	24,767	1.228				
255.00	**2.00**	1.93	0.055	1.00	1.84	1.268	**na**	**na**	**na**	25,733	1.322				
255.05	**2.05**	1.98	0.055	1.05	1.84	1.364	**na**	**na**	**na**	**26,700**	**1.419**	**0.895**	**1.191**	**1.150**	**1.3**

Prject No.: 2018 - 4692
SWM Pond 11
883 Mapleview Drive East
City of Barrie
Date: March 2020

Perforated Pipes Holes Calculation

Maximum Number of Holes

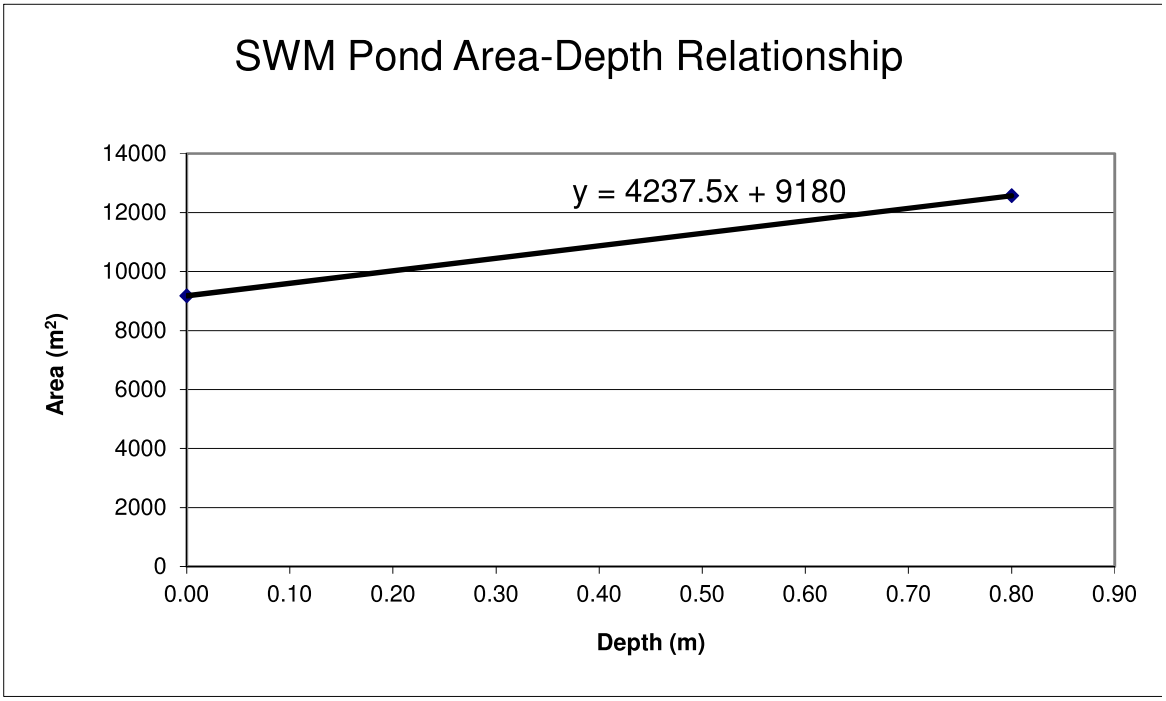
Input:			
	Pipe Diameter	300	mm
	Pipe Length	2.0	m
	Size of holes	25	mm
	Spacing of holes	100	mm
Output:	Number of Holes	**98**	
Check Area:	Area of holes	48153	mm^2
	Interpolated Diam	248	mm
	Orifice Diam Req'd	135	mm
	Safety Factor	2	

883 MAPLEVIEW DRIVE RESIDENTIAL SUBDIVISION-CITY OF BARRIE
EROSION DETENTION DRAWDOWN TIME CALCULATION

SWM Pond Area-Depth Relationship

Depth	Surface Area (m^2)
0.00	9180
0.80	12570

(see SWM Pond Provided Storage Volume Calculaiton in Appen



Drawdown Time Equation 4.11 from MOE SWM Manual

$$t = \frac{0.66 C_2 h^{1.5} + 2 C_3 h^{0.5}}{2.75 A_o}$$

where

t = drawdown time in seconds
A_o = cross-sectional area of the orifice (m^2)
h = maximum water elevation above the orifice (m)
C_2 = slope coefficient from the area-depth linear regression
C_3 = intercept from the area-depth linear regression

Input

A_o = 0.0143 m^2 (135 mm diameter)
h = 0.7325 m
C_2 = 4237.5
C_3 = 9180

Output

t = 443739 s
= 123 hours

City of Barrie
883 Mapleview Drive East Proposed Subdivision
Project No: 2018-4692
DATE: March 2020

WATER QUALITY CONTROL STORAGE VOLUME (PERMANENT POOL) SIZING CALCULATIONS

Protection Level	SWMP Type	Storage Volume (m^3/ha) for Impervious Level					
		0%	35%	55%	70%	85%	100%
Level 1	Wetlands	36	80	105	120	140	160
	Wet Pond	53	140	190	225	250	275

Source: SWM Planning & Design Manual (MOE, 2003)

SWM POND 11

Input:

Weighted Imperviousness =	64%	
Area =	42.11	ha
Level of Protection:	1	
SWMP Type :	Wet Pond	

Calculation:

Total Storage Volume Required =	211	m^3/ha →	8,885	m^3
Permanent Pool Volume =	**171**	**m^3/ha →**	**7,201**	**m^3**
Active Storage Volume =	40	m^3/ha →	1,684	m^3
Provided Permanent Pool Volume =				m^3

SWM Pond Provided Storage Volume Calcuation

Elevation	Surface Area (m^2)				depth	Average Volume (m^3)		
(m)	Forebay	Wet Cell	Total	Average	(m)	Forebay	Wet Cell	Total
251.40	1150	4145	5295					
252.50	1750	5504	7254	4720	1.1	1595	5307	6902
253.00	2370	6810	9180	8217	0.5	1030	3079	4109
Total					1.6	2625	8385	11010

Percentage of Permanent Pool Area at Elevation 253.0 m = 26% of the Total Area
Percentage of Permanent Pool Volume at 253.0 m = 24% of the Total Volume

Post-development CN* Calculation

Input Values

CN (AMC II) =	68
100 YEAR Rainfall (mm) =	87.58
Initial Abstraction (mm) =	1.5

Output Values

Factor* =	1.23
CN (AMC III) =	83.5
S =	50.18
Ia =	10.0
Q =	47.1
S* =	71.3
CN* (AMC III) =	78.1
CN* (AMC II)	64

*Factor for converting CN (AMC II) to CN (AMC III)

Notes:

City of Barrie 100 year Storm Depth of Precipitation (City Design Guidelines)
Soil type based on Geotechnical Report for the subject site is Silty Sand
The soil belongs to hydrological group B/BC and has been used as crops land

Procedures:

1. Determine CN based on typical AMC II condition
2. Convert CN from AMC II to AMC III conditions
3. Calculate S, using the equation and CN (AMC III)
4. Get precipitation depth P for 100 -year storm
5. Use CN_{III} with $I_a = 0.2S$ compute Q_{III} for 100-yr Storm
6. For the same Q_{III} calculate S^*_{III}, using I_a =5 mm (or otherwise)
7. Calculate CN^*_{III}, using S^*_{III}
8. calculate CN^*_{II} using SCS conversion factor.

Equations

$$S = \left(\frac{25400}{CN}\right) - 254$$

$$I_a = 0.2S$$

$$Q = \frac{(P - I_a)^2}{(P - I_a + S)}$$

$$S^* = \frac{(P - I_a^*)^2}{Q} - P + I_a$$

$$CN^* = \frac{25400}{(254 + S^*)}$$

Culvert Calculator Report
Outlet Storm Sewer Headwater Elevation Calculation

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	254.00	m	Headwater Depth/Height	1.20	
Computed Headwater Elevation	253.66	m	Discharge	1.3740	m³/s
Inlet Control HW Elev.	253.66	m	Tailwater Elevation	252.65	m
Outlet Control HW Elev.	253.66	m	Control Type	Inlet Control	

Grades					
Upstream Invert	252.56	m	Downstream Invert	251.50	m
Length	112.00	m	Constructed Slope	0.009464	m/m

Hydraulic Profile					
Profile	CompositePressure ProfileS1 S2		Depth, Downstream	0.59	m
Slope Type	N/A		Normal Depth	0.59	m
Flow Regime	N/A		Critical Depth	0.69	m
Velocity Downstream	3.07	m/s	Critical Slope	0.006246	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	0.91	m
Section Size	900 mm		Rise	0.91	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	253.66	m	Upstream Velocity Head	0.34	m
Ke	0.20		Entrance Loss	0.07	m

Inlet Control Properties					
Inlet Control HW Elev.	253.66	m	Flow Control	Transition	
Inlet Type	Beveled ring, 33.7° bevels		Area Full	0.7	m²
K	0.00180		HDS 5 Chart	3	
M	2.50000		HDS 5 Scale	B	
C	0.02430		Equation Form	1	
Y	0.83000				

Range Data:

	Minimum	Maximum	Increment	
Discharge	0.0000	2.7000	0.1000	m^3/s

Discharge (m^3/s)	HW Elev. (m)
0.0000	252.65
0.1000	252.81
0.2000	252.92
0.3000	253.01
0.4000	253.09
0.5000	253.16
0.6000	253.22
0.7000	253.28
0.8000	253.34
0.9000	253.40
1.0000	253.46
1.1000	253.51
1.2000	253.56
1.3000	253.62
1.4000	253.68
1.5000	253.73
1.6000	253.81
1.7000	253.97
1.8000	254.13
1.9000	254.30
2.0000	254.47
2.1000	254.66
2.2000	254.86
2.3000	255.06
2.4000	255.28
2.5000	255.50
2.6000	255.73
2.7000	255.97

Ontario

MINISTRY OF THE ENVIRONMENT

Database Version: V 2.0 Release Update
Update Date: 30-Mar-12

Project DEVELOPMENT Summary

DEVELOPMENT: 883 Mapleview Drive East Proposed Residential Subdivision
Subwatershed: Hewitts Creek

Total Pre-Development Area (ha):	42.110	Total Pre-Development Phosphorus Load (kg/yr):	8.00

Pre-Development Land Use	Area (ha)	P coeff. (kg/ha)	P Load (kg/yr)
Cropland	42.11	0.19	8.00

POST-DEVELOPMENT LOAD

Post-Development Land Use	Area (ha)	P coeff. (kg/ha)	Best Management Practice applied with P Removal Efficiency		P Load (kg/yr)
High Intensity - Residential	1.25	1.32	Treatment Train Approach	99%	0.02
Perforated Pipe Infiltration (87%) - SWM Pond (63%) - Sorbtive in Filtration Bed (79%)					
High Intensity - Residential	40.86	1.32	Other	92%	4.31
SWM Pond (63%) and Sorptive in Filtration Bed (79%)					
Low Intensity Development	0	0.13	Wet Detention Ponds	63%	0.00

Post-Development Area Altered:	**42.11**
Total Pre-Development Area:	**42.11**
Unaffected Area:	**0**

	P Load (kg/yr)
Pre-Development:	**8.00**
Post-Development:	**55.59**
Change (Pre - Post):	**-47.58**
595% Net Increase in Load	
Post-Development (with BMPs):	**4.33**
Change (Pre - Post):	**3.67**
46% Net Reduction in Load	

DEVELOPMENT: 883 Mapleview Drive East Proposed Residential Subdivision
Subwatershed: Hewitts Creek

CONSTRUCTION PHASE LOAD

SUMMARY WITH IMPLEMENTATION OF BMPs	**P Load (kg/yr)**
Pre-Development:	**8.00**
Construction Phase Amortized Over 8 Years :	to be determined
Post-Development:	**4.33**
Post-Development + Amortized Construction:	**to be determined**
Pre-Development Load - Post-Development Load:	**3.67**
Conclusion:	**46% Reduction in Load**
Pre-Development Load - (Post-Development + Amortized Construction Load):	**to be determined**
Conclusion:	**to be determined**

Based on a comparison of Pre-Development and Post-Development loads, and in consideration of Construction Phase loads, the Ministry would encourage the Municipality to:

Q=0.0028*C*I*A (cms)
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CITY of BARRIE

STORM SEWER DESIGN

R.A. ARCHER OPERATIONS CENTRE, 165 FERNDALE DRIVE

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5-YEAR DESIGN STORM

STREETS	MANHOLE		LENGTH	INCREMENT			TOTAL	FLOW TIME (min)		I	TOTAL Q	S
	FROM	TO	(m)	C	A	CA	CA	TO	IN	(mm/h)	(cms)	(%)
External -Constant flow		21			7.01						2.000	
Maple view drive ROW		21	320.00	0.90	1.00	0.90	0.90	12.90	2.39	94.89	0.239	0.50
(to be diverted to pond conflict)							**0.90**	**12.90**				
AREA 4												
Street 2 (100 Year)	21	22	86.50	0.88	1.41	1.23	1.23	12.72	0.72	159.08	0.550	0.25
							1.23	**13.44**				
Street 2 (5 Year)	21	22	86.50	0.70	1.41	0.99	0.99	12.72	0.72	95.64	0.264	0.25
							0.99	**13.44**				
											0.285	
100 Year - 5 Year												
From External							0.90	12.90			2.000	Provided Box
Street 2	21	22	86.50	0.68	0.67	0.46	1.36	12.90	0.71	94.89	2.645	0.25
							1.36	**12.90**				
AREA 1												
Street 4 (100 Year)	15	16	70.50	0.91	0.74	0.67	0.67	11.07	0.99	171.13	0.323	0.30
							0.67	**12.06**				
Street 4 (5 Year)	15	16	70.50	0.73	0.74	0.54	0.54	11.07	0.99	103.21	0.156	0.30
							0.54	**12.06**				
											0.167	
100 Year - 5 Year												
Steet 4	15	16	70.50	0.73	0.39	0.28	0.28	10.00	0.99	108.92	0.253	0.30
	16	17	7.50	0.73	0.06	0.04	0.33	10.99	0.11	103.63	0.262	0.30
	17	18	60.50	0.73	0.23	0.17	0.50	11.09	0.78	103.10	0.310	0.30

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CITY of BARRIE

STORM SEWER DESIGN

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5-YEAR DESIGN STORM

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STREETS	MANHOLE		LENGTH	INCREMENT			TOTAL	FLOW TIME (min)		I	TOTAL Q	S
	FROM	TO	(m)	C	A	CA	CA	TO	IN	(mm/h)	(cms)	(%)
	11	12	52.00	0.73	0.23	0.17	0.17	10.00	0.90	108.92	0.051	0.50
Street 4	12	14	18.00	0.73	0.06	0.04	0.21	10.90	0.27	104.10	0.062	0.50
							0.21	**11.16**				
Street 5	13	14	42.00	0.62	0.39	0.24	0.24	10.00	0.62	108.92	0.074	0.50
							0.24	**10.62**				
From Street 4		14					**0.21**	**11.16**				
From Street 5		14					**0.24**	**10.62**				
	14	19	100.50	0.66	0.89	0.59	1.04	11.16	0.84	102.75	0.299	1.00
							1.04	**12.01**				
From Street 4		19					**0.50**	**12.01**				
From Street 5		19					**1.04**	**12.01**				
Street 5	19	20	60.50	0.62	0.30	0.19	1.73	12.01	0.69	98.75	0.645	0.30
	20	22	16.50	0.62	0.02	0.01	1.74	12.69	0.19	95.76	0.634	0.30
							1.74	**12.88**				
Steet 6	23	24	39.00	0.62	0.38	0.24	0.24	10.00	0.58	108.92	0.072	0.50
	24	25	96.00	0.62	0.44	0.27	0.51	10.58	1.26	105.75	0.151	0.50
	25	26	75.50	0.62	0.35	0.22	0.73	11.84	0.90	99.51	0.202	0.50
	26	28	8.50	0.62	0.01	0.01	0.73	12.74	0.10	95.57	0.196	0.50
							0.73	**12.84**				
Steet 7	29	30	44.00	0.62	0.52	0.32	0.32	10.00	0.65	108.92	0.098	0.50
				0.62	0.76	0.47	0.79	10.65	1.11	105.35	0.234	0.50

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CITY of BARRIE

STORM SEWER DESIGN

R.A. ARCHER OPERATIONS CENTRE, 165 FERNDALE DRIVE

5-YEAR DESIGN STORM

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STREETS	MANHOLE		LENGTH	INCREMENT			TOTAL	FLOW TIME (min)		I	TOTAL Q	S
	FROM	TO	(m)	C	A	CA	CA	TO	IN	(mm/h)	(cms)	(%)
		di										
Steet 8	33	34	45.00	0.62	0.51	0.32	0.32	10.00	0.67	108.92	0.096	0.50
	34	35	93.00	0.62	0.68	0.42	0.74	10.67	1.22	105.28	0.217	0.50
	35	36	71.00	0.62	0.47	0.29	1.03	11.89	0.84	99.28	0.286	0.50
	36	37	8.50	0.62	0.01	0.01	1.04	12.73	0.10	95.58	0.277	0.50
							1.04	**12.83**				
Steet 1 (East)	38	39	45.00	0.62	0.45	0.28	0.28	10.00	0.56	108.92	0.085	0.70
	39	40	92.00	0.62	0.61	0.38	0.66	10.56	0.60	105.82	0.195	2.00
	40	41	62.00	0.62	0.35	0.22	0.87	11.17	0.67	102.72	0.251	0.50
	41	43	17.50	0.62	0.03	0.02	0.89	11.84	0.10	99.50	0.249	1.80
							0.89	**11.94**				
Street 2		22					**1.36**	**12.90**			2.285	
From Street 5		22					**1.74**	**12.69**			0.167	Provided Box
Street 2	22	28	74.00	0.62	0.32	0.20	3.30	12.90	0.61	94.89	3.327	0.25
							3.30	**13.51**				
External Street 6 (From East)				0.70	0.29	0.20	0.20	10.73	0.50	104.95	0.060	0.50
Street 6 East	27	28	36.00	0.62	0.06	0.04	0.24	11.23	0.53	102.42	0.069	0.50
							0.24	**11.76**				
From Street 2		28					**3.30**	**13.51**				
From Street 6		28					**0.24**	**11.76**				
From Street 6 east		28					**0.24**	**11.76**				Provided Box
Street 2	28	32	75.50	0.62	0.33	0.20	3.98	13.51	0.56	92.45	3.482	0.30
							3.98	**14.07**				

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5-YEAR DESIGN STORM

STREETS	MANHOLE		LENGTH	INCREMENT			TOTAL	FLOW TIME (min)		I	TOTAL Q	S
	FROM	TO	(m)	C	A	CA	CA	TO	IN	(mm/h)	(cms)	(%)
Street 2	32	37	76.50	0.62	0.60	0.37	5.62	14.07	0.57	90.32	3.874	0.30
							5.62	**14.64**				
From Street 2		37					**5.62**	**14.64**				
From Street 8		37					**1.04**	**12.73**				Provided Box
Street 2	37	43	79.50	0.62	0.42	0.26	6.92	14.64	0.59	88.27	4.162	0.30
							6.92	**15.24**				
External Street 1 (From East)				0.70	4.83	3.38	3.38	14.86	0.50	87.52	0.828	0.50
Street 1 East	42	43	36.50	0.62	0.08	0.05	3.43	15.36	0.30	85.84	0.825	0.50
							3.43	**15.36**				
External Street 9 (From East)				0.70	1.20	0.84	0.84	11.42	0.50	101.49	0.239	0.50
Street 9 East	44	71 (pipe)	35.50	0.62	0.06	0.04	0.88	11.92	0.42	99.15	0.244	0.50
							0.88	**12.34**				
From Street 2		43					**6.92**	**15.24**				
From street 1 (East)		43					**3.43**	**15.36**				
From Street 1 (west)		43					**0.89**	**11.84**				
From Street 9 East (to pipe)		43					**0.88**	**12.34**				Provided Box
Street 2	43	71	83.00	0.62	0.46	0.29	12.41	15.36	0.56	85.84	5.433	0.30
							12.41	**15.36**				
AREA 2												
Street 3 (100 Year)	1	2	80.00	0.83	1.16	0.96	0.96	10.15	0.84	178.82	0.479	0.40
							0.96	**10.99**				
Street 3 (5 Year)	1	2	80.00	0.66	1.16	0.77	0.77	10.15	0.84	108.08	0.232	0.40

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5-YEAR DESIGN STORM

CITY of BARRIE

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STREETS	MANHOLE		LENGTH	INCREMENT			TOTAL	FLOW TIME (min)		I	TOTAL Q	S
	FROM	TO	(m)	C	A	CA	CA	TO	iN	(mm/h)	(cms)	(%)
Steet 3	1	2	80.00	0.66	0.69	0.46	1.41	10.00	0.84	108.92	0.678	0.40
	2	3	75.50	0.62	0.47	0.29	1.70	10.84	0.86	104.40	0.746	0.30
	3	4	75.50	0.62	0.42	0.26	1.96	11.69	0.82	100.20	0.799	0.30
	4	5	75.50	0.62	0.44	0.27	2.24	12.51	0.82	96.51	0.852	0.30
	5	9	78.50	0.62	0.42	0.26	2.50	13.34	0.84	93.12	0.899	0.30
							2.50	**14.18**				
Steet 1 (West)	6	7	86.50	0.70	0.89	0.62	0.62	10.00	1.03	108.92	0.190	0.50
	7	8	100.00	0.68	0.86	0.58	1.21	11.03	1.09	103.43	0.350	0.50
	8	9	100.00	0.68	0.55	0.37	1.58	12.11	0.94	98.28	0.435	0.50
							1.58	**13.05**				
Street 3		9					**2.50**	**14.18**				
From Street 1 (West)		9					**1.58**	**13.05**				
Street 3	9	10	68.00	0.62	0.36	0.22	4.30	14.18	0.66	89.93	1.331	0.30
	10	61	11.00	0.62	0.01	0.01	4.31	14.83	0.11	87.61	1.057	0.30
							4.31	**14.94**				
Steet 9 (West)	45	46	20.00	0.73	0.24	0.18	0.18	10.00	0.25	108.92	0.053	0.70
	46	47	74.50	0.62	0.37	0.23	0.40	10.25	0.83	107.52	0.122	0.70
	47	58	74.50	0.62	0.33	0.20	0.61	11.08	0.83	103.17	0.176	0.70
							0.61	**11.91**				
Steet 10	48	49	77.00	0.62	0.59	0.37	0.37	10.00	1.01	108.92	0.112	0.50
	49	50	23.50	0.62	0.13	0.08	0.45	11.01	0.15	103.50	0.129	2.00
	50	51	15.50	0.62	0.09	0.06	0.50	11.17	0.14	102.73	0.144	1.00
AREA 3												

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5-YEAR DESIGN STORM

STREETS	MANHOLE		LENGTH	INCREMENT			TOTAL	FLOW TIME (min)		I	TOTAL Q	S
	FROM	TO	(m)	C	A	CA	CA	TO	IN	(mm/h)	(cms)	(%)
Street 10 (5 Year)		54	122.50	0.66	3.54	2.34	2.34	10.74	1.13	104.90	0.686	0.40
							2.34	**11.87**				
100 Year - 5 Year											**0.735**	
Street 10 Add (100yr-5yr)	51	54	64.00	0.62	0.18	0.11	0.61	11.31	0.53	102.02	0.910	0.50
							0.61	**11.84**				
Street 11	52	53	91.50	0.62	0.71	0.44	0.44	10.00	1.20	108.92	0.134	0.50
	53	54	18.00	0.62	0.12	0.07	0.51	11.20	0.12	102.55	0.148	1.80
							0.51	**11.33**				
From Street 10		54					**0.61**	**11.84**			0.910	
From Street 11		54					**0.51**	**11.33**				
Steet 10	54	55	60.50	0.62	0.23	0.14	1.27	11.84	0.45	99.51	1.089	0.50
	55	56	18.00	0.62	0.09	0.06	1.33	12.29	0.13	97.47	1.097	0.50
	56	57	67.00	0.62	0.31	0.19	1.52	12.43	0.50	96.89	1.147	0.50
	57	58	40.00	0.62	0.16	0.10	1.62	12.93	0.30	94.77	1.164	0.50
							1.62	**13.23**				
From Street 10		58					**1.62**	**13.23**				
From Street 9		58					**0.61**	**11.91**				
Steet 9	58	60	74.50	0.62	0.28	0.17	2.40	13.23	0.36	93.56	1.364	1.20
							2.40	**13.59**				
Street 3 (from South)	59	60	99.00	0.62	0.66	0.41	0.41	10.00	1.30	108.92	0.125	0.50
							0.41	**11.30**				

Q=0.0028*C*I*A (cms)
C : RUNOFF COEFFICIENT
I : RAINFALL INTENSITY
A : AREA (ha)

5-YEAR DESIGN STORM

CITY of BARRIE

STORM SEWER DESIGN

R.A. ARCHER OPERATIONS CENTRE, 165 FERNDALE DRIVE

SCHAEFFERS
Consulting Engineers
SCHAEFFER & ASSOCIATES LTD
6 Ronrose Drive, Concord, Ontario L4K 4R3
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design@schaeffers.com

STREETS	MANHOLE		LENGTH	INCREMENT			TOTAL	FLOW TIME (min)		I	TOTAL Q	S	
	FROM	TO	(m)	C	A	CA	CA	TO	IN	(mm/h)	(cms)	(%)	
							2.81	**13.62**					
From Street 9 (West)		61					**2.81**	**13.62**					
From Street 3 (North)		61					**4.31**	**14.94**					Provided Box
Street 9	61	62	67.50	0.62	0.31	0.19	7.31	14.94	0.50	87.25	2.769	0.30	
	62	70	74.50	0.62	0.47	0.29	7.60	15.44	0.56	85.57	2.804	0.30	
							7.60	**16.00**					
Steet 12	63	64	66.00	0.62	0.51	0.32	0.32	10.00	0.98	108.92	0.096	0.50	
	64	65	32.00	0.62	0.18	0.11	0.11	0.00	0.34	260.92	0.082	1.00	
	65	66	15.50	0.62	0.16	0.10	0.42	10.98	0.20	103.67	0.121	0.50	
	66	67	50.00	0.62	0.21	0.13	0.55	11.18	0.59	102.65	0.157	0.50	
	67	68	17.00	0.62	0.07	0.04	0.59	11.78	0.20	99.80	0.165	0.50	
	68	69	67.50	0.62	0.46	0.29	0.87	11.98	0.73	98.88	0.242	0.50	
	69	70	39.50	0.62	0.21	0.13	1.00	12.71	0.43	95.68	0.269	0.50	
							1.00	**13.14**					
From Street 9 (West)		70					**7.60**	**16.00**					
From Street 12		70					**1.00**	**13.14**					Provided Box
Steet 9 (West)	70	71	105.50	0.62	0.44	0.27	8.88	16.00	0.79	83.80	3.067	0.30	
							8.88	**16.79**					
From Street 2		71					**12.41**	**15.36**					
From Street 9 (West)		71					**8.88**	**16.79**					Provided Box
To Pond	71	HW	7.00	0.62	0.00	0.00	21.29	16.79	0.03	81.43	8.288	0.60	
1200x2400 box							**21.29**	**16.82**					

Q=0.0028*C*I*A (cms)
C : RUNOFF COEFFICIENT
I : RAINFALL INTENSITY
A : AREA (ha)

5-YEAR DESIGN STORM

CITY of BARRIE

STORM SEWER DESIGN

R.A. ARCHER OPERATIONS CENTRE, 165 FERNDALE DRIVE

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design@schaeffers.com

STREETS	MANHOLE		LENGTH	INCREMENT			TOTAL	FLOW TIME (min)		I	TOTAL Q	S
	FROM	TO	(m)	C	A	CA	CA	TO	IN	(mm/h)	(cms)	(%)
							0.39	**10.59**				
Street 13 (External Street)	74	75	77.00	0.62	1.18	0.73	0.73	10.00	0.91	108.92	0.223	0.50
	75	76	81.00	0.62	0.74	0.46	1.19	10.91	0.88	104.01	0.347	0.50
							1.19	**11.79**				
		76					**0.39**	**10.59**				
		76					**1.19**	**11.79**				
	76	77	76.50	0.62	1.06	0.66	2.24	11.79	0.72	99.73	0.625	0.50
	77	78	75.50	0.62	0.93	0.58	2.81	12.51	0.66	96.54	0.761	0.50
	78	79	76.00	0.62	0.99	0.61	3.43	13.17	0.63	93.78	0.900	0.50
	79	80	74.00	0.62	0.87	0.54	3.97	13.80	0.61	91.33	1.015	0.50
							3.97	**14.41**				
Prince William Way	72	73	97.50	0.62	0.60	0.37	0.37	10.00	1.32	108.92	0.113	0.60
	73	80	98.50	0.62	0.49	0.30	0.68	11.32	1.18	101.97	0.193	0.60
							0.68	**12.50**				
From Street 13		80					**3.97**	**14.41**				
From Price William		80					**0.68**	**12.50**				
total	80	FUT	7.00	0.62	0.00	0.00	4.64	14.41	0.05	89.08	1.158	0.60
							4.64	**14.46**				

October 24, 2019

1091369 Ontario Inc.
5423 Fallingbrook Drive
Mississauga, ON
L5V 1P7

Attention: Mr. Steve Bulut

Re: BAR-00055075-E0 Proposed Residential Development
883 Mapleview Drive East, Barrie, Ontario
Infiltration Water Balance Assessment

Dear Mr. Bulut:

Exp Services Inc. (EXP) is pleased to provide 1091369 Ontario Inc. with a pre and post development Site Specific Infiltration Water Balance assessment for groundwater for the proposed residential development located at 883 Mapleview Drive East in Barrie, Ontario (Site). It should be noted that the current report is an updated version of the report dated June 26, 2019. This updated report incorporates the revised site plan and additional information provided.

1. Background Information

The Site is currently undeveloped land located on the south side of Mapleview Dr. East, approximately 1.2 km west of 20th Sideroad. It is our understanding that the development plan consists of a residential development, including one (1) storm water management pond. The development will be provided with municipal roads and services, including sewers and watermains. The Site occupies an area of approximately 30 hectares (~74 acres). The currently Site condition can be described as an open farm field, which slopes towards southeast. The Site location plan is shown on Figure 1.

According to the draft plan for the proposed development area dated September 19, 2017, the development area will comprise the design and construction of a total of 570 residential buildings, including four-hundred and fifty-seven (457) detached dwellings and one-hundred and thirteen (113) townhouse dwellings, as well as one (1) storm water management pond (SWMP) and one (1) open space along with supporting infrastructures such as streets, walkways.

Further, EXP has conducted a Hydrogeological Investigation for the Site. The results of the latter investigation are presented under a separate cover (EXP, 2017).

2. Project Objectives

The objectives of this assignment are to:

- Assess pre and post development infiltration rates;
- Develop a water balance for pre and post development conditions using a GIS approach;
- Provide water balance deficits between pre and post development conditions;
- Prepare a water balance report.

3. Scope of Work

To achieve the project objectives, EXP completed the following scope of work:

- Reviewed existing site conditions, highlighting impervious and pervious areas on the site;
- Reviewed available 30 years of climatic data for the Site;
- Mapped existing areas in accordance to topography, soil cover, shallow soil types, and use a GIS approach to refine the water balance for pre and post-development conditions;
- Mapped surrounding natural features, mainly the creek;
- Conducted six (6) infiltration tests to evaluate the infiltration rates at subsurface (up to 1 mbgs) based on a broad scale across the site;
- Conducted one (1) round of water level measurements at all available on-Site monitoring wells;
- Assessed a pre-development water balance based on existing conditions and climatic data;
- Evaluated a post-development water balance based on preliminary development plans;
- Estimated deficits between pre and post-development conditions, and identify areas where mitigation measures can be implemented;
- Assessed potential impacts to Natural Heritage System and provided preliminary guidance to mitigate impacts; and
- Prepared an infiltration water balance report.

4. Methodology

The Thornthwaite water balance (Thornthwaite, 1948; Mather, 1978; 1979) is an accounting type method used to analyze the allocation of water among various components of the hydrologic cycle. This methodology was used to complete the pre-construction (existing conditions) and post development water balance. The model inputs include monthly mean temperature, total precipitation, runoff factor, soil-moisture storage capacity, rain temperature threshold, snow temperature threshold, maximum melt rate and the latitude of the Site. The model outputs include monthly potential and actual evapotranspiration, soil moisture storage, soil moisture storage change, surplus, infiltration, and runoff.

When precipitation (P) occurs, it can either runoff (R) through the surface water system, infiltrate (I) to the water table including an interflow component, or evapotranspire (ET) from the earth's surface and vegetation. The difference between total precipitation (P) and the total of evaporation and evapotranspiration (ET) is defined to be the water surplus (S) which is available for both infiltration (recharge to the groundwater system including interflow) and for run-off. When long-term averages of P, R, I, and ET are used, there is no net change in groundwater storage (ST). Annually, however, there is a potential for small changes in ST.

The annual water budget can be stated as follows:

$$P = ET + R + I + ST$$

Where:

P =	precipitation
ET =	evapotranspiration
R =	surface water run-off
I =	Infiltration
ST =	change in groundwater storage

For this assessment, the Thornthwaite and Mather method was used to estimate average infiltration rates. Based on the site conditions, as no recharge/infiltration to deep aquifer occurs, the component for infiltration in the Thornthwaite and Mater model was used to estimate infiltration, which corresponds to lateral movement of water in the unsaturated zone in the shallow sub-surface (first few meters) which discharges to surface water features.

Infiltration is governed by the surficial soil types, topography and land cover (Figures 2 to 6). Areas where shallow water table as measured in shallow monitoring wells, is at surface, then the percolation rate of precipitation into the shallow soils is considered negligible (Figures 7 and 8).

For ease of calculation, a spreadsheet model was used for the computation. The Thornthwaite and Mather Model was based on the United Stated Geological Survey (USGS) graphical user interface (Thornthwaite Monthly Water-Balance program, 2007).

4.1 Meteorological Data

Meteorological data including average monthly precipitation and average temperatures were obtained from the National Climate Data and Information Archive (Environment Canada) for the Barrie WPCC (Station ID No.6110557).

Meteorological data for 29 years from 1978 to 2006 was utilized for the assessment. Summary of input data is provided in Attachment 1.

4.2 Pre and Post-Development Site Characteristics

4.2.1 Pre-Development Site Characteristics

The Site is located in an unurbanized land use setting where it has been identified as a farm field.

A summary of the existing (pre-development) landscape features is provided in Table 4.1 below.

Table 4.1: Pre-Development (Existing) Land Use

Description	Pre-Construction (Existing) (m^2)
Total Site Area	302,539
Existing Buildings, Streets and paved areas	0
Farm Field Area	302,539
Site Area Available for Infiltration	302,539

It should be noted that the areas provided in Table 4.1 above were determined based on a review of available Site plans and these estimates are considered appropriate for the purpose of estimating the water balance.

As evident from the information provided in Table 4.1, under pre-development conditions, the entire Site area is pervious under pre-development conditions.

4.2.2 Post-Development Site Characteristics

Table 4.2 provides a summary of the post development site characteristics.

Table 4.2: Post Development Site Characteristics

Description		Impervious Areas (Buildings, Roads) m^2	Pervious Areas (Lawns, Gardens, Landscape, Open Spaces) m^2	Total Areas Post Construction (Proposed) m^2	
Previously Existing and Retained Impervious		0	0	0	
Detached and Town house Dwellings	Roofs	97,057	0	97,057	
	Driveway/Parking	26,993	0	26,993	Total: 200,197
	Lawns, Gardens, Landscape	0	76,147	76,147	
Roads, Sidewalks, Streets		58,047	0	58,047	
Storm Water Management Pond (SWMP)		5,650	0	5,650	
Open Space		0	38,645	38,645	
Totals		**187,747**	**114,792**	**302,539**	

Under post-development conditions, the total pervious area is decreased to 38% of the total Site area.

5. Pre-Development Water Balance Estimates

5.1 Climate Data Analysis

The mean annual water surplus was calculated using the Thornthwaite and Mather (1955) method. Monthly average precipitation values were obtained for 29 years from 1978 to 2006.

Soil moisture storage of 200 mm/yr was assumed for soils, and considered representative of the preconstruction site conditions. The closest Latitude to the Site is 440, which was used in the USGS model (2007).

Table 5.1 provides a summary of the climatic water balance analysis. Attachment 1 provides a summary of model input. Attachment 2 provides a summary of the model output.

Table 5.1: Summary of Climatic Water Balance Analysis in Pre-Development Conditions

Soil Moisture Storage (mm/yr)	Precipitation (mm/yr)	Potential ET (mm/yr)	Actual ET (mm/yr)	Surplus (mm/yr)
200 mm/yr Silt to Sandy Silt	933	566.70	556.35	376.67

Note: ET = Evapotranspiration

The results of climatic water balance analysis for the Site indicates that a surplus of 376.67 mm/year of water is available for surface run-off and infiltration.

5.2 Infiltration

The infiltration is expected to be controlled by soil type, topography, and soil cover type. Surplus water is portioned between run-off and infiltration based on the controlling factors provided by MOE (1995). It is noted that the controlling factors provided by the MOE for estimating infiltration were used to estimate the controlling factors for infiltration.

Attachment 3 provides a summary of the assumptions made for the Site, as well as the estimated sub factors and total factor based on the Site conditions.

The estimated pre-development total infiltration factor of 0.45 represents the fraction of the water surplus available for infiltration. Therefore, the fraction of the available water surplus for run-off is 0.55.

The infiltration factor is utilized to calculate the amount of infiltration (in units of m^3/yr) at the Site by multiplying it by the average yearly water surplus estimate by the site area available for infiltration.

Using the infiltration factor of 0.45, a water surplus of 376.67 mm/yr, the pre-development infiltration rate for the entire Site is estimated to be approximately 169.50 mm/yr.

Infiltration sub-factors were determined for the purpose of estimating predevelopment infiltration rates.

For areas were the shallow water table is at surface for existing and proposed grade, the infiltration rate corresponding to these areas were considered negligible.

5.3 Pre-Development Water Balance Analysis

The water balance analysis is based on available information on a regional scale and considered consistent for the Site.

Table 5.3 provides a summary of pre-development water balance analysis for the Site.

Table 5.3: Summary of Overall Pre-Development Water Balance Results

Location	Total Site Area (m^2)	Area Available for Infiltration (m^2)	Precipitation (m^3/y)	Actual Evapo-transpiration (m^3/y)	Run-off (m^3/y)	Uncorrected Infiltration (m^3/y)	*Corrected Infiltration (m^3/y)
Entire Site	**302,539**	**302,539**	**282,275**	**168,318**	**62,677**	**51,281**	**44,102**
Percentage of Total Precipitation			100%	60%	22%	18%	16%

Note- *The corrected infiltration was corrected for areas were the groundwater is at or above existing grade.

The total Site area was used to estimate the total volume of annual precipitation for the Site. As summarized in Table 5.3, the pre-development water balance is as follows: approximately 60% of the total precipitation will be subjected to evapotranspiration, 22% to run-off and 18% to uncorrected infiltration.

The pre-development infiltration volumes were then corrected for areas were the infiltration would be negligible due to the water table being at or above surface compared to the existing grade on site. This resulted in a corrected infiltration of 16 %.

The predevelopment water balance (uncorrected infiltration), on a weighted average depth basis (in mm) can be expressed as follows:

$$P\ (933.02) = ET\ (556.35) + R\ (207.17) + I\ (169.50) + ST\ (0)$$

6. Post-Development Water Balance Estimates

6.1 Post Development Water Balance

Based on the proposed development drawings provided, the total area of impervious surfaces under the post-development conditions is approximately 187,747 m^2 representing approximately 62% of the Site area (total area: 302,539 m^2), (Table 4.2). The remaining 114,792 m^2 is available to contribute to infiltration during post development stage (38% of the total land area), not considering areas of shallow water table.

Lot level post development infiltration sub-factors were determined based on the method recommended by MOE (1995), similar to the method used for estimating infiltration sub-factors for pre-development site conditions.

For post-development infiltration sub-factors, the landscaped areas were assumed to be consistent with cultivated cover with an infiltration sub-factor of 0.1 (Attachment 3).

Table 6.1 provides a summary of the overall post development water balance assessment.

Table 6.1: Summary of Overall Post Development Water Balance Forecast (Unmitigated)

Location	Total Site Area (m^2)	Area Available for Infiltration (m^2)	Precipitation (m^3/y)	Actual Evapo-transpiration (m^3/y)	Run-off (m^3/y)	Uncorrected Infiltration (m^3/y)	*Corrected Infiltration (m^3/y)
Total Site	302,539	114,792	282,275	63,865	199,871	18,540	17,427
Percentage of Total Precipitation			100%	23%	70%	7%	6%

Note- *The corrected infiltration was corrected for areas were the groundwater is at or above existing grade.

The total Site area was used to estimate the total volume of annual precipitation for the Site. As summarized in Table 6.1, the post-development water balance is as follows: approximately 23% of the total precipitation will be subjected to evapotranspiration, 70% to run-off and 7% to uncorrected infiltration.

The post-development infiltration volumes were then corrected for areas were the infiltration would be negligible due to the water table being at or above surface compared to the existing grade on site. This resulted in a corrected infiltration of 6%.

7. In-Situ Infiltration Testing Results

To examine the surficial soil at the Site for texture, weathering and secondary permeability features and to measure the in-situ infiltration rate of the surficial soil, infiltration tests (by adding water) were completed on June 6, 2019. The infiltration tests were completed at six (6) locations (IT1, IT2, IT3, IT4, IT-5 and IT-6). It should be noted that IT-6 location was advanced at number of attempts to different depths and each borehole had free water present to the top of borehole. As such, the infiltration test at IT-6 location was not feasible and excluded from this assessment. Figure 9 shows the infiltration test location plan.

The infiltration testing results are based on single well response falling head tests (SWRT) preformed at each borehole and are included in the Attachment 4.

Based on the *in situ* infiltration testing results, the geometric mean of the measured infiltration rate for the tested soil layers at subsurface is calculated at 66 mm/hr. Using the geometric mean infiltration rate and a safety factor (Appendix C, Low Impact Development (LID) Stormwater Management Planning and Design Guide, Appendix C, CVC – TRCA, 2010), the design infiltration rate was calculated to vary between 12 (min) and 27 (max) mm/hr for the entire Site with calculated geometric mean of design infiltration rates of 19 mm/hr.

8. Water Level Monitoring

As part of this investigation, static water levels in all monitoring wells across the site were inspected on June 6, 2019. All hand augured boreholes were reportedly dry at the time of initial monitoring, except for IT-6. The monitoring well locations are shown on Figure 9.

Water level monitoring results completed at all available monitoring wells at the Site are presented in Attachment 5. It should be noted that all monitoring wells on site vary in depths between 6.7 to 13.5 mbgs (~Elev. 242.14 to 249.07 masl). The water level elevations ranged from approximately 255.37 m (or 2.18 m above ground surface at BH32) to 256.43m (or 6.79 mbgs at BH19) across the site, as measured between November 23, 2017 and June 6, 2019.

It is noted that artesian (above ground water level) conditions were observed at BH12, BH28 and BH32 on June 6, 2019 monitoring event.

9. Impact Assessment and Proposed Mitigation Measures

If no remedial measures are implemented to maintain infiltration, it is expected that infiltration will be reduced from approximately 44,102 m^3/yr to 17,427 m^3/yr in post development, resulting a deficit of approximately 26,674 m^3/yr (Attachment 6).

Infiltration deficits based on pre and post Site conditions are provided and can be utilized to guide mitigation measures under ideal soil and groundwater conditions. With implementing suitable mitigation measures (LIDs), it is expected that the pre-development infiltration of 44,102 m^3/yr can be maintained under the post development. Reasonable mitigation measures on Site are therefore recommended to maintain the pre-development infiltration under post development Site conditions.

Under post-development conditions, a reduction in infiltration versus pre-development conditions may occur. As a result of this, contribution from infiltration to downgradient surface water features would decrease.

In order to maintain the estimated pre-development infiltration rate of 44,102 m^3/year, mitigation measures should be implemented to maintain these infiltration levels. These mitigation measures can include but not be limited to roof water collection and directing to open spaces, infiltration galleries, infiltration trenches and other feasible LID measures.

As indicated in Attachment 7 the design infiltration rate from the infiltration tests is 19 mm/hr. As shown in Attachment 8 (set of drawings and calculations by Schaeffers Consulting Engineers dated January 2019) proposed LIDs consisting of ten infiltration galleries will have a total area of 967 m^2.

Therefore, using the design infiltration rate, the area of LID (i.e. infiltration gallery, infiltration trenches or other feasible LIDs) that is required to offset the water balance deficit is approximately 261 m^2 (Attachment 7). Thus, the proposed LIDs will be sufficient to fully mitigate the deficit in post-development scenario.

We trust that the information provided in this report is satisfactory for your purposes. Should you have any questions or require more information, please do not hesitate to contact the undersigned.

Sincerely,

EXP Services Inc.

Jay Samarakkody, B.Sc., M.Phil. (Hydrogeology), P. Geo.
Senior Hydrogeologist
Environmental Services

Nataliya Tkach, P.Geo., P.Eng., PMP
Senior Hydrogeologist
Environmental Services

Figures:

Figure 1 – Site Location Map
Figure 2 – Surficial Soils
Figure 3 – Existing Slope
Figure 4 – Existing Land Use
Figure 5 – Proposed Slopes
Figure 6 – Proposed Land Use
Figure 7 – Shallow Groundwater and Existing Grade
Figure 8 – Shallow Groundwater and Proposed Grade
Figure 9 – Monitoring Well and Infiltration Test Location Map

Attachments:

Attachment 1 - Summary of Model In-put Data
Attachment 2 - Summary of Model Out-put
Attachment 3 – Infiltration Factors
Attachment 4 – *In Situ* Infiltration Test Results
Attachment 5 –Groundwater Elevations Summary
Attachment 6 – Summary of Pre-and Post-Development Water Balance Estimates
Attachment 7 – LID Mitigation
Attachment 8 – LID design drawings

References

- Chapman, L. J., and Donald F. Putnam (1984). The Physiography of Southern Ontario [Ontario Geological Survey Special Volume 2], Third Edition. Government of Ontario.
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- Gregory J. McCabe and Steven L. Markstrom., Monthly Water-Balance Model Driven By a Graphical User Interface; for U.S. Geological Survey, U.S. Department of Interior; Open File Report 2007-1088, 2007
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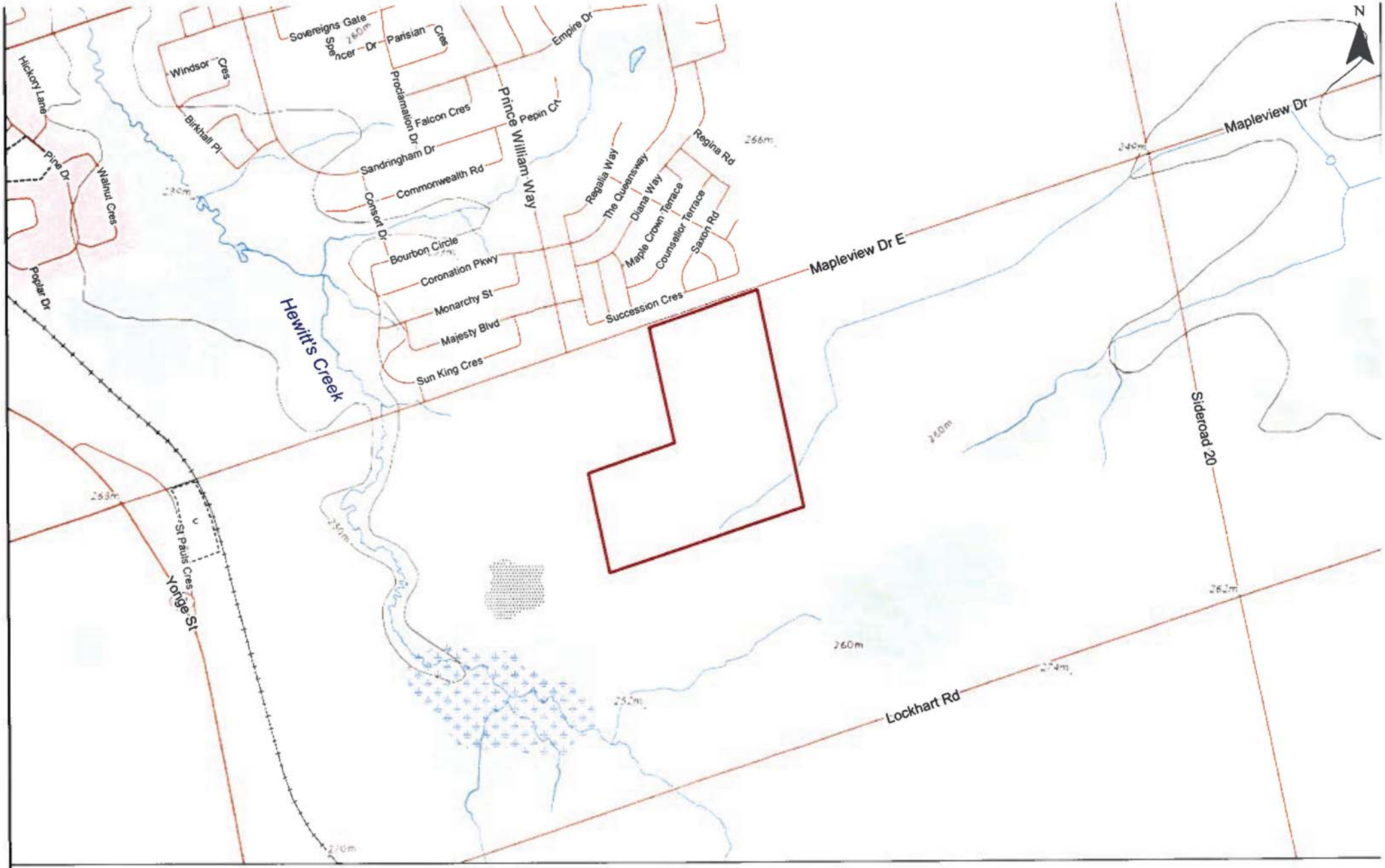
- Oak Ridges Moraine Groundwater Program – ORMGP portal (https://oakridgeswater.ca/)
- Site Plan of Subdivision North Half of Lot 18, Con.11 City of Barrie, County of Sincoe, Dwg No. – 17:7 prepared by KLM (September 19, 2017)
- Set of LIDs drawings and calculations prepared by Schaeffers Consulting Engineers dated January 11, 2019
- General Plans Parts 1 and 2 (GP-1 and GP-2) prepared by Schaeffers Consulting Engineers dated October 2019
- Storm Tributary Areas Plan Part 1 prepared by Schaeffers Consulting Engineers dated October 2019
- EXP (December 21, 2017) Hydrogeological Investigation, 883 Mapleview Drive East, Barrie, Ontario

Figures



EXP Services Inc.
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PROJECT TITLE:
WATER BALANCE INVESTIGATION
883 MAPLEVIEW DRIVE EAST
BARRIE, ONTARIO

DRAWING TITLE:
SITE LOCATION PLAN

PROJECT No. BRM-00055075-E0	DWN: AC
SCALE: AS NOTED	CHKD: RS
DATE: JUNE 2019	DWG. No. 1

Legend

- Approximate Site Boundary
- 20: Organic deposits (0.1)
- 9b: Coarse-textured glaciolacustrine deposits (Littoral-foreshore deposits)
- 6: Ice-contact stratified deposits (fine sand to gravel)
- 5b: Stone-poor, carbonate-derived silty to sandy till

0 100 200 300 400 500 m

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PROJECT TITLE:
WATER BALANCE INVESTIGATION
883 MAPLEVIEW DRIVE EAST
BARRIE, ONTARIO

DRAWING TITLE:
SURFICIAL SOILS

PROJECT No: BRM-00055075-E0	DWN: AC
SCALE: AS NOTED	CHKD: RS
DATE: JUNE 2019	DWG No: 2

Legend

Landuse

Approximate Site Boundary

Agricultural

0 80 160 240 320 400 m

EXP Services Inc.
1595 Clark Boulevard
Brampton, ON, L6T 4V1
Phone: +1.905.793.9800
Fax: +1.905.793.0641

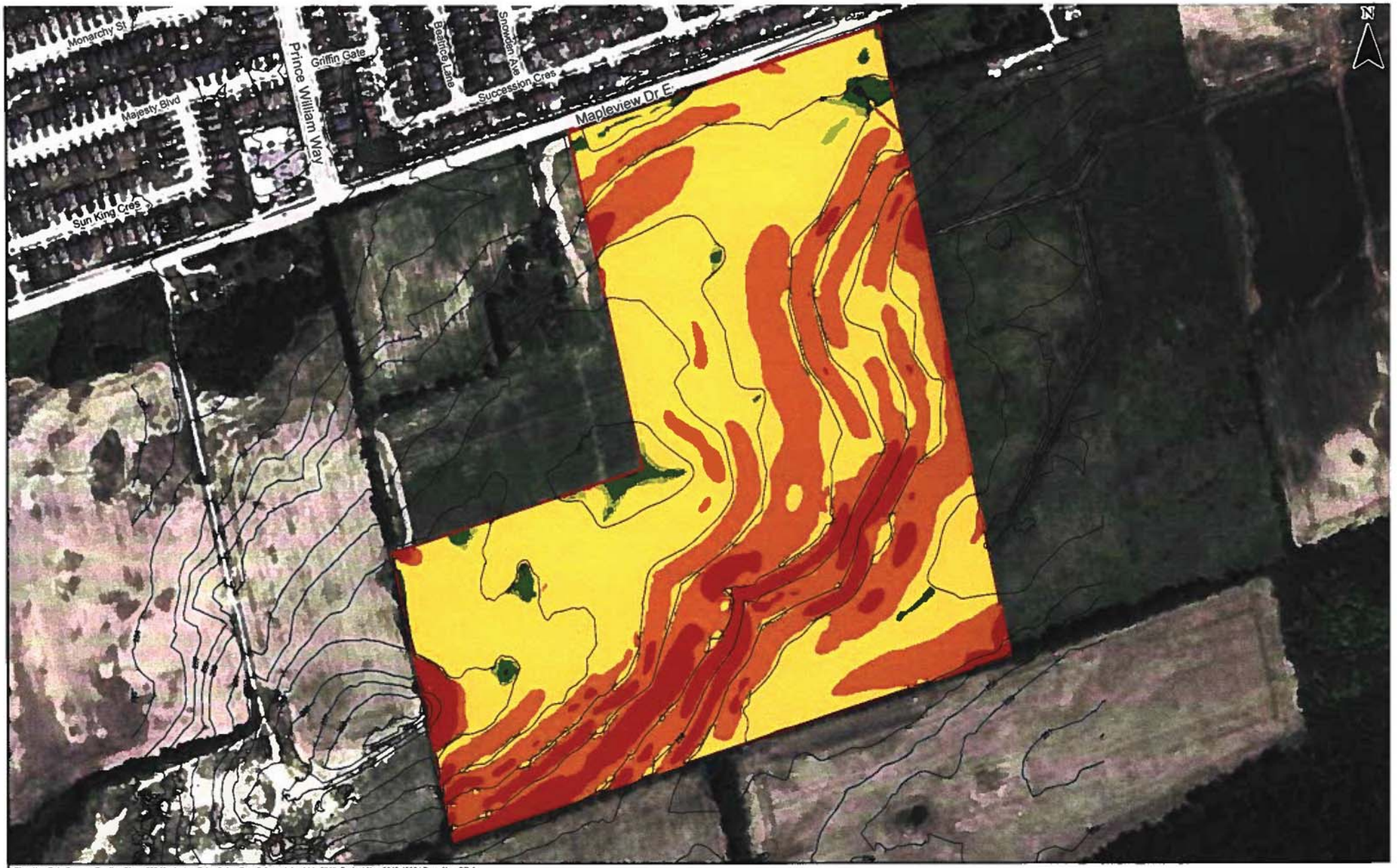
PROJECT TITLE:

WATER BALANCE INVESTIGATION
883 MAPLEVIEW DRIVE EAST
BARRIE, ONTARIO

DRAWING TITLE:

EXISTING LAND USE

PROJECT No: BRM-00055075-E0	DWN: AC
SCALE: AS NOTED	CHKD: RS
DATE: JUNE 2019	DWG No: 3



Elevation Data Source: Grading Plan - 883 Mapleview Drive,Schaeffers & Associates Ltd., 2019. Project No.: 2018-4892 | Dwg. No.: GR-1

Legend

Existing Slope (Infiltration Factor)

- Topographic Contour (m asl)
- Approximate Site Boundary
- <0.06% (0.30)
- 0.06 - 0.28% (0.25)
- 0.28 - 0.38% (0.20)
- 0.38 - 2.8% (0.15)
- 2.8 - 4.7% (0.10)
- >4.7% (0.05)

0 100 200 300 400 500 m

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PROJECT TITLE:

WATER BALANCE INVESTIGATION
883 MAPLEVIEW DRIVE EAST
BARRIE, ONTARIO

DRAWING TITLE:

EXISTING SLOPE

PROJECT No. BRM-00055075-E0	DWN AC
SCALE AS NOTED	CHKD RS
DATE JUNE 2019	DWG No. 4

Lot Configuration Source: Grading Plan - 883 Mapleview Drive.Schaeffers & Associates Ltd., 2019. Project No.: 2018-4892 | Dwg. No.: GR-1

Legend

Land Use

Approximate Site Boundary | Landscape | Paved Surface | Residential | SWM Pond Area

0 100 200 300 400 500 m

EXP Services Inc. 1595 Clark Boulevard Brampton, ON, L6T 4V1 Phone: +1.905.793.9800 Fax: +1.905.793.0641	PROJECT TITLE: WATER BALANCE INVESTIGATION 883 MAPLEVIEW DRIVE EASTt BARRIE, ONTARIO	DRAWING TITLE: PROPOSED LAND USE	PROJECT No: BRM-00055075-E0 DWN: AC SCALE: AS NOTED CHKD: RS DATE: JUNE 2019 DWG No: 5

Elevation Data Source: Grading Plan - 883 Mapleview Drive Schaeffers & Associates Ltd.; 2019; Project No: 2018-4892; Dwg. No.: GR-1

Legend

- Proposed Elevation Point (m asl)
- Approximate Site Boundary

Proposed Slope (Infiltration Factor)

- <0.06% (0.30)
- 0.06 - 0.28% (0.25)
- 0.28 - 0.38% (0.20)
- 0.38 - 2.8% (0.15)
- 2.8 - 4.7% (0.10)
- >4.7% (0.05)

0 100 200 300 400 500 m

EXP Services Inc.
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PROJECT TITLE:
WATER BALANCE INVESTIGATION
883 MAPLEVIEW DRIVE
BARRIE, ONTARIO

DRAWING TITLE:
PROPOSED SLOPE

PROJECT No: BRM-00605387-E0	DWN: AC
SCALE: AS NOTED	CHKD: RS
DATE: JUNE 2019	DWG No: 6

Note: Groundwater elevations were measured on November 28, 2017.

Legend

- Borehole / Monitoring Well
- xx.xx Groundwater Elevation (m asl)
- Groundwater Contour
- Topographic Contour (m asl)
- Area of Artesian Conditions
- Approximate Site Boundary

0 100 200 300 400 500 m

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1595 Clark Boulevard
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PROJECT TITLE:
WATER BALANCE INVESTIGATION
883 MAPLEVIEW DRIVE EAST
BARRIE, ONTARIO

DRAWING TITLE:
EXISTING GRADE VS.
GROUNDWATER TABLE

PROJECT No: BRM-00055075-E0	DWN: AC
SCALE: AS NOTED	CHKD: RS
DATE: JUNE 2019	DWG No: 7

Note: Groundwater elevations were measured on November 28, 2017.

Legend

- Borehole / Monitoring Well
- Groundwater Contour
- Area of Artesian Conditions
- XX.XX Groundwater Elevation (m asl)
- Proposed Elevation Point (m asl)
- Approximate Site Boundary

0 100 200 300 400 500 m

EXP Services Inc.
1595 Clark Boulevard
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Fax: +1.905.793.0641

PROJECT TITLE:
WATER BALANCE INVESTIGATION
883 MAPLEVIEW DRIVE EAST
BARRIE, ONTARIO

DRAWING TITLE:
PROPOSED GRADE VS. GROUNDWATER TABLE

PROJECT No: BRM-00055075-E0	DWN: AC
SCALE: AS NOTED	CHKD: RS
DATE: JUNE 2019	DWG No: 8

EXP Services Inc.
t: +1.905.793.9800 | f: +1.905.793.0641
1595 Clark Boulevard
Brampton, ON L6T 4V1
Canada
www.exp.com

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LEGEND

- APPROXIMATE SITE BOUNDARY
- ▲ INFILTRATION TEST LOCATION (EXP, 2019)
- ⊕ BOREHOLE / MONITORING WELL LOCATION (EXP, 2017)

TITLE AND LOCATION

INFILTRATION TEST / MONITORING WELL LOCATION PLAN

INFILTRATION WATER BALANCE ASSESSMENT
883 MAPLEVIEW DRIVE EAST,
BARRIE, ONTARIO

PROJECT NO	DWN
BAR-00055075-E0	AS
SCALE	CK
AS NOTED	NT
DATE	FIG NO
JUNE 2019	9

X:\DRAWINGS\55000\55000\55075\55075E\INFILTRATION TESTING\JUNE 4 2019\BAR-00055075-E0.dwg

Attachment 1 - Summary of Model In-put Data

Attachment 1: Model Input

883 Mapleview Drive East, Barrie, Ontario

BAR-00055075-E0

Year	Month	Ave. T (^{0}C)	Ave P (mm)
1978-2006	1	-7.76	91.86
1978-2006	2	-7.05	59.48
1978-2006	3	-1.82	55.36
1978-2006	4	5.48	63.44
1978-2006	5	12.33	80.20
1978-2006	6	17.78	84.02
1978-2006	7	20.75	76.87
1978-2006	8	19.76	88.70
1978-2006	9	15.26	91.34
1978-2006	10	8.58	80.24
1978-2006	11	2.71	84.66
1978-2006	12	-3.60	76.84

Attachment 2 - Summary of Model Out-put

Attachment 2: Model Output

883 Mapleview Drive East, Barrie, Ontario
BAR-00055075-E0

Month	PET	P	P-PET	Soil Moisture	AET	PET-AET	Snow Storage	Surplus	Direct Runoff
January	7.79	91.86	13.34	196.54	7.78	0.01	105.25	13.84	0.7
February	9.27	59.48	21.37	196.25	9.19	0.08	133.33	21.74	0.8
March	18.42	55.36	58.93	200.00	18.42	0.00	109.66	55.18	1.7
April	35.77	63.44	79.18	200.00	35.77	0.00	55.00	79.18	3.2
May	68.26	80.20	35.44	196.82	68.26	0.00	27.51	38.62	4.0
June	101.31	84.02	-7.62	179.64	101.16	0.16	13.64	9.70	4.2
July	120.43	76.87	-39.18	142.44	116.34	4.10	5.41	2.12	3.8
August	96.35	88.70	-7.93	136.53	91.04	5.30	1.27	3.27	4.4
September	55.70	91.34	32.33	156.60	54.98	0.71	0.00	12.99	4.6
October	29.15	80.24	47.07	180.53	29.12	0.03	0.00	23.18	4.0
November	15.06	84.66	63.73	196.96	15.06	0.00	1.90	47.29	4.0
December	9.24	76.84	32.50	198.74	9.24	0.00	35.22	30.71	1.8
Annual Rate (mm/yr)	566.74	933.02	329.16	2181.06	556.35	10.39	488.20	337.83	37.1

Attachment 3 – Infiltration Factors

883 Mapleview Drive East, Barrie, Ontario
BAR-00055075-E0

Attachment 3
Lot-level Average Infiltration Factors

1. Average Infiltration Factor – Pre Development Conditions

Category	Weighted Infiltration Factor
Topography/Slope	0.15
Soil Type Ice stratified fine deposits and sandy till	0.2
Cover 100% Cultivated Lands (0.1)	0.10
Total weighted Infiltration factor	**0.45**

2. Average Infilteration Factor – Post Development Conditions

Un-Mitigated

Category	Weighted IInfiltration Factor
Topography/Slope	0.12
Soil Type Ice stratified fine deposits and sandy till	0.2
Cover 100% Cultivated Lands (0.1)	0.10
Total weighted Infiltration factor	**0.42**

Notes:

Landscaped area considered equivalent to Cultivated Cover

Attachment 4 – *In Situ* Infiltration Test Results

883 Mapleview Drive East, Barrie, Ontario
BAR-00055075-E0
Low Impact Design (LID) Calculations for Infiltration Gallery

Test Location	Hydraulic Conductivity (K_{fs}) (cm/s)	Infiltration Rate (IR) (mm/hr)	Discrete Design Infiltration Rate(DIR) (mm/hr)
IT1	7.10E-05	42	12
IT2	4.30E-04	68	20
IT3	1.40E-03	94	27
IT4	4.20E-04	68	19
IT5	4.50E-04	69	20

Geology Units	Geometric Mean of K_{fs} (cm/s)	Infiltration Rate (I) (mm/hr)*	Ratio of Mean Measured Infiltration Rates	Safety Correction Factor (SCF)
Overlying Geology Unit	3.81E-04	66	1.4	3.5
Underlying Geology Unit (1.5 m below the bottom of trench)	1.00E-04	46		

Design Infiltration Rate(DIR) (mm/hr)	Minimum	12
	Maximum	27
	Geometric Mean	19

Note:
Analytical Solutions (CVC and TRCA 2010)

$$Infiltration\ Rate\ (IR) = \left(\frac{K_{fs}}{6x10^{-11}}\right)^{\frac{1}{3.7363}}$$

$$Design\ Infiltration\ Rate\ (DIR) = \frac{IR}{SCF}$$

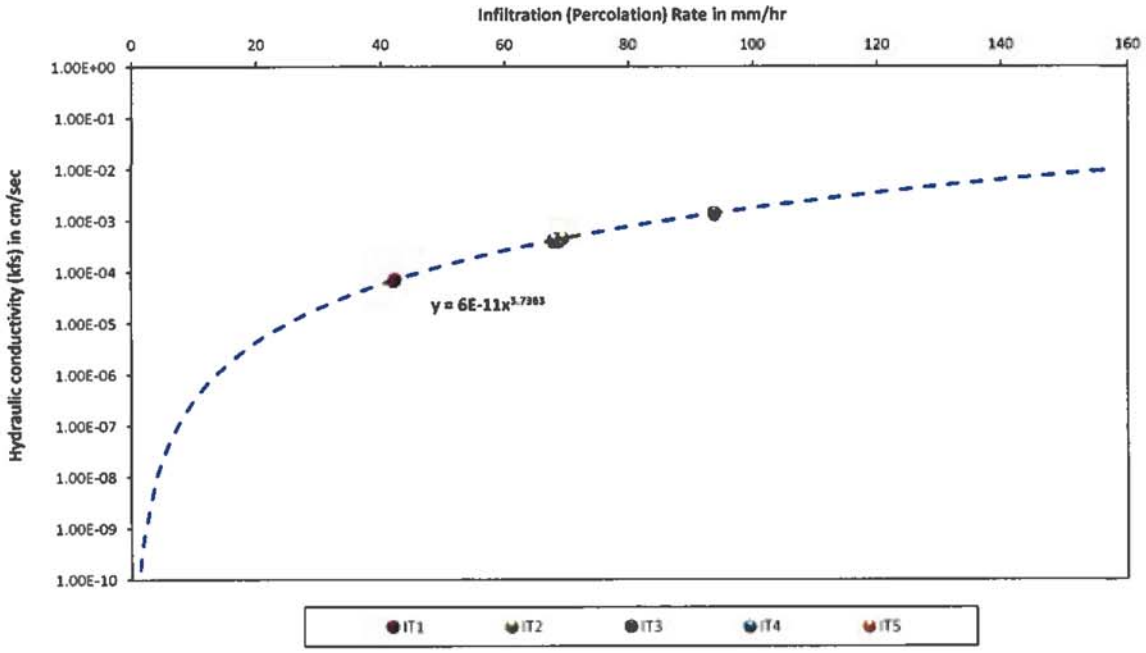
Kfs: hydraulic conductivity (cm/sec)

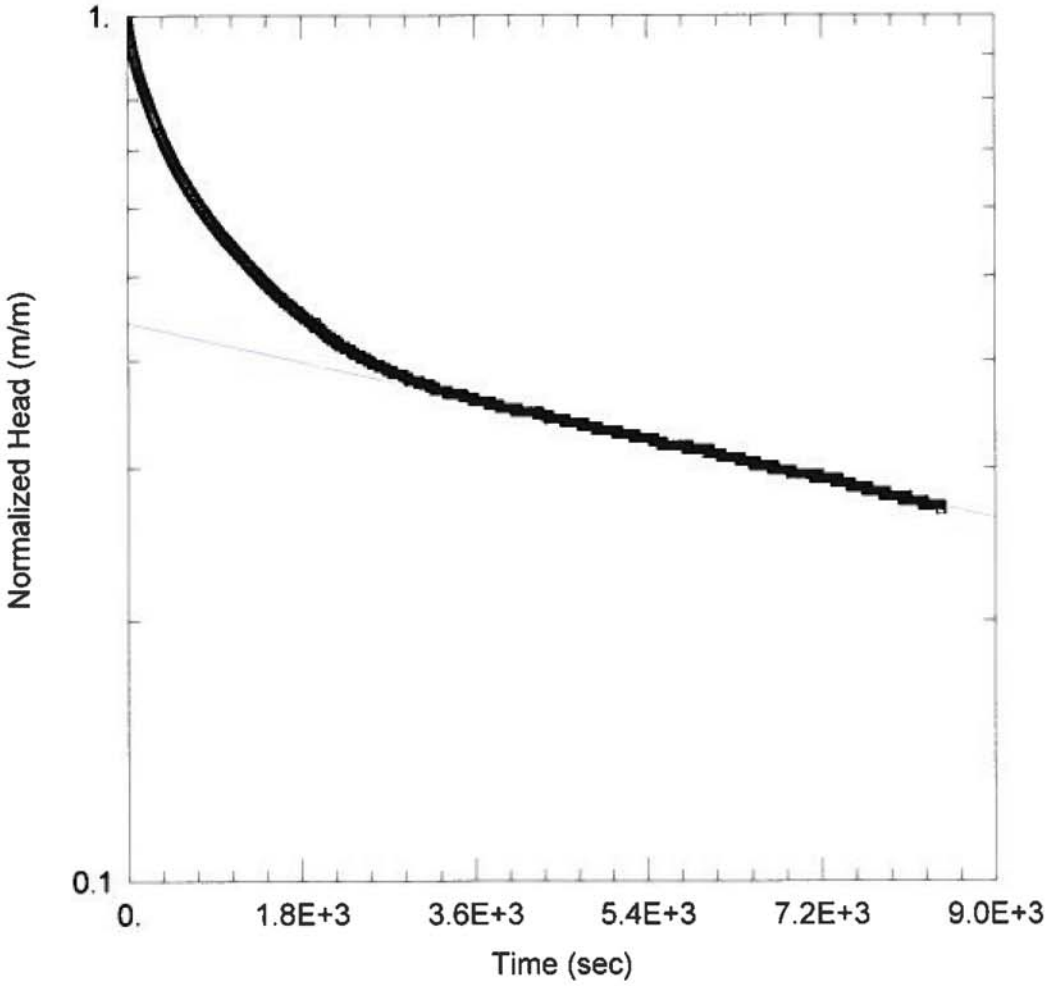
IR: infiltration rate (mm/hr)

DIR: design infiltration rate (mm/hr)

SCF: Safety Correction Factor (based on the chart recommended by CVC and TRCA, 2010)

Figure : Approximate relationship between infiltration rate and hydraulic conductivity (LID SWM planning and Design Guide, Appendix C1)





SWRT - FALLING HEAD

Data Set: I:\...\IT1 R.aqt
Date: 06/20/19 Time: 11:03:59

PROJECT INFORMATION

Company: EXP Service Inc.
Client: 1091369 Ontario Inc.
Project: BRM-00055075-E0
Location: 883 Mapleview Drive East
Test Well: IT1
Test Date: June 6, 2019

AQUIFER DATA

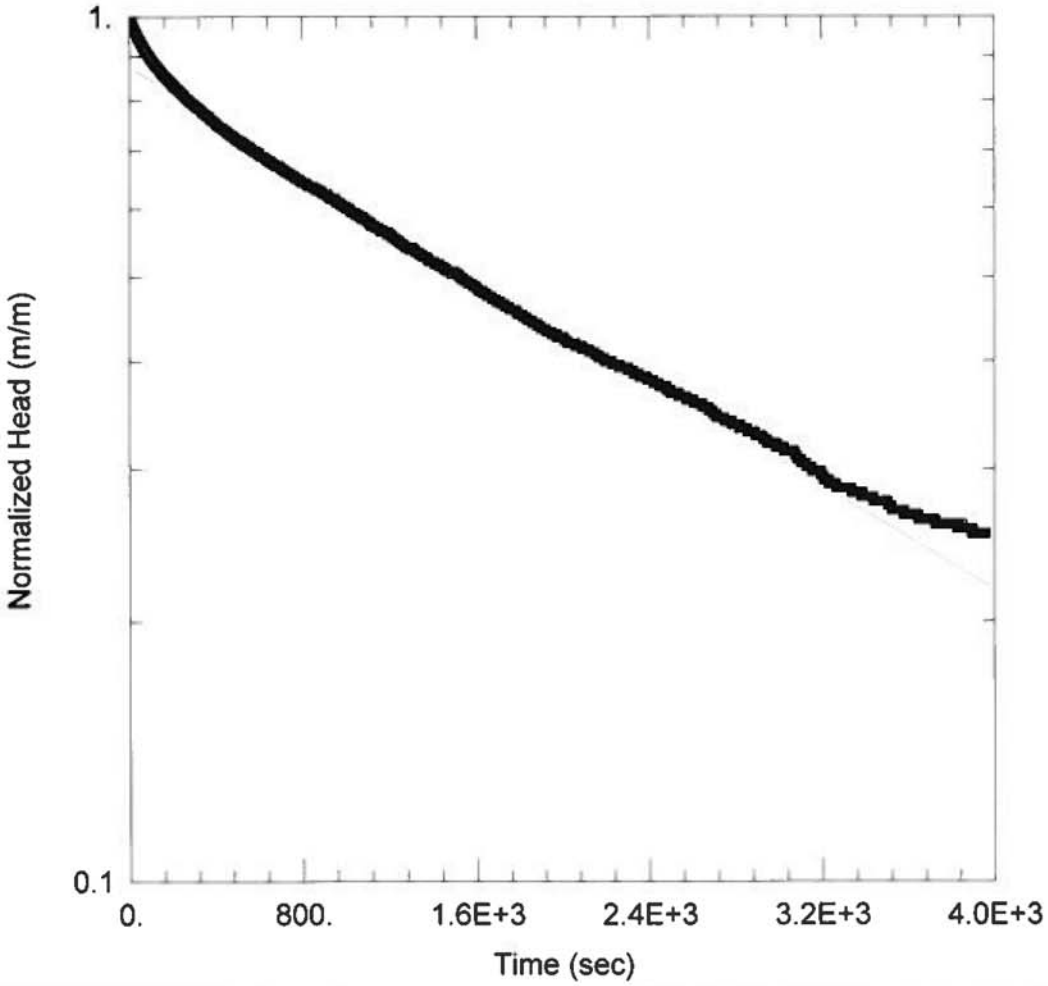
Saturated Thickness: 0.894 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (IT1)

Initial Displacement: 0.894 m
Total Well Penetration Depth: 0.01 m
Casing Radius: 0.02525 m
Static Water Column Height: 0.01 m
Screen Length: 0.01 m
Well Radius: 0.02525 m

SOLUTION

Aquifer Model: Confined
Solution Method: Hvorslev
K = 7.112E-7 m/sec
y0 = 0.3952 m



SWRT - RISING HEAD

Data Set: I:\...\IT2 R.aqt
Date: 06/20/19 Time: 11:04:33

PROJECT INFORMATION

Company: EXP Service Inc.
Client: 1091369 Ontario Inc.
Project: BRM-00055075-E0
Location: 883 Mapleview Drive East
Test Well: IT2
Test Date: June 6, 2019

AQUIFER DATA

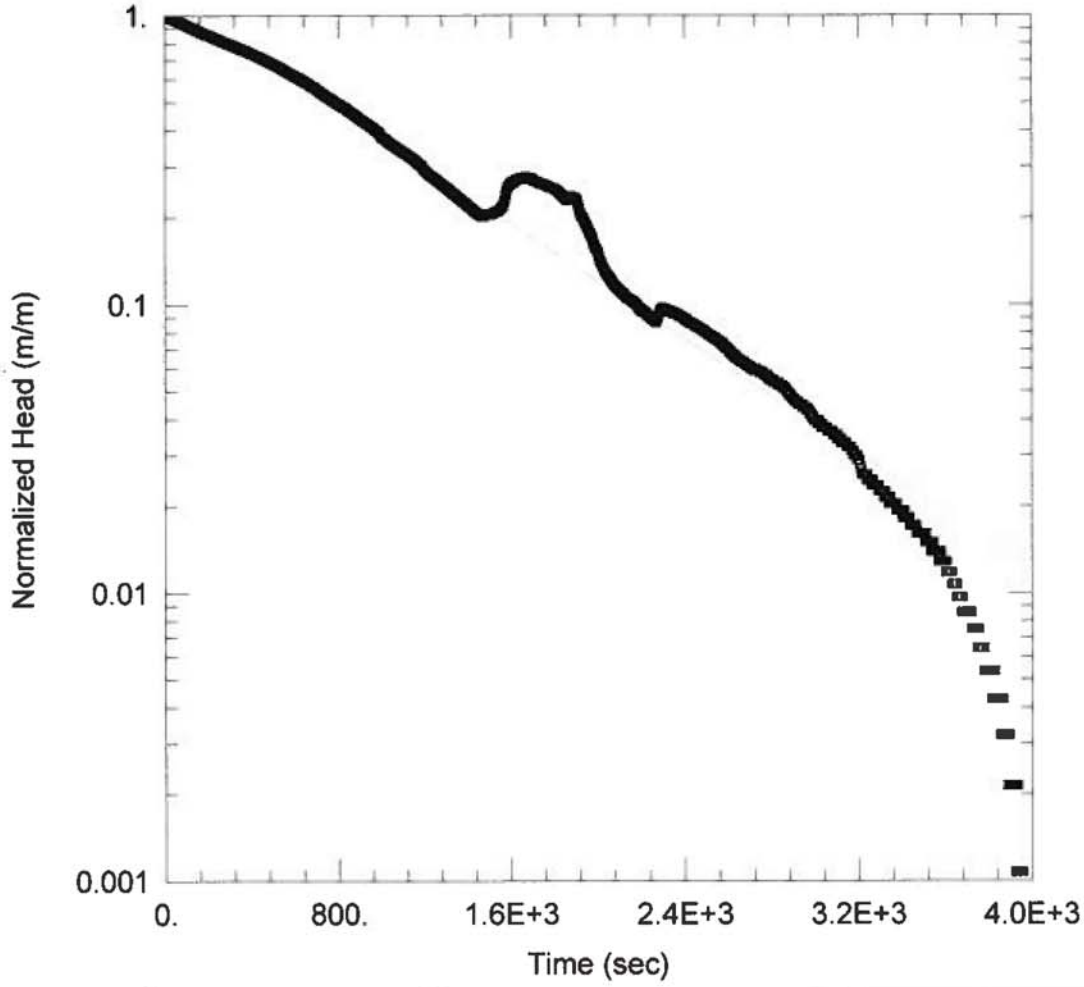
Saturated Thickness: 0.915 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (IT2)

Initial Displacement: 0.915 m
Total Well Penetration Depth: 0.01 m
Casing Radius: 0.02525 m
Static Water Column Height: 0.01 m
Screen Length: 0.01 m
Well Radius: 0.02525 m

SOLUTION

Aquifer Model: Confined
Solution Method: Hvorslev
K = 4.282E-6 m/sec
y0 = 0.7996 m



SWRT - FALLING HEAD

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PROJECT INFORMATION

Company: EXP Service Inc.
Client: 1091369 Ontario Inc.
Project: BRM-00055075-E0
Location: 883 Mapleview Drive East
Test Well: IT3
Test Date: June 6, 2019

AQUIFER DATA

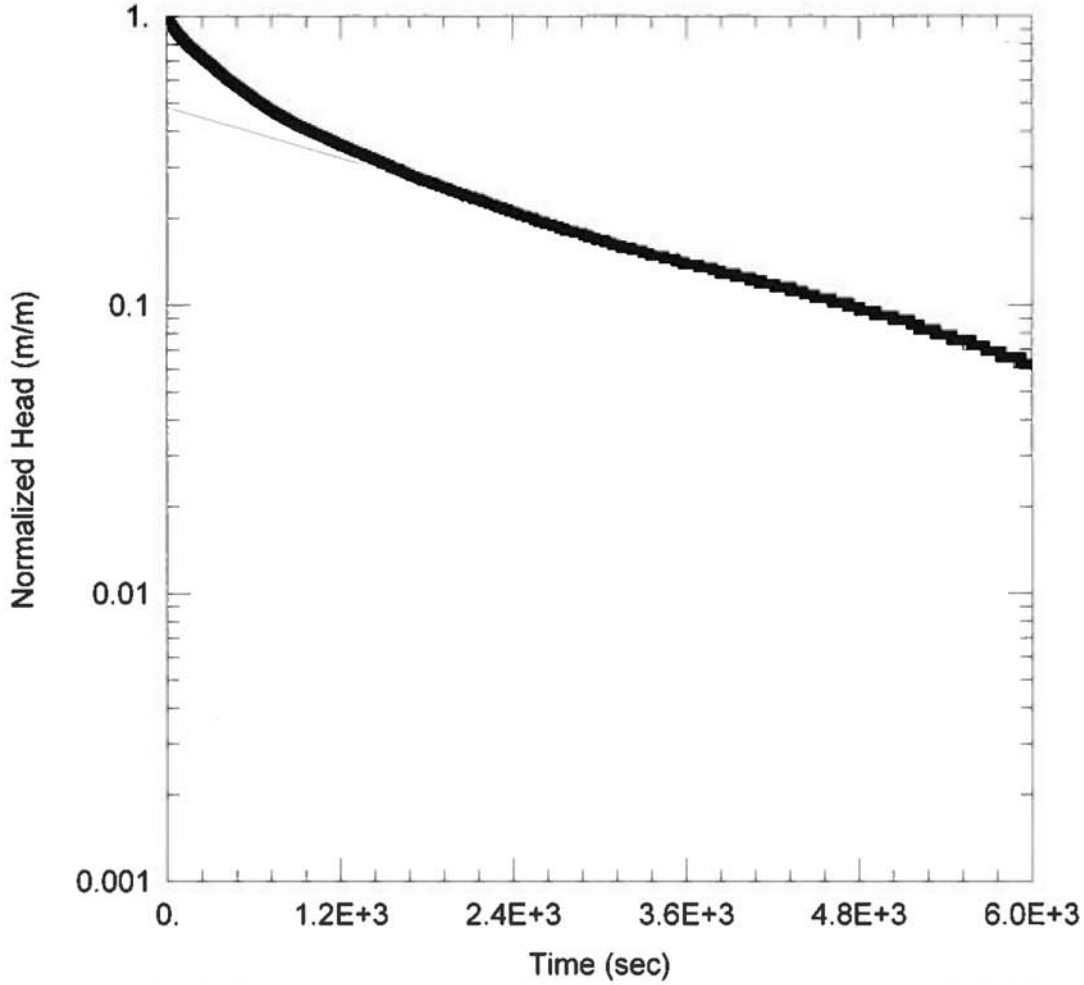
Saturated Thickness: 0.935 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (IT3)

Initial Displacement: 0.935 m
Total Well Penetration Depth: 0.01 m
Casing Radius: 0.02525 m
Static Water Column Height: 0.01 m
Screen Length: 0.01 m
Well Radius: 0.02525 m

SOLUTION

Aquifer Model: Confined
Solution Method: Hvorslev
K = 1.417E-5 m/sec
y0 = 1.124 m



SWRT - FALLING HEAD

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PROJECT INFORMATION

Company: EXP Service Inc.
Client: 1091369 Ontario Inc.
Project: BRM-00055075-E0
Location: 883 Mapleview Drive East
Test Well: IT4
Test Date: June 6, 2019

AQUIFER DATA

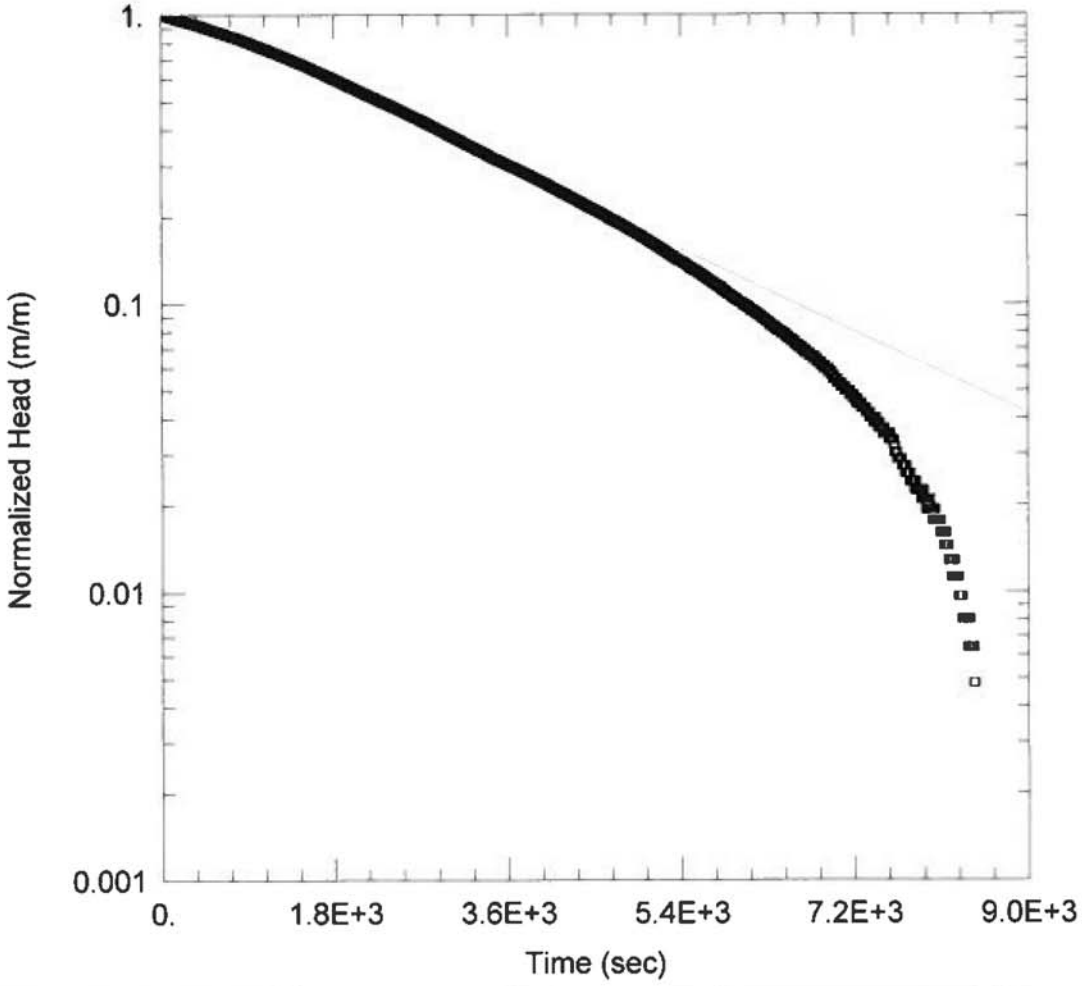
Saturated Thickness: 0.912 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (IT4)

Initial Displacement: 0.912 m
Total Well Penetration Depth: 0.01 m
Casing Radius: 0.02525 m
Static Water Column Height: 0.01 m
Screen Length: 0.01 m
Well Radius: 0.02525 m

SOLUTION

Aquifer Model: Confined
Solution Method: Hvorslev
K = 4.152E-6 m/sec
y0 = 0.4402 m



SWRT - RISING HEAD

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PROJECT INFORMATION

Company: EXP Service Inc.
Client: 1091369 Ontario Inc.
Project: BRM-00055075-E0
Location: 883 Mapleview Drive East
Test Well: IT5
Test Date: June 6, 2019

AQUIFER DATA

Saturated Thickness: 0.623 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (IT5)

Initial Displacement: 0.623 m
Total Well Penetration Depth: 0.01 m
Casing Radius: 0.02525 m
Static Water Column Height: 0.01 m
Screen Length: 0.01 m
Well Radius: 0.02525 m

SOLUTION

Aquifer Model: Confined
Solution Method: Hvorslev
K = 4.468E-6 m/sec
y0 = 0.6796 m

Attachment 5 –Groundwater Elevation Summary

TABLE 1: Groundwater Elevation Summary

Project Address: 883 Mapleview Drive East, Barrie, ON
Project Number: BAR-00055075-E0

Monitoring Well ID	Ground Surface Elevation (masl)	Stick Up (+)	Approximate Full Well Depth (mbgs)	Depth	23-Nov-17	24-Nov-17	28-Nov-17	6-Jun-19
BH 6	260.75	0.988	13.5	mbTOP	6.17	6.15	6.15	5.55
				mbgs	5.18	5.16	5.16	4.56
				masl	255.57	255.59	255.59	256.19
BH 12	255.60	0.808	6.7	mbTOP	0.86	0.87	0.87	0.57
				mbgs	0.05	0.06	0.06	-0.24
				masl	255.55	255.54	255.54	255.84
BH 19	263.22	0.903	14.9	mbTOP	8.74	8.76	8.76	7.70
				mbgs	7.84	7.86	7.86	6.79
				masl	255.38	255.36	255.36	256.43
BH 28	256.07	1.103	7.0	mbTOP	1.09	1.10	1.10	0.75
				mbgs	-0.02	0.00	0.00	-0.35
				masl	256.09	256.07	256.07	256.42
BH 32	253.19	2.234	11.1	mbTOP			1.23	0.05
				mbgs	-	-	-1.00	-2.18
				masl	-	-	254.19	255.37

Notes:
mbTOP - meters below top of the pipe
mbgs - meters below ground surface
masl - meters above mean sea level
Artesian

Attachment 6 – Summary of Pre-and Post-Development Water Balance Estimates

883 Mapleview Drive East, Barrie, Ontario
BAR-00055075-E0

Attachment 6
Summary of Pre and Post-Development Water Balance (Unmitigated)

1. Climate Data

	Pre-Development mm/a		Post-Development Un-Mitigated mm/a
Precipitation	933.02		933.02
Evapotranspiration	556.35		556.35
Water Surplus	376.67		376.67
Infiltration Rate	169.50		157.45
Runoff	207.17		219.22

2. Pre-Developed Study Area Statistics

Open spaces/ Wood Lot / Medows/ Landscaped	302,539	sq.m.
Paved Surfaces	0	sq.m.
Existing Buildings	0	sq.m.
TOTAL	302,539	sq.m.

3. Proposed Lot Coverage

Townhomes and Singles

Building Roofs	97,057	sq.m.
Paved Surface	26,993	sq.m.
Lawns, gardens, parks etc.	76,147	sq.m.
TOTAL	200,197	sq.m.

4. Annual Pre-Development Water Balance

Land Use	Area (sq.m.)	Precipitation (cu.m.)	Actual Evapotranspiration (cu.m.)	Uncorrected Infiltration Rate * (cu.m.)	Run-off (cu.m.)
Total Impervious	0	0	0	0	0
Undeveloped	302,539	282,275	168,318	51,281	62,677
TOTAL	302,539	282,275	168,318	51,281	62,677
			Pre-development Infiltration Rate	169.5	mm/a

*Notes: * Uncorrected for areas with groundwater at ground surface with zero infiltration.*

5. Annual Post-Development Water Balance Un-Mitigated

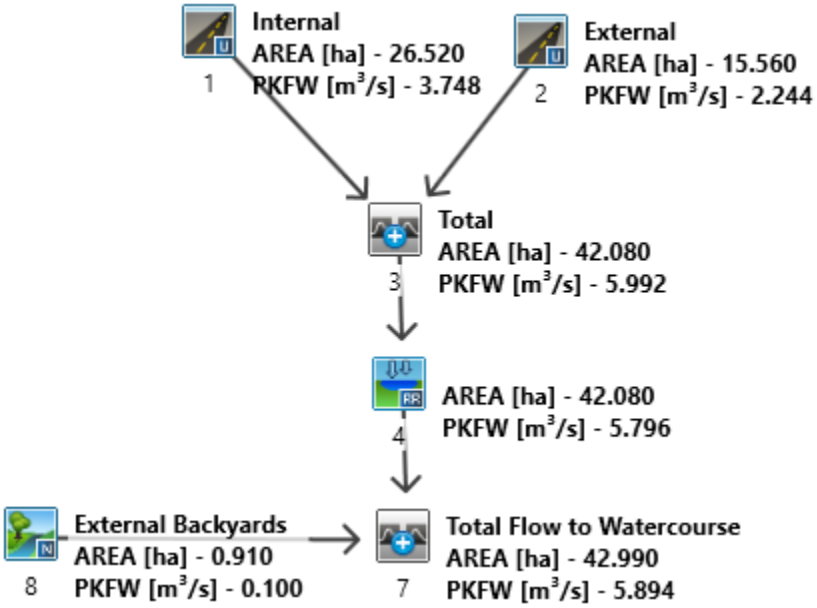
Land Use	Area (sq.m.)	Precipitation (cu.m.)	Actual Evapotranspiration (cu.m.)	Uncorrected Infiltration Rate * (cu.m.)	Run-off (cu.m.)
Previously existing Impervious	0	0	0	0	0
ROW (roads, sidewalks)	58,047	54,159	0	0	54,159
SWM Ponds	5,650	5,272	0	0	5,272
Natural Features and Greenspace	38,645	36,057	21,500	6,550	8,006
Lots					
Roofs	97,057	90,556	0	0	90,556
Driveways	26,993	25,185	0	0	25,185
Lawns, gardens, etc.	76,147	71,047	42,364	11,989	16,693
TOTAL	302,539	282,275	63,865	18,540	199,871
			Post-development Infiltration Rate Un-Mitigated	61.3	mm/a

*Notes: * Uncorrected for areas with groundwater at ground surface with zero infiltration.*

6. Comparison of Pre-Development and Post-Development Un-Mitigated

	Precipitation (cu.m.)	Actual Evapotranspiration (cu.m.)	Run-off (cu.m.)	Corrected Infiltration Rate for Areas with Shallow Groundwater Table (cu.m.)
Pre-Development	282,275	168,318	62,677	44,102
Post Development	282,275	63,865	199,871	17,427
			Pre-development Infiltration Rate	145.8
			Post-development Infiltration Rate Un-Mitigated	57.6
			Deficit Post Development Un-Mitigated	26,674

Appendix C:
Visual OTTHYMO and EPA SWMM Modelling Results



SCHAEFFERS
CONSULTING ENGINEERS

Visual OTTHYMO™ Schematic
883 Mapleview Drive East Subdivision
(Uncontrolled Regional Storm - Hazel)

Job #: 4692 | **Date: March 2020**

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                0.25    6.00 |  3.25   13.00 |  6.25   23.00 |  9.25   53.00
                0.50    6.00 |  3.50   13.00 |  6.50   23.00 |  9.50   53.00
                0.75    6.00 |  3.75   13.00 |  6.75   23.00 |  9.75   53.00
                1.00    6.00 |  4.00   13.00 |  7.00   23.00 | 10.00   53.00
                1.25    4.00 |  4.25   17.00 |  7.25   13.00 | 10.25   38.00
                1.50    4.00 |  4.50   17.00 |  7.50   13.00 | 10.50   38.00
                1.75    4.00 |  4.75   17.00 |  7.75   13.00 | 10.75   38.00
                2.00    4.00 |  5.00   17.00 |  8.00   13.00 | 11.00   38.00
                2.25    6.00 |  5.25   13.00 |  8.25   13.00 | 11.25   13.00
                2.50    6.00 |  5.50   13.00 |  8.50   13.00 | 11.50   13.00
                2.75    6.00 |  5.75   13.00 |  8.75   13.00 | 11.75   13.00
                3.00    6.00 |  6.00   13.00 |  9.00   13.00 | 12.00   13.00
--------------------------------------------------------------------------------


--------------------
| CALIB            |
| STANDHYD (  0001)|   Area    (ha)=  26.52
|ID= 1 DT=15.0 min |   Total Imp(%)=  61.00   Dir. Conn.(%)=  45.00
--------------------
                                  IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      16.18         10.34
     Dep. Storage     (mm)=       1.00          1.50
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     420.48         40.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=      53.00         72.24
               over (min)        15.00         30.00
     Storage Coeff.  (min)=       7.80 (ii)    15.83 (ii)
     Unit Hyd. Tpeak (min)=      15.00         30.00
     Unit Hyd. peak  (cms)=       0.10          0.05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.76          1.99          3.748 (iii)
     TIME TO PEAK    (hrs)=      10.00         10.00          10.00
     RUNOFF VOLUME    (mm)=     211.00        181.43         194.74
     TOTAL RAINFALL   (mm)=     212.00        212.00         212.00
     RUNOFF COEFFICIENT   =       1.00          0.86           0.92

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  84.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=  15.56
|ID= 1 DT=15.0 min |   Total Imp(%)=  68.00   Dir. Conn.(%)=  48.00
--------------------
                                  IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      10.58          4.98
     Dep. Storage     (mm)=       1.00          1.50
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     322.08         40.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=      53.00         83.85
               over (min)        15.00         15.00
     Storage Coeff.  (min)=       6.64 (ii)    14.22 (ii)
     Unit Hyd. Tpeak (min)=      15.00         15.00
     Unit Hyd. peak  (cms)=       0.10          0.07
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.10          1.14          2.244 (iii)
     TIME TO PEAK    (hrs)=      10.00         10.00          10.00
     RUNOFF VOLUME    (mm)=     211.00        184.98         197.47
     TOTAL RAINFALL   (mm)=     212.00        212.00         212.00
     RUNOFF COEFFICIENT   =       1.00          0.87           0.93

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
```

```
      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  84.0    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.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0001):    26.52   3.748    10.00   194.74
     + ID2= 2 (  0002):    15.56   2.244    10.00   197.47
       ====================================================
       ID = 3 (  0003):    42.08   5.992    10.00   195.75

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   0.8740     2.1555
                         0.0330     0.8230   |   1.1350     2.3805
                         0.0800     1.2250   |   1.4190     2.6735
                         0.3070     1.5840   |  10.7680     3.2800
                         0.4950     1.7925   |   0.0000     0.0000

                              AREA     QPEAK     TPEAK       R.V.
                              (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)     42.080      5.992     10.00      195.75
   OUTFLOW: ID= 1 (  0004)     42.080      5.796     10.08      192.44

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 96.74
                  TIME SHIFT OF PEAK FLOW         (min)=  5.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  2.9595

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0008)|   Area    (ha)=   0.91   Curve Number   (CN)= 64.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20

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

                          ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    6.00 | 3.083   13.00 | 6.083   23.00 |  9.08   53.00
               0.167    6.00 | 3.167   13.00 | 6.167   23.00 |  9.17   53.00
               0.250    6.00 | 3.250   13.00 | 6.250   23.00 |  9.25   53.00
               0.333    6.00 | 3.333   13.00 | 6.333   23.00 |  9.33   53.00
               0.417    6.00 | 3.417   13.00 | 6.417   23.00 |  9.42   53.00
               0.500    6.00 | 3.500   13.00 | 6.500   23.00 |  9.50   53.00
               0.583    6.00 | 3.583   13.00 | 6.583   23.00 |  9.58   53.00
               0.667    6.00 | 3.667   13.00 | 6.667   23.00 |  9.67   53.00
               0.750    6.00 | 3.750   13.00 | 6.750   23.00 |  9.75   53.00
               0.833    6.00 | 3.833   13.00 | 6.833   23.00 |  9.83   53.00
               0.917    6.00 | 3.917   13.00 | 6.917   23.00 |  9.92   53.00
               1.000    6.00 | 4.000   13.00 | 7.000   23.00 | 10.00   53.00
               1.083    4.00 | 4.083   17.00 | 7.083   13.00 | 10.08   38.00
               1.167    4.00 | 4.167   17.00 | 7.167   13.00 | 10.17   38.00
               1.250    4.00 | 4.250   17.00 | 7.250   13.00 | 10.25   38.00
               1.333    4.00 | 4.333   17.00 | 7.333   13.00 | 10.33   38.00
               1.417    4.00 | 4.417   17.00 | 7.417   13.00 | 10.42   38.00
               1.500    4.00 | 4.500   17.00 | 7.500   13.00 | 10.50   38.00
               1.583    4.00 | 4.583   17.00 | 7.583   13.00 | 10.58   38.00
               1.667    4.00 | 4.667   17.00 | 7.667   13.00 | 10.67   38.00
               1.750    4.00 | 4.750   17.00 | 7.750   13.00 | 10.75   38.00
               1.833    4.00 | 4.833   17.00 | 7.833   13.00 | 10.83   38.00
               1.917    4.00 | 4.917   17.00 | 7.917   13.00 | 10.92   38.00
               2.000    4.00 | 5.000   17.00 | 8.000   13.00 | 11.00   38.00
               2.083    6.00 | 5.083   13.00 | 8.083   13.00 | 11.08   13.00
               2.167    6.00 | 5.167   13.00 | 8.167   13.00 | 11.17   13.00
               2.250    6.00 | 5.250   13.00 | 8.250   13.00 | 11.25   13.00
               2.333    6.00 | 5.333   13.00 | 8.333   13.00 | 11.33   13.00
               2.417    6.00 | 5.417   13.00 | 8.417   13.00 | 11.42   13.00
               2.500    6.00 | 5.500   13.00 | 8.500   13.00 | 11.50   13.00
               2.583    6.00 | 5.583   13.00 | 8.583   13.00 | 11.58   13.00
               2.667    6.00 | 5.667   13.00 | 8.667   13.00 | 11.67   13.00
               2.750    6.00 | 5.750   13.00 | 8.750   13.00 | 11.75   13.00
               2.833    6.00 | 5.833   13.00 | 8.833   13.00 | 11.83   13.00
               2.917    6.00 | 5.917   13.00 | 8.917   13.00 | 11.92   13.00
               3.000    6.00 | 6.000   13.00 | 9.000   13.00 | 12.00   13.00

     Unit Hyd Qpeak  (cms)=   0.174

     PEAK FLOW       (cms)=   0.100 (i)
     TIME TO PEAK    (hrs)=  10.000
     RUNOFF VOLUME    (mm)= 122.236
     TOTAL RAINFALL   (mm)= 212.000
     RUNOFF COEFFICIENT   =   0.577

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

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--------------------
| ADD HYD  (  0007)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0004):    42.08   5.796    10.08   192.44
     + ID2= 2 (  0008):     0.91   0.100    10.00   122.24
       ====================================================
       ID = 3 (  0007):    42.99   5.894    10.08   190.95

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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 FINISH
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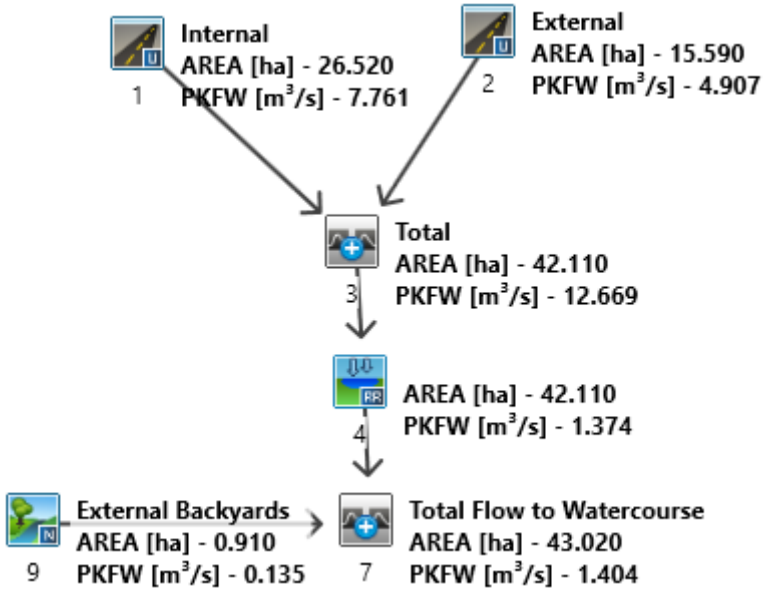

2020-02-20-24-hr-SCS-2-100yr Controlled Flows

Schematic | Hydrograph Results (instance)

Run: Run 01 | Show All Runs

Run	NHYD	DT [hr]	AREA [ha]	PKFW [m³/s]	TP [hr]	RV [mm]	DWF [m³/s]
Run 01	7	0.083	43.020	0.023	4.000	12.189	0.000
Run 02	7	0.083	43.020	0.077	20.250	31.725	0.000
Run 03	7	0.083	43.020	0.280	14.250	48.367	0.000
Run 04	7	0.083	43.020	0.488	13.083	59.970	0.000
Run 05	7	0.083	43.020	0.839	13.250	75.106	0.000
Run 06	7	0.083	43.020	1.136	12.750	86.654	0.000
Run 07	7	0.083	43.020	1.404	12.917	98.265	0.000

Flows to Watercourse Compared with Allowable Release Rates

Storm Event	2-year	5-year	10-year	25-year	50-year	100-year
Allowable Release Rates (m^3/s)	0.080	0.340	0.630	1.010	1.350	1.680
Expected Release Rate (m^3/s)	0.077	0.280	0.488	0.839	1.136	1.404

SCHAEFFERS CONSULTING ENGINEERS

Visual OTTHYMO™ Schematic
883 Mapleview Drive East Subdivision
(25 mm – 100-yr – 24-hour SCS Type II)
(Controlled Flows and Provided Storage)

Job #: 4692 | **Date: March 2020**

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       V    V   I    SSSSS  U   U    A    L
       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 5.0\VO2\voin.dat
  Output  filename: C:\Users\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-
45e7-8ee9-3237db384aff\c0c72731-a52b-4000-b17b-ce8dc78dc313\scen
  Summary filename: C:\Users\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-
45e7-8ee9-3237db384aff\c0c72731-a52b-4000-b17b-ce8dc78dc313\scen


DATE: 03-10-2020                          TIME: 09:47:19

USER:


COMMENTS: _____________________________________________________________


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  ****************************
  ** SIMULATION NUMBER:   0 **
  ****************************


--------------------
|    READ STORM    |    Filename: C:\Users\nkamran\AppD
|                  |              ata\Local\Temp\
|                  |              2d446286-7a4e-40ce-8e88-3197d691e164\37ab0616
| Ptotal= 25.00 mm |    Comments: Twenty-Five mm Four Hour Chicago Storm
--------------------
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.17    2.07 |  1.17    5.70 |  2.17    5.19 |  3.17    2.80
                0.33    2.27 |  1.33   10.78 |  2.33    4.47 |  3.33    2.62
                0.50    2.52 |  1.50   50.21 |  2.50    3.95 |  3.50    2.48
                0.67    2.88 |  1.67   13.37 |  2.67    3.56 |  3.67    2.35
                0.83    3.38 |  1.83    8.29 |  2.83    3.25 |  3.83    2.23
                1.00    4.18 |  2.00    6.30 |  3.00    3.01 |  4.00    2.14


--------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0009)|   Area     (ha)=   0.91   Curve Number    (CN)= 64.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20

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


                                ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    2.07 | 1.083    5.70 | 2.083    5.19 |  3.08    2.80
               0.167    2.07 | 1.167    5.70 | 2.167    5.19 |  3.17    2.80
               0.250    2.27 | 1.250   10.78 | 2.250    4.47 |  3.25    2.62
               0.333    2.27 | 1.333   10.78 | 2.333    4.47 |  3.33    2.62
               0.417    2.52 | 1.417   50.21 | 2.417    3.95 |  3.42    2.48
               0.500    2.52 | 1.500   50.21 | 2.500    3.95 |  3.50    2.48
               0.583    2.88 | 1.583   13.37 | 2.583    3.56 |  3.58    2.35
               0.667    2.88 | 1.667   13.37 | 2.667    3.56 |  3.67    2.35
               0.750    3.38 | 1.750    8.29 | 2.750    3.25 |  3.75    2.23
               0.833    3.38 | 1.833    8.29 | 2.833    3.25 |  3.83    2.23
               0.917    4.17 | 1.917    6.30 | 2.917    3.01 |  3.92    2.14
               1.000    4.18 | 2.000    6.29 | 3.000    3.01 |  4.00    2.14

    Unit Hyd Qpeak  (cms)=   0.174

    PEAK FLOW       (cms)=   0.005 (i)
    TIME TO PEAK    (hrs)=   1.667
    RUNOFF VOLUME    (mm)=   2.450
    TOTAL RAINFALL   (mm)=  24.996
    RUNOFF COEFFICIENT   =   0.098

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0001)|   Area     (ha)=  26.52
|ID= 1 DT=15.0 min |   Total Imp(%)=  61.00   Dir. Conn.(%)=  45.00
--------------------

                                  IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=         16.18          10.34
    Dep. Storage     (mm)=          1.00           1.50
    Average Slope     (%)=          1.00           2.00
    Length            (m)=        420.48          40.00
    Mannings n           =         0.013          0.250

        NOTE:  RAINFALL WAS TRANSFORMED TO  15.0 MIN. TIME STEP.


                                ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.250    2.14 | 1.250    7.39 | 2.250    4.95 |  3.25    2.74
               0.500    2.44 | 1.500   37.07 | 2.500    4.12 |  3.50    2.52
               0.750    3.05 | 1.750   11.67 | 2.750    3.46 |  3.75    2.31
               1.000    3.91 | 2.000    6.96 | 3.000    3.09 |  4.00    2.17

    Max.Eff.Inten.(mm/hr)=        37.07          5.69
                over (min)        15.00         45.00
    Storage Coeff.  (min)=         8.99 (ii)    31.21 (ii)
    Unit Hyd. Tpeak (min)=        15.00         45.00
    Unit Hyd. peak  (cms)=         0.09          0.03
                                                                  *TOTALS*
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```
     PEAK FLOW       (cms)=       1.04         0.09          1.063 (iii)
     TIME TO PEAK    (hrs)=       1.50         2.00           1.50
     RUNOFF VOLUME    (mm)=      24.00         4.57          13.31
     TOTAL RAINFALL   (mm)=      25.00        25.00          25.00
     RUNOFF COEFFICIENT   =       0.96         0.18           0.53

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=  15.59
|ID= 1 DT=15.0 min |   Total Imp(%)=  69.00   Dir. Conn.(%)=  48.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      10.76         4.83
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     322.39        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      37.07         7.95
               over (min)        15.00        30.00
     Storage Coeff.  (min)=       7.67 (ii)   27.10 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=       0.10         0.04
                                                      *TOTALS*
     PEAK FLOW       (cms)=       0.68         0.07          0.711 (iii)
     TIME TO PEAK    (hrs)=       1.50         1.75           1.50
     RUNOFF VOLUME    (mm)=      24.00         5.32          14.28
     TOTAL RAINFALL   (mm)=      25.00        25.00          25.00
     RUNOFF COEFFICIENT   =       0.96         0.21           0.57

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0001):    26.52   1.063     1.50    13.31
     + ID2= 2 (  0002):    15.59   0.711     1.50    14.28
       ================================================
       ID = 3 (  0003):    42.11   1.774     1.50    13.67

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.4950      1.7925
                          0.0330     0.8230   |   0.8740      2.1555
                          0.0800     1.2250   |   1.1350      2.3805
                          0.3070     1.5840   |   1.4190      2.6735

                                    AREA     QPEAK     TPEAK       R.V.
                                    (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)     42.110      1.774      1.50       13.67
   OUTFLOW: ID= 1 (  0004)     42.110      0.022      4.75       12.40

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  1.24
                  TIME SHIFT OF PEAK FLOW          (min)=195.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.5503

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0007)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0004):    42.11   0.022     4.75    12.40
     + ID2= 2 (  0009):     0.91   0.005     1.67     2.45
       ================================================
       ID = 3 (  0007):    43.02   0.023     4.00    12.19

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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       V    V   I    SSSSS  U   U    A    L
       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 5.0\VO2\voin.dat
  Output  filename: C:\Users\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-
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  Summary filename: C:\Users\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-
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DATE: 03-10-2020                          TIME: 09:47:18

USER:
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COMMENTS: _____

**** SIMULATION NUMBER: 0 **

READ STORM | Filename: C:\Users\nkamran\AppData\Local\Temp\2d446286-7a4e-40ce-8e88-3197d691e164\9232d4db
Ptotal= 55.00 mm | Comments: TWO YEAR SCS STORM WITH A 15 MINUTE TIM

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.25	0.00	6.50	1.10	12.75	7.92	19.00	0.99
0.50	0.55	6.75	1.10	13.00	4.07	19.25	0.99
0.75	0.55	7.00	1.10	13.25	4.07	19.50	0.99
1.00	0.55	7.25	1.10	13.50	0.77	19.75	0.99
1.25	0.55	7.50	1.10	13.75	0.77	20.00	0.99
1.50	0.55	7.75	1.10	14.00	4.51	20.25	0.99
1.75	0.55	8.00	1.10	14.25	4.51	20.50	0.66
2.00	0.55	8.25	1.10	14.50	1.65	20.75	0.66
2.25	0.99	8.50	1.49	14.75	1.65	21.00	0.66
2.50	0.71	8.75	1.49	15.00	1.65	21.25	0.66
2.75	0.71	9.00	1.49	15.25	1.65	21.50	0.66
3.00	0.71	9.25	1.49	15.50	1.65	21.75	0.66
3.25	0.71	9.50	1.76	15.75	1.65	22.00	0.66
3.50	0.71	9.75	1.76	16.00	1.65	22.25	0.66
3.75	0.71	10.00	1.98	16.25	1.65	22.50	0.66
4.00	0.71	10.25	1.98	16.50	0.99	22.75	0.66
4.25	0.71	10.50	2.53	16.75	0.99	23.00	0.66
4.50	0.88	10.75	2.53	17.00	0.99	23.25	0.66
4.75	0.88	11.00	3.41	17.25	0.99	23.50	0.66
5.00	0.88	11.25	3.41	17.50	0.99	23.75	0.66
5.25	0.88	11.50	5.28	17.75	0.99	24.00	0.66
5.50	0.88	11.75	5.28	18.00	0.99	24.25	0.66
5.75	0.88	12.00	22.88	18.25	0.99		
6.00	0.88	12.25	60.72	18.50	0.99		
6.25	0.88	12.50	7.92	18.75	0.99		

CALIB | NASHYD (0009) | ID= 1 DT= 5.0 min | Area (ha)= 0.91 Curve Number (CN)= 64.0 | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00 | U.H. Tp(hrs)= 0.20

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	0.00	6.167	0.88	12.250	60.72	18.33	0.99
0.167	0.00	6.250	0.88	12.333	7.93	18.42	0.99
0.250	0.00	6.333	1.10	12.417	7.92	18.50	0.99
0.333	0.55	6.417	1.10	12.500	7.92	18.58	0.99
0.417	0.55	6.500	1.10	12.583	7.92	18.67	0.99
0.500	0.55	6.583	1.10	12.667	7.92	18.75	0.99
0.583	0.55	6.667	1.10	12.750	7.92	18.83	0.99
0.667	0.55	6.750	1.10	12.833	4.07	18.92	0.99
0.750	0.55	6.833	1.10	12.917	4.07	19.00	0.99
0.833	0.55	6.917	1.10	13.000	4.07	19.08	0.99
0.917	0.55	7.000	1.10	13.083	4.07	19.17	0.99
1.000	0.55	7.083	1.10	13.167	4.07	19.25	0.99
1.083	0.55	7.167	1.10	13.250	4.07	19.33	0.99
1.167	0.55	7.250	1.10	13.333	0.77	19.42	0.99
1.250	0.55	7.333	1.10	13.417	0.77	19.50	0.99
1.333	0.55	7.417	1.10	13.500	0.77	19.58	0.99
1.417	0.55	7.500	1.10	13.583	0.77	19.67	0.99
1.500	0.55	7.583	1.10	13.667	0.77	19.75	0.99
1.583	0.55	7.667	1.10	13.750	0.77	19.83	0.99
1.667	0.55	7.750	1.10	13.833	4.51	19.92	0.99
1.750	0.55	7.833	1.10	13.917	4.51	20.00	0.99
1.833	0.55	7.917	1.10	14.000	4.51	20.08	0.99
1.917	0.55	8.000	1.10	14.083	4.51	20.17	0.99
2.000	0.55	8.083	1.10	14.167	4.51	20.25	0.99
2.083	0.99	8.167	1.10	14.250	4.51	20.33	0.66
2.167	0.99	8.250	1.10	14.333	1.65	20.42	0.66
2.250	0.99	8.333	1.49	14.417	1.65	20.50	0.66
2.333	0.71	8.417	1.49	14.500	1.65	20.58	0.66
2.417	0.71	8.500	1.48	14.583	1.65	20.67	0.66
2.500	0.71	8.583	1.49	14.667	1.65	20.75	0.66
2.583	0.71	8.667	1.49	14.750	1.65	20.83	0.66
2.667	0.71	8.750	1.48	14.833	1.65	20.92	0.66
2.750	0.71	8.833	1.49	14.917	1.65	21.00	0.66
2.833	0.71	8.917	1.49	15.000	1.65	21.08	0.66
2.917	0.71	9.000	1.48	15.083	1.65	21.17	0.66
3.000	0.71	9.083	1.49	15.167	1.65	21.25	0.66
3.083	0.71	9.167	1.49	15.250	1.65	21.33	0.66
3.167	0.71	9.250	1.48	15.333	1.65	21.42	0.66
3.250	0.71	9.333	1.76	15.417	1.65	21.50	0.66
3.333	0.71	9.417	1.76	15.500	1.65	21.58	0.66
3.417	0.71	9.500	1.76	15.583	1.65	21.67	0.66
3.500	0.71	9.583	1.76	15.667	1.65	21.75	0.66
3.583	0.71	9.667	1.76	15.750	1.65	21.83	0.66
3.667	0.71	9.750	1.76	15.833	1.65	21.92	0.66
3.750	0.71	9.833	1.98	15.917	1.65	22.00	0.66
3.833	0.71	9.917	1.98	16.000	1.65	22.08	0.66
3.917	0.71	10.000	1.98	16.083	1.65	22.17	0.66
4.000	0.71	10.083	1.98	16.167	1.65	22.25	0.66
4.083	0.71	10.167	1.98	16.250	1.65	22.33	0.66
4.167	0.71	10.250	1.98	16.333	0.99	22.42	0.66
4.250	0.71	10.333	2.53	16.417	0.99	22.50	0.66
4.333	0.88	10.417	2.53	16.500	0.99	22.58	0.66
4.417	0.88	10.500	2.53	16.583	0.99	22.67	0.66
4.500	0.88	10.583	2.53	16.667	0.99	22.75	0.66
4.583	0.88	10.667	2.53	16.750	0.99	22.83	0.66
4.667	0.88	10.750	2.53	16.833	0.99	22.92	0.66
4.750	0.88	10.833	3.41	16.917	0.99	23.00	0.66
4.833	0.88	10.917	3.41	17.000	0.99	23.08	0.66
4.917	0.88	11.000	3.41	17.083	0.99	23.17	0.66
5.000	0.88	11.083	3.41	17.167	0.99	23.25	0.66
5.083	0.88	11.167	3.41	17.250	0.99	23.33	0.66
5.167	0.88	11.250	3.41	17.333	0.99	23.42	0.66
5.250	0.88	11.333	5.28	17.417	0.99	23.50	0.66
5.333	0.88	11.417	5.28	17.500	0.99	23.58	0.66
5.417	0.88	11.500	5.28	17.583	0.99	23.67	0.66
5.500	0.88	11.583	5.28	17.667	0.99	23.75	0.66

5.583	0.88	11.667	5.28	17.750	0.99	23.83	0.66
5.667	0.88	11.750	5.28	17.833	0.99	23.92	0.66
5.750	0.88	11.833	22.88	17.917	0.99	24.00	0.66
5.833	0.88	11.917	22.88	18.000	0.99	24.08	0.66
5.917	0.88	12.000	22.88	18.083	0.99	24.17	0.66
6.000	0.88	12.083	60.72	18.167	0.99	24.25	0.66
6.083	0.88	12.167	60.72	18.250	0.99		

Unit Hyd Qpeak (cms)= 0.174

PEAK FLOW (cms)= 0.028 (i)
TIME TO PEAK (hrs)= 12.333
RUNOFF VOLUME (mm)= 12.937
TOTAL RAINFALL (mm)= 55.000
RUNOFF COEFFICIENT = 0.235

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

CALIB	
STANDHYD (0001)	Area (ha)= 26.52
ID= 1 DT=15.0 min	Total Imp(%)= 61.00 Dir. Conn.(%)= 45.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	16.18	10.34
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	1.00	2.00
Length	(m)=	420.48	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 15.0 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
0.250	0.00	6.500	1.10	12.750	7.92	19.00	0.99
0.500	0.55	6.750	1.10	13.000	4.07	19.25	0.99
0.750	0.55	7.000	1.10	13.250	4.07	19.50	0.99
1.000	0.55	7.250	1.10	13.500	0.77	19.75	0.99
1.250	0.55	7.500	1.10	13.750	0.77	20.00	0.99
1.500	0.55	7.750	1.10	14.000	4.51	20.25	0.99
1.750	0.55	8.000	1.10	14.250	4.51	20.50	0.66
2.000	0.55	8.250	1.10	14.500	1.65	20.75	0.66
2.250	0.99	8.500	1.48	14.750	1.65	21.00	0.66
2.500	0.71	8.750	1.48	15.000	1.65	21.25	0.66
2.750	0.71	9.000	1.48	15.250	1.65	21.50	0.66
3.000	0.71	9.250	1.48	15.500	1.65	21.75	0.66
3.250	0.71	9.500	1.76	15.750	1.65	22.00	0.66
3.500	0.71	9.750	1.76	16.000	1.65	22.25	0.66
3.750	0.71	10.000	1.98	16.250	1.65	22.50	0.66
4.000	0.71	10.250	1.98	16.500	0.99	22.75	0.66
4.250	0.71	10.500	2.53	16.750	0.99	23.00	0.66
4.500	0.88	10.750	2.53	17.000	0.99	23.25	0.66
4.750	0.88	11.000	3.41	17.250	0.99	23.50	0.66
5.000	0.88	11.250	3.41	17.500	0.99	23.75	0.66
5.250	0.88	11.500	5.28	17.750	0.99	24.00	0.66
5.500	0.88	11.750	5.28	18.000	0.99	24.25	0.66
5.750	0.88	12.000	22.88	18.250	0.99		
6.000	0.88	12.250	60.72	18.500	0.99		
6.250	0.88	12.500	7.92	18.750	0.99		

Max.Eff.Inten.(mm/hr)=	60.72	32.73	
over (min)	15.00	30.00	
Storage Coeff. (min)=	7.38 (ii)	18.42 (ii)	
Unit Hyd. Tpeak (min)=	15.00	30.00	
Unit Hyd. peak (cms)=	0.10	0.05	
			TOTALS
PEAK FLOW (cms)=	1.84	0.50	2.167 (iii)
TIME TO PEAK (hrs)=	12.25	12.50	12.25
RUNOFF VOLUME (mm)=	54.00	18.74	34.61
TOTAL RAINFALL (mm)=	55.00	55.00	55.00
RUNOFF COEFFICIENT =	0.98	0.34	0.63

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 64.0 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.

CALIB	
STANDHYD (0002)	Area (ha)= 15.59
ID= 1 DT=15.0 min	Total Imp(%)= 69.00 Dir. Conn.(%)= 48.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	10.76	4.83
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	1.00	2.00
Length	(m)=	322.39	40.00
Mannings n	=	0.013	0.250

Max.Eff.Inten.(mm/hr)=	60.72	43.88	
over (min)	15.00	30.00	
Storage Coeff. (min)=	6.30 (ii)	16.11 (ii)	
Unit Hyd. Tpeak (min)=	15.00	30.00	
Unit Hyd. peak (cms)=	0.10	0.05	
			TOTALS
PEAK FLOW (cms)=	1.19	0.33	1.407 (iii)
TIME TO PEAK (hrs)=	12.25	12.50	12.25
RUNOFF VOLUME (mm)=	54.00	21.02	36.85
TOTAL RAINFALL (mm)=	55.00	55.00	55.00
RUNOFF COEFFICIENT =	0.98	0.38	0.67

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 64.0 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.

ADD HYD (0003)				
1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0001):	26.52	2.167	12.25	34.61
+ ID2= 2 (0002):	15.59	1.407	12.25	36.85
ID = 3 (0003):	42.11	3.574	12.25	35.44

```
     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.4950      1.7925
                          0.0330     0.8230   |   0.8740      2.1555
                          0.0800     1.2250   |   1.1350      2.3805
                          0.3070     1.5840   |   1.4190      2.6735

                               AREA     QPEAK     TPEAK       R.V.
                               (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)     42.110     3.574     12.25      35.44
   OUTFLOW: ID= 1 (  0004)     42.110     0.076     20.42      32.13

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  2.12
                  TIME SHIFT OF PEAK FLOW         (min)=490.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  1.1882

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--------------------
| ADD HYD  (  0007)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0004):     42.11   0.076    20.42    32.13
     + ID2= 2 (  0009):      0.91   0.028    12.33    12.94
       ==========================================================
       ID = 3 (  0007):     43.02   0.077    20.25    31.72

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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       V    V   I    SSSSS  U   U    A    L
       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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DATE: 03-10-2020                          TIME: 09:47:18

USER:


COMMENTS: _____

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  ****************************
  ** SIMULATION NUMBER:   0 **
  ****************************


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|                  |              ata\Local\Temp\
|                  |              2d446286-7a4e-40ce-8e88-3197d691e164\41d57654
| Ptotal= 76.00 mm |    Comments: FIVE YR SCS STORM  WITH A 15 MINUTE TIME
--------------------
                  TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                  0.25    0.76 |  6.25    1.52 | 12.25   10.94 | 18.25    1.37
                  0.50    0.76 |  6.50    1.52 | 12.50   10.94 | 18.50    1.37
                  0.75    0.76 |  6.75    1.52 | 12.75    5.62 | 18.75    1.37
                  1.00    0.76 |  7.00    1.52 | 13.00    5.62 | 19.00    1.37
                  1.25    0.76 |  7.25    1.52 | 13.25    1.06 | 19.25    1.37
                  1.50    0.76 |  7.50    1.52 | 13.50    1.06 | 19.50    1.37
                  1.75    0.76 |  7.75    1.52 | 13.75    6.23 | 19.75    1.37
                  2.00    1.37 |  8.00    1.52 | 14.00    6.23 | 20.00    1.37
                  2.25    0.99 |  8.25    2.05 | 14.25    2.28 | 20.25    0.91
                  2.50    0.99 |  8.50    2.05 | 14.50    2.28 | 20.50    0.91
                  2.75    0.99 |  8.75    2.05 | 14.75    2.28 | 20.75    0.91
                  3.00    0.99 |  9.00    2.05 | 15.00    2.28 | 21.00    0.91
                  3.25    0.99 |  9.25    2.43 | 15.25    2.28 | 21.25    0.91
                  3.50    0.99 |  9.50    2.43 | 15.50    2.28 | 21.50    0.91
                  3.75    0.99 |  9.75    2.74 | 15.75    2.28 | 21.75    0.91
                  4.00    0.99 | 10.00    2.74 | 16.00    2.28 | 22.00    0.91
                  4.25    1.22 | 10.25    3.50 | 16.25    1.37 | 22.25    0.91
                  4.50    1.22 | 10.50    3.50 | 16.50    1.37 | 22.50    0.91
                  4.75    1.22 | 10.75    4.71 | 16.75    1.37 | 22.75    0.91
                  5.00    1.22 | 11.00    4.71 | 17.00    1.37 | 23.00    0.91
                  5.25    1.22 | 11.25    7.30 | 17.25    1.37 | 23.25    0.91
                  5.50    1.22 | 11.50    7.30 | 17.50    1.37 | 23.50    0.91
                  5.75    1.22 | 11.75   31.62 | 17.75    1.37 | 23.75    0.91
                  6.00    1.22 | 12.00   83.90 | 18.00    1.37 | 24.00    0.91

--------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0009)|   Area    (ha)=   0.91   Curve Number   (CN)= 64.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20

         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	0.76	6.083	1.52	12.083	10.95	18.08	1.37
0.167	0.76	6.167	1.52	12.167	10.94	18.17	1.37
0.250	0.76	6.250	1.52	12.250	10.94	18.25	1.37
0.333	0.76	6.333	1.52	12.333	10.94	18.33	1.37
0.417	0.76	6.417	1.52	12.417	10.94	18.42	1.37
0.500	0.76	6.500	1.52	12.500	10.94	18.50	1.37
0.583	0.76	6.583	1.52	12.583	5.62	18.58	1.37
0.667	0.76	6.667	1.52	12.667	5.62	18.67	1.37
0.750	0.76	6.750	1.52	12.750	5.62	18.75	1.37
0.833	0.76	6.833	1.52	12.833	5.62	18.83	1.37
0.917	0.76	6.917	1.52	12.917	5.62	18.92	1.37
1.000	0.76	7.000	1.52	13.000	5.62	19.00	1.37
1.083	0.76	7.083	1.52	13.083	1.06	19.08	1.37
1.167	0.76	7.167	1.52	13.167	1.06	19.17	1.37
1.250	0.76	7.250	1.52	13.250	1.06	19.25	1.37
1.333	0.76	7.333	1.52	13.333	1.06	19.33	1.37
1.417	0.76	7.417	1.52	13.417	1.06	19.42	1.37
1.500	0.76	7.500	1.52	13.500	1.06	19.50	1.37
1.583	0.76	7.583	1.52	13.583	6.23	19.58	1.37
1.667	0.76	7.667	1.52	13.667	6.23	19.67	1.37
1.750	0.76	7.750	1.52	13.750	6.23	19.75	1.37
1.833	1.37	7.833	1.52	13.833	6.23	19.83	1.37
1.917	1.37	7.917	1.52	13.917	6.23	19.92	1.37
2.000	1.37	8.000	1.52	14.000	6.23	20.00	1.37
2.083	0.99	8.083	2.05	14.083	2.28	20.08	0.91
2.167	0.99	8.167	2.05	14.167	2.28	20.17	0.91
2.250	0.99	8.250	2.05	14.250	2.28	20.25	0.91
2.333	0.99	8.333	2.05	14.333	2.28	20.33	0.91
2.417	0.99	8.417	2.05	14.417	2.28	20.42	0.91
2.500	0.99	8.500	2.05	14.500	2.28	20.50	0.91
2.583	0.99	8.583	2.05	14.583	2.28	20.58	0.91
2.667	0.99	8.667	2.05	14.667	2.28	20.67	0.91
2.750	0.99	8.750	2.05	14.750	2.28	20.75	0.91
2.833	0.99	8.833	2.05	14.833	2.28	20.83	0.91
2.917	0.99	8.917	2.05	14.917	2.28	20.92	0.91
3.000	0.99	9.000	2.05	15.000	2.28	21.00	0.91
3.083	0.99	9.083	2.43	15.083	2.28	21.08	0.91
3.167	0.99	9.167	2.43	15.167	2.28	21.17	0.91
3.250	0.99	9.250	2.43	15.250	2.28	21.25	0.91
3.333	0.99	9.333	2.43	15.333	2.28	21.33	0.91
3.417	0.99	9.417	2.43	15.417	2.28	21.42	0.91
3.500	0.99	9.500	2.43	15.500	2.28	21.50	0.91
3.583	0.99	9.583	2.74	15.583	2.28	21.58	0.91
3.667	0.99	9.667	2.74	15.667	2.28	21.67	0.91
3.750	0.99	9.750	2.74	15.750	2.28	21.75	0.91
3.833	0.99	9.833	2.74	15.833	2.28	21.83	0.91
3.917	0.99	9.917	2.74	15.917	2.28	21.92	0.91
4.000	0.99	10.000	2.74	16.000	2.28	22.00	0.91
4.083	1.22	10.083	3.50	16.083	1.37	22.08	0.91
4.167	1.22	10.167	3.50	16.167	1.37	22.17	0.91
4.250	1.22	10.250	3.50	16.250	1.37	22.25	0.91
4.333	1.22	10.333	3.50	16.333	1.37	22.33	0.91
4.417	1.22	10.417	3.50	16.417	1.37	22.42	0.91
4.500	1.22	10.500	3.50	16.500	1.37	22.50	0.91
4.583	1.22	10.583	4.71	16.583	1.37	22.58	0.91
4.667	1.22	10.667	4.71	16.667	1.37	22.67	0.91
4.750	1.22	10.750	4.71	16.750	1.37	22.75	0.91
4.833	1.22	10.833	4.71	16.833	1.37	22.83	0.91
4.917	1.22	10.917	4.71	16.917	1.37	22.92	0.91
5.000	1.22	11.000	4.71	17.000	1.37	23.00	0.91
5.083	1.22	11.083	7.30	17.083	1.37	23.08	0.91
5.167	1.22	11.167	7.30	17.167	1.37	23.17	0.91
5.250	1.22	11.250	7.30	17.250	1.37	23.25	0.91
5.333	1.22	11.333	7.30	17.333	1.37	23.33	0.91
5.417	1.22	11.417	7.30	17.417	1.37	23.42	0.91
5.500	1.22	11.500	7.30	17.500	1.37	23.50	0.91
5.583	1.22	11.583	31.61	17.583	1.37	23.58	0.91
5.667	1.22	11.667	31.62	17.667	1.37	23.67	0.91
5.750	1.22	11.750	31.62	17.750	1.37	23.75	0.91
5.833	1.22	11.833	83.90	17.833	1.37	23.83	0.91
5.917	1.22	11.917	83.90	17.917	1.37	23.92	0.91
6.000	1.22	12.000	83.90	18.000	1.37	24.00	0.91

Unit Hyd Qpeak (cms)= 0.174

PEAK FLOW (cms)= 0.051 (i)
TIME TO PEAK (hrs)= 12.083
RUNOFF VOLUME (mm)= 23.524
TOTAL RAINFALL (mm)= 76.000
RUNOFF COEFFICIENT = 0.310

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

CALIB	
STANDHYD (0001)	Area (ha)= 26.52
ID= 1 DT=15.0 min	Total Imp(%)= 61.00 Dir. Conn.(%)= 45.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	16.18	10.34
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	1.00	2.00
Length	(m)=	420.48	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 15.0 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
0.250	0.76	6.250	1.52	12.250	10.94	18.25	1.37
0.500	0.76	6.500	1.52	12.500	10.94	18.50	1.37
0.750	0.76	6.750	1.52	12.750	5.62	18.75	1.37
1.000	0.76	7.000	1.52	13.000	5.62	19.00	1.37
1.250	0.76	7.250	1.52	13.250	1.06	19.25	1.37
1.500	0.76	7.500	1.52	13.500	1.06	19.50	1.37
1.750	0.76	7.750	1.52	13.750	6.23	19.75	1.37
2.000	1.37	8.000	1.52	14.000	6.23	20.00	1.37
2.250	0.99	8.250	2.05	14.250	2.28	20.25	0.91
2.500	0.99	8.500	2.05	14.500	2.28	20.50	0.91
2.750	0.99	8.750	2.05	14.750	2.28	20.75	0.91
3.000	0.99	9.000	2.05	15.000	2.28	21.00	0.91
3.250	0.99	9.250	2.43	15.250	2.28	21.25	0.91
3.500	0.99	9.500	2.43	15.500	2.28	21.50	0.91
3.750	0.99	9.750	2.74	15.750	2.28	21.75	0.91
4.000	0.99	10.000	2.74	16.000	2.28	22.00	0.91
4.250	1.22	10.250	3.50	16.250	1.37	22.25	0.91
4.500	1.22	10.500	3.50	16.500	1.37	22.50	0.91
4.750	1.22	10.750	4.71	16.750	1.37	22.75	0.91
5.000	1.22	11.000	4.71	17.000	1.37	23.00	0.91
5.250	1.22	11.250	7.30	17.250	1.37	23.25	0.91
5.500	1.22	11.500	7.30	17.500	1.37	23.50	0.91

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               5.750    1.22 |11.750   31.62 |17.750    1.37 | 23.75    0.91
               6.000    1.22 |12.000   83.90 |18.000    1.37 | 24.00    0.91

     Max.Eff.Inten.(mm/hr)=      83.90        56.14
               over (min)        15.00        30.00
     Storage Coeff.  (min)=       6.49 (ii)   15.38 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=       0.10         0.05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       2.60         0.91          3.221 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.25          12.00
     RUNOFF VOLUME    (mm)=      75.00        31.86          51.27
     TOTAL RAINFALL   (mm)=      76.00        76.00          76.00
     RUNOFF COEFFICIENT   =       0.99         0.42           0.67

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=  15.59
|ID= 1 DT=15.0 min |   Total Imp(%)=  69.00   Dir. Conn.(%)=  48.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      10.76         4.83
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     322.39        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      83.90        74.05
               over (min)        15.00        15.00
     Storage Coeff.  (min)=       5.53 (ii)   13.49 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=       0.11         0.08
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.67         0.74          2.405 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.00          12.00
     RUNOFF VOLUME    (mm)=      75.00        35.19          54.30
     TOTAL RAINFALL   (mm)=      76.00        76.00          76.00
     RUNOFF COEFFICIENT   =       0.99         0.46           0.71

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.

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--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0001):    26.52   3.221    12.00    51.27
     + ID2= 2 (  0002):    15.59   2.405    12.00    54.30
       ================================================
       ID = 3 (  0003):    42.11   5.626    12.00    52.39

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000    |   0.4950      1.7925
                         0.0330     0.8230    |   0.8740      2.1555
                         0.0800     1.2250    |   1.1350      2.3805
                         0.3070     1.5840    |   1.4190      2.6735

                                    AREA     QPEAK     TPEAK       R.V.
                                    (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)     42.110      5.626     12.00      52.39
   OUTFLOW: ID= 1 (  0004)     42.110      0.276     14.42      48.90

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  4.90
                  TIME SHIFT OF PEAK FLOW          (min)=145.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  1.5376

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--------------------
| ADD HYD  (  0007)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0004):    42.11   0.276    14.42    48.90
     + ID2= 2 (  0009):     0.91   0.051    12.08    23.52
       ================================================
       ID = 3 (  0007):    43.02   0.280    14.25    48.37

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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       V    V   I    SSSSS  U   U    A    L
       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 5.0\VO2\voin.dat
```

Output filename: C:\Users\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-45e7-8ee9-3237db384aff\f454ea10-6cae-451a-b68d-c8bfb969f041\scen
Summary filename: C:\Users\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-45e7-8ee9-3237db384aff\f454ea10-6cae-451a-b68d-c8bfb969f041\scen

DATE: 03-10-2020 TIME: 09:47:19

USER:

COMMENTS: _____

****
** SIMULATION NUMBER: 0 **
****

READ STORM	Filename: C:\Users\nkamran\AppData\Local\Temp\2d446286-7a4e-40ce-8e88-3197d691e164\4647e1d2
Ptotal= 89.90 mm	Comments: TEN YR SCS STORM WITH A 15 MINUTE TIME

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.25	0.90	6.25	1.80	12.25	12.95	18.25	1.62
0.50	0.90	6.50	1.80	12.50	12.95	18.50	1.62
0.75	0.90	6.75	1.80	12.75	6.65	18.75	1.62
1.00	0.90	7.00	1.80	13.00	6.65	19.00	1.62
1.25	0.90	7.25	1.80	13.25	1.26	19.25	1.62
1.50	0.90	7.50	1.80	13.50	1.26	19.50	1.62
1.75	0.90	7.75	1.80	13.75	7.37	19.75	1.62
2.00	1.62	8.00	1.80	14.00	7.37	20.00	1.62
2.25	1.17	8.25	2.43	14.25	2.70	20.25	1.08
2.50	1.17	8.50	2.43	14.50	2.70	20.50	1.08
2.75	1.17	8.75	2.43	14.75	2.70	20.75	1.08
3.00	1.17	9.00	2.43	15.00	2.70	21.00	1.08
3.25	1.17	9.25	2.88	15.25	2.70	21.25	1.08
3.50	1.17	9.50	2.88	15.50	2.70	21.50	1.08
3.75	1.17	9.75	3.24	15.75	2.70	21.75	1.08
4.00	1.17	10.00	3.24	16.00	2.70	22.00	1.08
4.25	1.44	10.25	4.14	16.25	1.62	22.25	1.08
4.50	1.44	10.50	4.14	16.50	1.62	22.50	1.08
4.75	1.44	10.75	5.57	16.75	1.62	22.75	1.08
5.00	1.44	11.00	5.57	17.00	1.62	23.00	1.08
5.25	1.44	11.25	8.63	17.25	1.62	23.25	1.08
5.50	1.44	11.50	8.63	17.50	1.62	23.50	1.08
5.75	1.44	11.75	37.40	17.75	1.62	23.75	1.08
6.00	1.44	12.00	99.25	18.00	1.62	24.00	1.08

CALIB			
NASHYD (0009)	Area (ha)=	0.91	Curve Number (CN)= 64.0
ID= 1 DT= 5.0 min	Ia (mm)=	5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)=	0.20	

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	0.90	6.083	1.80	12.083	12.96	18.08	1.62
0.167	0.90	6.167	1.80	12.167	12.95	18.17	1.62
0.250	0.90	6.250	1.80	12.250	12.95	18.25	1.62
0.333	0.90	6.333	1.80	12.333	12.95	18.33	1.62
0.417	0.90	6.417	1.80	12.417	12.95	18.42	1.62
0.500	0.90	6.500	1.80	12.500	12.95	18.50	1.62
0.583	0.90	6.583	1.80	12.583	6.65	18.58	1.62
0.667	0.90	6.667	1.80	12.667	6.65	18.67	1.62
0.750	0.90	6.750	1.80	12.750	6.65	18.75	1.62
0.833	0.90	6.833	1.80	12.833	6.65	18.83	1.62
0.917	0.90	6.917	1.80	12.917	6.65	18.92	1.62
1.000	0.90	7.000	1.80	13.000	6.65	19.00	1.62
1.083	0.90	7.083	1.80	13.083	1.26	19.08	1.62
1.167	0.90	7.167	1.80	13.167	1.26	19.17	1.62
1.250	0.90	7.250	1.80	13.250	1.26	19.25	1.62
1.333	0.90	7.333	1.80	13.333	1.26	19.33	1.62
1.417	0.90	7.417	1.80	13.417	1.26	19.42	1.62
1.500	0.90	7.500	1.80	13.500	1.26	19.50	1.62
1.583	0.90	7.583	1.80	13.583	7.37	19.58	1.62
1.667	0.90	7.667	1.80	13.667	7.37	19.67	1.62
1.750	0.90	7.750	1.80	13.750	7.37	19.75	1.62
1.833	1.62	7.833	1.80	13.833	7.37	19.83	1.62
1.917	1.62	7.917	1.80	13.917	7.37	19.92	1.62
2.000	1.62	8.000	1.80	14.000	7.37	20.00	1.62
2.083	1.17	8.083	2.43	14.083	2.70	20.08	1.08
2.167	1.17	8.167	2.43	14.167	2.70	20.17	1.08
2.250	1.17	8.250	2.43	14.250	2.70	20.25	1.08
2.333	1.17	8.333	2.43	14.333	2.70	20.33	1.08
2.417	1.17	8.417	2.43	14.417	2.70	20.42	1.08
2.500	1.17	8.500	2.43	14.500	2.70	20.50	1.08
2.583	1.17	8.583	2.43	14.583	2.70	20.58	1.08
2.667	1.17	8.667	2.43	14.667	2.70	20.67	1.08
2.750	1.17	8.750	2.43	14.750	2.70	20.75	1.08
2.833	1.17	8.833	2.43	14.833	2.70	20.83	1.08
2.917	1.17	8.917	2.43	14.917	2.70	20.92	1.08
3.000	1.17	9.000	2.43	15.000	2.70	21.00	1.08
3.083	1.17	9.083	2.88	15.083	2.70	21.08	1.08
3.167	1.17	9.167	2.88	15.167	2.70	21.17	1.08
3.250	1.17	9.250	2.88	15.250	2.70	21.25	1.08
3.333	1.17	9.333	2.88	15.333	2.70	21.33	1.08
3.417	1.17	9.417	2.88	15.417	2.70	21.42	1.08
3.500	1.17	9.500	2.88	15.500	2.70	21.50	1.08
3.583	1.17	9.583	3.24	15.583	2.70	21.58	1.08
3.667	1.17	9.667	3.24	15.667	2.70	21.67	1.08
3.750	1.17	9.750	3.24	15.750	2.70	21.75	1.08
3.833	1.17	9.833	3.24	15.833	2.70	21.83	1.08
3.917	1.17	9.917	3.24	15.917	2.70	21.92	1.08
4.000	1.17	10.000	3.24	16.000	2.70	22.00	1.08
4.083	1.44	10.083	4.13	16.083	1.62	22.08	1.08
4.167	1.44	10.167	4.14	16.167	1.62	22.17	1.08
4.250	1.44	10.250	4.14	16.250	1.62	22.25	1.08
4.333	1.44	10.333	4.13	16.333	1.62	22.33	1.08
4.417	1.44	10.417	4.14	16.417	1.62	22.42	1.08
4.500	1.44	10.500	4.14	16.500	1.62	22.50	1.08
4.583	1.44	10.583	5.57	16.583	1.62	22.58	1.08
4.667	1.44	10.667	5.57	16.667	1.62	22.67	1.08
4.750	1.44	10.750	5.57	16.750	1.62	22.75	1.08

4.833	1.44	10.833	5.57	16.833	1.62	22.83	1.08
4.917	1.44	10.917	5.57	16.917	1.62	22.92	1.08
5.000	1.44	11.000	5.57	17.000	1.62	23.00	1.08
5.083	1.44	11.083	8.63	17.083	1.62	23.08	1.08
5.167	1.44	11.167	8.63	17.167	1.62	23.17	1.08
5.250	1.44	11.250	8.63	17.250	1.62	23.25	1.08
5.333	1.44	11.333	8.63	17.333	1.62	23.33	1.08
5.417	1.44	11.417	8.63	17.417	1.62	23.42	1.08
5.500	1.44	11.500	8.63	17.500	1.62	23.50	1.08
5.583	1.44	11.583	37.40	17.583	1.62	23.58	1.08
5.667	1.44	11.667	37.40	17.667	1.62	23.67	1.08
5.750	1.44	11.750	37.40	17.750	1.62	23.75	1.08
5.833	1.44	11.833	99.24	17.833	1.62	23.83	1.08
5.917	1.44	11.917	99.25	17.917	1.62	23.92	1.08
6.000	1.44	12.000	99.25	18.000	1.62	24.00	1.08

Unit Hyd Qpeak (cms)= 0.174

PEAK FLOW (cms)= 0.069 (i)
TIME TO PEAK (hrs)= 12.083
RUNOFF VOLUME (mm)= 31.585
TOTAL RAINFALL (mm)= 89.900
RUNOFF COEFFICIENT = 0.351

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

CALIB	
STANDHYD (0001)	Area (ha)= 26.52
ID= 1 DT=15.0 min	Total Imp(%)= 61.00 Dir. Conn.(%)= 45.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	16.18	10.34
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	1.00	2.00
Length	(m)=	420.48	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 15.0 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
0.250	0.90	6.250	1.80	12.250	12.95	18.25	1.62
0.500	0.90	6.500	1.80	12.500	12.95	18.50	1.62
0.750	0.90	6.750	1.80	12.750	6.65	18.75	1.62
1.000	0.90	7.000	1.80	13.000	6.65	19.00	1.62
1.250	0.90	7.250	1.80	13.250	1.26	19.25	1.62
1.500	0.90	7.500	1.80	13.500	1.26	19.50	1.62
1.750	0.90	7.750	1.80	13.750	7.37	19.75	1.62
2.000	1.62	8.000	1.80	14.000	7.37	20.00	1.62
2.250	1.17	8.250	2.43	14.250	2.70	20.25	1.08
2.500	1.17	8.500	2.43	14.500	2.70	20.50	1.08
2.750	1.17	8.750	2.43	14.750	2.70	20.75	1.08
3.000	1.17	9.000	2.43	15.000	2.70	21.00	1.08
3.250	1.17	9.250	2.88	15.250	2.70	21.25	1.08
3.500	1.17	9.500	2.88	15.500	2.70	21.50	1.08
3.750	1.17	9.750	3.24	15.750	2.70	21.75	1.08
4.000	1.17	10.000	3.24	16.000	2.70	22.00	1.08
4.250	1.44	10.250	4.13	16.250	1.62	22.25	1.08
4.500	1.44	10.500	4.13	16.500	1.62	22.50	1.08
4.750	1.44	10.750	5.57	16.750	1.62	22.75	1.08
5.000	1.44	11.000	5.57	17.000	1.62	23.00	1.08
5.250	1.44	11.250	8.63	17.250	1.62	23.25	1.08
5.500	1.44	11.500	8.63	17.500	1.62	23.50	1.08
5.750	1.44	11.750	37.40	17.750	1.62	23.75	1.08
6.000	1.44	12.000	99.25	18.000	1.62	24.00	1.08

Max.Eff.Inten.	(mm/hr)=	99.25	73.41	
over	(min)	15.00	15.00	
Storage Coeff.	(min)=	6.07 (ii)	14.05 (ii)	
Unit Hyd. Tpeak	(min)=	15.00	15.00	
Unit Hyd. peak	(cms)=	0.10	0.07	
				TOTALS
PEAK FLOW	(cms)=	3.11	1.53	4.642 (iii)
TIME TO PEAK	(hrs)=	12.00	12.00	12.00
RUNOFF VOLUME	(mm)=	88.90	41.50	62.83
TOTAL RAINFALL	(mm)=	89.90	89.90	89.90
RUNOFF COEFFICIENT	=	0.99	0.46	0.70

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 64.0 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.

CALIB	
STANDHYD (0002)	Area (ha)= 15.59
ID= 1 DT=15.0 min	Total Imp(%)= 69.00 Dir. Conn.(%)= 48.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	10.76	4.83
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	1.00	2.00
Length	(m)=	322.39	40.00
Mannings n	=	0.013	0.250

Max.Eff.Inten.	(mm/hr)=	99.25	95.99	
over	(min)	15.00	15.00	
Storage Coeff.	(min)=	5.17 (ii)	12.35 (ii)	
Unit Hyd. Tpeak	(min)=	15.00	15.00	
Unit Hyd. peak	(cms)=	0.11	0.08	
				TOTALS
PEAK FLOW	(cms)=	1.99	0.99	2.981 (iii)
TIME TO PEAK	(hrs)=	12.00	12.00	12.00
RUNOFF VOLUME	(mm)=	88.90	45.48	66.32
TOTAL RAINFALL	(mm)=	89.90	89.90	89.90
RUNOFF COEFFICIENT	=	0.99	0.51	0.74

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 64.0 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.

```
| ADD HYD  (  0003)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
-------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0001):    26.52   4.642    12.00    62.83
     + ID2= 2 (  0002):    15.59   2.981    12.00    66.32
       ====================================================
       ID = 3 (  0003):    42.11   7.624    12.00    64.12

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
-------------------
| RESERVOIR(  0004)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
-------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                        0.0000     0.0000   |   0.4950      1.7925
                        0.0330     0.8230   |   0.8740      2.1555
                        0.0800     1.2250   |   1.1350      2.3805
                        0.3070     1.5840   |   1.4190      2.6735

                              AREA     QPEAK     TPEAK       R.V.
                              (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)     42.110      7.624     12.00      64.12
   OUTFLOW: ID= 1 (  0004)     42.110      0.480     13.08      60.58

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  6.29
                  TIME SHIFT OF PEAK FLOW         (min)= 65.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  1.7764

--------------------------------------------------------------------------------
-------------------
| ADD HYD  (  0007)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
-------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0004):    42.11   0.480    13.08    60.58
     + ID2= 2 (  0009):     0.91   0.069    12.08    31.58
       ====================================================
       ID = 3 (  0007):    43.02   0.488    13.08    59.97

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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       V    V   I    SSSSS  U   U    A    L
       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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```
  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat
  Output  filename: C:\Users\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-
45e7-8ee9-3237db384aff\d44120e4-93fa-428f-905e-9289e3b2579c\scen
  Summary filename: C:\Users\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-
45e7-8ee9-3237db384aff\d44120e4-93fa-428f-905e-9289e3b2579c\scen

DATE: 03-10-2020                          TIME: 09:47:19

USER:


COMMENTS: _____________________________________________________

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  ****************************
  ** SIMULATION NUMBER:   0 **
  ****************************


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|    READ STORM    |    Filename: C:\Users\nkamran\AppD
|                  |              ata\Local\Temp\
|                  |              2d446286-7a4e-40ce-8e88-3197d691e164\e1081a48
| Ptotal=107.50 mm |    Comments: 25 YR SCS STORM  WITH A 15 MINUTE TIME S
--------------------
                  TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                  0.25    0.00 |  6.50    2.15 | 12.75   15.48 | 19.00    1.93
                  0.50    1.08 |  6.75    2.15 | 13.00    7.95 | 19.25    1.93
                  0.75    1.08 |  7.00    2.15 | 13.25    7.95 | 19.50    1.93
                  1.00    1.08 |  7.25    2.15 | 13.50    1.50 | 19.75    1.93
                  1.25    1.08 |  7.50    2.15 | 13.75    1.50 | 20.00    1.93
                  1.50    1.08 |  7.75    2.15 | 14.00    8.81 | 20.25    1.93
                  1.75    1.08 |  8.00    2.15 | 14.25    8.81 | 20.50    1.29
                  2.00    1.08 |  8.25    2.15 | 14.50    3.22 | 20.75    1.29
                  2.25    1.93 |  8.50    2.90 | 14.75    3.22 | 21.00    1.29
                  2.50    1.40 |  8.75    2.90 | 15.00    3.22 | 21.25    1.29
                  2.75    1.40 |  9.00    2.90 | 15.25    3.22 | 21.50    1.29
                  3.00    1.40 |  9.25    2.90 | 15.50    3.22 | 21.75    1.29
                  3.25    1.40 |  9.50    3.44 | 15.75    3.22 | 22.00    1.29
                  3.50    1.40 |  9.75    3.44 | 16.00    3.22 | 22.25    1.29
                  3.75    1.40 | 10.00    3.87 | 16.25    3.22 | 22.50    1.29
                  4.00    1.40 | 10.25    3.87 | 16.50    1.93 | 22.75    1.29
                  4.25    1.40 | 10.50    4.95 | 16.75    1.93 | 23.00    1.29
                  4.50    1.72 | 10.75    4.95 | 17.00    1.93 | 23.25    1.29
                  4.75    1.72 | 11.00    6.66 | 17.25    1.93 | 23.50    1.29
                  5.00    1.72 | 11.25    6.66 | 17.50    1.93 | 23.75    1.29
                  5.25    1.72 | 11.50   10.32 | 17.75    1.93 | 24.00    1.29
                  5.50    1.72 | 11.75   10.32 | 18.00    1.93 | 24.25    1.29
                  5.75    1.72 | 12.00   44.72 | 18.25    1.93 |
                  6.00    1.72 | 12.25  118.68 | 18.50    1.93 |
                  6.25    1.72 | 12.50   15.48 | 18.75    1.93 |

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| CALIB            |
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| NASHYD   (  0009)|   Area    (ha)=   0.91   Curve Number   (CN)= 64.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20

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

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.00	6.167	1.72	12.250	118.68	18.33	1.94
0.167	0.00	6.250	1.72	12.333	15.49	18.42	1.93
0.250	0.00	6.333	2.15	12.417	15.48	18.50	1.93
0.333	1.08	6.417	2.15	12.500	15.48	18.58	1.94
0.417	1.08	6.500	2.15	12.583	15.48	18.67	1.93
0.500	1.08	6.583	2.15	12.667	15.48	18.75	1.93
0.583	1.08	6.667	2.15	12.750	15.48	18.83	1.94
0.667	1.08	6.750	2.15	12.833	7.96	18.92	1.93
0.750	1.08	6.833	2.15	12.917	7.95	19.00	1.93
0.833	1.07	6.917	2.15	13.000	7.95	19.08	1.94
0.917	1.08	7.000	2.15	13.083	7.95	19.17	1.93
1.000	1.08	7.083	2.15	13.167	7.95	19.25	1.93
1.083	1.07	7.167	2.15	13.250	7.95	19.33	1.94
1.167	1.08	7.250	2.15	13.333	1.51	19.42	1.93
1.250	1.08	7.333	2.15	13.417	1.50	19.50	1.94
1.333	1.08	7.417	2.15	13.500	1.50	19.58	1.93
1.417	1.08	7.500	2.15	13.583	1.50	19.67	1.93
1.500	1.08	7.583	2.15	13.667	1.50	19.75	1.94
1.583	1.08	7.667	2.15	13.750	1.50	19.83	1.93
1.667	1.08	7.750	2.15	13.833	8.81	19.92	1.93
1.750	1.08	7.833	2.15	13.917	8.81	20.00	1.94
1.833	1.08	7.917	2.15	14.000	8.81	20.08	1.93
1.917	1.08	8.000	2.15	14.083	8.81	20.17	1.93
2.000	1.08	8.083	2.15	14.167	8.81	20.25	1.93
2.083	1.93	8.167	2.15	14.250	8.81	20.33	1.29
2.167	1.93	8.250	2.15	14.333	3.23	20.42	1.29
2.250	1.93	8.333	2.90	14.417	3.22	20.50	1.29
2.333	1.40	8.417	2.90	14.500	3.22	20.58	1.29
2.417	1.40	8.500	2.90	14.583	3.22	20.67	1.29
2.500	1.40	8.583	2.90	14.667	3.22	20.75	1.29
2.583	1.40	8.667	2.90	14.750	3.22	20.83	1.29
2.667	1.40	8.750	2.90	14.833	3.22	20.92	1.29
2.750	1.40	8.833	2.90	14.917	3.22	21.00	1.29
2.833	1.40	8.917	2.90	15.000	3.22	21.08	1.29
2.917	1.40	9.000	2.90	15.083	3.22	21.17	1.29
3.000	1.40	9.083	2.90	15.167	3.22	21.25	1.29
3.083	1.40	9.167	2.90	15.250	3.22	21.33	1.29
3.167	1.40	9.250	2.90	15.333	3.22	21.42	1.29
3.250	1.40	9.333	3.44	15.417	3.22	21.50	1.29
3.333	1.40	9.417	3.44	15.500	3.22	21.58	1.29
3.417	1.40	9.500	3.44	15.583	3.22	21.67	1.29
3.500	1.40	9.583	3.44	15.667	3.22	21.75	1.29
3.583	1.40	9.667	3.44	15.750	3.22	21.83	1.29
3.667	1.40	9.750	3.44	15.833	3.22	21.92	1.29
3.750	1.40	9.833	3.87	15.917	3.22	22.00	1.29
3.833	1.40	9.917	3.87	16.000	3.22	22.08	1.29
3.917	1.40	10.000	3.87	16.083	3.22	22.17	1.29
4.000	1.40	10.083	3.87	16.167	3.22	22.25	1.29
4.083	1.40	10.167	3.87	16.250	3.22	22.33	1.29
4.167	1.40	10.250	3.87	16.333	1.94	22.42	1.29
4.250	1.40	10.333	4.94	16.417	1.93	22.50	1.29
4.333	1.72	10.417	4.95	16.500	1.93	22.58	1.29
4.417	1.72	10.500	4.95	16.583	1.94	22.67	1.29
4.500	1.72	10.583	4.94	16.667	1.93	22.75	1.29
4.583	1.72	10.667	4.95	16.750	1.93	22.83	1.29
4.667	1.72	10.750	4.95	16.833	1.94	22.92	1.29
4.750	1.72	10.833	6.66	16.917	1.93	23.00	1.29
4.833	1.72	10.917	6.66	17.000	1.93	23.08	1.29
4.917	1.72	11.000	6.66	17.083	1.94	23.17	1.29
5.000	1.72	11.083	6.66	17.167	1.93	23.25	1.29
5.083	1.72	11.167	6.66	17.250	1.93	23.33	1.29
5.167	1.72	11.250	6.66	17.333	1.94	23.42	1.29
5.250	1.72	11.333	10.32	17.417	1.93	23.50	1.29
5.333	1.72	11.417	10.32	17.500	1.93	23.58	1.29
5.417	1.72	11.500	10.32	17.583	1.94	23.67	1.29
5.500	1.72	11.583	10.32	17.667	1.93	23.75	1.29
5.583	1.72	11.667	10.32	17.750	1.93	23.83	1.29
5.667	1.72	11.750	10.32	17.833	1.94	23.92	1.29
5.750	1.72	11.833	44.72	17.917	1.93	24.00	1.29
5.833	1.72	11.917	44.72	18.000	1.93	24.08	1.29
5.917	1.72	12.000	44.72	18.083	1.94	24.17	1.29
6.000	1.72	12.083	118.67	18.167	1.93	24.25	1.29
6.083	1.72	12.167	118.68	18.250	1.93		

```
     Unit Hyd Qpeak  (cms)=   0.174

     PEAK FLOW       (cms)=   0.094 (i)
     TIME TO PEAK    (hrs)=  12.333
     RUNOFF VOLUME    (mm)=  42.735
     TOTAL RAINFALL   (mm)= 107.500
     RUNOFF COEFFICIENT   =   0.398

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

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| CALIB            |
| STANDHYD (  0001)|   Area    (ha)=  26.52
|ID= 1 DT=15.0 min |   Total Imp(%)=  61.00   Dir. Conn.(%)=  45.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      16.18         10.34
     Dep. Storage     (mm)=       1.00          1.50
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     420.48         40.00
     Mannings n           =      0.013         0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO  15.0 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
0.250	0.00	6.500	2.15	12.750	15.48	19.00	1.93
0.500	1.08	6.750	2.15	13.000	7.95	19.25	1.93
0.750	1.07	7.000	2.15	13.250	7.95	19.50	1.93
1.000	1.07	7.250	2.15	13.500	1.50	19.75	1.93
1.250	1.07	7.500	2.15	13.750	1.50	20.00	1.93
1.500	1.07	7.750	2.15	14.000	8.81	20.25	1.93
1.750	1.07	8.000	2.15	14.250	8.81	20.50	1.29
2.000	1.07	8.250	2.15	14.500	3.22	20.75	1.29
2.250	1.93	8.500	2.90	14.750	3.22	21.00	1.29
2.500	1.40	8.750	2.90	15.000	3.22	21.25	1.29
2.750	1.40	9.000	2.90	15.250	3.22	21.50	1.29
3.000	1.40	9.250	2.90	15.500	3.22	21.75	1.29
3.250	1.40	9.500	3.44	15.750	3.22	22.00	1.29

```
               3.500    1.40 | 9.750    3.44 |16.000    3.22 | 22.25    1.29
               3.750    1.40 |10.000    3.87 |16.250    3.22 | 22.50    1.29
               4.000    1.40 |10.250    3.87 |16.500    1.93 | 22.75    1.29
               4.250    1.40 |10.500    4.94 |16.750    1.93 | 23.00    1.29
               4.500    1.72 |10.750    4.94 |17.000    1.93 | 23.25    1.29
               4.750    1.72 |11.000    6.66 |17.250    1.93 | 23.50    1.29
               5.000    1.72 |11.250    6.66 |17.500    1.93 | 23.75    1.29
               5.250    1.72 |11.500   10.32 |17.750    1.93 | 24.00    1.29
               5.500    1.72 |11.750   10.32 |18.000    1.93 | 24.25    1.29
               5.750    1.72 |12.000   44.72 |18.250    1.93 |
               6.000    1.72 |12.250  118.68 |18.500    1.93 |
               6.250    1.72 |12.500   15.48 |18.750    1.93 |

     Max.Eff.Inten.(mm/hr)=     118.68        96.76
               over (min)       15.00        15.00
     Storage Coeff.  (min)=      5.65 (ii)   12.80 (ii)
     Unit Hyd. Tpeak (min)=     15.00        15.00
     Unit Hyd. peak  (cms)=      0.11         0.08
                                                      *TOTALS*
     PEAK FLOW       (cms)=      3.76         2.11       5.863 (iii)
     TIME TO PEAK    (hrs)=     12.25        12.25       12.25
     RUNOFF VOLUME    (mm)=    106.50        54.53       77.92
     TOTAL RAINFALL   (mm)=    107.50       107.50      107.50
     RUNOFF COEFFICIENT   =      0.99         0.51        0.72

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=  15.59
|ID= 1 DT=15.0 min |   Total Imp(%)=  69.00   Dir. Conn.(%)=  48.00
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=     10.76         4.83
     Dep. Storage     (mm)=      1.00         1.50
     Average Slope     (%)=      1.00         2.00
     Length            (m)=    322.39        40.00
     Mannings n           =     0.013        0.250

     Max.Eff.Inten.(mm/hr)=     118.68       125.32
               over (min)       15.00        15.00
     Storage Coeff.  (min)=      4.82 (ii)   11.26 (ii)
     Unit Hyd. Tpeak (min)=     15.00        15.00
     Unit Hyd. peak  (cms)=      0.11         0.08
                                                      *TOTALS*
     PEAK FLOW       (cms)=      2.40         1.34       3.740 (iii)
     TIME TO PEAK    (hrs)=     12.25        12.25       12.25
     RUNOFF VOLUME    (mm)=    106.50        59.26       81.93
     TOTAL RAINFALL   (mm)=    107.50       107.50      107.50
     RUNOFF COEFFICIENT   =      0.99         0.55        0.76

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.

--------------------------------------------------------------------------------
--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0001):    26.52   5.863    12.25    77.92
      + ID2= 2 (  0002):    15.59   3.740    12.25    81.93
        ==========================================================
        ID = 3 (  0003):    42.11   9.603    12.25    79.40

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.4950      1.7925
                          0.0330     0.8230   |   0.8740      2.1555
                          0.0800     1.2250   |   1.1350      2.3805
                          0.3070     1.5840   |   1.4190      2.6735

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)     42.110     9.603     12.25      79.40
   OUTFLOW: ID= 1 (  0004)     42.110     0.826     13.25      75.81

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=  8.61
                    TIME SHIFT OF PEAK FLOW          (min)= 60.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  2.1099

--------------------------------------------------------------------------------
--------------------
| ADD HYD  (  0007)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0004):    42.11   0.826    13.25    75.81
      + ID2= 2 (  0009):     0.91   0.094    12.33    42.74
        ==========================================================
        ID = 3 (  0007):    43.02   0.839    13.25    75.11

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

       V    V   I    SSSSS  U   U    A    L
       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 5.0\VO2\voin.dat
Output filename: C:\Users\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-45e7-8ee9-3237db384aff\8e1a9490-7d62-42ae-86b7-3b8bee431aae\scen
Summary filename: C:\Users\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-45e7-8ee9-3237db384aff\8e1a9490-7d62-42ae-86b7-3b8bee431aae\scen

DATE: 03-10-2020 TIME: 09:47:18

USER:

COMMENTS: _____

****
** SIMULATION NUMBER: 0 **
****

READ STORM	Filename: C:\Users\nkamran\AppData\Local\Temp\2d446286-7a4e-40ce-8e88-3197d691e164\e1ef23c7
Ptotal=120.60 mm	Comments: 50 YR SCS STORM WITH A 15 MINUTE TIME S

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.25	1.21	6.25	2.41	12.25	17.37	18.25	2.17
0.50	1.21	6.50	2.41	12.50	17.37	18.50	2.17
0.75	1.21	6.75	2.41	12.75	8.92	18.75	2.17
1.00	1.21	7.00	2.41	13.00	8.92	19.00	2.17
1.25	1.21	7.25	2.41	13.25	1.69	19.25	2.17
1.50	1.21	7.50	2.41	13.50	1.69	19.50	2.17
1.75	1.21	7.75	2.41	13.75	9.89	19.75	2.17
2.00	2.17	8.00	2.41	14.00	9.89	20.00	2.17
2.25	1.57	8.25	3.26	14.25	3.62	20.25	1.45
2.50	1.57	8.50	3.26	14.50	3.62	20.50	1.45
2.75	1.57	8.75	3.26	14.75	3.62	20.75	1.45
3.00	1.57	9.00	3.26	15.00	3.62	21.00	1.45
3.25	1.57	9.25	3.86	15.25	3.62	21.25	1.45
3.50	1.57	9.50	3.86	15.50	3.62	21.50	1.45
3.75	1.57	9.75	4.34	15.75	3.62	21.75	1.45
4.00	1.57	10.00	4.34	16.00	3.62	22.00	1.45
4.25	1.93	10.25	5.55	16.25	2.17	22.25	1.45
4.50	1.93	10.50	5.55	16.50	2.17	22.50	1.45
4.75	1.93	10.75	7.48	16.75	2.17	22.75	1.45
5.00	1.93	11.00	7.48	17.00	2.17	23.00	1.45
5.25	1.93	11.25	11.58	17.25	2.17	23.25	1.45
5.50	1.93	11.50	11.58	17.50	2.17	23.50	1.45
5.75	1.93	11.75	50.17	17.75	2.17	23.75	1.45
6.00	1.93	12.00	133.14	18.00	2.17	24.00	1.45

CALIB					
NASHYD (0009)	Area (ha)=	0.91	Curve Number (CN)=	64.0	
ID= 1 DT= 5.0 min	Ia (mm)=	5.00	# of Linear Res.(N)=	3.00	
	U.H. Tp(hrs)=	0.20			

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	1.21	6.083	2.41	12.083	17.38	18.08	2.17
0.167	1.21	6.167	2.41	12.167	17.37	18.17	2.17
0.250	1.21	6.250	2.41	12.250	17.37	18.25	2.17
0.333	1.21	6.333	2.41	12.333	17.37	18.33	2.17
0.417	1.21	6.417	2.41	12.417	17.37	18.42	2.17
0.500	1.21	6.500	2.41	12.500	17.37	18.50	2.17
0.583	1.21	6.583	2.41	12.583	8.93	18.58	2.17
0.667	1.21	6.667	2.41	12.667	8.92	18.67	2.17
0.750	1.21	6.750	2.41	12.750	8.92	18.75	2.17
0.833	1.21	6.833	2.41	12.833	8.92	18.83	2.17
0.917	1.21	6.917	2.41	12.917	8.92	18.92	2.17
1.000	1.21	7.000	2.41	13.000	8.92	19.00	2.17
1.083	1.21	7.083	2.41	13.083	1.69	19.08	2.17
1.167	1.21	7.167	2.41	13.167	1.69	19.17	2.17
1.250	1.21	7.250	2.41	13.250	1.69	19.25	2.17
1.333	1.21	7.333	2.41	13.333	1.69	19.33	2.17
1.417	1.21	7.417	2.41	13.417	1.69	19.42	2.17
1.500	1.21	7.500	2.41	13.500	1.69	19.50	2.17
1.583	1.21	7.583	2.41	13.583	9.89	19.58	2.17
1.667	1.21	7.667	2.41	13.667	9.89	19.67	2.17
1.750	1.21	7.750	2.41	13.750	9.89	19.75	2.17
1.833	2.17	7.833	2.41	13.833	9.89	19.83	2.17
1.917	2.17	7.917	2.41	13.917	9.89	19.92	2.17
2.000	2.17	8.000	2.41	14.000	9.89	20.00	2.17
2.083	1.57	8.083	3.26	14.083	3.62	20.08	1.45
2.167	1.57	8.167	3.26	14.167	3.62	20.17	1.45
2.250	1.57	8.250	3.26	14.250	3.62	20.25	1.45
2.333	1.57	8.333	3.26	14.333	3.62	20.33	1.45
2.417	1.57	8.417	3.26	14.417	3.62	20.42	1.45
2.500	1.57	8.500	3.26	14.500	3.62	20.50	1.45
2.583	1.57	8.583	3.26	14.583	3.62	20.58	1.45
2.667	1.57	8.667	3.26	14.667	3.62	20.67	1.45
2.750	1.57	8.750	3.26	14.750	3.62	20.75	1.45
2.833	1.57	8.833	3.26	14.833	3.62	20.83	1.45
2.917	1.57	8.917	3.26	14.917	3.62	20.92	1.45
3.000	1.57	9.000	3.26	15.000	3.62	21.00	1.45
3.083	1.57	9.083	3.86	15.083	3.62	21.08	1.45
3.167	1.57	9.167	3.86	15.167	3.62	21.17	1.45
3.250	1.57	9.250	3.86	15.250	3.62	21.25	1.45
3.333	1.57	9.333	3.86	15.333	3.62	21.33	1.45
3.417	1.57	9.417	3.86	15.417	3.62	21.42	1.45
3.500	1.57	9.500	3.86	15.500	3.62	21.50	1.45
3.583	1.57	9.583	4.34	15.583	3.62	21.58	1.45
3.667	1.57	9.667	4.34	15.667	3.62	21.67	1.45
3.750	1.57	9.750	4.34	15.750	3.62	21.75	1.45
3.833	1.57	9.833	4.34	15.833	3.62	21.83	1.45
3.917	1.57	9.917	4.34	15.917	3.62	21.92	1.45
4.000	1.57	10.000	4.34	16.000	3.62	22.00	1.45

4.083	1.93	10.083	5.55	16.083	2.17	22.08	1.45
4.167	1.93	10.167	5.55	16.167	2.17	22.17	1.45
4.250	1.93	10.250	5.55	16.250	2.17	22.25	1.45
4.333	1.93	10.333	5.55	16.333	2.17	22.33	1.45
4.417	1.93	10.417	5.55	16.417	2.17	22.42	1.45
4.500	1.93	10.500	5.55	16.500	2.17	22.50	1.45
4.583	1.93	10.583	7.48	16.583	2.17	22.58	1.45
4.667	1.93	10.667	7.48	16.667	2.17	22.67	1.45
4.750	1.93	10.750	7.48	16.750	2.17	22.75	1.45
4.833	1.93	10.833	7.48	16.833	2.17	22.83	1.45
4.917	1.93	10.917	7.48	16.917	2.17	22.92	1.45
5.000	1.93	11.000	7.48	17.000	2.17	23.00	1.45
5.083	1.93	11.083	11.58	17.083	2.17	23.08	1.45
5.167	1.93	11.167	11.58	17.167	2.17	23.17	1.45
5.250	1.93	11.250	11.58	17.250	2.17	23.25	1.45
5.333	1.93	11.333	11.58	17.333	2.17	23.33	1.45
5.417	1.93	11.417	11.58	17.417	2.17	23.42	1.45
5.500	1.93	11.500	11.58	17.500	2.17	23.50	1.45
5.583	1.93	11.583	50.17	17.583	2.17	23.58	1.45
5.667	1.93	11.667	50.17	17.667	2.17	23.67	1.45
5.750	1.93	11.750	50.17	17.750	2.17	23.75	1.45
5.833	1.93	11.833	133.13	17.833	2.17	23.83	1.45
5.917	1.93	11.917	133.14	17.917	2.17	23.92	1.45
6.000	1.93	12.000	133.14	18.000	2.17	24.00	1.45

Unit Hyd Qpeak (cms)= 0.174

PEAK FLOW (cms)= 0.114 (i)
TIME TO PEAK (hrs)= 12.083
RUNOFF VOLUME (mm)= 51.602
TOTAL RAINFALL (mm)= 120.601
RUNOFF COEFFICIENT = 0.428

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

CALIB	
STANDHYD (0001)	Area (ha)= 26.52
ID= 1 DT=15.0 min	Total Imp(%)= 61.00 Dir. Conn.(%)= 45.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	16.18	10.34
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	1.00	2.00
Length	(m)=	420.48	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 15.0 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
0.250	1.21	6.250	2.41	12.250	17.37	18.25	2.17
0.500	1.21	6.500	2.41	12.500	17.37	18.50	2.17
0.750	1.21	6.750	2.41	12.750	8.92	18.75	2.17
1.000	1.21	7.000	2.41	13.000	8.92	19.00	2.17
1.250	1.21	7.250	2.41	13.250	1.69	19.25	2.17
1.500	1.21	7.500	2.41	13.500	1.69	19.50	2.17
1.750	1.21	7.750	2.41	13.750	9.89	19.75	2.17
2.000	2.17	8.000	2.41	14.000	9.89	20.00	2.17
2.250	1.57	8.250	3.26	14.250	3.62	20.25	1.45
2.500	1.57	8.500	3.26	14.500	3.62	20.50	1.45
2.750	1.57	8.750	3.26	14.750	3.62	20.75	1.45
3.000	1.57	9.000	3.26	15.000	3.62	21.00	1.45
3.250	1.57	9.250	3.86	15.250	3.62	21.25	1.45
3.500	1.57	9.500	3.86	15.500	3.62	21.50	1.45
3.750	1.57	9.750	4.34	15.750	3.62	21.75	1.45
4.000	1.57	10.000	4.34	16.000	3.62	22.00	1.45
4.250	1.93	10.250	5.55	16.250	2.17	22.25	1.45
4.500	1.93	10.500	5.55	16.500	2.17	22.50	1.45
4.750	1.93	10.750	7.48	16.750	2.17	22.75	1.45
5.000	1.93	11.000	7.48	17.000	2.17	23.00	1.45
5.250	1.93	11.250	11.58	17.250	2.17	23.25	1.45
5.500	1.93	11.500	11.58	17.500	2.17	23.50	1.45
5.750	1.93	11.750	50.17	17.750	2.17	23.75	1.45
6.000	1.93	12.000	133.14	18.000	2.17	24.00	1.45

			TOTALS
Max.Eff.Inten.(mm/hr)=	133.14	114.97	
over (min)	15.00	15.00	
Storage Coeff. (min)=	5.39 (ii)	12.07 (ii)	
Unit Hyd. Tpeak (min)=	15.00	15.00	
Unit Hyd. peak (cms)=	0.11	0.08	
PEAK FLOW (cms)=	4.24	2.57	6.804 (iii)
TIME TO PEAK (hrs)=	12.00	12.00	12.00
RUNOFF VOLUME (mm)=	119.60	64.70	89.41
TOTAL RAINFALL (mm)=	120.60	120.60	120.60
RUNOFF COEFFICIENT =	0.99	0.54	0.74

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 64.0 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.

CALIB	
STANDHYD (0002)	Area (ha)= 15.59
ID= 1 DT=15.0 min	Total Imp(%)= 69.00 Dir. Conn.(%)= 48.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	10.76	4.83
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	1.00	2.00
Length	(m)=	322.39	40.00
Mannings n	=	0.013	0.250

			TOTALS
Max.Eff.Inten.(mm/hr)=	133.14	148.00	
over (min)	15.00	15.00	
Storage Coeff. (min)=	4.60 (ii)	10.63 (ii)	
Unit Hyd. Tpeak (min)=	15.00	15.00	
Unit Hyd. peak (cms)=	0.11	0.09	
PEAK FLOW (cms)=	2.70	1.62	4.320 (iii)
TIME TO PEAK (hrs)=	12.00	12.00	12.00
RUNOFF VOLUME (mm)=	119.60	69.94	93.78
TOTAL RAINFALL (mm)=	120.60	120.60	120.60
RUNOFF COEFFICIENT =	0.99	0.58	0.78

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

```
      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  64.0    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.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
-------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0001):    26.52   6.804    12.00    89.41
     + ID2= 2 (  0002):    15.59   4.320    12.00    93.78
       ====================================================
       ID = 3 (  0003):    42.11  11.125    12.00    91.02

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
-------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                        0.0000     0.0000   |   0.4950     1.7925
                        0.0330     0.8230   |   0.8740     2.1555
                        0.0800     1.2250   |   1.1350     2.3805
                        0.3070     1.5840   |   1.4190     2.6735

                             AREA     QPEAK     TPEAK       R.V.
                             (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)     42.110     11.125     12.00      91.02
   OUTFLOW: ID= 1 (  0004)     42.110      1.116     12.75      87.41

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 10.03
                  TIME SHIFT OF PEAK FLOW         (min)= 45.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  2.3641

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0007)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
-------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0004):    42.11   1.116    12.75    87.41
     + ID2= 2 (  0009):     0.91   0.114    12.08    51.60
       ====================================================
       ID = 3 (  0007):    43.02   1.136    12.75    86.65

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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       V    V   I    SSSSS  U   U    A    L
       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 5.0\VO2\voin.dat
  Output  filename: C:\Users\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-
45e7-8ee9-3237db384aff\ae407175-56d8-4e9f-a0c2-676a7c2703ae\scen
  Summary filename: C:\Users\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-
45e7-8ee9-3237db384aff\ae407175-56d8-4e9f-a0c2-676a7c2703ae\scen


DATE: 03-10-2020                          TIME: 09:47:19

USER:


COMMENTS: _____________________________________________________

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  ****************************
  ** SIMULATION NUMBER:   0 **
  ****************************


--------------------
|    READ STORM    |    Filename: C:\Users\nkamran\AppD
|                  |              ata\Local\Temp\
|                  |              2d446286-7a4e-40ce-8e88-3197d691e164\d6160af4
| Ptotal=133.60 mm |    Comments: 100 YR SCS STORM  WITH A 15 MINUTE TIME
--------------------
                  TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                  0.25    0.00 |  6.50    2.67 | 12.75   19.24 | 19.00    2.40
                  0.50    1.34 |  6.75    2.67 | 13.00    9.89 | 19.25    2.40
                  0.75    1.34 |  7.00    2.67 | 13.25    9.89 | 19.50    2.40
                  1.00    1.34 |  7.25    2.67 | 13.50    1.87 | 19.75    2.40
                  1.25    1.34 |  7.50    2.67 | 13.75    1.87 | 20.00    2.40
                  1.50    1.34 |  7.75    2.67 | 14.00   10.95 | 20.25    2.40
                  1.75    1.34 |  8.00    2.67 | 14.25   10.95 | 20.50    1.60
                  2.00    1.34 |  8.25    2.67 | 14.50    4.01 | 20.75    1.60
                  2.25    2.40 |  8.50    3.61 | 14.75    4.01 | 21.00    1.60
                  2.50    1.74 |  8.75    3.61 | 15.00    4.01 | 21.25    1.60
                  2.75    1.74 |  9.00    3.61 | 15.25    4.01 | 21.50    1.60
                  3.00    1.74 |  9.25    3.61 | 15.50    4.01 | 21.75    1.60
                  3.25    1.74 |  9.50    4.28 | 15.75    4.01 | 22.00    1.60
                  3.50    1.74 |  9.75    4.28 | 16.00    4.01 | 22.25    1.60
                  3.75    1.74 | 10.00    4.81 | 16.25    4.01 | 22.50    1.60
                  4.00    1.74 | 10.25    4.81 | 16.50    2.40 | 22.75    1.60
                  4.25    1.74 | 10.50    6.15 | 16.75    2.40 | 23.00    1.60
                  4.50    2.14 | 10.75    6.15 | 17.00    2.40 | 23.25    1.60
                  4.75    2.14 | 11.00    8.28 | 17.25    2.40 | 23.50    1.60
                  5.00    2.14 | 11.25    8.28 | 17.50    2.40 | 23.75    1.60
                  5.25    2.14 | 11.50   12.83 | 17.75    2.40 | 24.00    1.60
```

5.50	2.14	11.75	12.83	18.00	2.40	24.25	1.60
5.75	2.14	12.00	55.58	18.25	2.40		
6.00	2.14	12.25	147.49	18.50	2.40		
6.25	2.14	12.50	19.24	18.75	2.40		

CALIB			
NASHYD (0009)	Area (ha)=	0.91	Curve Number (CN)= 64.0
ID= 1 DT= 5.0 min	Ia (mm)=	5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)=	0.20	

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	0.00	6.167	2.14	12.250	147.49	18.33	2.41
0.167	0.00	6.250	2.14	12.333	19.25	18.42	2.40
0.250	0.00	6.333	2.67	12.417	19.24	18.50	2.40
0.333	1.34	6.417	2.67	12.500	19.24	18.58	2.41
0.417	1.34	6.500	2.67	12.583	19.24	18.67	2.40
0.500	1.34	6.583	2.67	12.667	19.24	18.75	2.40
0.583	1.34	6.667	2.67	12.750	19.24	18.83	2.41
0.667	1.34	6.750	2.67	12.833	9.89	18.92	2.40
0.750	1.34	6.833	2.67	12.917	9.89	19.00	2.40
0.833	1.34	6.917	2.67	13.000	9.89	19.08	2.41
0.917	1.34	7.000	2.67	13.083	9.89	19.17	2.40
1.000	1.34	7.083	2.67	13.167	9.89	19.25	2.40
1.083	1.34	7.167	2.67	13.250	9.89	19.33	2.41
1.167	1.34	7.250	2.67	13.333	1.87	19.42	2.40
1.250	1.34	7.333	2.67	13.417	1.87	19.50	2.41
1.333	1.34	7.417	2.67	13.500	1.87	19.58	2.40
1.417	1.34	7.500	2.67	13.583	1.87	19.67	2.40
1.500	1.34	7.583	2.67	13.667	1.87	19.75	2.41
1.583	1.34	7.667	2.67	13.750	1.87	19.83	2.40
1.667	1.34	7.750	2.67	13.833	10.95	19.92	2.40
1.750	1.34	7.833	2.67	13.917	10.95	20.00	2.41
1.833	1.34	7.917	2.67	14.000	10.95	20.08	2.40
1.917	1.34	8.000	2.67	14.083	10.95	20.17	2.40
2.000	1.34	8.083	2.67	14.167	10.95	20.25	2.40
2.083	2.40	8.167	2.67	14.250	10.95	20.33	1.60
2.167	2.40	8.250	2.67	14.333	4.01	20.42	1.60
2.250	2.40	8.333	3.61	14.417	4.01	20.50	1.60
2.333	1.74	8.417	3.61	14.500	4.01	20.58	1.60
2.417	1.74	8.500	3.61	14.583	4.01	20.67	1.60
2.500	1.74	8.583	3.61	14.667	4.01	20.75	1.60
2.583	1.74	8.667	3.61	14.750	4.01	20.83	1.60
2.667	1.74	8.750	3.61	14.833	4.01	20.92	1.60
2.750	1.74	8.833	3.61	14.917	4.01	21.00	1.60
2.833	1.74	8.917	3.61	15.000	4.01	21.08	1.60
2.917	1.74	9.000	3.61	15.083	4.01	21.17	1.60
3.000	1.74	9.083	3.61	15.167	4.01	21.25	1.60
3.083	1.74	9.167	3.61	15.250	4.01	21.33	1.60
3.167	1.74	9.250	3.61	15.333	4.01	21.42	1.60
3.250	1.74	9.333	4.28	15.417	4.01	21.50	1.60
3.333	1.74	9.417	4.28	15.500	4.01	21.58	1.60
3.417	1.74	9.500	4.28	15.583	4.01	21.67	1.60
3.500	1.74	9.583	4.27	15.667	4.01	21.75	1.60
3.583	1.74	9.667	4.28	15.750	4.01	21.83	1.60
3.667	1.74	9.750	4.28	15.833	4.01	21.92	1.60
3.750	1.74	9.833	4.81	15.917	4.01	22.00	1.60
3.833	1.74	9.917	4.81	16.000	4.01	22.08	1.60
3.917	1.74	10.000	4.81	16.083	4.01	22.17	1.60
4.000	1.74	10.083	4.81	16.167	4.01	22.25	1.60
4.083	1.74	10.167	4.81	16.250	4.01	22.33	1.60
4.167	1.74	10.250	4.81	16.333	2.41	22.42	1.60
4.250	1.74	10.333	6.15	16.417	2.40	22.50	1.60
4.333	2.14	10.417	6.15	16.500	2.40	22.58	1.60
4.417	2.14	10.500	6.15	16.583	2.41	22.67	1.60
4.500	2.14	10.583	6.15	16.667	2.40	22.75	1.60
4.583	2.14	10.667	6.15	16.750	2.40	22.83	1.60
4.667	2.14	10.750	6.15	16.833	2.41	22.92	1.60
4.750	2.14	10.833	8.28	16.917	2.40	23.00	1.60
4.833	2.14	10.917	8.28	17.000	2.40	23.08	1.60
4.917	2.14	11.000	8.28	17.083	2.41	23.17	1.60
5.000	2.14	11.083	8.28	17.167	2.40	23.25	1.60
5.083	2.14	11.167	8.28	17.250	2.40	23.33	1.60
5.167	2.14	11.250	8.28	17.333	2.41	23.42	1.60
5.250	2.14	11.333	12.83	17.417	2.40	23.50	1.60
5.333	2.14	11.417	12.83	17.500	2.40	23.58	1.60
5.417	2.14	11.500	12.83	17.583	2.41	23.67	1.60
5.500	2.14	11.583	12.83	17.667	2.40	23.75	1.60
5.583	2.14	11.667	12.83	17.750	2.40	23.83	1.60
5.667	2.14	11.750	12.83	17.833	2.41	23.92	1.60
5.750	2.14	11.833	55.57	17.917	2.40	24.00	1.60
5.833	2.14	11.917	55.58	18.000	2.40	24.08	1.60
5.917	2.14	12.000	55.58	18.083	2.41	24.17	1.60
6.000	2.14	12.083	147.48	18.167	2.40	24.25	1.60
6.083	2.14	12.167	147.49	18.250	2.40		

Unit Hyd Qpeak (cms)= 0.174

PEAK FLOW (cms)= 0.135 (i)
TIME TO PEAK (hrs)= 12.333
RUNOFF VOLUME (mm)= 60.803
TOTAL RAINFALL (mm)= 133.601
RUNOFF COEFFICIENT = 0.455

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

CALIB			
STANDHYD (0001)	Area (ha)=	26.52	
ID= 1 DT=15.0 min	Total Imp(%)=	61.00	Dir. Conn.(%)= 45.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	16.18	10.34
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	1.00	2.00
Length	(m)=	420.48	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 15.0 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
0.250	0.00	6.500	2.67	12.750	19.24	19.00	2.40
0.500	1.34	6.750	2.67	13.000	9.89	19.25	2.40
0.750	1.34	7.000	2.67	13.250	9.89	19.50	2.40
1.000	1.34	7.250	2.67	13.500	1.87	19.75	2.40

```
                1.250    1.34 | 7.500    2.67 |13.750    1.87 | 20.00    2.40
                1.500    1.34 | 7.750    2.67 |14.000   10.95 | 20.25    2.40
                1.750    1.34 | 8.000    2.67 |14.250   10.95 | 20.50    1.60
                2.000    1.34 | 8.250    2.67 |14.500    4.01 | 20.75    1.60
                2.250    2.40 | 8.500    3.61 |14.750    4.01 | 21.00    1.60
                2.500    1.74 | 8.750    3.61 |15.000    4.01 | 21.25    1.60
                2.750    1.74 | 9.000    3.61 |15.250    4.01 | 21.50    1.60
                3.000    1.74 | 9.250    3.61 |15.500    4.01 | 21.75    1.60
                3.250    1.74 | 9.500    4.27 |15.750    4.01 | 22.00    1.60
                3.500    1.74 | 9.750    4.27 |16.000    4.01 | 22.25    1.60
                3.750    1.74 |10.000    4.81 |16.250    4.01 | 22.50    1.60
                4.000    1.74 |10.250    4.81 |16.500    2.40 | 22.75    1.60
                4.250    1.74 |10.500    6.15 |16.750    2.40 | 23.00    1.60
                4.500    2.14 |10.750    6.15 |17.000    2.40 | 23.25    1.60
                4.750    2.14 |11.000    8.28 |17.250    2.40 | 23.50    1.60
                5.000    2.14 |11.250    8.28 |17.500    2.40 | 23.75    1.60
                5.250    2.14 |11.500   12.83 |17.750    2.40 | 24.00    1.60
                5.500    2.14 |11.750   12.83 |18.000    2.40 | 24.25    1.60
                5.750    2.14 |12.000   55.58 |18.250    2.40 |
                6.000    2.14 |12.250  147.49 |18.500    2.40 |
                6.250    2.14 |12.500   19.24 |18.750    2.40 |

     Max.Eff.Inten.(mm/hr)=     147.49       133.60
               over (min)       15.00        15.00
     Storage Coeff.  (min)=      5.18 (ii)   11.46 (ii)
     Unit Hyd. Tpeak (min)=     15.00        15.00
     Unit Hyd. peak  (cms)=      0.11         0.08
                                                      *TOTALS*
     PEAK FLOW       (cms)=      4.72         3.04       7.761 (iii)
     TIME TO PEAK    (hrs)=     12.25        12.25       12.25
     RUNOFF VOLUME    (mm)=    132.60        75.12      100.98
     TOTAL RAINFALL   (mm)=    133.60       133.60      133.60
     RUNOFF COEFFICIENT   =      0.99         0.56        0.76

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=  15.59
|ID= 1 DT=15.0 min |   Total Imp(%)=  69.00   Dir. Conn.(%)=  48.00
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=     10.76         4.83
     Dep. Storage     (mm)=      1.00         1.50
     Average Slope     (%)=      1.00         2.00
     Length            (m)=    322.39        40.00
     Mannings n            =     0.013        0.250

     Max.Eff.Inten.(mm/hr)=     147.49       171.05
               over (min)       15.00        15.00
     Storage Coeff.  (min)=      4.41 (ii)   10.11 (ii)
     Unit Hyd. Tpeak (min)=     15.00        15.00
     Unit Hyd. peak  (cms)=      0.11         0.09
                                                      *TOTALS*
     PEAK FLOW       (cms)=      3.00         1.91       4.907 (iii)
     TIME TO PEAK    (hrs)=     12.25        12.25       12.25

     RUNOFF VOLUME    (mm)=    132.60        80.83      105.68
     TOTAL RAINFALL   (mm)=    133.60       133.60      133.60
     RUNOFF COEFFICIENT   =      0.99         0.60        0.79

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0001):    26.52   7.761    12.25   100.98
     + ID2= 2 (  0002):    15.59   4.907    12.25   105.68
       ================================================
       ID = 3 (  0003):    42.11  12.669    12.25   102.72

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   0.4950     1.7925
                         0.0330     0.8230   |   0.8740     2.1555
                         0.0800     1.2250   |   1.1350     2.3805
                         0.3070     1.5840   |   1.4190     2.6735

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)     42.110     12.669     12.25     102.72
   OUTFLOW: ID= 1 (  0004)     42.110      1.374     13.00      99.07

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 10.85
                  TIME SHIFT OF PEAK FLOW          (min)= 45.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  2.6299

--------------------------------------------------------------------------------
--------------------
| ADD HYD  (  0007)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0004):    42.11   1.374    13.00    99.07
     + ID2= 2 (  0009):     0.91   0.135    12.33    60.80
       ================================================
       ID = 3 (  0007):    43.02   1.404    12.92    98.26

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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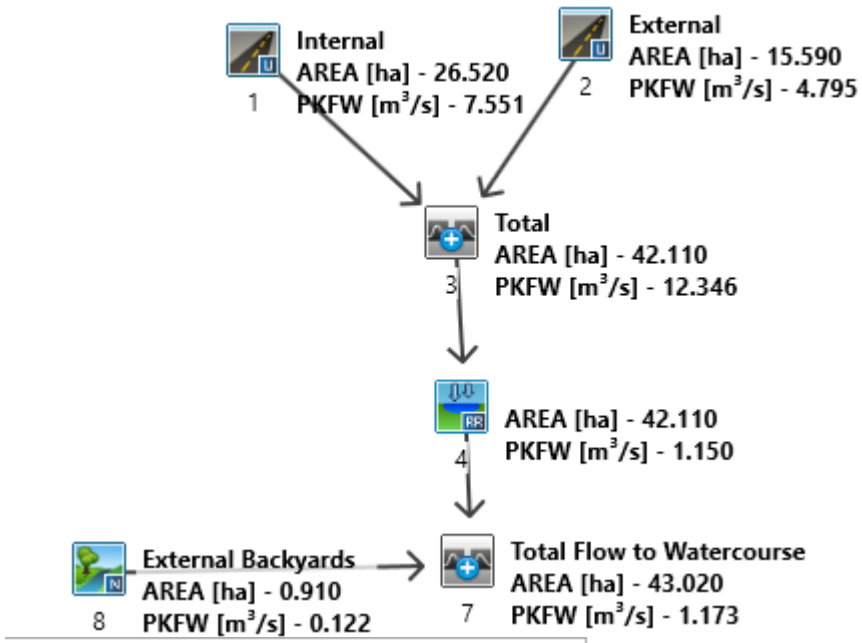

2020-02-20-12-hr-SCS-2-100yr Controlled Flows

Schematic | Hydrograph Results (instance)

Run: Run 01 | Show All Runs

Run	NHYD	DT [hr]	AREA [ha]	PKFW [m³/s]	TP [hr]	RV [mm]	DWF [m³/s]
Run 01	7	0.083	43.020	0.023	4.000	12.189	0.000
Run 02	7	0.083	43.020	0.065	12.000	26.054	0.000
Run 03	7	0.083	43.020	0.216	8.750	39.339	0.000
Run 04	7	0.083	43.020	0.382	8.083	48.782	0.000
Run 05	7	0.083	43.020	0.658	7.083	61.070	0.000
Run 06	7	0.083	43.020	0.900	6.833	70.506	0.000
Run 07	7	0.083	43.020	1.173	6.667	79.931	0.000

Flows to Watercourse Compared with Allowable Release Rates

Storm Event	2-year	5-year	10-year	25-year	50-year	100-year
Allowable Release Rates (m^3/s)	0.080	0.340	0.630	1.010	1.350	1.680
Expected Release Rate (m^3/s)	0.065	0.216	0.382	0.658	0.900	1.173

SCHAEFFERS CONSULTING ENGINEERS

Visual OTTHYMO™ Schematic
883 Mapleview Drive East Subdivision
(25 mm – 100-yr – 12-hour SCS Type II)
(Controlled Flows and Provided Storage)

Job #: 4692 | **Date: March 2020**

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================================================================================
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       V    V   I    SSSSS  U   U    A    L
       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 5.0\VO2\voin.dat
  Output  filename: C:\Users\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-
45e7-8ee9-3237db384aff\2ee8ec5d-84bc-4ecc-b5b3-ff27f740abb1\scen
  Summary filename: C:\Users\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-
45e7-8ee9-3237db384aff\2ee8ec5d-84bc-4ecc-b5b3-ff27f740abb1\scen


DATE: 03-23-2020                          TIME: 10:57:12

USER:


COMMENTS: _____________________________________________________________


--------------------------------------------------------------------------------
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  ****************************
  ** SIMULATION NUMBER:   0 **
  ****************************


--------------------
|    READ STORM    |    Filename: C:\Users\nkamran\AppD
|                  |              ata\Local\Temp\
|                  |              635f07bc-721f-4fb1-bba8-c37fffe39f73\37ab0616
| Ptotal= 25.00 mm |    Comments: Twenty-Five mm Four Hour Chicago Storm
--------------------
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.17    2.07 |  1.17    5.70 |  2.17    5.19 |  3.17    2.80
                0.33    2.27 |  1.33   10.78 |  2.33    4.47 |  3.33    2.62
                0.50    2.52 |  1.50   50.21 |  2.50    3.95 |  3.50    2.48
                0.67    2.88 |  1.67   13.37 |  2.67    3.56 |  3.67    2.35
                0.83    3.38 |  1.83    8.29 |  2.83    3.25 |  3.83    2.23
                1.00    4.18 |  2.00    6.30 |  3.00    3.01 |  4.00    2.14


--------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0008)|   Area     (ha)=   0.91   Curve Number    (CN)= 64.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20

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


                                ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    2.07 | 1.083    5.70 | 2.083    5.19 |  3.08    2.80
               0.167    2.07 | 1.167    5.70 | 2.167    5.19 |  3.17    2.80
               0.250    2.27 | 1.250   10.78 | 2.250    4.47 |  3.25    2.62
               0.333    2.27 | 1.333   10.78 | 2.333    4.47 |  3.33    2.62
               0.417    2.52 | 1.417   50.21 | 2.417    3.95 |  3.42    2.48
               0.500    2.52 | 1.500   50.21 | 2.500    3.95 |  3.50    2.48
               0.583    2.88 | 1.583   13.37 | 2.583    3.56 |  3.58    2.35
               0.667    2.88 | 1.667   13.37 | 2.667    3.56 |  3.67    2.35
               0.750    3.38 | 1.750    8.29 | 2.750    3.25 |  3.75    2.23
               0.833    3.38 | 1.833    8.29 | 2.833    3.25 |  3.83    2.23
               0.917    4.17 | 1.917    6.30 | 2.917    3.01 |  3.92    2.14
               1.000    4.18 | 2.000    6.29 | 3.000    3.01 |  4.00    2.14

    Unit Hyd Qpeak  (cms)=   0.174

    PEAK FLOW       (cms)=   0.005 (i)
    TIME TO PEAK    (hrs)=   1.667
    RUNOFF VOLUME    (mm)=   2.450
    TOTAL RAINFALL   (mm)=  24.996
    RUNOFF COEFFICIENT   =   0.098

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

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--------------------
| CALIB            |
| STANDHYD (  0001)|   Area     (ha)=  26.52
|ID= 1 DT=15.0 min |   Total Imp(%)=  61.00   Dir. Conn.(%)=  45.00
--------------------

                                  IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=         16.18          10.34
    Dep. Storage     (mm)=          1.00           1.50
    Average Slope     (%)=          1.00           2.00
    Length            (m)=        420.48          40.00
    Mannings n           =         0.013          0.250

        NOTE:  RAINFALL WAS TRANSFORMED TO  15.0 MIN. TIME STEP.


                                ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.250    2.14 | 1.250    7.39 | 2.250    4.95 |  3.25    2.74
               0.500    2.44 | 1.500   37.07 | 2.500    4.12 |  3.50    2.52
               0.750    3.05 | 1.750   11.67 | 2.750    3.46 |  3.75    2.31
               1.000    3.91 | 2.000    6.96 | 3.000    3.09 |  4.00    2.17

    Max.Eff.Inten.(mm/hr)=        37.07          5.69
                over (min)        15.00         45.00
    Storage Coeff.  (min)=         8.99 (ii)    31.21 (ii)
    Unit Hyd. Tpeak (min)=        15.00         45.00
    Unit Hyd. peak  (cms)=         0.09          0.03
                                                                  *TOTALS*
```

```
     PEAK FLOW       (cms)=       1.04         0.09          1.063 (iii)
     TIME TO PEAK    (hrs)=       1.50         2.00           1.50
     RUNOFF VOLUME    (mm)=      24.00         4.57          13.31
     TOTAL RAINFALL   (mm)=      25.00        25.00          25.00
     RUNOFF COEFFICIENT   =       0.96         0.18           0.53

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=  15.59
|ID= 1 DT=15.0 min |   Total Imp(%)=  69.00   Dir. Conn.(%)=  48.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      10.76         4.83
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     322.39        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      37.07         7.95
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       7.67 (ii)   27.10 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=       0.10         0.04
                                                      *TOTALS*
     PEAK FLOW       (cms)=       0.68         0.07          0.711 (iii)
     TIME TO PEAK    (hrs)=       1.50         1.75           1.50
     RUNOFF VOLUME    (mm)=      24.00         5.32          14.28
     TOTAL RAINFALL   (mm)=      25.00        25.00          25.00
     RUNOFF COEFFICIENT   =       0.96         0.21           0.57

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.

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--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0001):    26.52   1.063     1.50    13.31
     + ID2= 2 (  0002):    15.59   0.711     1.50    14.28
       ================================================
       ID = 3 (  0003):    42.11   1.774     1.50    13.67

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.4950      1.7925
                          0.0330     0.8230   |   0.8740      2.1555
                          0.0800     1.2250   |   1.1350      2.3805
                          0.3070     1.5840   |   1.4190      2.6735

                                    AREA     QPEAK     TPEAK       R.V.
                                    (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)     42.110      1.774      1.50       13.67
   OUTFLOW: ID= 1 (  0004)     42.110      0.022      4.75       12.40

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  1.24
                  TIME SHIFT OF PEAK FLOW          (min)=195.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.5503

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--------------------
| ADD HYD  (  0007)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0004):    42.11   0.022     4.75    12.40
     + ID2= 2 (  0008):     0.91   0.005     1.67     2.45
       ================================================
       ID = 3 (  0007):    43.02   0.023     4.00    12.19

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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       V    V   I    SSSSS  U   U    A    L
       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 5.0\VO2\voin.dat
  Output  filename: C:\Users\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-
45e7-8ee9-3237db384aff\644a0afb-d421-451b-b8d8-a8afe193f5ff\scen
  Summary filename: C:\Users\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-
45e7-8ee9-3237db384aff\644a0afb-d421-451b-b8d8-a8afe193f5ff\scen


DATE: 03-23-2020                          TIME: 10:57:12

USER:
```

COMMENTS: _____

****
**** SIMULATION NUMBER: 0 ****
****

READ STORM	Filename: C:\Users\nkamran\AppData\Local\Temp\635f07bc-721f-4fb1-bba8-c37fffe39f73\2f54cf99
Ptotal= 46.70 mm	Comments: TWO YEAR 12 HOUR SCS STORM WITH A 15 MI

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.25	1.17	3.25	1.87	6.25	8.41	9.25	1.63
0.50	1.17	3.50	1.87	6.50	8.41	9.50	1.63
0.75	1.17	3.75	1.87	6.75	3.74	9.75	1.63
1.00	1.17	4.00	1.87	7.00	3.74	10.00	1.63
1.25	1.17	4.25	2.80	7.25	2.80	10.25	0.93
1.50	1.17	4.50	2.80	7.50	2.80	10.50	0.93
1.75	1.17	4.75	3.74	7.75	2.80	10.75	0.93
2.00	1.17	5.00	3.74	8.00	2.80	11.00	0.93
2.25	1.40	5.25	5.60	8.25	1.63	11.25	0.93
2.50	1.40	5.50	5.60	8.50	1.63	11.50	0.93
2.75	1.40	5.75	22.42	8.75	1.63	11.75	0.93
3.00	1.40	6.00	61.64	9.00	1.63	12.00	0.93

CALIB NASHYD (0008) | ID= 1 DT= 5.0 min	Area (ha)= 0.91 Curve Number (CN)= 64.0 | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00 | U.H. Tp(hrs)= 0.20

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	1.17	3.083	1.87	6.083	8.41	9.08	1.63
0.167	1.17	3.167	1.87	6.167	8.41	9.17	1.63
0.250	1.17	3.250	1.87	6.250	8.41	9.25	1.63
0.333	1.17	3.333	1.87	6.333	8.41	9.33	1.63
0.417	1.17	3.417	1.87	6.417	8.41	9.42	1.63
0.500	1.17	3.500	1.87	6.500	8.41	9.50	1.63
0.583	1.17	3.583	1.87	6.583	3.74	9.58	1.63
0.667	1.17	3.667	1.87	6.667	3.74	9.67	1.63
0.750	1.17	3.750	1.87	6.750	3.74	9.75	1.63
0.833	1.17	3.833	1.87	6.833	3.74	9.83	1.63
0.917	1.17	3.917	1.87	6.917	3.74	9.92	1.63
1.000	1.17	4.000	1.87	7.000	3.74	10.00	1.63
1.083	1.17	4.083	2.80	7.083	2.80	10.08	0.93
1.167	1.17	4.167	2.80	7.167	2.80	10.17	0.93
1.250	1.17	4.250	2.80	7.250	2.80	10.25	0.93
1.333	1.17	4.333	2.80	7.333	2.80	10.33	0.93
1.417	1.17	4.417	2.80	7.417	2.80	10.42	0.93
1.500	1.17	4.500	2.80	7.500	2.80	10.50	0.93
1.583	1.17	4.583	3.74	7.583	2.80	10.58	0.93
1.667	1.17	4.667	3.74	7.667	2.80	10.67	0.93
1.750	1.17	4.750	3.74	7.750	2.80	10.75	0.93
1.833	1.17	4.833	3.74	7.833	2.80	10.83	0.93
1.917	1.17	4.917	3.74	7.917	2.80	10.92	0.93
2.000	1.17	5.000	3.74	8.000	2.80	11.00	0.93
2.083	1.40	5.083	5.60	8.083	1.63	11.08	0.93
2.167	1.40	5.167	5.60	8.167	1.63	11.17	0.93
2.250	1.40	5.250	5.60	8.250	1.63	11.25	0.93
2.333	1.40	5.333	5.60	8.333	1.63	11.33	0.93
2.417	1.40	5.417	5.60	8.417	1.63	11.42	0.93
2.500	1.40	5.500	5.60	8.500	1.63	11.50	0.93
2.583	1.40	5.583	22.42	8.583	1.63	11.58	0.93
2.667	1.40	5.667	22.42	8.667	1.63	11.67	0.93
2.750	1.40	5.750	22.42	8.750	1.63	11.75	0.93
2.833	1.40	5.833	61.64	8.833	1.63	11.83	0.93
2.917	1.40	5.917	61.64	8.917	1.63	11.92	0.93
3.000	1.40	6.000	61.64	9.000	1.63	12.00	0.93

Unit Hyd Qpeak (cms)= 0.174

PEAK FLOW (cms)= 0.024 (i)
TIME TO PEAK (hrs)= 6.083
RUNOFF VOLUME (mm)= 9.403
TOTAL RAINFALL (mm)= 46.700
RUNOFF COEFFICIENT = 0.201

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

CALIB STANDHYD (0001) | ID= 1 DT=15.0 min	Area (ha)= 26.52 | Total Imp(%)= 61.00 Dir. Conn.(%)= 45.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	16.18	10.34
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	1.00	2.00
Length	(m)=	420.48	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 15.0 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
0.250	1.17	3.250	1.87	6.250	8.41	9.25	1.63
0.500	1.17	3.500	1.87	6.500	8.41	9.50	1.63
0.750	1.17	3.750	1.87	6.750	3.74	9.75	1.63
1.000	1.17	4.000	1.87	7.000	3.74	10.00	1.63
1.250	1.17	4.250	2.80	7.250	2.80	10.25	0.93
1.500	1.17	4.500	2.80	7.500	2.80	10.50	0.93
1.750	1.17	4.750	3.74	7.750	2.80	10.75	0.93
2.000	1.17	5.000	3.74	8.000	2.80	11.00	0.93
2.250	1.40	5.250	5.60	8.250	1.63	11.25	0.93
2.500	1.40	5.500	5.60	8.500	1.63	11.50	0.93
2.750	1.40	5.750	22.42	8.750	1.63	11.75	0.93
3.000	1.40	6.000	61.64	9.000	1.63	12.00	0.93

```
     Max.Eff.Inten.(mm/hr)=      61.64        29.82
               over (min)        15.00        30.00
     Storage Coeff.  (min)=       7.34 (ii)   18.79 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=       0.10         0.05
                                                        *TOTALS*
     PEAK FLOW       (cms)=       1.87         0.45        2.148 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25         6.00
     RUNOFF VOLUME    (mm)=      45.70        14.17        28.36
     TOTAL RAINFALL   (mm)=      46.70        46.70        46.70
     RUNOFF COEFFICIENT   =       0.98         0.30         0.61

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=  15.59
|ID= 1 DT=15.0 min |   Total Imp(%)=  69.00   Dir. Conn.(%)=  48.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      10.76         4.83
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     322.39        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      61.64        40.26
               over (min)        15.00        30.00
     Storage Coeff.  (min)=       6.26 (ii)   16.41 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=       0.10         0.05
                                                        *TOTALS*
     PEAK FLOW       (cms)=       1.20         0.30        1.395 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25         6.00
     RUNOFF VOLUME    (mm)=      45.70        16.02        30.27
     TOTAL RAINFALL   (mm)=      46.70        46.70        46.70
     RUNOFF COEFFICIENT   =       0.98         0.34         0.65

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0001):    26.52   2.148     6.00    28.36
      + ID2= 2 (  0002):    15.59   1.395     6.00    30.27
        ====================================================
        ID = 3 (  0003):    42.11   3.543     6.00    29.07

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.4950      1.7925
                          0.0330     0.8230   |   0.8740      2.1555
                          0.0800     1.2250   |   1.1350      2.3805
                          0.3070     1.5840   |   1.4190      2.6735

                                    AREA     QPEAK     TPEAK       R.V.
                                    (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)     42.110      3.543      6.00       29.07
   OUTFLOW: ID= 1 (  0004)     42.110      0.064     12.08       26.41

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  1.82
                  TIME SHIFT OF PEAK FLOW          (min)=365.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  1.0917

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0007)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0004):    42.11   0.064    12.08    26.41
      + ID2= 2 (  0008):     0.91   0.024     6.08     9.40
        ====================================================
        ID = 3 (  0007):    43.02   0.065    12.00    26.05

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

       V    V   I    SSSSS  U   U    A    L
       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 5.0\VO2\voin.dat
  Output  filename: C:\Users\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-
45e7-8ee9-3237db384aff\c64c2b19-3853-4da6-876c-485d985458b2\scen
  Summary filename: C:\Users\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-
45e7-8ee9-3237db384aff\c64c2b19-3853-4da6-876c-485d985458b2\scen
```

DATE: 03-23-2020 TIME: 10:57:12

USER:

COMMENTS: _____

****
** SIMULATION NUMBER: 0 **
****

READ STORM	Filename: C:\Users\nkamran\AppData\Local\Temp\635f07bc-721f-4fb1-bba8-c37fffe39f73\035e7869
Ptotal= 64.30 mm	Comments: FIVE YR 12 HOUR SCS STORM WITH A 15 MIN

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.25	1.61	3.25	2.57	6.25	11.57	9.25	2.25
0.50	1.61	3.50	2.57	6.50	11.57	9.50	2.25
0.75	1.61	3.75	2.57	6.75	5.14	9.75	2.25
1.00	1.61	4.00	2.57	7.00	5.14	10.00	2.25
1.25	1.61	4.25	3.86	7.25	3.86	10.25	1.29
1.50	1.61	4.50	3.86	7.50	3.86	10.50	1.29
1.75	1.61	4.75	5.14	7.75	3.86	10.75	1.29
2.00	1.61	5.00	5.14	8.00	3.86	11.00	1.29
2.25	1.93	5.25	7.72	8.25	2.25	11.25	1.29
2.50	1.93	5.50	7.72	8.50	2.25	11.50	1.29
2.75	1.93	5.75	30.86	8.75	2.25	11.75	1.29
3.00	1.93	6.00	84.88	9.00	2.25	12.00	1.29

CALIB	
NASHYD (0008)	Area (ha)= 0.91 Curve Number (CN)= 64.0
ID= 1 DT= 5.0 min	Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 0.20

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	1.61	3.083	2.57	6.083	11.57	9.08	2.25
0.167	1.61	3.167	2.57	6.167	11.57	9.17	2.25
0.250	1.61	3.250	2.57	6.250	11.57	9.25	2.25
0.333	1.61	3.333	2.57	6.333	11.57	9.33	2.25
0.417	1.61	3.417	2.57	6.417	11.57	9.42	2.25
0.500	1.61	3.500	2.57	6.500	11.57	9.50	2.25
0.583	1.61	3.583	2.57	6.583	5.14	9.58	2.25
0.667	1.61	3.667	2.57	6.667	5.14	9.67	2.25
0.750	1.61	3.750	2.57	6.750	5.14	9.75	2.25
0.833	1.61	3.833	2.57	6.833	5.14	9.83	2.25
0.917	1.61	3.917	2.57	6.917	5.14	9.92	2.25
1.000	1.61	4.000	2.57	7.000	5.14	10.00	2.25
1.083	1.61	4.083	3.86	7.083	3.86	10.08	1.29
1.167	1.61	4.167	3.86	7.167	3.86	10.17	1.29
1.250	1.61	4.250	3.86	7.250	3.86	10.25	1.29
1.333	1.61	4.333	3.86	7.333	3.86	10.33	1.29
1.417	1.61	4.417	3.86	7.417	3.86	10.42	1.29
1.500	1.61	4.500	3.86	7.500	3.86	10.50	1.29
1.583	1.61	4.583	5.14	7.583	3.86	10.58	1.29
1.667	1.61	4.667	5.14	7.667	3.86	10.67	1.29
1.750	1.61	4.750	5.14	7.750	3.86	10.75	1.29
1.833	1.61	4.833	5.14	7.833	3.86	10.83	1.29
1.917	1.61	4.917	5.14	7.917	3.86	10.92	1.29
2.000	1.61	5.000	5.14	8.000	3.86	11.00	1.29
2.083	1.93	5.083	7.72	8.083	2.25	11.08	1.29
2.167	1.93	5.167	7.72	8.167	2.25	11.17	1.29
2.250	1.93	5.250	7.72	8.250	2.25	11.25	1.29
2.333	1.93	5.333	7.72	8.333	2.25	11.33	1.29
2.417	1.93	5.417	7.72	8.417	2.25	11.42	1.29
2.500	1.93	5.500	7.72	8.500	2.25	11.50	1.29
2.583	1.93	5.583	30.86	8.583	2.25	11.58	1.29
2.667	1.93	5.667	30.86	8.667	2.25	11.67	1.29
2.750	1.93	5.750	30.86	8.750	2.25	11.75	1.29
2.833	1.93	5.833	84.88	8.833	2.25	11.83	1.29
2.917	1.93	5.917	84.88	8.917	2.25	11.92	1.29
3.000	1.93	6.000	84.87	9.000	2.25	12.00	1.29

Unit Hyd Qpeak (cms)= 0.174

PEAK FLOW (cms)= 0.045 (i)
TIME TO PEAK (hrs)= 6.083
RUNOFF VOLUME (mm)= 17.360
TOTAL RAINFALL (mm)= 64.300
RUNOFF COEFFICIENT = 0.270

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

CALIB	
STANDHYD (0001)	Area (ha)= 26.52
ID= 1 DT=15.0 min	Total Imp(%)= 61.00 Dir. Conn.(%)= 45.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	16.18	10.34
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	1.00	2.00
Length	(m)=	420.48	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 15.0 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
0.250	1.61	3.250	2.57	6.250	11.57	9.25	2.25
0.500	1.61	3.500	2.57	6.500	11.57	9.50	2.25
0.750	1.61	3.750	2.57	6.750	5.14	9.75	2.25
1.000	1.61	4.000	2.57	7.000	5.14	10.00	2.25
1.250	1.61	4.250	3.86	7.250	3.86	10.25	1.29
1.500	1.61	4.500	3.86	7.500	3.86	10.50	1.29
1.750	1.61	4.750	5.14	7.750	3.86	10.75	1.29

```
               2.000    1.61 | 5.000    5.14 | 8.000    3.86 | 11.00    1.29
               2.250    1.93 | 5.250    7.72 | 8.250    2.25 | 11.25    1.29
               2.500    1.93 | 5.500    7.72 | 8.500    2.25 | 11.50    1.29
               2.750    1.93 | 5.750   30.86 | 8.750    2.25 | 11.75    1.29
               3.000    1.93 | 6.000   84.88 | 9.000    2.25 | 12.00    1.29

     Max.Eff.Inten.(mm/hr)=      84.88        51.51
               over (min)        15.00        30.00
     Storage Coeff.  (min)=       6.46 (ii)   15.66 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=       0.10         0.05
                                                        *TOTALS*
     PEAK FLOW       (cms)=       2.63         0.83        3.168 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25         6.00
     RUNOFF VOLUME    (mm)=      63.30        24.30        41.85
     TOTAL RAINFALL   (mm)=      64.30        64.30        64.30
     RUNOFF COEFFICIENT   =       0.98         0.38         0.65

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=  15.59
|ID= 1 DT=15.0 min |   Total Imp(%)=  69.00   Dir. Conn.(%)=  48.00
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      10.76         4.83
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     322.39        40.00
     Mannings n             =    0.013        0.250

     Max.Eff.Inten.(mm/hr)=      84.88        68.45
               over (min)        15.00        15.00
     Storage Coeff.  (min)=       5.51 (ii)   13.72 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=       0.11         0.08
                                                        *TOTALS*
     PEAK FLOW       (cms)=       1.69         0.67        2.356 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.00         6.00
     RUNOFF VOLUME    (mm)=      63.30        27.06        44.45
     TOTAL RAINFALL   (mm)=      64.30        64.30        64.30
     RUNOFF COEFFICIENT   =       0.98         0.42         0.69

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0001):    26.52   3.168     6.00    41.85
     + ID2= 2 (  0002):    15.59   2.356     6.00    44.45
       ================================================
       ID = 3 (  0003):    42.11   5.524     6.00    42.81

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000    |   0.4950      1.7925
                         0.0330     0.8230    |   0.8740      2.1555
                         0.0800     1.2250    |   1.1350      2.3805
                         0.3070     1.5840    |   1.4190      2.6735

                                   AREA     QPEAK     TPEAK       R.V.
                                   (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)     42.110      5.524      6.00      42.81
   OUTFLOW: ID= 1 (  0004)     42.110      0.214      8.75      39.81

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  3.87
                  TIME SHIFT OF PEAK FLOW          (min)=165.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  1.4362

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0007)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0004):    42.11   0.214     8.75    39.81
     + ID2= 2 (  0008):     0.91   0.045     6.08    17.36
       ================================================
       ID = 3 (  0007):    43.02   0.216     8.75    39.34

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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================================================================================
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       V    V   I    SSSSS  U   U    A    L
       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 5.0\VO2\voin.dat
  Output  filename: C:\Users\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-
45e7-8ee9-3237db384aff\89a590ff-23a0-451f-9350-0d66f3f1e9d1\scen
  Summary filename: C:\Users\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-
45e7-8ee9-3237db384aff\89a590ff-23a0-451f-9350-0d66f3f1e9d1\scen


DATE: 03-23-2020                          TIME: 10:57:12

USER:



COMMENTS: _____________________________________________________________

--------------------------------------------------------------------------------
----------------------------
  ****************************
  ** SIMULATION NUMBER:   0 **
  ****************************


--------------------
|    READ STORM    |    Filename: C:\Users\nkamran\AppD
|                  |              ata\Local\Temp\
|                  |              635f07bc-721f-4fb1-bba8-c37fffe39f73\3771488e
| Ptotal= 76.00 mm |    Comments: TEN YR 12 HOUR SCS STORM  WITH A 15 MINU
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.25	1.90	3.25	3.04	6.25	13.68	9.25	2.66
0.50	1.90	3.50	3.04	6.50	13.68	9.50	2.66
0.75	1.90	3.75	3.04	6.75	6.08	9.75	2.66
1.00	1.90	4.00	3.04	7.00	6.08	10.00	2.66
1.25	1.90	4.25	4.56	7.25	4.56	10.25	1.52
1.50	1.90	4.50	4.56	7.50	4.56	10.50	1.52
1.75	1.90	4.75	6.08	7.75	4.56	10.75	1.52
2.00	1.90	5.00	6.08	8.00	4.56	11.00	1.52
2.25	2.28	5.25	9.12	8.25	2.66	11.25	1.52
2.50	2.28	5.50	9.12	8.50	2.66	11.50	1.52
2.75	2.28	5.75	36.48	8.75	2.66	11.75	1.52
3.00	2.28	6.00	100.32	9.00	2.66	12.00	1.52

```
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0008)|   Area    (ha)=   0.91   Curve Number   (CN)= 64.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20

        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	1.90	3.083	3.04	6.083	13.68	9.08	2.66
0.167	1.90	3.167	3.04	6.167	13.68	9.17	2.66
0.250	1.90	3.250	3.04	6.250	13.68	9.25	2.66
0.333	1.90	3.333	3.04	6.333	13.68	9.33	2.66
0.417	1.90	3.417	3.04	6.417	13.68	9.42	2.66
0.500	1.90	3.500	3.04	6.500	13.68	9.50	2.66
0.583	1.90	3.583	3.04	6.583	6.08	9.58	2.66
0.667	1.90	3.667	3.04	6.667	6.08	9.67	2.66
0.750	1.90	3.750	3.04	6.750	6.08	9.75	2.66
0.833	1.90	3.833	3.04	6.833	6.08	9.83	2.66
0.917	1.90	3.917	3.04	6.917	6.08	9.92	2.66
1.000	1.90	4.000	3.04	7.000	6.08	10.00	2.66
1.083	1.90	4.083	4.56	7.083	4.56	10.08	1.52
1.167	1.90	4.167	4.56	7.167	4.56	10.17	1.52
1.250	1.90	4.250	4.56	7.250	4.56	10.25	1.52
1.333	1.90	4.333	4.56	7.333	4.56	10.33	1.52
1.417	1.90	4.417	4.56	7.417	4.56	10.42	1.52
1.500	1.90	4.500	4.56	7.500	4.56	10.50	1.52
1.583	1.90	4.583	6.08	7.583	4.56	10.58	1.52
1.667	1.90	4.667	6.08	7.667	4.56	10.67	1.52
1.750	1.90	4.750	6.08	7.750	4.56	10.75	1.52
1.833	1.90	4.833	6.08	7.833	4.56	10.83	1.52
1.917	1.90	4.917	6.08	7.917	4.56	10.92	1.52
2.000	1.90	5.000	6.08	8.000	4.56	11.00	1.52
2.083	2.28	5.083	9.12	8.083	2.66	11.08	1.52
2.167	2.28	5.167	9.12	8.167	2.66	11.17	1.52
2.250	2.28	5.250	9.12	8.250	2.66	11.25	1.52
2.333	2.28	5.333	9.12	8.333	2.66	11.33	1.52
2.417	2.28	5.417	9.12	8.417	2.66	11.42	1.52
2.500	2.28	5.500	9.12	8.500	2.66	11.50	1.52
2.583	2.28	5.583	36.48	8.583	2.66	11.58	1.52
2.667	2.28	5.667	36.48	8.667	2.66	11.67	1.52
2.750	2.28	5.750	36.48	8.750	2.66	11.75	1.52
2.833	2.28	5.833	100.32	8.833	2.66	11.83	1.52
2.917	2.28	5.917	100.32	8.917	2.66	11.92	1.52
3.000	2.28	6.000	100.32	9.000	2.66	12.00	1.52

```
     Unit Hyd Qpeak  (cms)=   0.174

     PEAK FLOW       (cms)=   0.062 (i)
     TIME TO PEAK    (hrs)=   6.083
     RUNOFF VOLUME    (mm)=  23.524
     TOTAL RAINFALL   (mm)=  76.000
     RUNOFF COEFFICIENT   =   0.310

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0001)|   Area    (ha)=  26.52
|ID= 1 DT=15.0 min |   Total Imp(%)=  61.00   Dir. Conn.(%)=  45.00
--------------------

                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      16.18         10.34
     Dep. Storage     (mm)=       1.00          1.50
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     420.48         40.00
     Mannings n           =      0.013         0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO  15.0 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
0.250	1.90	3.250	3.04	6.250	13.68	9.25	2.66

```
                0.500    1.90 | 3.500    3.04 | 6.500   13.68 |  9.50    2.66
                0.750    1.90 | 3.750    3.04 | 6.750    6.08 |  9.75    2.66
                1.000    1.90 | 4.000    3.04 | 7.000    6.08 | 10.00    2.66
                1.250    1.90 | 4.250    4.56 | 7.250    4.56 | 10.25    1.52
                1.500    1.90 | 4.500    4.56 | 7.500    4.56 | 10.50    1.52
                1.750    1.90 | 4.750    6.08 | 7.750    4.56 | 10.75    1.52
                2.000    1.90 | 5.000    6.08 | 8.000    4.56 | 11.00    1.52
                2.250    2.28 | 5.250    9.12 | 8.250    2.66 | 11.25    1.52
                2.500    2.28 | 5.500    9.12 | 8.500    2.66 | 11.50    1.52
                2.750    2.28 | 5.750   36.48 | 8.750    2.66 | 11.75    1.52
                3.000    2.28 | 6.000  100.32 | 9.000    2.66 | 12.00    1.52

     Max.Eff.Inten.(mm/hr)=     100.32        67.76
               over (min)       15.00        15.00
     Storage Coeff.  (min)=      6.04 (ii)   14.29 (ii)
     Unit Hyd. Tpeak (min)=     15.00        15.00
     Unit Hyd. peak  (cms)=      0.10         0.07
                                                        *TOTALS*
     PEAK FLOW       (cms)=      3.14         1.39         4.530 (iii)
     TIME TO PEAK    (hrs)=      6.00         6.00          6.00
     RUNOFF VOLUME    (mm)=     75.00        31.86         51.27
     TOTAL RAINFALL   (mm)=     76.00        76.00         76.00
     RUNOFF COEFFICIENT   =      0.99         0.42          0.67

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=  15.59
|ID= 1 DT=15.0 min |   Total Imp(%)=  69.00   Dir. Conn.(%)=  48.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=     10.76         4.83
     Dep. Storage     (mm)=      1.00         1.50
     Average Slope     (%)=      1.00         2.00
     Length            (m)=    322.39        40.00
     Mannings n           =     0.013        0.250

     Max.Eff.Inten.(mm/hr)=     100.32        89.28
               over (min)       15.00        15.00
     Storage Coeff.  (min)=      5.15 (ii)   12.54 (ii)
     Unit Hyd. Tpeak (min)=     15.00        15.00
     Unit Hyd. peak  (cms)=      0.11         0.08
                                                        *TOTALS*
     PEAK FLOW       (cms)=      2.01         0.91         2.918 (iii)
     TIME TO PEAK    (hrs)=      6.00         6.00          6.00
     RUNOFF VOLUME    (mm)=     75.00        35.19         54.30
     TOTAL RAINFALL   (mm)=     76.00        76.00         76.00
     RUNOFF COEFFICIENT   =      0.99         0.46          0.71

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.

--------------------------------------------------------------------------------
--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0001):    26.52   4.530     6.00    51.27
     + ID2= 2 (  0002):    15.59   2.918     6.00    54.30
       ================================================
       ID = 3 (  0003):    42.11   7.448     6.00    52.39

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.4950     1.7925
                          0.0330     0.8230   |   0.8740     2.1555
                          0.0800     1.2250   |   1.1350     2.3805
                          0.3070     1.5840   |   1.4190     2.6735

                                    AREA     QPEAK     TPEAK       R.V.
                                    (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)     42.110      7.448      6.00      52.39
   OUTFLOW: ID= 1 (  0004)     42.110      0.376      8.08      49.33

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=  5.05
                    TIME SHIFT OF PEAK FLOW          (min)=125.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  1.6608

--------------------------------------------------------------------------------
--------------------
| ADD HYD  (  0007)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0004):    42.11   0.376     8.08    49.33
     + ID2= 2 (  0008):     0.91   0.062     6.08    23.52
       ================================================
       ID = 3 (  0007):    43.02   0.382     8.08    48.78

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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================================================================================
============================

       V    V   I    SSSSS  U   U    A    L
       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 5.0\VO2\voin.dat
Output filename: C:\Users\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-45e7-8ee9-3237db384aff\c73d8b0b-c7f8-4be8-8848-a3dc749922dc\scen
Summary filename: C:\Users\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-45e7-8ee9-3237db384aff\c73d8b0b-c7f8-4be8-8848-a3dc749922dc\scen

DATE: 03-23-2020 TIME: 10:57:12

USER:

COMMENTS: _____

**** SIMULATION NUMBER: 0 ****

READ STORM	Filename: C:\Users\nkamran\AppData\Local\Temp\635f07bc-721f-4fb1-bba8-c37fffe39f73\081217d4
Ptotal= 90.70 mm	Comments: 25 YR 12 HOUR SCS STORM WITH A 15 MINUT

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.25	2.27	3.25	3.63	6.25	16.33	9.25	3.17
0.50	2.27	3.50	3.63	6.50	16.33	9.50	3.17
0.75	2.27	3.75	3.63	6.75	7.26	9.75	3.17
1.00	2.27	4.00	3.63	7.00	7.26	10.00	3.17
1.25	2.27	4.25	5.44	7.25	5.44	10.25	1.81
1.50	2.27	4.50	5.44	7.50	5.44	10.50	1.81
1.75	2.27	4.75	7.26	7.75	5.44	10.75	1.81
2.00	2.27	5.00	7.26	8.00	5.44	11.00	1.81
2.25	2.72	5.25	10.88	8.25	3.17	11.25	1.81
2.50	2.72	5.50	10.88	8.50	3.17	11.50	1.81
2.75	2.72	5.75	43.54	8.75	3.17	11.75	1.81
3.00	2.72	6.00	119.72	9.00	3.17	12.00	1.81

CALIB					
NASHYD (0008)	Area (ha)=	0.91	Curve Number (CN)=	64.0	
ID= 1 DT= 5.0 min	Ia (mm)=	5.00	# of Linear Res.(N)=	3.00	
	U.H. Tp(hrs)=	0.20			

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	2.27	3.083	3.63	6.083	16.33	9.08	3.17
0.167	2.27	3.167	3.63	6.167	16.33	9.17	3.17
0.250	2.27	3.250	3.63	6.250	16.33	9.25	3.17
0.333	2.27	3.333	3.63	6.333	16.33	9.33	3.17
0.417	2.27	3.417	3.63	6.417	16.33	9.42	3.17
0.500	2.27	3.500	3.63	6.500	16.33	9.50	3.17
0.583	2.27	3.583	3.63	6.583	7.26	9.58	3.17
0.667	2.27	3.667	3.63	6.667	7.26	9.67	3.17
0.750	2.27	3.750	3.63	6.750	7.26	9.75	3.17
0.833	2.27	3.833	3.63	6.833	7.26	9.83	3.17
0.917	2.27	3.917	3.63	6.917	7.26	9.92	3.17
1.000	2.27	4.000	3.63	7.000	7.26	10.00	3.17
1.083	2.27	4.083	5.44	7.083	5.44	10.08	1.81
1.167	2.27	4.167	5.44	7.167	5.44	10.17	1.81
1.250	2.27	4.250	5.44	7.250	5.44	10.25	1.81
1.333	2.27	4.333	5.44	7.333	5.44	10.33	1.81
1.417	2.27	4.417	5.44	7.417	5.44	10.42	1.81
1.500	2.27	4.500	5.44	7.500	5.44	10.50	1.81
1.583	2.27	4.583	7.26	7.583	5.44	10.58	1.81
1.667	2.27	4.667	7.26	7.667	5.44	10.67	1.81
1.750	2.27	4.750	7.26	7.750	5.44	10.75	1.81
1.833	2.27	4.833	7.26	7.833	5.44	10.83	1.81
1.917	2.27	4.917	7.26	7.917	5.44	10.92	1.81
2.000	2.27	5.000	7.26	8.000	5.44	11.00	1.81
2.083	2.72	5.083	10.88	8.083	3.17	11.08	1.81
2.167	2.72	5.167	10.88	8.167	3.17	11.17	1.81
2.250	2.72	5.250	10.88	8.250	3.17	11.25	1.81
2.333	2.72	5.333	10.88	8.333	3.17	11.33	1.81
2.417	2.72	5.417	10.88	8.417	3.17	11.42	1.81
2.500	2.72	5.500	10.88	8.500	3.17	11.50	1.81
2.583	2.72	5.583	43.54	8.583	3.17	11.58	1.81
2.667	2.72	5.667	43.54	8.667	3.17	11.67	1.81
2.750	2.72	5.750	43.54	8.750	3.17	11.75	1.81
2.833	2.72	5.833	119.72	8.833	3.17	11.83	1.81
2.917	2.72	5.917	119.72	8.917	3.17	11.92	1.81
3.000	2.72	6.000	119.72	9.000	3.17	12.00	1.81

Unit Hyd Qpeak (cms)= 0.174

PEAK FLOW (cms)= 0.084 (i)
TIME TO PEAK (hrs)= 6.083
RUNOFF VOLUME (mm)= 32.070
TOTAL RAINFALL (mm)= 90.700
RUNOFF COEFFICIENT = 0.354

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

CALIB					
STANDHYD (0001)	Area (ha)=	26.52			
ID= 1 DT=15.0 min	Total Imp(%)=	61.00	Dir. Conn.(%)=	45.00	

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	16.18	10.34
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	1.00	2.00
Length	(m)=	420.48	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 15.0 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
0.250	2.27	3.250	3.63	6.250	16.33	9.25	3.17
0.500	2.27	3.500	3.63	6.500	16.33	9.50	3.17
0.750	2.27	3.750	3.63	6.750	7.26	9.75	3.17
1.000	2.27	4.000	3.63	7.000	7.26	10.00	3.17
1.250	2.27	4.250	5.44	7.250	5.44	10.25	1.81
1.500	2.27	4.500	5.44	7.500	5.44	10.50	1.81
1.750	2.27	4.750	7.26	7.750	5.44	10.75	1.81
2.000	2.27	5.000	7.26	8.000	5.44	11.00	1.81
2.250	2.72	5.250	10.88	8.250	3.17	11.25	1.81
2.500	2.72	5.500	10.88	8.500	3.17	11.50	1.81
2.750	2.72	5.750	43.54	8.750	3.17	11.75	1.81
3.000	2.72	6.000	119.72	9.000	3.17	12.00	1.81

			TOTALS
Max.Eff.Inten.(mm/hr)=	119.72	89.74	
over (min)	15.00	15.00	
Storage Coeff. (min)=	5.63 (ii)	13.00 (ii)	
Unit Hyd. Tpeak (min)=	15.00	15.00	
Unit Hyd. peak (cms)=	0.11	0.08	
PEAK FLOW (cms)=	3.79	1.92	5.709 (iii)
TIME TO PEAK (hrs)=	6.00	6.00	6.00
RUNOFF VOLUME (mm)=	89.70	42.08	63.51
TOTAL RAINFALL (mm)=	90.70	90.70	90.70
RUNOFF COEFFICIENT =	0.99	0.46	0.70

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 64.0 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.

CALIB	
STANDHYD (0002)	Area (ha)= 15.59
ID= 1 DT=15.0 min	Total Imp(%)= 69.00 Dir. Conn.(%)= 48.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	10.76	4.83	
Dep. Storage	(mm)=	1.00	1.50	
Average Slope	(%)=	1.00	2.00	
Length	(m)=	322.39	40.00	
Mannings n	=	0.013	0.250	
Max.Eff.Inten.(mm/hr)=		119.72	117.16	
over (min)		15.00	15.00	
Storage Coeff. (min)=		4.80 (ii)	11.42 (ii)	
Unit Hyd. Tpeak (min)=		15.00	15.00	
Unit Hyd. peak (cms)=		0.11	0.08	
PEAK FLOW (cms)=		2.42	1.24	3.655 (iii)
TIME TO PEAK (hrs)=		6.00	6.00	6.00
RUNOFF VOLUME (mm)=		89.70	46.09	67.02
TOTAL RAINFALL (mm)=		90.70	90.70	90.70
RUNOFF COEFFICIENT =		0.99	0.51	0.74

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 64.0 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.

ADD HYD (0003)		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3	ID1= 1 (0001):	26.52	5.709	6.00	63.51
	+ ID2= 2 (0002):	15.59	3.655	6.00	67.02
	ID = 3 (0003):	42.11	9.364	6.00	64.81

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR(0004)					
IN= 2---> OUT= 1					
DT= 5.0 min	OUTFLOW (cms)	STORAGE (ha.m.)		OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000		0.4950	1.7925
	0.0330	0.8230		0.8740	2.1555
	0.0800	1.2250		1.1350	2.3805
	0.3070	1.5840		1.4190	2.6735

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0003)	42.110	9.364	6.00	64.81
OUTFLOW: ID= 1 (0004)	42.110	0.648	7.17	61.70

PEAK FLOW REDUCTION [Qout/Qin](%)= 6.92
TIME SHIFT OF PEAK FLOW (min)= 70.00
MAXIMUM STORAGE USED (ha.m.)= 1.9396

ADD HYD (0007)		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3	ID1= 1 (0004):	42.11	0.648	7.17	61.70
	+ ID2= 2 (0008):	0.91	0.084	6.08	32.07
	ID = 3 (0007):	43.02	0.658	7.08	61.07

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

FINISH

```
       V    V   I    SSSSS  U   U    A    L
       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 5.0\VO2\voin.dat
Output filename: C:\Users\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-45e7-8ee9-3237db384aff\5828eee9-3ea7-46c5-a482-322861805754\scen
Summary filename: C:\Users\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-45e7-8ee9-3237db384aff\5828eee9-3ea7-46c5-a482-322861805754\scen

DATE: 03-23-2020 TIME: 10:57:12

USER:

COMMENTS: _____

** SIMULATION NUMBER: 0 **

READ STORM	Filename: C:\Users\nkamran\AppData\Local\Temp\635f07bc-721f-4fb1-bba8-c37fffe39f73\2e6fd115
Ptotal=101.70 mm	Comments: 50 YR 12 HOUR SCS STORM WITH A 15 MINUT

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.25	2.54	3.25	4.07	6.25	18.31	9.25	3.56
0.50	2.54	3.50	4.07	6.50	18.31	9.50	3.56
0.75	2.54	3.75	4.07	6.75	8.14	9.75	3.56
1.00	2.54	4.00	4.07	7.00	8.14	10.00	3.56
1.25	2.54	4.25	6.10	7.25	6.10	10.25	2.03
1.50	2.54	4.50	6.10	7.50	6.10	10.50	2.03
1.75	2.54	4.75	8.14	7.75	6.10	10.75	2.03
2.00	2.54	5.00	8.14	8.00	6.10	11.00	2.03
2.25	3.05	5.25	12.20	8.25	3.56	11.25	2.03
2.50	3.05	5.50	12.20	8.50	3.56	11.50	2.03
2.75	3.05	5.75	48.82	8.75	3.56	11.75	2.03
3.00	3.05	6.00	134.24	9.00	3.56	12.00	2.03

CALIB	
NASHYD (0008)	Area (ha)= 0.91 Curve Number (CN)= 64.0
ID= 1 DT= 5.0 min	Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 0.20

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	2.54	3.083	4.07	6.083	18.31	9.08	3.56
0.167	2.54	3.167	4.07	6.167	18.31	9.17	3.56
0.250	2.54	3.250	4.07	6.250	18.31	9.25	3.56
0.333	2.54	3.333	4.07	6.333	18.31	9.33	3.56
0.417	2.54	3.417	4.07	6.417	18.31	9.42	3.56
0.500	2.54	3.500	4.07	6.500	18.31	9.50	3.56
0.583	2.54	3.583	4.07	6.583	8.14	9.58	3.56
0.667	2.54	3.667	4.07	6.667	8.14	9.67	3.56
0.750	2.54	3.750	4.07	6.750	8.14	9.75	3.56
0.833	2.54	3.833	4.07	6.833	8.14	9.83	3.56
0.917	2.54	3.917	4.07	6.917	8.14	9.92	3.56
1.000	2.54	4.000	4.07	7.000	8.14	10.00	3.56
1.083	2.54	4.083	6.10	7.083	6.10	10.08	2.03
1.167	2.54	4.167	6.10	7.167	6.10	10.17	2.03
1.250	2.54	4.250	6.10	7.250	6.10	10.25	2.03
1.333	2.54	4.333	6.10	7.333	6.10	10.33	2.03
1.417	2.54	4.417	6.10	7.417	6.10	10.42	2.03
1.500	2.54	4.500	6.10	7.500	6.10	10.50	2.03
1.583	2.54	4.583	8.14	7.583	6.10	10.58	2.03
1.667	2.54	4.667	8.14	7.667	6.10	10.67	2.03
1.750	2.54	4.750	8.14	7.750	6.10	10.75	2.03
1.833	2.54	4.833	8.14	7.833	6.10	10.83	2.03
1.917	2.54	4.917	8.14	7.917	6.10	10.92	2.03
2.000	2.54	5.000	8.14	8.000	6.10	11.00	2.03
2.083	3.05	5.083	12.20	8.083	3.56	11.08	2.03
2.167	3.05	5.167	12.20	8.167	3.56	11.17	2.03
2.250	3.05	5.250	12.20	8.250	3.56	11.25	2.03
2.333	3.05	5.333	12.20	8.333	3.56	11.33	2.03
2.417	3.05	5.417	12.20	8.417	3.56	11.42	2.03
2.500	3.05	5.500	12.20	8.500	3.56	11.50	2.03
2.583	3.05	5.583	48.82	8.583	3.56	11.58	2.03
2.667	3.05	5.667	48.82	8.667	3.56	11.67	2.03
2.750	3.05	5.750	48.82	8.750	3.56	11.75	2.03
2.833	3.05	5.833	134.24	8.833	3.56	11.83	2.03
2.917	3.05	5.917	134.24	8.917	3.56	11.92	2.03
3.000	3.05	6.000	134.24	9.000	3.56	12.00	2.03

Unit Hyd Qpeak (cms)= 0.174

PEAK FLOW (cms)= 0.103 (i)
TIME TO PEAK (hrs)= 6.083
RUNOFF VOLUME (mm)= 38.957
TOTAL RAINFALL (mm)= 101.700
RUNOFF COEFFICIENT = 0.383

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

CALIB

```
| STANDHYD (  0001)|   Area    (ha)=  26.52
|ID= 1 DT=15.0 min |   Total Imp(%)=  61.00   Dir. Conn.(%)=  45.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=     16.18         10.34
     Dep. Storage     (mm)=      1.00          1.50
     Average Slope     (%)=      1.00          2.00
     Length            (m)=    420.48         40.00
     Mannings n             =    0.013         0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO  15.0 MIN. TIME STEP.

                          ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.250    2.54 | 3.250    4.07 | 6.250   18.31 |  9.25    3.56
               0.500    2.54 | 3.500    4.07 | 6.500   18.31 |  9.50    3.56
               0.750    2.54 | 3.750    4.07 | 6.750    8.14 |  9.75    3.56
               1.000    2.54 | 4.000    4.07 | 7.000    8.14 | 10.00    3.56
               1.250    2.54 | 4.250    6.10 | 7.250    6.10 | 10.25    2.03
               1.500    2.54 | 4.500    6.10 | 7.500    6.10 | 10.50    2.03
               1.750    2.54 | 4.750    8.14 | 7.750    6.10 | 10.75    2.03
               2.000    2.54 | 5.000    8.14 | 8.000    6.10 | 11.00    2.03
               2.250    3.05 | 5.250   12.20 | 8.250    3.56 | 11.25    2.03
               2.500    3.05 | 5.500   12.20 | 8.500    3.56 | 11.50    2.03
               2.750    3.05 | 5.750   48.82 | 8.750    3.56 | 11.75    2.03
               3.000    3.05 | 6.000  134.24 | 9.000    3.56 | 12.00    2.03

     Max.Eff.Inten.(mm/hr)=    134.24       107.11
               over (min)      15.00        15.00
     Storage Coeff.  (min)=     5.38 (ii)   12.24 (ii)
     Unit Hyd. Tpeak (min)=    15.00        15.00
     Unit Hyd. peak  (cms)=     0.11         0.08
                                                      *TOTALS*
     PEAK FLOW       (cms)=     4.27         2.35        6.626 (iii)
     TIME TO PEAK    (hrs)=     6.00         6.00        6.00
     RUNOFF VOLUME    (mm)=   100.70        50.15       72.90
     TOTAL RAINFALL   (mm)=   101.70       101.70      101.70
     RUNOFF COEFFICIENT   =     0.99         0.49        0.72

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=  15.59
|ID= 1 DT=15.0 min |   Total Imp(%)=  69.00   Dir. Conn.(%)=  48.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=     10.76         4.83
     Dep. Storage     (mm)=      1.00         1.50
     Average Slope     (%)=      1.00         2.00
     Length            (m)=    322.39        40.00
     Mannings n             =    0.013        0.250

     Max.Eff.Inten.(mm/hr)=    134.24       138.99
               over (min)      15.00        15.00
     Storage Coeff.  (min)=     4.58 (ii)   10.77 (ii)
     Unit Hyd. Tpeak (min)=    15.00        15.00
     Unit Hyd. peak  (cms)=     0.11         0.09
                                                      *TOTALS*
     PEAK FLOW       (cms)=     2.72         1.50        4.225 (iii)
     TIME TO PEAK    (hrs)=     6.00         6.00        6.00
     RUNOFF VOLUME    (mm)=   100.70        54.64       76.75
     TOTAL RAINFALL   (mm)=   101.70       101.70      101.70
     RUNOFF COEFFICIENT   =     0.99         0.54        0.75

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.

--------------------------------------------------------------------------------
--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0001):    26.52   6.626     6.00    72.90
     + ID2= 2 (  0002):    15.59   4.225     6.00    76.75
       ==========================================================
       ID = 3 (  0003):    42.11  10.851     6.00    74.32

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000    |   0.4950     1.7925
                         0.0330     0.8230    |   0.8740     2.1555
                         0.0800     1.2250    |   1.1350     2.3805
                         0.3070     1.5840    |   1.4190     2.6735

                                   AREA     QPEAK     TPEAK       R.V.
                                   (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)     42.110    10.851      6.00       74.32
   OUTFLOW: ID= 1 (  0004)     42.110     0.886      6.92       71.19

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  8.16
                  TIME SHIFT OF PEAK FLOW          (min)= 55.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  2.1658

--------------------------------------------------------------------------------
--------------------
| ADD HYD  (  0007)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0004):    42.11   0.886     6.92    71.19
     + ID2= 2 (  0008):     0.91   0.103     6.08    38.96
       ==========================================================
       ID = 3 (  0007):    43.02   0.900     6.83    70.51
```

```
     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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       V    V   I    SSSSS  U   U    A    L
       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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45e7-8ee9-3237db384aff\7a62a684-eb1c-4a70-9d44-4845696b373b\scen


DATE: 03-23-2020                          TIME: 10:57:12

USER:



COMMENTS: _____________________________________________________________


--------------------------------------------------------------------------------
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  ****************************
  ** SIMULATION NUMBER:   0 **
  ****************************


--------------------
|    READ STORM    |    Filename: C:\Users\nkamran\AppD
|                  |              ata\Local\Temp\
|                  |              635f07bc-721f-4fb1-bba8-c37fffe39f73\24556f52
| Ptotal=112.50 mm |    Comments: 100 YR 12 HOUR SCS STORM  WITH A 15 MINU
--------------------
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.25    2.81 |  3.25    4.50 |  6.25   20.25 |  9.25    3.94
                0.50    2.81 |  3.50    4.50 |  6.50   20.25 |  9.50    3.94
                0.75    2.81 |  3.75    4.50 |  6.75    9.00 |  9.75    3.94
                1.00    2.81 |  4.00    4.50 |  7.00    9.00 | 10.00    3.94
                1.25    2.81 |  4.25    6.75 |  7.25    6.75 | 10.25    2.25
                1.50    2.81 |  4.50    6.75 |  7.50    6.75 | 10.50    2.25
                1.75    2.81 |  4.75    9.00 |  7.75    6.75 | 10.75    2.25
                2.00    2.81 |  5.00    9.00 |  8.00    6.75 | 11.00    2.25
                2.25    3.37 |  5.25   13.50 |  8.25    3.94 | 11.25    2.25
                2.50    3.37 |  5.50   13.50 |  8.50    3.94 | 11.50    2.25
                2.75    3.37 |  5.75   54.00 |  8.75    3.94 | 11.75    2.25
                3.00    3.37 |  6.00  148.50 |  9.00    3.94 | 12.00    2.25

--------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0008)|   Area    (ha)=   0.91   Curve Number   (CN)= 64.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20

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


                              ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    2.81 | 3.083    4.50 | 6.083   20.25 |  9.08    3.94
               0.167    2.81 | 3.167    4.50 | 6.167   20.25 |  9.17    3.94
               0.250    2.81 | 3.250    4.50 | 6.250   20.25 |  9.25    3.94
               0.333    2.81 | 3.333    4.50 | 6.333   20.25 |  9.33    3.94
               0.417    2.81 | 3.417    4.50 | 6.417   20.25 |  9.42    3.94
               0.500    2.81 | 3.500    4.50 | 6.500   20.25 |  9.50    3.94
               0.583    2.81 | 3.583    4.50 | 6.583    9.00 |  9.58    3.94
               0.667    2.81 | 3.667    4.50 | 6.667    9.00 |  9.67    3.94
               0.750    2.81 | 3.750    4.50 | 6.750    9.00 |  9.75    3.94
               0.833    2.81 | 3.833    4.50 | 6.833    9.00 |  9.83    3.94
               0.917    2.81 | 3.917    4.50 | 6.917    9.00 |  9.92    3.94
               1.000    2.81 | 4.000    4.50 | 7.000    9.00 | 10.00    3.94
               1.083    2.81 | 4.083    6.75 | 7.083    6.75 | 10.08    2.25
               1.167    2.81 | 4.167    6.75 | 7.167    6.75 | 10.17    2.25
               1.250    2.81 | 4.250    6.75 | 7.250    6.75 | 10.25    2.25
               1.333    2.81 | 4.333    6.75 | 7.333    6.75 | 10.33    2.25
               1.417    2.81 | 4.417    6.75 | 7.417    6.75 | 10.42    2.25
               1.500    2.81 | 4.500    6.75 | 7.500    6.75 | 10.50    2.25
               1.583    2.81 | 4.583    9.00 | 7.583    6.75 | 10.58    2.25
               1.667    2.81 | 4.667    9.00 | 7.667    6.75 | 10.67    2.25
               1.750    2.81 | 4.750    9.00 | 7.750    6.75 | 10.75    2.25
               1.833    2.81 | 4.833    9.00 | 7.833    6.75 | 10.83    2.25
               1.917    2.81 | 4.917    9.00 | 7.917    6.75 | 10.92    2.25
               2.000    2.81 | 5.000    9.00 | 8.000    6.75 | 11.00    2.25
               2.083    3.37 | 5.083   13.50 | 8.083    3.94 | 11.08    2.25
               2.167    3.37 | 5.167   13.50 | 8.167    3.94 | 11.17    2.25
               2.250    3.37 | 5.250   13.50 | 8.250    3.94 | 11.25    2.25
               2.333    3.37 | 5.333   13.50 | 8.333    3.94 | 11.33    2.25
               2.417    3.37 | 5.417   13.50 | 8.417    3.94 | 11.42    2.25
               2.500    3.37 | 5.500   13.50 | 8.500    3.94 | 11.50    2.25
               2.583    3.37 | 5.583   54.00 | 8.583    3.94 | 11.58    2.25
               2.667    3.37 | 5.667   54.00 | 8.667    3.94 | 11.67    2.25
               2.750    3.37 | 5.750   54.00 | 8.750    3.94 | 11.75    2.25
               2.833    3.37 | 5.833  148.50 | 8.833    3.94 | 11.83    2.25
               2.917    3.37 | 5.917  148.50 | 8.917    3.94 | 11.92    2.25
               3.000    3.37 | 6.000  148.50 | 9.000    3.94 | 12.00    2.25

    Unit Hyd Qpeak  (cms)=   0.174

    PEAK FLOW       (cms)=   0.122 (i)
    TIME TO PEAK    (hrs)=   6.083
    RUNOFF VOLUME    (mm)=  46.067
    TOTAL RAINFALL   (mm)= 112.500
    RUNOFF COEFFICIENT   =   0.409
```

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0001)|   Area    (ha)=  26.52
|ID= 1 DT=15.0 min |   Total Imp(%)=  61.00   Dir. Conn.(%)=  45.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      16.18         10.34
     Dep. Storage     (mm)=       1.00          1.50
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     420.48         40.00
     Mannings n           =      0.013         0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO  15.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.250    2.81 | 3.250    4.50 | 6.250   20.25 |  9.25    3.94
               0.500    2.81 | 3.500    4.50 | 6.500   20.25 |  9.50    3.94
               0.750    2.81 | 3.750    4.50 | 6.750    9.00 |  9.75    3.94
               1.000    2.81 | 4.000    4.50 | 7.000    9.00 | 10.00    3.94
               1.250    2.81 | 4.250    6.75 | 7.250    6.75 | 10.25    2.25
               1.500    2.81 | 4.500    6.75 | 7.500    6.75 | 10.50    2.25
               1.750    2.81 | 4.750    9.00 | 7.750    6.75 | 10.75    2.25
               2.000    2.81 | 5.000    9.00 | 8.000    6.75 | 11.00    2.25
               2.250    3.37 | 5.250   13.50 | 8.250    3.94 | 11.25    2.25
               2.500    3.37 | 5.500   13.50 | 8.500    3.94 | 11.50    2.25
               2.750    3.37 | 5.750   54.00 | 8.750    3.94 | 11.75    2.25
               3.000    3.37 | 6.000  148.50 | 9.000    3.94 | 12.00    2.25

     Max.Eff.Inten.(mm/hr)=     148.50       124.78
               over (min)       15.00        15.00
     Storage Coeff.  (min)=       5.16 (ii)   11.62 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=       0.11         0.08
                                                          *TOTALS*
     PEAK FLOW       (cms)=       4.75         2.80          7.551 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.00          6.00
     RUNOFF VOLUME    (mm)=     111.50        58.37         82.28
     TOTAL RAINFALL   (mm)=     112.50       112.50        112.50
     RUNOFF COEFFICIENT   =       0.99         0.52          0.73

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=  15.59
|ID= 1 DT=15.0 min |   Total Imp(%)=  69.00   Dir. Conn.(%)=  48.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      10.76          4.83
     Dep. Storage     (mm)=       1.00          1.50
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     322.39         40.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=     148.50       161.06
               over (min)       15.00        15.00
     Storage Coeff.  (min)=       4.40 (ii)   10.24 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=       0.11         0.09
                                                          *TOTALS*
     PEAK FLOW       (cms)=       3.02         1.77          4.795 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.00          6.00
     RUNOFF VOLUME    (mm)=     111.50        63.30         86.43
     TOTAL RAINFALL   (mm)=     112.50       112.50        112.50
     RUNOFF COEFFICIENT   =       0.99         0.56          0.77

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0001):    26.52   7.551     6.00    82.28
     + ID2= 2 (  0002):    15.59   4.795     6.00    86.43
       ==================================================
       ID = 3 (  0003):    42.11  12.346     6.00    83.82

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000    |   0.4950     1.7925
                         0.0330     0.8230    |   0.8740     2.1555
                         0.0800     1.2250    |   1.1350     2.3805
                         0.3070     1.5840    |   1.4190     2.6735

                                   AREA     QPEAK     TPEAK       R.V.
                                   (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)     42.110     12.346      6.00      83.82
   OUTFLOW: ID= 1 (  0004)     42.110      1.150      6.75      80.66

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  9.32
                  TIME SHIFT OF PEAK FLOW          (min)= 45.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  2.3964

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0007)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
```

```
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0004):    42.11   1.150     6.75    80.66
      + ID2= 2 (  0008):     0.91   0.122     6.08    46.07
        ==================================================
        ID = 3 (  0007):    43.02   1.173     6.67    79.93

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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 FINISH
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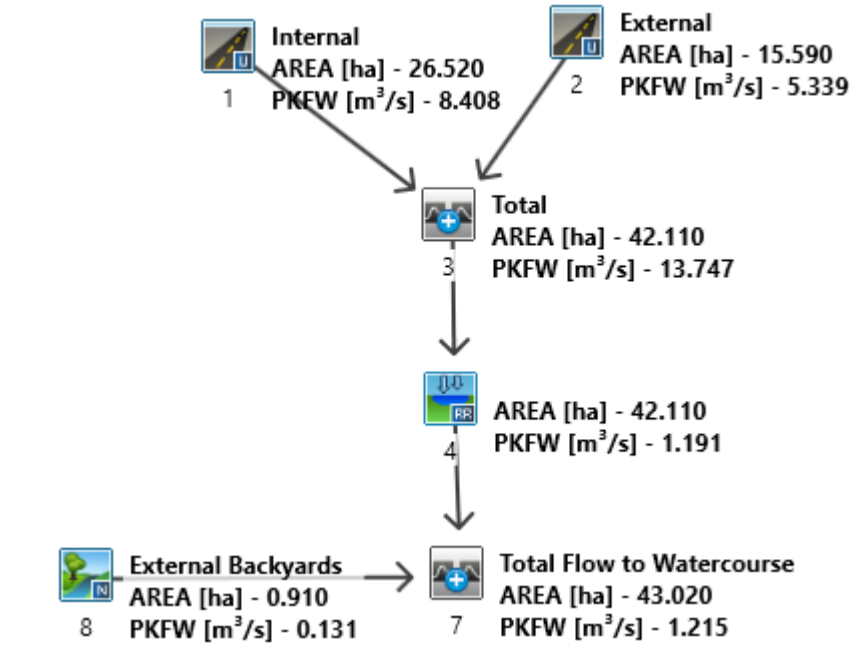

2020-02-20-6-hr-SCS-2-100yr Controlled Flows

Schematic | Hydrograph Results (instance)

Run: Run 01 | Show All Runs

Run	NHYD	DT [hr]	AREA [ha]	PKFW [m³/s]	TP [hr]	RV [mm]	DWF [m³/s]
Run 01	7	0.083	43.020	0.023	4.000	12.189	0.000
Run 02	7	0.083	43.020	0.058	6.083	23.118	0.000
Run 03	7	0.083	43.020	0.220	6.000	35.743	0.000
Run 04	7	0.083	43.020	0.398	5.000	44.715	0.000
Run 05	7	0.083	43.020	0.690	4.417	56.600	0.000
Run 06	7	0.083	43.020	0.942	4.083	65.683	0.000
Run 07	7	0.083	43.020	1.215	3.750	74.851	0.000

Flows to Watercourse Compared with Allowable Release Rates

Storm Event	2-year	5-year	10-year	25-year	50-year	100-year
Allowable Release Rates (m^3/s)	0.080	0.340	0.630	1.010	1.350	1.680
Expected Release Rate (m^3/s)	0.058	0.220	0.398	0.690	0.942	1.215

SCHAEFFERS CONSULTING ENGINEERS

Visual OTTHYMO™ Schematic
883 Mapleview Drive East Subdivision
(25 mm – 100-yr – 6-hour SCS Type II)
(Controlled Flows and Provided Storage)

Job #: 4692 | **Date: March 2020**

```
================================================================================
============================

       V    V   I    SSSSS  U   U    A    L
       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 5.0\VO2\voin.dat
  Output  filename: C:\Users\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-
45e7-8ee9-3237db384aff\341b7404-0cb9-490c-b37d-85caf0b296e9\scen
  Summary filename: C:\Users\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-
45e7-8ee9-3237db384aff\341b7404-0cb9-490c-b37d-85caf0b296e9\scen


DATE: 03-10-2020                          TIME: 09:46:20

USER:


COMMENTS: _____________________________________________________________


--------------------------------------------------------------------------------
----------------------------
  ****************************
  ** SIMULATION NUMBER:   0 **
  ****************************


--------------------
|    READ STORM    |    Filename: C:\Users\nkamran\AppD
|                  |              ata\Local\Temp\
|                  |              e25a5b7b-04ac-48ce-9821-73071e080b61\37ab0616
| Ptotal= 25.00 mm |    Comments: Twenty-Five mm Four Hour Chicago Storm
--------------------
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.17    2.07 |  1.17    5.70 |  2.17    5.19 |  3.17    2.80
                0.33    2.27 |  1.33   10.78 |  2.33    4.47 |  3.33    2.62
                0.50    2.52 |  1.50   50.21 |  2.50    3.95 |  3.50    2.48
                0.67    2.88 |  1.67   13.37 |  2.67    3.56 |  3.67    2.35
                0.83    3.38 |  1.83    8.29 |  2.83    3.25 |  3.83    2.23
                1.00    4.18 |  2.00    6.30 |  3.00    3.01 |  4.00    2.14

--------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0008)|   Area     (ha)=   0.91   Curve Number    (CN)= 64.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20

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


                                ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    2.07 | 1.083    5.70 | 2.083    5.19 |  3.08    2.80
               0.167    2.07 | 1.167    5.70 | 2.167    5.19 |  3.17    2.80
               0.250    2.27 | 1.250   10.78 | 2.250    4.47 |  3.25    2.62
               0.333    2.27 | 1.333   10.78 | 2.333    4.47 |  3.33    2.62
               0.417    2.52 | 1.417   50.21 | 2.417    3.95 |  3.42    2.48
               0.500    2.52 | 1.500   50.21 | 2.500    3.95 |  3.50    2.48
               0.583    2.88 | 1.583   13.37 | 2.583    3.56 |  3.58    2.35
               0.667    2.88 | 1.667   13.37 | 2.667    3.56 |  3.67    2.35
               0.750    3.38 | 1.750    8.29 | 2.750    3.25 |  3.75    2.23
               0.833    3.38 | 1.833    8.29 | 2.833    3.25 |  3.83    2.23
               0.917    4.17 | 1.917    6.30 | 2.917    3.01 |  3.92    2.14
               1.000    4.18 | 2.000    6.29 | 3.000    3.01 |  4.00    2.14

    Unit Hyd Qpeak  (cms)=   0.174

    PEAK FLOW       (cms)=   0.005 (i)
    TIME TO PEAK    (hrs)=   1.667
    RUNOFF VOLUME    (mm)=   2.450
    TOTAL RAINFALL   (mm)=  24.996
    RUNOFF COEFFICIENT   =   0.098

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0001)|   Area     (ha)=  26.52
|ID= 1 DT=15.0 min |   Total Imp(%)=  61.00   Dir. Conn.(%)=  45.00
--------------------

                                  IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=         16.18          10.34
    Dep. Storage     (mm)=          1.00           1.50
    Average Slope     (%)=          1.00           2.00
    Length            (m)=        420.48          40.00
    Mannings n           =         0.013          0.250

        NOTE:  RAINFALL WAS TRANSFORMED TO  15.0 MIN. TIME STEP.


                                ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.250    2.14 | 1.250    7.39 | 2.250    4.95 |  3.25    2.74
               0.500    2.44 | 1.500   37.07 | 2.500    4.12 |  3.50    2.52
               0.750    3.05 | 1.750   11.67 | 2.750    3.46 |  3.75    2.31
               1.000    3.91 | 2.000    6.96 | 3.000    3.09 |  4.00    2.17

    Max.Eff.Inten.(mm/hr)=      37.07          5.69
              over (min)        15.00         45.00
    Storage Coeff.  (min)=       8.99 (ii)    31.21 (ii)
    Unit Hyd. Tpeak (min)=      15.00         45.00
    Unit Hyd. peak  (cms)=       0.09          0.03
                                                              *TOTALS*
```

```
     PEAK FLOW       (cms)=       1.04         0.09          1.063 (iii)
     TIME TO PEAK    (hrs)=       1.50         2.00           1.50
     RUNOFF VOLUME    (mm)=      24.00         4.57          13.31
     TOTAL RAINFALL   (mm)=      25.00        25.00          25.00
     RUNOFF COEFFICIENT   =       0.96         0.18           0.53

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=  15.59
|ID= 1 DT=15.0 min |   Total Imp(%)=  69.00   Dir. Conn.(%)=  48.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      10.76         4.83
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     322.39        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      37.07         7.95
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       7.67 (ii)   27.10 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=       0.10         0.04
                                                      *TOTALS*
     PEAK FLOW       (cms)=       0.68         0.07          0.711 (iii)
     TIME TO PEAK    (hrs)=       1.50         1.75           1.50
     RUNOFF VOLUME    (mm)=      24.00         5.32          14.28
     TOTAL RAINFALL   (mm)=      25.00        25.00          25.00
     RUNOFF COEFFICIENT   =       0.96         0.21           0.57

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0001):    26.52   1.063     1.50    13.31
     + ID2= 2 (  0002):    15.59   0.711     1.50    14.28
       ================================================
       ID = 3 (  0003):    42.11   1.774     1.50    13.67

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.4950      1.7925
                          0.0330     0.8230   |   0.8740      2.1555
                          0.0800     1.2250   |   1.1350      2.3805
                          0.3070     1.5840   |   1.4190      2.6735

                                    AREA     QPEAK     TPEAK       R.V.
                                    (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)     42.110      1.774      1.50       13.67
   OUTFLOW: ID= 1 (  0004)     42.110      0.022      4.75       12.40

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  1.24
                  TIME SHIFT OF PEAK FLOW          (min)=195.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.5503

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0007)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0004):    42.11   0.022     4.75    12.40
     + ID2= 2 (  0008):     0.91   0.005     1.67     2.45
       ================================================
       ID = 3 (  0007):    43.02   0.023     4.00    12.19

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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       V    V   I    SSSSS  U   U    A    L
       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 5.0\VO2\voin.dat
  Output  filename: C:\Users\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-
45e7-8ee9-3237db384aff\1e39a817-01c0-495a-a95f-08a9bf95bfd8\scen
  Summary filename: C:\Users\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-
45e7-8ee9-3237db384aff\1e39a817-01c0-495a-a95f-08a9bf95bfd8\scen


DATE: 03-10-2020                          TIME: 09:46:20

USER:
```

COMMENTS: _____

```
---------------------------------------------------------------------------------
---------------------------
  ***************************
  ** SIMULATION NUMBER:   0 **
  ***************************


--------------------
|    READ STORM    |    Filename: C:\Users\nkamran\AppD
|                  |              ata\Local\Temp\
|                  |              e25a5b7b-04ac-48ce-9821-73071e080b61\1c4b9582
| Ptotal= 42.30 mm |    Comments: TWO YEAR 6 HOUR SCS STORM  WITH A 15 MIN
--------------------
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.25    1.69 |  1.75    4.23 |  3.25    9.31 |  4.75    2.54
                0.50    1.69 |  2.00    4.23 |  3.50    9.31 |  5.00    2.54
                0.75    2.54 |  2.25    5.08 |  3.75    4.23 |  5.25    1.69
                1.00    2.54 |  2.50    5.08 |  4.00    4.23 |  5.50    1.69
                1.25    2.54 |  2.75   25.38 |  4.25    3.38 |  5.75    1.69
                1.50    2.54 |  3.00   65.99 |  4.50    3.38 |  6.00    1.69

---------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0008)|   Area    (ha)=   0.91   Curve Number   (CN)= 64.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20

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

                           ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    1.69 | 1.583    4.23 | 3.083    9.31 |  4.58    2.54
               0.167    1.69 | 1.667    4.23 | 3.167    9.31 |  4.67    2.54
               0.250    1.69 | 1.750    4.23 | 3.250    9.31 |  4.75    2.54
               0.333    1.69 | 1.833    4.23 | 3.333    9.31 |  4.83    2.54
               0.417    1.69 | 1.917    4.23 | 3.417    9.31 |  4.92    2.54
               0.500    1.69 | 2.000    4.23 | 3.500    9.31 |  5.00    2.54
               0.583    2.54 | 2.083    5.08 | 3.583    4.23 |  5.08    1.69
               0.667    2.54 | 2.167    5.08 | 3.667    4.23 |  5.17    1.69
               0.750    2.54 | 2.250    5.08 | 3.750    4.23 |  5.25    1.69
               0.833    2.54 | 2.333    5.08 | 3.833    4.23 |  5.33    1.69
               0.917    2.54 | 2.417    5.08 | 3.917    4.23 |  5.42    1.69
               1.000    2.54 | 2.500    5.08 | 4.000    4.23 |  5.50    1.69
               1.083    2.54 | 2.583   25.38 | 4.083    3.38 |  5.58    1.69
               1.167    2.54 | 2.667   25.38 | 4.167    3.38 |  5.67    1.69
               1.250    2.54 | 2.750   25.38 | 4.250    3.38 |  5.75    1.69
               1.333    2.54 | 2.833   65.99 | 4.333    3.38 |  5.83    1.69
               1.417    2.54 | 2.917   65.99 | 4.417    3.38 |  5.92    1.69
               1.500    2.54 | 3.000   65.99 | 4.500    3.38 |  6.00    1.69

    Unit Hyd Qpeak  (cms)=   0.174

    PEAK FLOW       (cms)=   0.023 (i)
    TIME TO PEAK    (hrs)=   3.083
    RUNOFF VOLUME    (mm)=   7.707
    TOTAL RAINFALL   (mm)=  42.300
    RUNOFF COEFFICIENT   =   0.182

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

---------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0001)|   Area    (ha)=  26.52
|ID= 1 DT=15.0 min |   Total Imp(%)=  61.00   Dir. Conn.(%)=  45.00
--------------------
                                IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=       16.18         10.34
    Dep. Storage     (mm)=        1.00          1.50
    Average Slope     (%)=        1.00          2.00
    Length            (m)=      420.48         40.00
    Mannings n           =       0.013         0.250

        NOTE:  RAINFALL WAS TRANSFORMED TO  15.0 MIN. TIME STEP.

                           ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.250    1.69 | 1.750    4.23 | 3.250    9.31 |  4.75    2.54
               0.500    1.69 | 2.000    4.23 | 3.500    9.31 |  5.00    2.54
               0.750    2.54 | 2.250    5.08 | 3.750    4.23 |  5.25    1.69
               1.000    2.54 | 2.500    5.08 | 4.000    4.23 |  5.50    1.69
               1.250    2.54 | 2.750   25.38 | 4.250    3.38 |  5.75    1.69
               1.500    2.54 | 3.000   65.99 | 4.500    3.38 |  6.00    1.69

    Max.Eff.Inten.(mm/hr)=      65.99         29.51
                over (min)      15.00         30.00
    Storage Coeff.  (min)=       7.14 (ii)    18.64 (ii)
    Unit Hyd. Tpeak (min)=      15.00         30.00
    Unit Hyd. peak  (cms)=       0.10          0.05
                                                          *TOTALS*
    PEAK FLOW       (cms)=       2.01          0.44          2.280 (iii)
    TIME TO PEAK    (hrs)=       3.00          3.25           3.00
    RUNOFF VOLUME    (mm)=      41.30         11.93          25.15
    TOTAL RAINFALL   (mm)=      42.30         42.30          42.30
    RUNOFF COEFFICIENT   =       0.98          0.28           0.59

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.

---------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=  15.59
|ID= 1 DT=15.0 min |   Total Imp(%)=  69.00   Dir. Conn.(%)=  48.00
--------------------
                                IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=       10.76          4.83
    Dep. Storage     (mm)=        1.00          1.50
    Average Slope     (%)=        1.00          2.00
```

```
     Length            (m)=     322.39        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      65.99        40.01
               over (min)        15.00        30.00
     Storage Coeff.  (min)=       6.09 (ii)   16.27 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=       0.10         0.05
                                                      *TOTALS*
     PEAK FLOW       (cms)=       1.30         0.29      1.479 (iii)
     TIME TO PEAK    (hrs)=       3.00         3.25       3.00
     RUNOFF VOLUME    (mm)=      41.30        13.54      26.87
     TOTAL RAINFALL   (mm)=      42.30        42.30      42.30
     RUNOFF COEFFICIENT   =       0.98         0.32       0.64

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.
```

```
--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0001):    26.52   2.280     3.00    25.15
     + ID2= 2 (  0002):    15.59   1.479     3.00    26.87
       ================================================
       ID = 3 (  0003):    42.11   3.759     3.00    25.78

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

```
--------------------
| RESERVOIR(  0004)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   0.4950     1.7925
                         0.0330     0.8230   |   0.8740     2.1555
                         0.0800     1.2250   |   1.1350     2.3805
                         0.3070     1.5840   |   1.4190     2.6735

                              AREA     QPEAK     TPEAK       R.V.
                              (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)    42.110     3.759      3.00      25.78
   OUTFLOW: ID= 1 (  0004)    42.110     0.057      6.25      23.45

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  1.51
                  TIME SHIFT OF PEAK FLOW         (min)=195.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  1.0251
```

```
--------------------
| ADD HYD  (  0007)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0004):    42.11   0.057     6.25    23.45
     + ID2= 2 (  0008):     0.91   0.023     3.08     7.71
       ================================================
       ID = 3 (  0007):    43.02   0.058     6.08    23.12

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

```
       V    V   I    SSSSS  U   U    A    L
       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 5.0\VO2\voin.dat
  Output  filename: C:\Users\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-
45e7-8ee9-3237db384aff\59c6e74f-a312-4077-aa9a-7344b5125f7a\scen
  Summary filename: C:\Users\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-
45e7-8ee9-3237db384aff\59c6e74f-a312-4077-aa9a-7344b5125f7a\scen

DATE: 03-10-2020                          TIME: 09:46:20

USER:

COMMENTS: _____
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  ****************************
  ** SIMULATION NUMBER:   0 **
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|    READ STORM    |    Filename: C:\Users\nkamran\AppD
|                  |              ata\Local\Temp\
|                  |              e25a5b7b-04ac-48ce-9821-73071e080b61\56a3c743
| Ptotal= 59.50 mm |    Comments: FIVE YR 6 HOUR SCS STORM  WITH A 15 MINU
--------------------
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.25    2.38 |  1.75    5.95 |  3.25   13.09 |  4.75    3.57
                0.50    2.38 |  2.00    5.95 |  3.50   13.09 |  5.00    3.57
                0.75    3.57 |  2.25    7.14 |  3.75    5.95 |  5.25    2.38
                1.00    3.57 |  2.50    7.14 |  4.00    5.95 |  5.50    2.38
```

1.25	3.57	2.75	35.70	4.25	4.76	5.75	2.38
1.50	3.57	3.00	92.82	4.50	4.76	6.00	2.38

CALIB			
NASHYD (0008)	Area (ha)=	0.91	Curve Number (CN)= 64.0
ID= 1 DT= 5.0 min	Ia (mm)=	5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)=	0.20	

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	2.38	1.583	5.95	3.083	13.09	4.58	3.57
0.167	2.38	1.667	5.95	3.167	13.09	4.67	3.57
0.250	2.38	1.750	5.95	3.250	13.09	4.75	3.57
0.333	2.38	1.833	5.95	3.333	13.09	4.83	3.57
0.417	2.38	1.917	5.95	3.417	13.09	4.92	3.57
0.500	2.38	2.000	5.95	3.500	13.09	5.00	3.57
0.583	3.57	2.083	7.14	3.583	5.95	5.08	2.38
0.667	3.57	2.167	7.14	3.667	5.95	5.17	2.38
0.750	3.57	2.250	7.14	3.750	5.95	5.25	2.38
0.833	3.57	2.333	7.14	3.833	5.95	5.33	2.38
0.917	3.57	2.417	7.14	3.917	5.95	5.42	2.38
1.000	3.57	2.500	7.14	4.000	5.95	5.50	2.38
1.083	3.57	2.583	35.70	4.083	4.76	5.58	2.38
1.167	3.57	2.667	35.70	4.167	4.76	5.67	2.38
1.250	3.57	2.750	35.70	4.250	4.76	5.75	2.38
1.333	3.57	2.833	92.82	4.333	4.76	5.83	2.38
1.417	3.57	2.917	92.82	4.417	4.76	5.92	2.38
1.500	3.57	3.000	92.82	4.500	4.76	6.00	2.38

Unit Hyd Qpeak (cms)=	0.174	
PEAK FLOW (cms)=	0.046	(i)
TIME TO PEAK (hrs)=	3.083	
RUNOFF VOLUME (mm)=	15.020	
TOTAL RAINFALL (mm)=	59.500	
RUNOFF COEFFICIENT =	0.252	

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

CALIB			
STANDHYD (0001)	Area (ha)=	26.52	
ID= 1 DT=15.0 min	Total Imp(%)=	61.00	Dir. Conn.(%)= 45.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	16.18	10.34
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	1.00	2.00
Length	(m)=	420.48	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 15.0 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
0.250	2.38	1.750	5.95	3.250	13.09	4.75	3.57
0.500	2.38	2.000	5.95	3.500	13.09	5.00	3.57
0.750	3.57	2.250	7.14	3.750	5.95	5.25	2.38
1.000	3.57	2.500	7.14	4.000	5.95	5.50	2.38
1.250	3.57	2.750	35.70	4.250	4.76	5.75	2.38
1.500	3.57	3.000	92.82	4.500	4.76	6.00	2.38

Max.Eff.Inten.(mm/hr)=	92.82	53.29	
over (min)	15.00	30.00	
Storage Coeff. (min)=	6.23 (ii)	15.31 (ii)	
Unit Hyd. Tpeak (min)=	15.00	30.00	
Unit Hyd. peak (cms)=	0.10	0.05	
			TOTALS
PEAK FLOW (cms)=	2.90	0.86	3.438 (iii)
TIME TO PEAK (hrs)=	3.00	3.25	3.00
RUNOFF VOLUME (mm)=	58.50	21.38	38.08
TOTAL RAINFALL (mm)=	59.50	59.50	59.50
RUNOFF COEFFICIENT =	0.98	0.36	0.64

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 64.0 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.

CALIB			
STANDHYD (0002)	Area (ha)=	15.59	
ID= 1 DT=15.0 min	Total Imp(%)=	69.00	Dir. Conn.(%)= 48.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	10.76	4.83
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	1.00	2.00
Length	(m)=	322.39	40.00
Mannings n	=	0.013	0.250

Max.Eff.Inten.(mm/hr)=	92.82	71.07	
over (min)	15.00	15.00	
Storage Coeff. (min)=	5.31 (ii)	13.40 (ii)	
Unit Hyd. Tpeak (min)=	15.00	15.00	
Unit Hyd. peak (cms)=	0.11	0.08	
			TOTALS
PEAK FLOW (cms)=	1.86	0.69	2.551 (iii)
TIME TO PEAK (hrs)=	3.00	3.00	3.00
RUNOFF VOLUME (mm)=	58.50	23.89	40.50
TOTAL RAINFALL (mm)=	59.50	59.50	59.50
RUNOFF COEFFICIENT =	0.98	0.40	0.68

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 64.0 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.

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--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0001):    26.52   3.438     3.00    38.08
      + ID2= 2 (  0002):    15.59   2.551     3.00    40.50
        ================================================
        ID = 3 (  0003):    42.11   5.988     3.00    38.98

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| RESERVOIR(  0004)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   0.4950      1.7925
                         0.0330     0.8230   |   0.8740      2.1555
                         0.0800     1.2250   |   1.1350      2.3805
                         0.3070     1.5840   |   1.4190      2.6735

                              AREA     QPEAK     TPEAK       R.V.
                              (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)     42.110      5.988      3.00      38.98
   OUTFLOW: ID= 1 (  0004)     42.110      0.218      6.00      36.19

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  3.63
                  TIME SHIFT OF PEAK FLOW         (min)=180.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  1.4426

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--------------------
| ADD HYD  (  0007)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0004):    42.11   0.218     6.00    36.19
      + ID2= 2 (  0008):     0.91   0.046     3.08    15.02
        ================================================
        ID = 3 (  0007):    43.02   0.220     6.00    35.74

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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       V    V   I    SSSSS  U   U    A    L
       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\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-
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  Summary filename: C:\Users\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-
45e7-8ee9-3237db384aff\6fb74b47-13f3-4cfc-9caf-e05ae6a46201\scen

DATE: 03-10-2020                          TIME: 09:46:20

USER:


COMMENTS: _____________________________________________________

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  ****************************
  ** SIMULATION NUMBER:   0 **
  ****************************


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|    READ STORM    |    Filename: C:\Users\nkamran\AppD
|                  |              ata\Local\Temp\
|                  |              e25a5b7b-04ac-48ce-9821-73071e080b61\a5bb21ba
| Ptotal= 70.80 mm |    Comments: TEN YR 6 HOUR SCS STORM  WITH A 15 MINUT
--------------------
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.25    2.83 |  1.75    7.08 |  3.25   15.58 |  4.75    4.25
                0.50    2.83 |  2.00    7.08 |  3.50   15.58 |  5.00    4.25
                0.75    4.25 |  2.25    8.50 |  3.75    7.08 |  5.25    2.83
                1.00    4.25 |  2.50    8.50 |  4.00    7.08 |  5.50    2.83
                1.25    4.25 |  2.75   42.48 |  4.25    5.66 |  5.75    2.83
                1.50    4.25 |  3.00  110.45 |  4.50    5.66 |  6.00    2.83

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--------------------
| CALIB            |
| NASHYD   (  0008)|   Area    (ha)=   0.91   Curve Number   (CN)= 64.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20

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


                          ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    2.83 | 1.583    7.08 | 3.083   15.58 |  4.58    4.25
               0.167    2.83 | 1.667    7.08 | 3.167   15.58 |  4.67    4.25
               0.250    2.83 | 1.750    7.08 | 3.250   15.58 |  4.75    4.25
               0.333    2.83 | 1.833    7.08 | 3.333   15.58 |  4.83    4.25
               0.417    2.83 | 1.917    7.08 | 3.417   15.58 |  4.92    4.25
               0.500    2.83 | 2.000    7.08 | 3.500   15.58 |  5.00    4.25
               0.583    4.25 | 2.083    8.50 | 3.583    7.08 |  5.08    2.83
```

0.667	4.25	2.167	8.50	3.667	7.08	5.17	2.83
0.750	4.25	2.250	8.50	3.750	7.08	5.25	2.83
0.833	4.25	2.333	8.50	3.833	7.08	5.33	2.83
0.917	4.25	2.417	8.50	3.917	7.08	5.42	2.83
1.000	4.25	2.500	8.50	4.000	7.08	5.50	2.83
1.083	4.25	2.583	42.48	4.083	5.66	5.58	2.83
1.167	4.25	2.667	42.48	4.167	5.66	5.67	2.83
1.250	4.25	2.750	42.48	4.250	5.66	5.75	2.83
1.333	4.25	2.833	110.45	4.333	5.66	5.83	2.83
1.417	4.25	2.917	110.45	4.417	5.66	5.92	2.83
1.500	4.25	3.000	110.45	4.500	5.66	6.00	2.83

Unit Hyd Qpeak (cms)= 0.174

PEAK FLOW (cms)= 0.064 (i)
TIME TO PEAK (hrs)= 3.083
RUNOFF VOLUME (mm)= 20.708
TOTAL RAINFALL (mm)= 70.800
RUNOFF COEFFICIENT = 0.292

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

CALIB	
STANDHYD (0001)	Area (ha)= 26.52
ID= 1 DT=15.0 min	Total Imp(%)= 61.00 Dir. Conn.(%)= 45.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	16.18	10.34
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	1.00	2.00
Length	(m)=	420.48	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 15.0 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
0.250	2.83	1.750	7.08	3.250	15.58	4.75	4.25
0.500	2.83	2.000	7.08	3.500	15.58	5.00	4.25
0.750	4.25	2.250	8.50	3.750	7.08	5.25	2.83
1.000	4.25	2.500	8.50	4.000	7.08	5.50	2.83
1.250	4.25	2.750	42.48	4.250	5.66	5.75	2.83
1.500	4.25	3.000	110.45	4.500	5.66	6.00	2.83

				TOTALS
Max.Eff.Inten.(mm/hr)=		110.45	71.12	
over (min)		15.00	15.00	
Storage Coeff. (min)=		5.81 (ii)	13.90 (ii)	
Unit Hyd. Tpeak (min)=		15.00	15.00	
Unit Hyd. peak (cms)=		0.10	0.07	
PEAK FLOW	(cms)=	3.48	1.46	4.946 (iii)
TIME TO PEAK	(hrs)=	3.00	3.00	3.00
RUNOFF VOLUME	(mm)=	69.80	28.43	47.05
TOTAL RAINFALL	(mm)=	70.80	70.80	70.80
RUNOFF COEFFICIENT	=	0.99	0.40	0.66

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 64.0 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.

CALIB	
STANDHYD (0002)	Area (ha)= 15.59
ID= 1 DT=15.0 min	Total Imp(%)= 69.00 Dir. Conn.(%)= 48.00

		IMPERVIOUS	PERVIOUS (i)	*TOTALS*
Surface Area	(ha)=	10.76	4.83	
Dep. Storage	(mm)=	1.00	1.50	
Average Slope	(%)=	1.00	2.00	
Length	(m)=	322.39	40.00	
Mannings n	=	0.013	0.250	
Max.Eff.Inten.(mm/hr)=		110.45	94.03	
over (min)		15.00	15.00	
Storage Coeff. (min)=		4.96 (ii)	12.19 (ii)	
Unit Hyd. Tpeak (min)=		15.00	15.00	
Unit Hyd. peak (cms)=		0.11	0.08	
PEAK FLOW	(cms)=	2.23	0.96	3.185 (iii)
TIME TO PEAK	(hrs)=	3.00	3.00	3.00
RUNOFF VOLUME	(mm)=	69.80	31.51	49.89
TOTAL RAINFALL	(mm)=	70.80	70.80	70.80
RUNOFF COEFFICIENT	=	0.99	0.45	0.70

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 64.0 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.

ADD HYD (0003)				
1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0001):	26.52	4.946	3.00	47.05
+ ID2= 2 (0002):	15.59	3.185	3.00	49.89
ID = 3 (0003):	42.11	8.131	3.00	48.10

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR(0004)				
IN= 2---> OUT= 1				
DT= 5.0 min	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	0.4950	1.7925
	0.0330	0.8230	0.8740	2.1555
	0.0800	1.2250	1.1350	2.3805
	0.3070	1.5840	1.4190	2.6735

	AREA	QPEAK	TPEAK	R.V.

```
                              (ha)      (cms)      (hrs)       (mm)
   INFLOW : ID= 2 (  0003)     42.110      8.131      3.00      48.10
   OUTFLOW: ID= 1 (  0004)     42.110      0.392      5.00      45.23

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  4.82
                  TIME SHIFT OF PEAK FLOW          (min)=120.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  1.6784

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--------------------
| ADD HYD  (  0007)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0004):    42.11   0.392     5.00    45.23
      + ID2= 2 (  0008):     0.91   0.064     3.08    20.71
        ==================================================
        ID = 3 (  0007):    43.02   0.398     5.00    44.71

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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       V    V   I    SSSSS  U   U    A    L
       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 5.0\VO2\voin.dat
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DATE: 03-10-2020                          TIME: 09:46:20

USER:



COMMENTS: _____________________________________________________________

--------------------------------------------------------------------------------
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  ****************************
  ** SIMULATION NUMBER:   0 **
  ****************************


--------------------
|    READ STORM    |    Filename: C:\Users\nkamran\AppD
|                  |              ata\Local\Temp\
|                  |              e25a5b7b-04ac-48ce-9821-73071e080b61\1ad597ec
| Ptotal= 85.20 mm |    Comments: 25 YR 6 HOUR SCS STORM  WITH A 15 MINUTE
--------------------
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.25    3.41 |  1.75    8.52 |  3.25   18.74 |  4.75    5.11
                0.50    3.41 |  2.00    8.52 |  3.50   18.74 |  5.00    5.11
                0.75    5.11 |  2.25   10.22 |  3.75    8.52 |  5.25    3.41
                1.00    5.11 |  2.50   10.22 |  4.00    8.52 |  5.50    3.41
                1.25    5.11 |  2.75   51.12 |  4.25    6.82 |  5.75    3.41
                1.50    5.11 |  3.00  132.91 |  4.50    6.82 |  6.00    3.41

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--------------------
| CALIB            |
| NASHYD   (  0008)|   Area     (ha)=   0.91   Curve Number   (CN)= 64.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20

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


                              ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    3.41 | 1.583    8.52 | 3.083   18.74 |  4.58    5.11
               0.167    3.41 | 1.667    8.52 | 3.167   18.74 |  4.67    5.11
               0.250    3.41 | 1.750    8.52 | 3.250   18.74 |  4.75    5.11
               0.333    3.41 | 1.833    8.52 | 3.333   18.74 |  4.83    5.11
               0.417    3.41 | 1.917    8.52 | 3.417   18.74 |  4.92    5.11
               0.500    3.41 | 2.000    8.52 | 3.500   18.74 |  5.00    5.11
               0.583    5.11 | 2.083   10.22 | 3.583    8.52 |  5.08    3.41
               0.667    5.11 | 2.167   10.22 | 3.667    8.52 |  5.17    3.41
               0.750    5.11 | 2.250   10.22 | 3.750    8.52 |  5.25    3.41
               0.833    5.11 | 2.333   10.22 | 3.833    8.52 |  5.33    3.41
               0.917    5.11 | 2.417   10.22 | 3.917    8.52 |  5.42    3.41
               1.000    5.11 | 2.500   10.22 | 4.000    8.52 |  5.50    3.41
               1.083    5.11 | 2.583   51.12 | 4.083    6.82 |  5.58    3.41
               1.167    5.11 | 2.667   51.12 | 4.167    6.82 |  5.67    3.41
               1.250    5.11 | 2.750   51.12 | 4.250    6.82 |  5.75    3.41
               1.333    5.11 | 2.833  132.91 | 4.333    6.82 |  5.83    3.41
               1.417    5.11 | 2.917  132.91 | 4.417    6.82 |  5.92    3.41
               1.500    5.11 | 3.000  132.91 | 4.500    6.82 |  6.00    3.41

    Unit Hyd Qpeak  (cms)=   0.174

    PEAK FLOW       (cms)=   0.089 (i)
    TIME TO PEAK    (hrs)=   3.083
    RUNOFF VOLUME    (mm)=  28.778
    TOTAL RAINFALL   (mm)=  85.200
    RUNOFF COEFFICIENT   =   0.338

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

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```
| CALIB            |
| STANDHYD (  0001)|   Area    (ha)=  26.52
|ID= 1 DT=15.0 min |   Total Imp(%)=  61.00   Dir. Conn.(%)=  45.00
--------------------

                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      16.18         10.34
     Dep. Storage     (mm)=       1.00          1.50
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     420.48         40.00
     Mannings n           =      0.013         0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO  15.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.250    3.41 | 1.750    8.52 | 3.250   18.74 |  4.75    5.11
              0.500    3.41 | 2.000    8.52 | 3.500   18.74 |  5.00    5.11
              0.750    5.11 | 2.250   10.22 | 3.750    8.52 |  5.25    3.41
              1.000    5.11 | 2.500   10.22 | 4.000    8.52 |  5.50    3.41
              1.250    5.11 | 2.750   51.12 | 4.250    6.82 |  5.75    3.41
              1.500    5.11 | 3.000  132.91 | 4.500    6.82 |  6.00    3.41

     Max.Eff.Inten.(mm/hr)=     132.91         95.78
                 over (min)       15.00         15.00
     Storage Coeff.  (min)=       5.40 (ii)   12.58 (ii)
     Unit Hyd. Tpeak (min)=      15.00         15.00
     Unit Hyd. peak  (cms)=       0.11          0.08
                                                          *TOTALS*
     PEAK FLOW       (cms)=       4.23          2.06          6.296 (iii)
     TIME TO PEAK    (hrs)=       3.00          3.00           3.00
     RUNOFF VOLUME    (mm)=      84.20         38.17          58.88
     TOTAL RAINFALL   (mm)=      85.20         85.20          85.20
     RUNOFF COEFFICIENT   =       0.99          0.45           0.69

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=  15.59
|ID= 1 DT=15.0 min |   Total Imp(%)=  69.00   Dir. Conn.(%)=  48.00
--------------------

                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      10.76          4.83
     Dep. Storage     (mm)=       1.00          1.50
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     322.39         40.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=     132.91        125.44
                 over (min)       15.00         15.00
     Storage Coeff.  (min)=       4.60 (ii)   11.05 (ii)
     Unit Hyd. Tpeak (min)=      15.00         15.00
     Unit Hyd. peak  (cms)=       0.11          0.08
                                                          *TOTALS*
     PEAK FLOW       (cms)=       2.70          1.33          4.031 (iii)
     TIME TO PEAK    (hrs)=       3.00          3.00           3.00
     RUNOFF VOLUME    (mm)=      84.20         41.94          62.22
     TOTAL RAINFALL   (mm)=      85.20         85.20          85.20
     RUNOFF COEFFICIENT   =       0.99          0.49           0.73

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.

--------------------------------------------------------------------------------
--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0001):    26.52    6.296     3.00    58.88
     + ID2= 2 (  0002):    15.59    4.031     3.00    62.22
       ================================================
       ID = 3 (  0003):    42.11   10.327     3.00    60.12

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000    |   0.4950     1.7925
                         0.0330     0.8230    |   0.8740     2.1555
                         0.0800     1.2250    |   1.1350     2.3805
                         0.3070     1.5840    |   1.4190     2.6735

                                    AREA     QPEAK     TPEAK       R.V.
                                    (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)     42.110     10.327      3.00      60.12
   OUTFLOW: ID= 1 (  0004)     42.110      0.680      4.50      57.20

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  6.59
                  TIME SHIFT OF PEAK FLOW          (min)= 90.00
                  MAXIMUM  STORAGE   USED        (ha.m.)=  1.9700

--------------------------------------------------------------------------------
--------------------
| ADD HYD  (  0007)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0004):    42.11    0.680     4.50    57.20
     + ID2= 2 (  0008):     0.91    0.089     3.08    28.78
       ================================================
       ID = 3 (  0007):    43.02    0.690     4.42    56.60

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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```
       V    V   I    SSSSS  U   U    A    L
       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 5.0\VO2\voin.dat
  Output  filename: C:\Users\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-
45e7-8ee9-3237db384aff\ff564669-1598-4c36-b852-66cd5bf27a27\scen
  Summary filename: C:\Users\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-
45e7-8ee9-3237db384aff\ff564669-1598-4c36-b852-66cd5bf27a27\scen

DATE: 03-10-2020                          TIME: 09:46:20

USER:

COMMENTS: _____
```

```
  ****************************
  ** SIMULATION NUMBER:   0 **
  ****************************
```

```
--------------------
|    READ STORM    |    Filename: C:\Users\nkamran\AppD
|                  |              ata\Local\Temp\
|                  |              e25a5b7b-04ac-48ce-9821-73071e080b61\2f37a573
| Ptotal= 95.90 mm |    Comments: 50 YR 6 HOUR SCS STORM  WITH A 15 MINUTE
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.25	3.84	1.75	9.59	3.25	21.10	4.75	5.75
0.50	3.84	2.00	9.59	3.50	21.10	5.00	5.75
0.75	5.75	2.25	11.51	3.75	9.59	5.25	3.84
1.00	5.75	2.50	11.51	4.00	9.59	5.50	3.84
1.25	5.75	2.75	57.54	4.25	7.67	5.75	3.84
1.50	5.75	3.00	149.60	4.50	7.67	6.00	3.84

```
--------------------
| CALIB            |
| NASHYD   (  0008)|   Area     (ha)=   0.91   Curve Number    (CN)= 64.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20
```

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	3.84	1.583	9.59	3.083	21.10	4.58	5.75
0.167	3.84	1.667	9.59	3.167	21.10	4.67	5.75
0.250	3.84	1.750	9.59	3.250	21.10	4.75	5.75
0.333	3.84	1.833	9.59	3.333	21.10	4.83	5.75
0.417	3.84	1.917	9.59	3.417	21.10	4.92	5.75
0.500	3.84	2.000	9.59	3.500	21.10	5.00	5.75
0.583	5.75	2.083	11.51	3.583	9.59	5.08	3.84
0.667	5.75	2.167	11.51	3.667	9.59	5.17	3.84
0.750	5.75	2.250	11.51	3.750	9.59	5.25	3.84
0.833	5.75	2.333	11.51	3.833	9.59	5.33	3.84
0.917	5.75	2.417	11.51	3.917	9.59	5.42	3.84
1.000	5.75	2.500	11.51	4.000	9.59	5.50	3.84
1.083	5.75	2.583	57.54	4.083	7.67	5.58	3.84
1.167	5.75	2.667	57.54	4.167	7.67	5.67	3.84
1.250	5.75	2.750	57.54	4.250	7.67	5.75	3.84
1.333	5.75	2.833	149.60	4.333	7.67	5.83	3.84
1.417	5.75	2.917	149.60	4.417	7.67	5.92	3.84
1.500	5.75	3.000	149.60	4.500	7.67	6.00	3.84

```
     Unit Hyd Qpeak  (cms)=   0.174

     PEAK FLOW       (cms)=   0.109 (i)
     TIME TO PEAK    (hrs)=   3.083
     RUNOFF VOLUME    (mm)=  35.278
     TOTAL RAINFALL   (mm)=  95.900
     RUNOFF COEFFICIENT   =   0.368

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

```
--------------------
| CALIB            |
| STANDHYD (  0001)|   Area     (ha)=  26.52
|ID= 1 DT=15.0 min |   Total Imp(%)=  61.00   Dir. Conn.(%)=  45.00
--------------------
```

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	16.18	10.34
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	1.00	2.00
Length	(m)=	420.48	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 15.0 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
0.250	3.84	1.750	9.59	3.250	21.10	4.75	5.75
0.500	3.84	2.000	9.59	3.500	21.10	5.00	5.75
0.750	5.75	2.250	11.51	3.750	9.59	5.25	3.84
1.000	5.75	2.500	11.51	4.000	9.59	5.50	3.84
1.250	5.75	2.750	57.54	4.250	7.67	5.75	3.84
1.500	5.75	3.000	149.60	4.500	7.67	6.00	3.84

```
     Max.Eff.Inten.(mm/hr)=     149.60       115.24
               over (min)        15.00        15.00
     Storage Coeff.  (min)=       5.15 (ii)   11.82 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=       0.11         0.08
                                                        *TOTALS*
     PEAK FLOW       (cms)=       4.79         2.55          7.342 (iii)
     TIME TO PEAK    (hrs)=       3.00         3.00           3.00
     RUNOFF VOLUME    (mm)=      94.90        45.85          67.92
     TOTAL RAINFALL   (mm)=      95.90        95.90          95.90
     RUNOFF COEFFICIENT   =       0.99         0.48           0.71

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=  15.59
|ID= 1 DT=15.0 min |   Total Imp(%)=  69.00   Dir. Conn.(%)=  48.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      10.76         4.83
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     322.39        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     149.60       150.00
               over (min)        15.00        15.00
     Storage Coeff.  (min)=       4.39 (ii)   10.39 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=       0.11         0.09
                                                        *TOTALS*
     PEAK FLOW       (cms)=       3.05         1.63          4.680 (iii)
     TIME TO PEAK    (hrs)=       3.00         3.00           3.00
     RUNOFF VOLUME    (mm)=      94.90        50.09          71.60
     TOTAL RAINFALL   (mm)=      95.90        95.90          95.90
     RUNOFF COEFFICIENT   =       0.99         0.52           0.75

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0001):    26.52   7.342     3.00    67.92
      + ID2= 2 (  0002):    15.59   4.680     3.00    71.60
        ====================================================
        ID = 3 (  0003):    42.11  12.023     3.00    69.29

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.4950      1.7925
                          0.0330     0.8230   |   0.8740      2.1555
                          0.0800     1.2250   |   1.1350      2.3805
                          0.3070     1.5840   |   1.4190      2.6735

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)     42.110    12.023      3.00      69.29
   OUTFLOW: ID= 1 (  0004)     42.110     0.928      4.08      66.34

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  7.72
                  TIME SHIFT OF PEAK FLOW          (min)= 65.00
                  MAXIMUM  STORAGE   USED        (ha.m.)=  2.2018

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--------------------
| ADD HYD  (  0007)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0004):    42.11   0.928     4.08    66.34
      + ID2= 2 (  0008):     0.91   0.109     3.08    35.28
        ====================================================
        ID = 3 (  0007):    43.02   0.942     4.08    65.68

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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 FINISH
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       V    V   I    SSSSS  U   U    A    L
       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 5.0\VO2\voin.dat
  Output  filename: C:\Users\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-
45e7-8ee9-3237db384aff\0db2c8e2-b177-4c6f-9b0d-2b67c644eb50\scen
  Summary filename: C:\Users\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-
45e7-8ee9-3237db384aff\0db2c8e2-b177-4c6f-9b0d-2b67c644eb50\scen


DATE: 03-10-2020                          TIME: 09:46:20

USER:



COMMENTS: _____________________________________________________________

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  ****************************
  ** SIMULATION NUMBER:   0 **
  ****************************


--------------------
|    READ STORM    |    Filename: C:\Users\nkamran\AppD
|                  |              ata\Local\Temp\
|                  |              e25a5b7b-04ac-48ce-9821-73071e080b61\03d405f1
| Ptotal=106.50 mm |    Comments: 100 YR 6 HOUR SCS STORM  WITH A 15 MINUT
--------------------
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.25    4.26 |  1.75   10.65 |  3.25   23.43 |  4.75    6.39
                0.50    4.26 |  2.00   10.65 |  3.50   23.43 |  5.00    6.39
                0.75    6.39 |  2.25   12.78 |  3.75   10.65 |  5.25    4.26
                1.00    6.39 |  2.50   12.78 |  4.00   10.65 |  5.50    4.26
                1.25    6.39 |  2.75   63.90 |  4.25    8.52 |  5.75    4.26
                1.50    6.39 |  3.00  166.14 |  4.50    8.52 |  6.00    4.26

--------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0008)|   Area    (ha)=   0.91   Curve Number   (CN)= 64.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20

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


                          ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    4.26 | 1.583   10.65 | 3.083   23.43 |  4.58    6.39
               0.167    4.26 | 1.667   10.65 | 3.167   23.43 |  4.67    6.39
               0.250    4.26 | 1.750   10.65 | 3.250   23.43 |  4.75    6.39
               0.333    4.26 | 1.833   10.65 | 3.333   23.43 |  4.83    6.39
               0.417    4.26 | 1.917   10.65 | 3.417   23.43 |  4.92    6.39
               0.500    4.26 | 2.000   10.65 | 3.500   23.43 |  5.00    6.39
               0.583    6.39 | 2.083   12.78 | 3.583   10.65 |  5.08    4.26
               0.667    6.39 | 2.167   12.78 | 3.667   10.65 |  5.17    4.26
               0.750    6.39 | 2.250   12.78 | 3.750   10.65 |  5.25    4.26
               0.833    6.39 | 2.333   12.78 | 3.833   10.65 |  5.33    4.26
               0.917    6.39 | 2.417   12.78 | 3.917   10.65 |  5.42    4.26
               1.000    6.39 | 2.500   12.78 | 4.000   10.65 |  5.50    4.26
               1.083    6.39 | 2.583   63.90 | 4.083    8.52 |  5.58    4.26
               1.167    6.39 | 2.667   63.90 | 4.167    8.52 |  5.67    4.26
               1.250    6.39 | 2.750   63.90 | 4.250    8.52 |  5.75    4.26
               1.333    6.39 | 2.833  166.14 | 4.333    8.52 |  5.83    4.26
               1.417    6.39 | 2.917  166.14 | 4.417    8.52 |  5.92    4.26
               1.500    6.39 | 3.000  166.14 | 4.500    8.52 |  6.00    4.26

     Unit Hyd Qpeak  (cms)=   0.174

     PEAK FLOW       (cms)=   0.131 (i)
     TIME TO PEAK    (hrs)=   3.083
     RUNOFF VOLUME    (mm)=  42.077
     TOTAL RAINFALL   (mm)= 106.500
     RUNOFF COEFFICIENT   =   0.395

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0001)|   Area    (ha)=  26.52
|ID= 1 DT=15.0 min |   Total Imp(%)=  61.00   Dir. Conn.(%)=  45.00
--------------------

                                IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      16.18         10.34
     Dep. Storage     (mm)=       1.00          1.50
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     420.48         40.00
     Mannings n           =      0.013         0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO  15.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.250    4.26 | 1.750   10.65 | 3.250   23.43 |  4.75    6.39
               0.500    4.26 | 2.000   10.65 | 3.500   23.43 |  5.00    6.39
               0.750    6.39 | 2.250   12.78 | 3.750   10.65 |  5.25    4.26
               1.000    6.39 | 2.500   12.78 | 4.000   10.65 |  5.50    4.26
               1.250    6.39 | 2.750   63.90 | 4.250    8.52 |  5.75    4.26
               1.500    6.39 | 3.000  166.14 | 4.500    8.52 |  6.00    4.26

     Max.Eff.Inten.(mm/hr)=     166.14       135.29
               over (min)       15.00        15.00
     Storage Coeff.  (min)=      4.94 (ii)   11.19 (ii)
     Unit Hyd. Tpeak (min)=     15.00        15.00
     Unit Hyd. peak  (cms)=      0.11         0.08
                                                          *TOTALS*
     PEAK FLOW       (cms)=      5.34         3.07          8.408 (iii)
     TIME TO PEAK    (hrs)=      3.00         3.00           3.00
     RUNOFF VOLUME    (mm)=    105.50        53.77          77.05
     TOTAL RAINFALL   (mm)=    106.50       106.50         106.50
     RUNOFF COEFFICIENT   =      0.99         0.50           0.72

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.
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--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=  15.59
|ID= 1 DT=15.0 min |   Total Imp(%)=  69.00   Dir. Conn.(%)=  48.00
--------------------

                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      10.76         4.83
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     322.39        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     166.14       175.12
               over (min)       15.00        15.00
     Storage Coeff.  (min)=      4.21 (ii)    9.85 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=       0.11         0.09
                                                        *TOTALS*
     PEAK FLOW       (cms)=       3.39         1.95          5.339 (iii)
     TIME TO PEAK    (hrs)=       3.00         3.00           3.00
     RUNOFF VOLUME    (mm)=     105.50        58.46          81.04
     TOTAL RAINFALL   (mm)=     106.50       106.50         106.50
     RUNOFF COEFFICIENT   =       0.99         0.55           0.76

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0001):    26.52   8.408     3.00    77.05
     + ID2= 2 (  0002):    15.59   5.339     3.00    81.04
       ====================================================
       ID = 3 (  0003):    42.11  13.747     3.00    78.53

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   0.4950     1.7925
                         0.0330     0.8230   |   0.8740     2.1555
                         0.0800     1.2250   |   1.1350     2.3805
                         0.3070     1.5840   |   1.4190     2.6735

                               AREA     QPEAK     TPEAK       R.V.
                               (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)     42.110     13.747      3.00      78.53
   OUTFLOW: ID= 1 (  0004)     42.110      1.191      3.92      75.56

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=  8.66
                    TIME SHIFT OF PEAK FLOW          (min)= 55.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  2.4380

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--------------------
| ADD HYD  (  0007)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0004):    42.11   1.191     3.92    75.56
     + ID2= 2 (  0008):     0.91   0.131     3.08    42.08
       ====================================================
       ID = 3 (  0007):    43.02   1.215     3.75    74.85

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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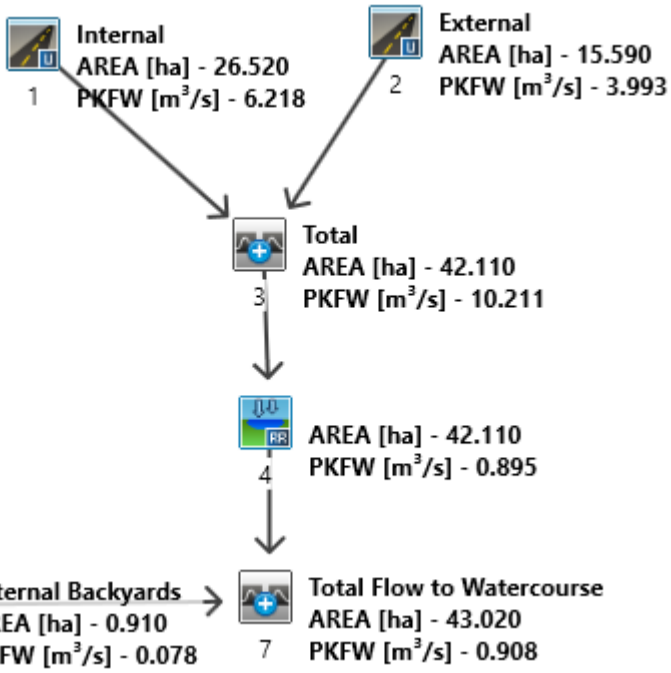

2020-02-20-4-hr-Chicago-25 mm - 100yr Controlled Flows

Schematic | Hydrograph Results (instance)

Run: Run 01 | Show All Runs

Run	NHYD	DT [hr]	AREA [ha]	PKFW [m³/s]	TP [hr]	RV [mm]	DWF [m³/s]
Run 01	7	0.083	43.020	0.033	4.083	13.025	0.000
Run 02	7	0.083	43.020	0.060	4.083	20.936	0.000
Run 03	7	0.083	43.020	0.166	4.083	30.712	0.000
Run 04	7	0.083	43.020	0.310	4.000	37.771	0.000
Run 05	7	0.083	43.020	0.532	3.583	47.000	0.000
Run 06	7	0.083	43.020	0.713	3.250	53.762	0.000
Run 07	7	0.083	43.020	0.908	2.917	60.578	0.000

Flows to Watercourse Compared with Allowable Release Rates

Storm Event	2-year	5-year	10-year	25-year	50-year	100-year
Allowable Release Rates (m^3/s)	0.080	0.340	0.630	1.010	1.350	1.680
Expected Release Rate (m^3/s)	0.060	0.166	0.310	0.532	0.713	0.908

SCHAEFFERS CONSULTING ENGINEERS

Visual OTTHYMO™ Schematic
883 Mapleview Drive East Subdivision
(25 mm – 100-yr – 4-hour Chicago Storm)
(Controlled Flows and Provided Storage)

Job #: 4692 | **Date: March 2020**

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============================

       V    V   I    SSSSS  U   U    A    L
       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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DATE: 03-10-2020                          TIME: 09:45:18

USER:


COMMENTS: _____________________________________________________________


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  ****************************
  ** SIMULATION NUMBER:   0 **
  ****************************


--------------------
|    READ STORM    |    Filename: C:\Users\nkamran\AppD
|                  |              ata\Local\Temp\
|                  |              d2828f70-12e1-4b66-b28e-e19623ca8cdb\37ab0616
| Ptotal= 25.00 mm |    Comments: Twenty-Five mm Four Hour Chicago Storm
--------------------
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.17    2.07 |  1.17    5.70 |  2.17    5.19 |  3.17    2.80
                0.33    2.27 |  1.33   10.78 |  2.33    4.47 |  3.33    2.62
                0.50    2.52 |  1.50   50.21 |  2.50    3.95 |  3.50    2.48
                0.67    2.88 |  1.67   13.37 |  2.67    3.56 |  3.67    2.35
                0.83    3.38 |  1.83    8.29 |  2.83    3.25 |  3.83    2.23
                1.00    4.18 |  2.00    6.30 |  3.00    3.01 |  4.00    2.14


--------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0008)|   Area     (ha)=   0.91   Curve Number    (CN)= 64.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20

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


                                ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    2.07 | 1.083    5.70 | 2.083    5.19 |  3.08    2.80
               0.167    2.07 | 1.167    5.70 | 2.167    5.19 |  3.17    2.80
               0.250    2.27 | 1.250   10.78 | 2.250    4.47 |  3.25    2.62
               0.333    2.27 | 1.333   10.78 | 2.333    4.47 |  3.33    2.62
               0.417    2.52 | 1.417   50.21 | 2.417    3.95 |  3.42    2.48
               0.500    2.52 | 1.500   50.21 | 2.500    3.95 |  3.50    2.48
               0.583    2.88 | 1.583   13.37 | 2.583    3.56 |  3.58    2.35
               0.667    2.88 | 1.667   13.37 | 2.667    3.56 |  3.67    2.35
               0.750    3.38 | 1.750    8.29 | 2.750    3.25 |  3.75    2.23
               0.833    3.38 | 1.833    8.29 | 2.833    3.25 |  3.83    2.23
               0.917    4.17 | 1.917    6.30 | 2.917    3.01 |  3.92    2.14
               1.000    4.18 | 2.000    6.29 | 3.000    3.01 |  4.00    2.14

    Unit Hyd Qpeak  (cms)=   0.174

    PEAK FLOW       (cms)=   0.005 (i)
    TIME TO PEAK    (hrs)=   1.667
    RUNOFF VOLUME    (mm)=   2.450
    TOTAL RAINFALL   (mm)=  24.996
    RUNOFF COEFFICIENT   =   0.098

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0001)|   Area     (ha)=  26.52
|ID= 1 DT=15.0 min |   Total Imp(%)=  61.00   Dir. Conn.(%)=  45.00
--------------------

                                 IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=       16.18         10.34
    Dep. Storage     (mm)=        1.00          1.50
    Average Slope     (%)=        1.00          2.00
    Length            (m)=      420.48         40.00
    Mannings n           =       0.013         0.250

        NOTE:  RAINFALL WAS TRANSFORMED TO  15.0 MIN. TIME STEP.


                                ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.250    2.14 | 1.250    7.39 | 2.250    4.95 |  3.25    2.74
               0.500    2.44 | 1.500   37.07 | 2.500    4.12 |  3.50    2.52
               0.750    3.05 | 1.750   11.67 | 2.750    3.46 |  3.75    2.31
               1.000    3.91 | 2.000    6.96 | 3.000    3.09 |  4.00    2.17

    Max.Eff.Inten.(mm/hr)=      37.07         5.69
              over (min)        15.00        45.00
    Storage Coeff.  (min)=       8.99 (ii)   31.21 (ii)
    Unit Hyd. Tpeak (min)=      15.00        45.00
    Unit Hyd. peak  (cms)=       0.09         0.03
                                                          *TOTALS*
```

```
     PEAK FLOW       (cms)=       1.04         0.09          1.063 (iii)
     TIME TO PEAK    (hrs)=       1.50         2.00           1.50
     RUNOFF VOLUME    (mm)=      24.00         4.57          13.31
     TOTAL RAINFALL   (mm)=      25.00        25.00          25.00
     RUNOFF COEFFICIENT   =       0.96         0.18           0.53

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=  15.59
|ID= 1 DT=15.0 min |   Total Imp(%)=  69.00   Dir. Conn.(%)=  48.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      10.76         4.83
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     322.39        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      37.07         7.95
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       7.67 (ii)   27.10 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=       0.10         0.04
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.68         0.07          0.711 (iii)
     TIME TO PEAK    (hrs)=       1.50         1.75           1.50
     RUNOFF VOLUME    (mm)=      24.00         5.32          14.28
     TOTAL RAINFALL   (mm)=      25.00        25.00          25.00
     RUNOFF COEFFICIENT   =       0.96         0.21           0.57

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0001):    26.52   1.063     1.50    13.31
     + ID2= 2 (  0002):    15.59   0.711     1.50    14.28
       ================================================
       ID = 3 (  0003):    42.11   1.774     1.50    13.67

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.5600      1.6774
                          0.0310     0.5265   |   0.9420      1.9885
                          0.0790     1.1220   |   1.2450      2.2323
                          0.3150     1.4435   |   1.3880      2.5015

                                    AREA     QPEAK     TPEAK       R.V.
                                    (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)     42.110      1.774      1.50       13.67
   OUTFLOW: ID= 1 (  0004)     42.110      0.032      4.58       13.25

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  1.81
                  TIME SHIFT OF PEAK FLOW          (min)=185.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.5407

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0007)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0004):    42.11   0.032     4.58    13.25
     + ID2= 2 (  0008):     0.91   0.005     1.67     2.45
       ================================================
       ID = 3 (  0007):    43.02   0.033     4.08    13.02

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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       V    V   I    SSSSS  U   U    A    L
       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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DATE: 03-10-2020 TIME: 09:45:18

USER:

COMMENTS: _____

****
** SIMULATION NUMBER: 0 **
****

| CHICAGO STORM | Ptotal= 36.96 mm |

IDF curve parameters: A= 678.085
B= 4.699
C= 0.781
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 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
0.08	2.30	1.08	10.01	2.08	6.37	3.08	3.06
0.17	2.44	1.17	15.36	2.17	5.80	3.17	2.94
0.25	2.60	1.25	35.54	2.25	5.34	3.25	2.83
0.33	2.78	1.33	114.99	2.33	4.94	3.33	2.74
0.42	3.00	1.42	45.87	2.42	4.61	3.42	2.64
0.50	3.26	1.50	25.25	2.50	4.32	3.50	2.56
0.58	3.57	1.58	17.41	2.58	4.07	3.58	2.48
0.67	3.96	1.67	13.34	2.67	3.85	3.67	2.41
0.75	4.46	1.75	10.85	2.75	3.66	3.75	2.34
0.83	5.13	1.83	9.18	2.83	3.49	3.83	2.27
0.92	6.08	1.92	7.98	2.92	3.33	3.92	2.21
1.00	7.52	2.00	7.08	3.00	3.19	4.00	2.15

| CALIB | NASHYD (0008) | ID= 1 DT= 5.0 min |

Area (ha)= 0.91 Curve Number (CN)= 64.0
Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= 0.20

Unit Hyd Qpeak (cms)= 0.174

PEAK FLOW (cms)= 0.015 (i)
TIME TO PEAK (hrs)= 1.583
RUNOFF VOLUME (mm)= 5.832
TOTAL RAINFALL (mm)= 36.965
RUNOFF COEFFICIENT = 0.158

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

| CALIB | STANDHYD (0001) | ID= 1 DT=15.0 min |

Area (ha)= 26.52 Total Imp(%)= 61.00 Dir. Conn.(%)= 45.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	16.18	10.34
Dep. Storage (mm)=	1.00	1.50
Average Slope (%)=	1.00	2.00
Length (m)=	420.48	40.00
Mannings n =	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 15.0 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
0.250	2.45	1.250	20.30	2.250	5.84	3.25	2.95
0.500	3.01	1.500	62.04	2.500	4.63	3.50	2.65
0.750	4.00	1.750	13.87	2.750	3.86	3.75	2.41
1.000	6.24	2.000	8.08	3.000	3.33	4.00	2.21

			TOTALS
Max.Eff.Inten.(mm/hr)=	62.04	21.60	
over (min)	15.00	30.00	
Storage Coeff. (min)=	7.32 (ii)	20.35 (ii)	
Unit Hyd. Tpeak (min)=	15.00	30.00	
Unit Hyd. peak (cms)=	0.10	0.05	
PEAK FLOW (cms)=	1.87	0.32	2.034 (iii)
TIME TO PEAK (hrs)=	1.50	1.75	1.50
RUNOFF VOLUME (mm)=	35.96	9.39	21.35
TOTAL RAINFALL (mm)=	36.96	36.96	36.96
RUNOFF COEFFICIENT =	0.97	0.25	0.58

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 64.0 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.

| CALIB | STANDHYD (0002) | ID= 1 DT=15.0 min |

Area (ha)= 15.59
Total Imp(%)= 69.00 Dir. Conn.(%)= 48.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	10.76	4.83
Dep. Storage (mm)=	1.00	1.50
Average Slope (%)=	1.00	2.00
Length (m)=	322.39	40.00
Mannings n =	0.013	0.250

			TOTALS
Max.Eff.Inten.(mm/hr)=	62.04	29.67	
over (min)	15.00	30.00	
Storage Coeff. (min)=	6.24 (ii)	17.72 (ii)	
Unit Hyd. Tpeak (min)=	15.00	30.00	
Unit Hyd. peak (cms)=	0.10	0.05	
PEAK FLOW (cms)=	1.21	0.22	1.323 (iii)
TIME TO PEAK (hrs)=	1.50	1.75	1.50
RUNOFF VOLUME (mm)=	35.96	10.73	22.84
TOTAL RAINFALL (mm)=	36.96	36.96	36.96

```
     RUNOFF COEFFICIENT   =       0.97         0.29          0.62

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0001):    26.52   2.034     1.50    21.35
     + ID2= 2 (  0002):    15.59   1.323     1.50    22.84
       ================================================
       ID = 3 (  0003):    42.11   3.357     1.50    21.90

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000    |   0.5600     1.6774
                         0.0310     0.5265    |   0.9420     1.9885
                         0.0790     1.1220    |   1.2450     2.2323
                         0.3150     1.4435    |   1.3880     2.5015

                              AREA     QPEAK     TPEAK       R.V.
                              (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)    42.110     3.357      1.50      21.90
   OUTFLOW: ID= 1 (  0004)    42.110     0.058      4.33      21.26

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  1.74
                  TIME SHIFT OF PEAK FLOW         (min)=170.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.8660

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0007)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0004):    42.11   0.058     4.33    21.26
     + ID2= 2 (  0008):     0.91   0.015     1.58     5.83
       ================================================
       ID = 3 (  0007):    43.02   0.060     4.08    20.94

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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      V    V   I    SSSSS  U   U    A    L
      V    V   I    SS     U   U   A A   L
       V  V    I     SS    U   U  AAAAA  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 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 5.0\VO2\voin.dat
  Output  filename: C:\Users\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-
45e7-8ee9-3237db384aff\1010bfe2-6d24-48e1-a14f-61b6906c3f4f\scen
  Summary filename: C:\Users\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-
45e7-8ee9-3237db384aff\1010bfe2-6d24-48e1-a14f-61b6906c3f4f\scen


DATE: 03-10-2020                          TIME: 09:45:18

USER:


COMMENTS: _____________________________________________________

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  ****************************
  ** SIMULATION NUMBER:   0 **
  ****************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 853.608
| Ptotal= 50.53 mm |                          B=   4.699
--------------------                          C=   0.766
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  4.00 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
  0.08    3.34 |  1.08   13.95 |  2.08    9.00 |  3.08    4.41
  0.17    3.53 |  1.17   21.13 |  2.17    8.22 |  3.17    4.24
  0.25    3.76 |  1.25   47.65 |  2.25    7.57 |  3.25    4.09
  0.33    4.02 |  1.33  149.77 |  2.33    7.03 |  3.33    3.95
  0.42    4.32 |  1.42   61.12 |  2.42    6.57 |  3.42    3.82
  0.50    4.68 |  1.50   34.23 |  2.50    6.17 |  3.50    3.70
  0.58    5.12 |  1.58   23.87 |  2.58    5.83 |  3.58    3.59
  0.67    5.67 |  1.67   18.43 |  2.67    5.52 |  3.67    3.49
  0.75    6.37 |  1.75   15.09 |  2.75    5.25 |  3.75    3.39
  0.83    7.30 |  1.83   12.84 |  2.83    5.01 |  3.83    3.30
  0.92    8.60 |  1.92   11.20 |  2.92    4.79 |  3.92    3.21
  1.00   10.57 |  2.00    9.97 |  3.00    4.59 |  4.00    3.13
```

```
| CALIB            |
| NASHYD   (  0008)|   Area    (ha)=   0.91   Curve Number   (CN)= 64.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20

     Unit Hyd Qpeak  (cms)=   0.174

     PEAK FLOW       (cms)=   0.028 (i)
     TIME TO PEAK    (hrs)=   1.583
     RUNOFF VOLUME    (mm)=  10.983
     TOTAL RAINFALL   (mm)=  50.535
     RUNOFF COEFFICIENT   =   0.217

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

```
| CALIB            |
| STANDHYD (  0001)|   Area    (ha)=  26.52
|ID= 1 DT=15.0 min |   Total Imp(%)=  61.00   Dir. Conn.(%)=  45.00
--------------------

                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      16.18         10.34
     Dep. Storage     (mm)=       1.00          1.50
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     420.48         40.00
     Mannings n             =      0.013         0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO  15.0 MIN. TIME STEP.

                          ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.250    3.54 | 1.250   27.57 | 2.250    8.26 |  3.25    4.25
              0.500    4.34 | 1.500   81.71 | 2.500    6.59 |  3.50    3.83
              0.750    5.72 | 1.750   19.13 | 2.750    5.53 |  3.75    3.49
              1.000    8.82 | 2.000   11.34 | 3.000    4.79 |  4.00    3.21

     Max.Eff.Inten.(mm/hr)=      81.71         36.46
               over (min)        15.00         30.00
     Storage Coeff.  (min)=       6.56 (ii)    17.12 (ii)
     Unit Hyd. Tpeak (min)=      15.00         30.00
     Unit Hyd. peak  (cms)=       0.10          0.05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       2.52          0.58          2.832 (iii)
     TIME TO PEAK    (hrs)=       1.50          1.75           1.50
     RUNOFF VOLUME    (mm)=      49.53         16.23          31.22
     TOTAL RAINFALL   (mm)=      50.53         50.53          50.53
     RUNOFF COEFFICIENT   =       0.98          0.32           0.62

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.
```

```
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=  15.59
|ID= 1 DT=15.0 min |   Total Imp(%)=  69.00   Dir. Conn.(%)=  48.00
--------------------

                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      10.76          4.83
     Dep. Storage     (mm)=       1.00          1.50
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     322.39         40.00
     Mannings n             =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=      81.71         49.40
               over (min)        15.00         15.00
     Storage Coeff.  (min)=       5.59 (ii)    14.95 (ii)
     Unit Hyd. Tpeak (min)=      15.00         15.00
     Unit Hyd. peak  (cms)=       0.11          0.07
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.62          0.45          2.065 (iii)
     TIME TO PEAK    (hrs)=       1.50          1.50           1.50
     RUNOFF VOLUME    (mm)=      49.53         18.28          33.28
     TOTAL RAINFALL   (mm)=      50.53         50.53          50.53
     RUNOFF COEFFICIENT   =       0.98          0.36           0.66

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.
```

```
| ADD HYD  (  0003)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0001):    26.52   2.832     1.50    31.22
     + ID2= 2 (  0002):    15.59   2.065     1.50    33.28
       ================================================
       ID = 3 (  0003):    42.11   4.897     1.50    31.98

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

```
| RESERVOIR(  0004)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.5600     1.6774
                          0.0310     0.5265   |   0.9420     1.9885
                          0.0790     1.1220   |   1.2450     2.2323
                          0.3150     1.4435   |   1.3880     2.5015

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)     42.110     4.897      1.50      31.98
   OUTFLOW: ID= 1 (  0004)     42.110     0.164      4.17      31.14

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=  3.35
                    TIME SHIFT OF PEAK FLOW          (min)=160.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  1.2378
```

```
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0007)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)      (mm)
       ID1= 1 (  0004):    42.11   0.164     4.17    31.14
     + ID2= 2 (  0008):     0.91   0.028     1.58    10.98
       ================================================
       ID = 3 (  0007):    43.02   0.166     4.08    30.71

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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       V    V   I    SSSSS  U   U    A    L
       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\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-
45e7-8ee9-3237db384aff\cfe98fef-6017-4b6b-a59b-30b0a81b094b\scen


DATE: 03-10-2020                          TIME: 09:45:18

USER:



COMMENTS: _____________________________________________________________

--------------------------------------------------------------------------------
----------------------------
  ****************************
  ** SIMULATION NUMBER:   0 **
  ****************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 975.865
| Ptotal= 59.71 mm |                          B=   4.699
--------------------                          C=   0.760
                       used in:   INTENSITY =  A / (t + B)^C
                                  Duration of storm  =  4.00 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
   0.08    4.04 |  1.08   16.60 |'  2.08   10.77 |  3.08    5.31
   0.17    4.27 |  1.17   25.02 |'  2.17    9.84 |  3.17    5.12
   0.25    4.54 |  1.25   55.85 |'  2.25    9.08 |  3.25    4.94
   0.33    4.85 |  1.33  173.57 |'  2.33    8.44 |  3.33    4.77
   0.42    5.21 |  1.42   71.48 |'  2.42    7.89 |  3.42    4.62
   0.50    5.64 |  1.50   40.30 |'  2.50    7.42 |  3.50    4.47
   0.58    6.17 |  1.58   28.22 |'  2.58    7.01 |  3.58    4.34
   0.67    6.81 |  1.67   21.86 |'  2.67    6.64 |  3.67    4.21
   0.75    7.65 |  1.75   17.95 |'  2.75    6.32 |  3.75    4.10
   0.83    8.75 |  1.83   15.29 |'  2.83    6.03 |  3.83    3.99
   0.92   10.29 |  1.92   13.37 |'  2.92    5.77 |  3.92    3.88
   1.00   12.63 |  2.00   11.91 |'  3.00    5.53 |  4.00    3.79

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0008)|   Area     (ha)=   0.91   Curve Number    (CN)= 64.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20

     Unit Hyd Qpeak  (cms)=   0.174

     PEAK FLOW       (cms)=   0.038 (i)
     TIME TO PEAK    (hrs)=   1.583
     RUNOFF VOLUME    (mm)=  15.120
     TOTAL RAINFALL   (mm)=  59.711
     RUNOFF COEFFICIENT   =   0.253

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0001)|   Area     (ha)=  26.52
|ID= 1 DT=15.0 min |   Total Imp(%)=  61.00   Dir. Conn.(%)=  45.00
--------------------

                                IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      16.18         10.34
     Dep. Storage     (mm)=       1.00          1.50
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     420.48         40.00
     Mannings n           =      0.013         0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO  15.0 MIN. TIME STEP.

                              ---- TRANSFORMED HYETOGRAPH ----
   TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
    hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
  0.250    4.28 | 1.250   32.49 | 2.250    9.90 |  3.25    5.12
  0.500    5.23 | 1.500   95.12 | 2.500    7.92 |  3.50    4.62
  0.750    6.88 | 1.750   22.68 | 2.750    6.65 |  3.75    4.22
  1.000   10.56 | 2.000   13.52 | 3.000    5.78 |  4.00    3.89

     Max.Eff.Inten.(mm/hr)=      95.12         48.02
```

```
                over (min)        15.00        30.00
     Storage Coeff.  (min)=        6.17 (ii)   15.63 (ii)
     Unit Hyd. Tpeak (min)=       15.00        30.00
     Unit Hyd. peak  (cms)=        0.10         0.05
                                                          *TOTALS*
     PEAK FLOW       (cms)=        2.96         0.80          3.401 (iii)
     TIME TO PEAK    (hrs)=        1.50         1.75           1.50
     RUNOFF VOLUME    (mm)=       58.71        21.50          38.25
     TOTAL RAINFALL   (mm)=       59.71        59.71          59.71
     RUNOFF COEFFICIENT   =        0.98         0.36           0.64

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=  15.59
|ID= 1 DT=15.0 min |   Total Imp(%)=  69.00   Dir. Conn.(%)=  48.00
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      10.76         4.83
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     322.39        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      95.12        64.57
                over (min)       15.00        15.00
     Storage Coeff.  (min)=        5.26 (ii)   13.67 (ii)
     Unit Hyd. Tpeak (min)=       15.00        15.00
     Unit Hyd. peak  (cms)=        0.11         0.08
                                                          *TOTALS*
     PEAK FLOW       (cms)=        1.90         0.61          2.512 (iii)
     TIME TO PEAK    (hrs)=        1.50         1.50           1.50
     RUNOFF VOLUME    (mm)=       58.71        24.02          40.67
     TOTAL RAINFALL   (mm)=       59.71        59.71          59.71
     RUNOFF COEFFICIENT   =        0.98         0.40           0.68

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0001):    26.52   3.401     1.50    38.25
     + ID2= 2 (  0002):    15.59   2.512     1.50    40.67
       ====================================================
       ID = 3 (  0003):    42.11   5.912     1.50    39.14

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000    |   0.5600      1.6774
                         0.0310     0.5265    |   0.9420      1.9885
                         0.0790     1.1220    |   1.2450      2.2323
                         0.3150     1.4435    |   1.3880      2.5015

                                    AREA     QPEAK     TPEAK       R.V.
                                    (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)     42.110      5.912      1.50       39.14
   OUTFLOW: ID= 1 (  0004)     42.110      0.306      4.08       38.26

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  5.18
                   TIME SHIFT OF PEAK FLOW          (min)=155.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.4315

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0007)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0004):    42.11   0.306     4.08    38.26
     + ID2= 2 (  0008):     0.91   0.038     1.58    15.12
       ====================================================
       ID = 3 (  0007):    43.02   0.310     4.00    37.77

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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================================================================================
============================

       V    V   I    SSSSS  U   U    A    L
       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 5.0\VO2\voin.dat
  Output  filename: C:\Users\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-
45e7-8ee9-3237db384aff\c3a16a49-5576-4aa8-9fb3-359f88ca0ff1\scen
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```

DATE: 03-10-2020 TIME: 09:45:18

USER:

COMMENTS: _____

****
** SIMULATION NUMBER: 0 **
****

| CHICAGO STORM | Ptotal= 71.26 mm |

IDF curve parameters: A=1146.275
B= 4.922
C= 0.757
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 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
0.08	4.89	1.08	20.02	2.08	13.00	3.08	6.43
0.17	5.17	1.17	30.12	2.17	11.89	3.17	6.19
0.25	5.49	1.25	66.69	2.25	10.97	3.25	5.97
0.33	5.86	1.33	201.77	2.33	10.19	3.33	5.77
0.42	6.30	1.42	85.09	2.42	9.53	3.42	5.58
0.50	6.82	1.50	48.36	2.50	8.96	3.50	5.41
0.58	7.45	1.58	33.96	2.58	8.47	3.58	5.25
0.67	8.24	1.67	26.35	2.67	8.03	3.67	5.10
0.75	9.24	1.75	21.64	2.75	7.64	3.75	4.96
0.83	10.57	1.83	18.45	2.83	7.29	3.83	4.82
0.92	12.43	1.92	16.14	2.92	6.97	3.92	4.70
1.00	15.24	2.00	14.38	3.00	6.69	4.00	4.58

| CALIB | NASHYD (0008) | ID= 1 DT= 5.0 min |

Area (ha)= 0.91 Curve Number (CN)= 64.0
Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= 0.20

Unit Hyd Qpeak (cms)= 0.174

PEAK FLOW (cms)= 0.054 (i)
TIME TO PEAK (hrs)= 1.583
RUNOFF VOLUME (mm)= 20.950
TOTAL RAINFALL (mm)= 71.255
RUNOFF COEFFICIENT = 0.294

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

| CALIB | STANDHYD (0001) | ID= 1 DT=15.0 min |

Area (ha)= 26.52 Total Imp(%)= 61.00 Dir. Conn.(%)= 45.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	16.18	10.34
Dep. Storage (mm)=	1.00	1.50
Average Slope (%)=	1.00	2.00
Length (m)=	420.48	40.00
Mannings n =	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 15.0 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
0.250	5.18	1.250	38.94	2.250	11.95	3.25	6.20
0.500	6.33	1.500	111.74	2.500	9.56	3.50	5.59
0.750	8.31	1.750	27.32	2.750	8.04	3.75	5.10
1.000	12.75	2.000	16.32	3.000	6.98	4.00	4.70

			TOTALS
Max.Eff.Inten.(mm/hr)=	111.74	63.84	
over (min)	15.00	15.00	
Storage Coeff. (min)=	5.78 (ii)	14.23 (ii)	
Unit Hyd. Tpeak (min)=	15.00	15.00	
Unit Hyd. peak (cms)=	0.10	0.07	
PEAK FLOW (cms)=	3.52	1.27	4.789 (iii)
TIME TO PEAK (hrs)=	1.50	1.50	1.50
RUNOFF VOLUME (mm)=	70.26	28.73	47.41
TOTAL RAINFALL (mm)=	71.26	71.26	71.26
RUNOFF COEFFICIENT =	0.99	0.40	0.67

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 64.0 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.

| CALIB | STANDHYD (0002) | ID= 1 DT=15.0 min |

Area (ha)= 15.59 Total Imp(%)= 69.00 Dir. Conn.(%)= 48.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	10.76	4.83
Dep. Storage (mm)=	1.00	1.50
Average Slope (%)=	1.00	2.00
Length (m)=	322.39	40.00
Mannings n =	0.013	0.250

			TOTALS
Max.Eff.Inten.(mm/hr)=	111.74	85.12	
over (min)	15.00	15.00	
Storage Coeff. (min)=	4.93 (ii)	12.46 (ii)	
Unit Hyd. Tpeak (min)=	15.00	15.00	
Unit Hyd. peak (cms)=	0.11	0.08	
PEAK FLOW (cms)=	2.25	0.84	3.094 (iii)
TIME TO PEAK (hrs)=	1.50	1.50	1.50
RUNOFF VOLUME (mm)=	70.26	31.83	50.27
TOTAL RAINFALL (mm)=	71.26	71.26	71.26

```
     RUNOFF COEFFICIENT   =       0.99         0.45          0.71

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0001):    26.52   4.789     1.50    47.41
     + ID2= 2 (  0002):    15.59   3.094     1.50    50.27
       ================================================
       ID = 3 (  0003):    42.11   7.884     1.50    48.47

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000    |   0.5600     1.6774
                         0.0310     0.5265    |   0.9420     1.9885
                         0.0790     1.1220    |   1.2450     2.2323
                         0.3150     1.4435    |   1.3880     2.5015

                              AREA     QPEAK     TPEAK       R.V.
                              (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)    42.110     7.884      1.50      48.47
   OUTFLOW: ID= 1 (  0004)    42.110     0.525      3.58      47.56

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  6.66
                  TIME SHIFT OF PEAK FLOW         (min)=125.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  1.6438

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0007)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0004):    42.11   0.525     3.58    47.56
     + ID2= 2 (  0008):     0.91   0.054     1.58    20.95
       ================================================
       ID = 3 (  0007):    43.02   0.532     3.58    47.00

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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      V    V   I    SSSSS  U   U    A    L
      V    V   I    SS     U   U   A A   L
       V  V    I     SS    U   U  AAAAA  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 5.0\VO2\voin.dat
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45e7-8ee9-3237db384aff\6d7ded0e-dbdd-4906-a621-2dc6c47f866a\scen


DATE: 03-10-2020                          TIME: 09:45:18

USER:


COMMENTS: _____________________________________________________

--------------------------------------------------------------------------------
----------------------------
  ****************************
  ** SIMULATION NUMBER:   0 **
  ****************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1236.152
| Ptotal= 79.48 mm |                          B=   4.699
--------------------                          C=   0.751
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  4.00 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
    0.08    5.55 |  1.08   22.32 |  2.08   14.59 |  3.08    7.28
    0.17    5.87 |  1.17   33.39 |  2.17   13.36 |  3.17    7.02
    0.25    6.23 |  1.25   73.46 |  2.25   12.34 |  3.25    6.77
    0.33    6.65 |  1.33  224.41 |  2.33   11.48 |  3.33    6.55
    0.42    7.14 |  1.42   93.66 |  2.42   10.75 |  3.42    6.34
    0.50    7.72 |  1.50   53.34 |  2.50   10.11 |  3.50    6.14
    0.58    8.43 |  1.58   37.60 |  2.58    9.56 |  3.58    5.96
    0.67    9.30 |  1.67   29.26 |  2.67    9.07 |  3.67    5.79
    0.75   10.42 |  1.75   24.10 |  2.75    8.63 |  3.75    5.64
    0.83   11.90 |  1.83   20.60 |  2.83    8.24 |  3.83    5.49
    0.92   13.96 |  1.92   18.05 |  2.92    7.89 |  3.92    5.35
    1.00   17.06 |  2.00   16.11 |  3.00    7.57 |  4.00    5.22
```

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--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0008)|   Area    (ha)=   0.91   Curve Number   (CN)= 64.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20

     Unit Hyd Qpeak  (cms)=   0.174

     PEAK FLOW       (cms)=   0.065 (i)
     TIME TO PEAK    (hrs)=   1.583
     RUNOFF VOLUME    (mm)=  25.470
     TOTAL RAINFALL   (mm)=  79.475
     RUNOFF COEFFICIENT   =   0.320

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0001)|   Area    (ha)=  26.52
|ID= 1 DT=15.0 min |   Total Imp(%)=  61.00   Dir. Conn.(%)=  45.00
--------------------

                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      16.18         10.34
     Dep. Storage     (mm)=       1.00          1.50
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     420.48         40.00
     Mannings n             =      0.013         0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO  15.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.250    5.89 | 1.250   43.06 | 2.250   13.43 |  3.25    7.02
              0.500    7.17 | 1.500  123.80 | 2.500   10.78 |  3.50    6.34
              0.750    9.38 | 1.750   30.32 | 2.750    9.09 |  3.75    5.80
              1.000   14.30 | 2.000   18.25 | 3.000    7.90 |  4.00    5.35

     Max.Eff.Inten.(mm/hr)=     123.80         75.96
               over (min)       15.00         15.00
     Storage Coeff.  (min)=      5.55 (ii)    13.43 (ii)
     Unit Hyd. Tpeak (min)=     15.00         15.00
     Unit Hyd. peak  (cms)=      0.11          0.08
                                                      *TOTALS*
     PEAK FLOW       (cms)=      3.92          1.56      5.478 (iii)
     TIME TO PEAK    (hrs)=      1.50          1.50       1.50
     RUNOFF VOLUME    (mm)=     78.48         34.21      54.13
     TOTAL RAINFALL   (mm)=     79.48         79.48      79.48
     RUNOFF COEFFICIENT   =      0.99          0.43       0.68

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=  15.59
|ID= 1 DT=15.0 min |   Total Imp(%)=  69.00   Dir. Conn.(%)=  48.00
--------------------

                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      10.76          4.83
     Dep. Storage     (mm)=       1.00          1.50
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     322.39         40.00
     Mannings n             =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=     123.80        100.75
               over (min)       15.00         15.00
     Storage Coeff.  (min)=      4.73 (ii)    11.77 (ii)
     Unit Hyd. Tpeak (min)=     15.00         15.00
     Unit Hyd. peak  (cms)=      0.11          0.08
                                                      *TOTALS*
     PEAK FLOW       (cms)=      2.50          1.03      3.529 (iii)
     TIME TO PEAK    (hrs)=      1.50          1.50       1.50
     RUNOFF VOLUME    (mm)=     78.48         37.71      57.28
     TOTAL RAINFALL   (mm)=     79.48         79.48      79.48
     RUNOFF COEFFICIENT   =      0.99          0.47       0.72

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0001):    26.52   5.478     1.50    54.13
     + ID2= 2 (  0002):    15.59   3.529     1.50    57.28
       ==================================================
       ID = 3 (  0003):    42.11   9.007     1.50    55.29

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000    |   0.5600     1.6774
                         0.0310     0.5265    |   0.9420     1.9885
                         0.0790     1.1220    |   1.2450     2.2323
                         0.3150     1.4435    |   1.3880     2.5015

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)     42.110     9.007      1.50      55.29
   OUTFLOW: ID= 1 (  0004)     42.110     0.703      3.25      54.37

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=  7.81
                    TIME SHIFT OF PEAK FLOW         (min)=105.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  1.7940
```

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--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0007)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0004):    42.11   0.703     3.25    54.37
     + ID2= 2 (  0008):     0.91   0.065     1.58    25.47
       ================================================
       ID = 3 (  0007):    43.02   0.713     3.25    53.76

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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       V    V   I    SSSSS  U   U    A    L
       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 5.0\VO2\voin.dat
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  Summary filename: C:\Users\nkamran\AppData\Local\Civica\VH5\d5937511-9e09-
45e7-8ee9-3237db384aff\87806299-b906-4fe8-b260-00cc7664f42a\scen

DATE: 03-10-2020                          TIME: 09:45:18

USER:

COMMENTS: _____

--------------------------------------------------------------------------------
---------------------------
  ***************************
  ** SIMULATION NUMBER:   0 **
  ***************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1426.408
| Ptotal= 87.60 mm |                          B=   5.273
--------------------                          C=   0.759
                       used in:   INTENSITY =  A / (t + B)^C
                                  Duration of storm  =  4.00 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
   0.08    5.99 |  1.08   24.83 |'  2.08   16.06 |  3.08    7.89
   0.17    6.34 |  1.17   37.46 |'  2.17   14.68 |  3.17    7.60
   0.25    6.73 |  1.25   82.72 |'  2.25   13.53 |  3.25    7.33
   0.33    7.20 |  1.33  243.43 |'  2.33   12.57 |  3.33    7.08
   0.42    7.74 |  1.42  105.36 |'  2.42   11.75 |  3.42    6.85
   0.50    8.38 |  1.50   60.19 |'  2.50   11.04 |  3.50    6.64
   0.58    9.16 |  1.58   42.26 |'  2.58   10.42 |  3.58    6.44
   0.67   10.14 |  1.67   32.74 |'  2.67    9.88 |  3.67    6.25
   0.75   11.38 |  1.75   26.86 |'  2.75    9.39 |  3.75    6.08
   0.83   13.03 |  1.83   22.87 |'  2.83    8.96 |  3.83    5.91
   0.92   15.35 |  1.92   19.98 |'  2.92    8.57 |  3.92    5.76
   1.00   18.86 |  2.00   17.78 |'  3.00    8.22 |  4.00    5.61

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0008)|   Area     (ha)=   0.91   Curve Number    (CN)= 64.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20

     Unit Hyd Qpeak  (cms)=   0.174

     PEAK FLOW       (cms)=   0.078 (i)
     TIME TO PEAK    (hrs)=   1.583
     RUNOFF VOLUME    (mm)=  30.204
     TOTAL RAINFALL   (mm)=  87.604
     RUNOFF COEFFICIENT   =   0.345

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0001)|   Area     (ha)=  26.52
|ID= 1 DT=15.0 min |   Total Imp(%)=  61.00   Dir. Conn.(%)=  45.00
--------------------

                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       16.18         10.34
     Dep. Storage     (mm)=        1.00          1.50
     Average Slope     (%)=        1.00          2.00
     Length            (m)=      420.48         40.00
     Mannings n           =       0.013         0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO  15.0 MIN. TIME STEP.

                                ---- TRANSFORMED HYETOGRAPH ----
    TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
     hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
   0.250    6.35 | 1.250   48.34 | 2.250   14.76 |  3.25    7.61
   0.500    7.77 | 1.500  136.32 | 2.500   11.78 |  3.50    6.86
   0.750   10.23 | 1.750   33.95 | 2.750    9.90 |  3.75    6.25
   1.000   15.75 | 2.000   20.21 | 3.000    8.58 |  4.00    5.76

     Max.Eff.Inten.(mm/hr)=     136.32        89.16
```

```
                over (min)       15.00        15.00
     Storage Coeff.  (min)=       5.34 (ii)   12.73 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=       0.11         0.08
                                                        *TOTALS*
     PEAK FLOW       (cms)=       4.34         1.88          6.218 (iii)
     TIME TO PEAK    (hrs)=       1.50         1.50           1.50
     RUNOFF VOLUME    (mm)=      86.60        39.87          60.90
     TOTAL RAINFALL   (mm)=      87.60        87.60          87.60
     RUNOFF COEFFICIENT   =       0.99         0.46           0.70

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=  15.59
|ID= 1 DT=15.0 min |   Total Imp(%)=  69.00   Dir. Conn.(%)=  48.00
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      10.76         4.83
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     322.39        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     136.32       117.66
                over (min)       15.00        15.00
     Storage Coeff.  (min)=       4.56 (ii)   11.17 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=       0.11         0.08
                                                        *TOTALS*
     PEAK FLOW       (cms)=       2.76         1.23          3.993 (iii)
     TIME TO PEAK    (hrs)=       1.50         1.50           1.50
     RUNOFF VOLUME    (mm)=      86.60        43.74          64.32
     TOTAL RAINFALL   (mm)=      87.60        87.60          87.60
     RUNOFF COEFFICIENT   =       0.99         0.50           0.73

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  64.0    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.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0001):    26.52   6.218     1.50    60.90
      + ID2= 2 (  0002):    15.59   3.993     1.50    64.32
        ================================================
        ID = 3 (  0003):    42.11  10.211     1.50    62.16

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   0.5600      1.6774
                         0.0310     0.5265   |   0.9420      1.9885
                         0.0790     1.1220   |   1.2450      2.2323
                         0.3150     1.4435   |   1.3880      2.5015

                                    AREA     QPEAK     TPEAK       R.V.
                                    (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)     42.110     10.211      1.50      62.16
   OUTFLOW: ID= 1 (  0004)     42.110      0.895      3.00      61.23

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=  8.76
                    TIME SHIFT OF PEAK FLOW          (min)= 90.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  1.9503

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--------------------
| ADD HYD  (  0007)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0004):    42.11   0.895     3.00    61.23
      + ID2= 2 (  0008):     0.91   0.078     1.58    30.20
        ================================================
        ID = 3 (  0007):    43.02   0.908     2.92    60.58

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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 FINISH
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EPA SWMM Node Table Inputs

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ID	System	X*	Y*	Invert Elevation	Max Depth	Initial Depth	Surcharge Depth	Ponding Area
		[m]	[m]	[m]	[m]	[m]	[m]	[m2]
1	Minor	611016.53	4912010.63	255.918	2.541	0	0	0
2	Minor	611033.17	4911932.38	255.523	4.669	0	0	0
3	Minor	611055.82	4911861.92	260.38	1.907	0	0	0
4	Minor	611048.87	4911858.55	255.219	7.066	0	0	0
6	Minor	611071.52	4911788.1	258.978	2.887	0	0	0
7	Minor	611064.57	4911784.73	254.961	6.995	0	0	0
9	Minor	611087.22	4911714.28	259.443	2.268	0	0	0
10	Minor	611080.27	4911710.91	254.705	7.109	0	0	0
11	Minor	610824.8	4911543.54	260.5	2.629	0	0	0
12	Minor	610906.86	4911570.89	258.917	3.944	0	0	0
13	Minor	611001.73	4911602.51	257.261	4.75	0	0	0
15	Minor	611096.68	4911634.16	254.317	7.493	0	0	0
16	Minor	611111.19	4911567.71	254.033	7.316	0	0	0
17	Minor	611089.25	4912024.39	257.389	1.921	0	0	0
19	Minor	611100.07	4911973.53	257.054	2.656	0	0	0
21	Minor	611065.87	4911943.27	257.224	2.763	0	0	0
22	Minor	611105.73	4911956.56	256.814	2.975	0	0	0
23	Minor	611112.6	4912038.22	256.237	2.387	0	0	0
24	Minor	611179.41	4912060.99	255.996	2.965	0	0	0
25	Minor	611185.94	4912057.37	255.899	3.204	0	0	0
26	Minor	611197.96	4911998.03	255.688	3.647	0	0	0
27	Minor	611201.18	4911988.37	255.507	3.935	0	0	0
28	Minor	611258.76	4912007.56	255.295	3.842	0	0	0
29	Minor	611255.61	4912106.25	255.143	3.919	0	0	0
30	Minor	611274.95	4912010.85	254.87	4.375	0	0	0
31	Minor	611081.8	4911869.53	258.829	3.268	0	0	0
32	Minor	611118.8	4911881.86	258.259	3.645	0	0	0
33	Minor	611209.87	4911912.21	256.522	3.468	0	0	0
34	Minor	611226.97	4911917.91	256.588	2.955	0	0	0
35	Minor	611281.67	4911936.14	256.454	2.343	0	0	0
36	Minor	611323.71	4911950.16	256.426	2.483	0	0	0
37	Minor	611289.66	4911938.28	254.651	4.245	0	0	0
38	Minor	611097.76	4911795.79	258.71	2.872	0	0	0
39	Minor	611139.5	4911809.7	258.415	2.727	0	0	0
40	Minor	611228.2	4911839.27	256.938	2.474	0	0	0
41	Minor	611250.69	4911846.76	256.552	2.383	0	0	0
42	Minor	611304.6	4911864.54	254.394	4.122	0	0	0
43	Minor	611113.24	4911721.89	257.485	4.064	0	0	0
44	Minor	611155.93	4911736.12	257.727	3.269	0	0	0
45	Minor	611244.16	4911765.53	256.132	2.663	0	0	0
47	Minor	611311.69	4911788.04	255.22	2.815	0	0	0
48	Minor	611319.77	4911789.68	254.137	3.998	0	0	0
49	Minor	611129.8	4911645.19	258	3.6	0	0	0
50	Minor	611172.49	4911659.42	257.61	3.546	0	0	0
51	Minor	611259.56	4911688.45	255.624	3.838	0	0	0
52	Minor	611318.35	4911708.04	254.984	3.284	0	0	0
53	Minor	611369.81	4911725.19	254.779	3.288	0	0	0
54	Minor	611335.52	4911711.97	253.868	4.692	0	0	0
55	Minor	611386.05	4911649.44	254.79	2.597	0	0	0
57	Minor	610882.38	4911481.57	260.14	2.718	0	0	0
58	Minor	610901.36	4911487.89	260.42	2.303	0	0	0
60	Minor	610971.98	4911511.43	259.824	2.613	0	0	0
61	Minor	611027.16	4911529.82	259.117	3.649	0	0	0
62	Minor	610903.04	4911480.07	258.568	3.941	0	0	0

EPA SWMM Node Table Inputs

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ID	System	X*	Y*	Invert Elevation	Max Depth	Initial Depth	Surcharge Depth	Ponding Area
		[m]	[m]	[m]	[m]	[m]	[m]	[m2]
63	Minor	610919.28	4911404.8	258.033	2.289	0	0	0
64	Minor	610924.19	4911382.05	257.487	2.629	0	0	0
65	Minor	610938.3	4911375.73	256.882	3.153	0	0	0
67	Minor	610973.88	4911502.63	257.948	4.235	0	0	0
68	Minor	610993.17	4911413.19	257.34	2.368	0	0	0
69	Minor	610998.92	4911395.9	256.412	3.345	0	0	0
71	Minor	611056.41	4911415.02	256.079	4.49	0	0	0
72	Minor	611065.12	4911430.61	255.96	5.159	0	0	0
73	Minor	611051.04	4911495.87	255.593	7.11	0	0	0
74	Minor	611042.61	4911534.97	255.243	7.432	0	0	0
76	Minor	611133.89	4911462.71	256.302	2.967	0	0	0
76B-mid	Minor	611138.37	4911441.72	256.483	1.994	0	0	0
76-Mid	Minor	611127.43	4911491.75	257	2.886	0	0	0
77	Minor	611113.03	4911559.5	254.122	7.253	0	0	0
78	Minor	611119.59	4911561.68	253.852	7.38	0	0	0
80	Minor	611183.49	4911582.98	253.62	5.743	0	0	0
81	Minor	611185.54	4911574.23	255.996	3.225	0	0	0
82	Minor	611199.46	4911509.71	255.636	2.781	0	0	0
83	Minor	611206.19	4911478.48	255.242	2.797	0	0	0
84	Minor	611220.19	4911471.68	255.084	2.883	0	0	0
85	Minor	611267.6	4911487.48	254.754	2.966	0	0	0
86	Minor	611276.85	4911501.88	254.588	3.062	0	0	0
87	Minor	611262.6	4911567.95	254.223	3.088	0	0	0
88	Minor	611254.11	4911606.52	253.367	3.895	0	0	0
89	Minor	611352.66	4911628.61	252.974	4.17	0	0	0
90	Minor	610826.51	4911462.95	261.4	2.16	0	0	0
91	Minor	610846.84	4911367.59	257.421	2.461	0	0	0
92	Minor	611303.95	4911418.33	254.505	2.428	0	0	0
93	Minor	611231.1	4911393.4	254.045	2.586	0	0	0
94	Minor	611154.47	4911367.18	252.333	4.143	0	0	0
95	Minor	611081.9	4911342.97	251.873	4.59	0	0	0
96	Minor	611010.28	4911319.08	251.42	5.035	0	0	0
97	Minor	610938.18	4911295.04	251.01	5.35	0	0	0
98	Minor	610867.76	4911271.55	250.639	0	0	0	0
Ext-1	Minor	611430.44	4911663.15	255.79	2.597	0	0	0
Ext-2	Minor	611477.16	4911677.88	256.79	2.597	0	0	0
Ext-3	Minor	611416.39	4911741.37	255.779	3.288	0	0	0
Ext-4	Minor	611449.91	4911752.37	256.779	3.288	0	0	0
Ext-5	Minor	611428.19	4911814.89	257.779	3.288	0	0	0
Ext-6	Minor	611411.11	4911869.71	258.779	3.288	0	0	0
Ext-7	Minor	611394.94	4911925.12	259.779	3.288	0	0	0
Other	Minor	610826.6	4911253.88	0	0	0	0	0
SN1	Major	611020.53	4912014.63	258.459	0	0	0	0
SN10	Major	611084.27	4911714.91	261.814	0	0	0	0
SN10.2	Major	611086.01	4911715.75	261.78825	0	0	0	0
SN10HP	Major	611091.19	4911682.73	261.95	0	0	0	0
SN11	Major	610828.8	4911547.54	263.129	0	0	0	0
SN12	Major	610910.86	4911574.89	262.861	0	0	0	0
SN13	Major	611005.73	4911606.51	262.011	0	0	0	0
SN15	Major	611100.68	4911638.16	261.81	0	0	0	0
SN1S.1	Major	611104.31	4911621.55	261.69475	0	0	0	0
SN16	Major	611115.19	4911571.71	261.349	0	0	0	0
SN17	Major	611093.25	4912028.39	259.31	0	0	0	0
SN17HP	Major	611099.5	4911999.14	259.95	0	0	0	0

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ID	System	X*	Y*	Invert Elevation	Max Depth	Initial Depth	Surcharge Depth	Ponding Area
		[m]	[m]	[m]	[m]	[m]	[m]	[m2]
SN19	Major	611104.07	4911977.53	259.71	0	0	0	0
SN2	Major	611037.17	4911936.38	260.192	0	0	0	0
SN21	Major	611069.87	4911947.27	259.987	0	0	0	0
SN22	Major	611109.73	4911960.56	259.789	0	0	0	0
SN22.1	Major	611108.31	4911964.8	259.76925	0	0	0	0
SN22.2	Major	611133.59	4911968.51	259.70225	0	0	0	0
SN23	Major	611116.6	4912042.22	258.624	0	0	0	0
SN24	Major	611183.41	4912064.99	258.961	0	0	0	0
SN25	Major	611189.94	4912061.37	259.103	0	0	0	0
SN25HP	Major	611196.18	4912031	259.6	0	0	0	0
SN26	Major	611201.96	4912002.03	259.335	0	0	0	0
SN27	Major	611205.18	4911992.37	259.442	0	0	0	0
SN27.1	Major	611219.58	4911997.17	259.36575	0	0	0	0
SN27.2	Major	611204.38	4911994.79	259.41525	0	0	0	0
SN28	Major	611262.76	4912011.56	259.137	0	0	0	0
SN29	Major	611259.61	4912110.25	259.062	0	0	0	0
SN3	Major	611059.82	4911865.92	262.287	0	0	0	0
SN30	Major	611278.95	4912014.85	259.245	0	0	0	0
SN30.2	Major	611282.63	4911996.7	259.15775	0	0	0	0
SN30.3	Major	611274.12	4912038.7	259.19925	0	0	0	0
SN31	Major	611085.8	4911873.53	262.097	0	0	0	0
SN32	Major	611122.8	4911885.86	261.904	0	0	0	0
SN33	Major	611213.87	4911916.21	259.99	0	0	0	0
SN33.1	Major	611218.15	4911917.64	259.87825	0	0	0	0
SN34	Major	611230.97	4911921.91	259.543	0	0	0	0
SN35	Major	611285.67	4911940.14	258.797	0	0	0	0
SN36	Major	611327.71	4911954.16	258.909	0	0	0	0
SN37	Major	611293.66	4911942.28	258.896	0	0	0	0
SN37.2	Major	611297.39	4911923.84	258.801	0	0	0	0
SN38	Major	611101.76	4911799.79	261.582	0	0	0	0
SN39	Major	611143.5	4911813.7	261.142	0	0	0	0
SN4	Major	611052.87	4911862.55	262.285	0	0	0	0
SN4.1	Major	611056.79	4911844.1	262.20275	0	0	0	0
SN4.2	Major	611048.94	4911881.01	261.76175	0	0	0	0
SN40	Major	611232.2	4911843.27	259.412	0	0	0	0
SN41	Major	611254.69	4911850.76	258.935	0	0	0	0
SN42	Major	611308.6	4911868.54	258.516	0	0	0	0
SN42.1	Major	611312.39	4911849.82	258.42075	0	0	0	0
SN43	Major	611117.24	4911725.89	261.549	0	0	0	0
SN44	Major	611159.93	4911740.12	260.996	0	0	0	0
SN45	Major	611248.16	4911769.53	258.795	0	0	0	0
SN47	Major	611315.69	4911792.04	258.035	0	0	0	0
SN48	Major	611323.77	4911793.68	258.135	0	0	0	0
SN48.1	Major	611327.71	4911774.25	257.63125	0	0	0	0
SN48.2	Major	611321.75	4911793.27	258.11	0	0	0	0
SN49	Major	611133.8	4911649.19	261.6	0	0	0	0
SN50	Major	611176.49	4911663.42	261.156	0	0	0	0
SN51	Major	611263.56	4911692.45	259.462	0	0	0	0
SN52	Major	611322.35	4911712.04	258.268	0	0	0	0
SN53	Major	611373.81	4911729.19	258.067	0	0	0	0
SN54	Major	611339.52	4911715.97	257.96	0	0	0	0
SN55	Major	611390.05	4911653.44	257.387	0	0	0	0
SN57	Major	610886.38	4911485.57	262.858	0	0	0	0
SN58	Major	610905.36	4911491.89	262.723	0	0	0	0

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ID	System	X*	Y*	Invert Elevation	Max Depth	Initial Depth	Surcharge Depth	Ponding Area
		[m]	[m]	[m]	[m]	[m]	[m]	[m2]
SN6	Major	611075.52	4911792.1	261.865	0	0	0	0
SN60	Major	610975.98	4911515.43	262.437	0	0	0	0
SN61	Major	611031.16	4911533.82	262.766	0	0	0	0
SN62	Major	610907.04	4911484.07	262.509	0	0	0	0
SN63	Major	610923.28	4911408.8	260.322	0	0	0	0
SN64	Major	610928.19	4911386.05	260.116	0	0	0	0
SN65	Major	610942.3	4911379.73	260.035	0	0	0	0
SN67	Major	610977.88	4911506.63	262.183	0	0	0	0
SN68	Major	610997.17	4911417.19	259.708	0	0	0	0
SN69	Major	611002.92	4911399.9	259.757	0	0	0	0
SN69.1	Major	611001.49	4911404.22	259.74475	0	0	0	0
SN7	Major	611068.57	4911788.73	261.956	0	0	0	0
SN7.1	Major	611072.49	4911770.27	261.9205	0	0	0	0
SN7.2	Major	611070.31	4911789.57	261.93325	0	0	0	0
SN71	Major	611060.41	4911419.02	260.569	0	0	0	0
SN72	Major	611069.12	4911434.61	261.119	0	0	0	0
SN73	Major	611055.04	4911499.87	262.703	0	0	0	0
SN74	Major	611046.61	4911538.97	262.675	0	0	0	0
SN74.1	Major	611064.21	4911545.1	262.35	0	0	0	0
SN76	Major	611137.89	4911466.71	259.269	0	0	0	0
SN76B-mid	Major	611142.41	4911445.47	258.477	0	0	0	0
SN77	Major	611117.03	4911563.5	261.375	0	0	0	0
SN77.2	Major	611124.97	4911525.63	261.42	0	0	0	0
SN78	Major	611123.59	4911565.68	261.232	0	0	0	0
SN78.1	Major	611139.56	4911571.01	260.76475	0	0	0	0
SN80	Major	611187.49	4911586.98	259.363	0	0	0	0
SN81	Major	611189.54	4911578.23	259.221	0	0	0	0
SN82	Major	611203.46	4911513.71	258.417	0	0	0	0
SN83	Major	611210.19	4911482.48	258.039	0	0	0	0
SN84	Major	611224.19	4911475.68	257.967	0	0	0	0
SN85	Major	611271.6	4911491.48	257.72	0	0	0	0
SN86	Major	611280.85	4911505.88	257.65	0	0	0	0
SN87	Major	611266.6	4911571.95	257.311	0	0	0	0
SN88	Major	611258.11	4911610.52	257.262	0	0	0	0
SN88.1	Major	611284.02	4911619.54	256.48	0	0	0	0
SN89	Major	611352.77	4911641.86	257.144	0	0	0	0
SN89.2	Major	611352.38	4911653.45	257.03	0	0	0	0
SN9	Major	611091.22	4911718.28	261.711	0	0	0	0
SN90	Major	610830.51	4911466.95	263.56	0	0	0	0
SN91	Major	610850.84	4911371.59	259.882	0	0	0	0
SN92	Major	611307.95	4911422.33	256.933	0	0	0	0
SN93	Major	611235.1	4911397.4	256.631	0	0	0	0
SN94	Major	611158.47	4911371.18	256.476	0	0	0	0
SN94.1	Major	611140.33	4911365.13	256.47275	0	0	0	0
SN95	Major	611085.9	4911346.97	256.463	0	0	0	0
SN96	Major	611014.28	4911323.08	256.455	0	0	0	0
SN97	Major	610942.18	4911299.04	256.36	0	0	0	0
SN98	Major	610871.76	4911275.55	256.269	0	0	0	0
SNExt-1	Major	611432.3	4911667.05	258.387	0	0	0	0
SNExt-2	Major	611479.53	4911681.27	259.387	0	0	0	0
SNExt-3	Major	611417.74	4911744.41	259.067	0	0	0	0
SNExt-4	Major	611451.77	4911756.94	260.067	0	0	0	0
SNExt-5	Major	611429.69	4911822.38	261.067	0	0	0	0
SNExt-6	Major	611413.21	4911874.5	262.067	0	0	0	0

EPA SWMM Node Table Inputs

Printed on: 2019-04-26

ID	System	X*	Y*	Invert Elevation	Max Depth	Initial Depth	Surcharge Depth	Ponding Area
		[m]	[m]	[m]	[m]	[m]	[m]	[m2]
SNExt-7	Major	611397.33	4911929.32	263.067	0	0	0	0

*Please Note that the X and Y coordinates of the major system nodes are offset from the minor system nodes for visual representation. Conceptually, the major system nodes are directly over the minor system nodes for the purpose of modeling

EPA SWMM Link Table Inputs

Printed on: 2019-04-26

ID	System	From Node	To Node	Length	Roughness	Inlet Offset	Outlet Offset	Initial Flow	Max Flow	Shape	Geom1	Geom2	Geom3	Geom4	Barrels	K Entry	K Exit	K Avg	Flap Gate	Seepage
				[m]		[m]	[m]	[m^3/s]	[m^3/s]											
1	Minor	1	2	80	0.013	0.3	0.376	0	0	CIRCULAR	0.75	0	0	0	1	0	0.05	0	NO	0
2	Minor	2	4	75.474	0.013	0.3	0.375	0	0	CIRCULAR	0.825	0	0	0	1	0	0.05	0	NO	0
3	Minor	3	4	7.725	0.013	0.3	5.384	0	0	CIRCULAR	0.3	0	0	0	1	0	0.05	0	NO	0
4	Minor	4	7	75.474	0.013	0.3	0.329	0	0	CIRCULAR	0.9	0	0	0	1	0	0.05	0	NO	0
6	Minor	6	7	7.725	0.013	0.3	4.239	0	0	CIRCULAR	0.3	0	0	0	1	0	0.05	0	NO	0
7	Minor	7	10	75.474	0.013	0.3	0.33	0	0	CIRCULAR	0.9	0	0	0	1	0	0.05	0	NO	0
9	Minor	9	10	7.724	0.013	0.3	4.96	0	0	CIRCULAR	0.3	0	0	0	1	0	0.05	0	NO	0
10	Minor	10	15	78.483	0.013	0.3	0.45	0	0	CIRCULAR	0.9	0	0	0	1	0	0.05	0	NO	0
11	Minor	11	12	86.5	0.013	0	1.15	0	0	CIRCULAR	0.525	0	0	0	1	0	0.05	0	NO	0
12	Minor	12	13	100	0.013	1.12	1.276	0	0	CIRCULAR	0.525	0	0	0	1	0	0.05	0	NO	0
13	Minor	13	15	100.09	0.013	1.201	2.643	0	0	CIRCULAR	0.6	0	0	0	1	0	0.05	0	NO	0
15	Minor	15	16	68.009	0.013	0.3	0.38	0	0	CIRCULAR	1.05	0	0	0	1	0	0.05	0	NO	0
16	Minor	16	78	10.337	0.013	0.3	0.45	0	0	CIRCULAR	1.05	0	0	0	1	0	0.5	0	NO	0
17	Minor	17	19	52	0.013	0.3	0.375	0	0	CIRCULAR	0.3	0	0	0	1	0	0.05	0	NO	0
19	Minor	19	22	17.887	0.013	0.3	0.45	0	0	CIRCULAR	0.375	0	0	0	1	0	0.75	0	NO	0
21	Minor	21	22	42.015	0.013	0.3	0.501	0	0	CIRCULAR	0.375	0	0	0	1	0	0.05	0	NO	0
22	Minor	22	27	100.616	0.013	0.3	0.6	0	0	CIRCULAR	0.525	0	0	0	1	0	0.05	0	NO	0
23	Minor	23	24	70.592	0.013	0.3	0.33	0	0	CIRCULAR	0.6	0	0	0	1	0	0.05	0	NO	0
24	Minor	24	25	7.461	0.013	0.3	0.374	0	0	CIRCULAR	0.6	0	0	0	1	0	0.05	0	NO	0
25	Minor	25	26	60.543	0.013	0.3	0.33	0	0	CIRCULAR	0.675	0	0	0	1	0	0.05	0	NO	0
26	Minor	26	27	10.181	0.013	0.3	0.45	0	0	CIRCULAR	0.675	0	0	0	1	0	0.75	0	NO	0
27	Minor	27	28	60.696	0.013	0.3	0.33	0	0	CIRCULAR	0.825	0	0	0	1	0	0.05	0	NO	0
28	Minor	28	30	16.517	0.013	0.3	0.675	0	0	CIRCULAR	0.825	0	0	0	1	0	0.75	0	NO	0
29	Minor	29	30	97.343	0.013	0.3	0.33	0	0	RECT_CLOSED	1.2	1.8	0	0	1	0	0.05	0	NO	0
30	Minor	30	37	74.043	0.013	0.3	0.33	0	0	RECT_CLOSED	1.2	1.8	0	0	1	0	0.05	0	NO	0
31	Minor	31	32	39	0.013	0	0.375	0	0	CIRCULAR	0.375	0	0	0	1	0	0.05	0	NO	0
32	Minor	32	33	96	0.013	0.3	0.597	0	0	CIRCULAR	0.45	0	0	0	1	0	0.05	0	NO	0
33	Minor	33	34	18.023	0.013	0.522	0.33	0	0	CIRCULAR	0.525	0	0	0	1	0	0.05	0	NO	0
34	Minor	34	35	57.658	0.013	0.3	0.03	0	0	CIRCULAR	0.525	0	0	0	1	0	0.05	0	NO	0
35	Minor	35	37	8.265	0.013	0	1.745	0	0	CIRCULAR	0.525	0	0	0	1	0	0.75	0	NO	0
36	Minor	36	37	36.065	0.013	0.3	1.895	0	0	CIRCULAR	0.375	0	0	0	1	0	0.05	0	NO	0
37	Minor	37	42	75.238	0.013	0.3	0.33	0	0	RECT_CLOSED	1.2	1.8	0	0	1	0	0.05	0	NO	0
38	Minor	38	39	44	0.013	0.3	0.375	0	0	CIRCULAR	0.375	0	0	0	1	0	0.05	0	NO	0
39	Minor	39	40	93.5	0.013	0.3	0.375	0	0	CIRCULAR	0.45	0	0	0	1	0	0.05	0	NO	0
40	Minor	40	41	23.7	0.013	0.3	0.33	0	0	CIRCULAR	0.525	0	0	0	1	0	0.05	0	NO	0
41	Minor	41	42	56.77	0.013	0.3	1.323	0	0	CIRCULAR	0.525	0	0	0	1	0	0.75	0	NO	0
42	Minor	42	48	76.385	0.013	0.3	0.33	0	0	RECT_CLOSED	1.2	1.8	0	0	1	0	0.05	0	NO	0
43	Minor	43	44	45	0.013	0.966	0.499	0	0	CIRCULAR	0.375	0	0	0	1	0	0.05	0	NO	0
44	Minor	44	45	93	0.013	0.3	0.5	0	0	CIRCULAR	0.45	0	0	0	1	0	0.05	0	NO	0
45	Minor	45	47	71.181	0.013	0.3	0.5	0	0	CIRCULAR	0.525	0	0	0	1	0	0.05	0	NO	0
47	Minor	47	48	8.25	0.013	0.3	1.3	0	0	CIRCULAR	0.525	0	0	0	1	0	0.75	0	NO	0
48	Minor	48	54	79.287	0.013	0.3	0.33	0	0	RECT_CLOSED	1.2	1.8	0	0	1	0	0.05	0	NO	0
49	Minor	49	50	45	0.013	0	0.075	0	0	CIRCULAR	0.375	0	0	0	1	0	0.05	0	NO	0
50	Minor	50	51	91.787	0.013	0	0.15	0	0	CIRCULAR	0.45	0	0	0	1	0	0.05	0	NO	0
51	Minor	51	52	61.964	0.013	0	0.33	0	0	CIRCULAR	0.6	0	0	0	1	0	0.05	0	NO	0
52	Minor	52	54	17.615	0.013	0.3	1.327	0	0	CIRCULAR	0.6	0	0	0	1	0	0.75	0	NO	0
53	Minor	53	54	36.748	0.013	0.3	1.027	0	0	CIRCULAR	0.9	0	0	0	1	0	0.75	0	NO	0
54	Minor	54	89	85.1	0.013	0.3	0.938	0	0	RECT_CLOSED	1.2	2.4	0	0	1	0	0.05	0	NO	0
55	Minor	55	89	35.8	0.013	0	1.637	0	0	CIRCULAR	0.525	0	0	0	1	0	0.75	0	NO	0
57	Minor	57	58	20	0.013	0.795	0.375	0	0	CIRCULAR	0.375	0	0	0	1	0	0.05	0	NO	0
58	Minor	58	60	74.444	0.013	0.3	0.375	0	0	CIRCULAR	0.45	0	0	0	1	0	0.05	0	NO	0
60	Minor	60	61	58.162	0.013	0.3	0.601	0	0	CIRCULAR	0.525	0	0	0	1	0	0.05	0	NO	0
61	Minor	61	74	16.282	0.013	0.3	4.059	0	0	CIRCULAR	0.825	0	0	0	1	0	0.05	0	NO	0
62	Minor	62	63	77	0.013	0.3	0.45	0	0	CIRCULAR	0.45	0	0	0	1	0	0.05	0	NO	0
63	Minor	63	64	23.279	0.013	0.3	0.38	0	0	CIRCULAR	0.45	0	0	0	1	0	0.05	0	NO	0
64	Minor	64	65	15.462	0.013	0.3	0.75	0	0	CIRCULAR	0.45	0	0	0	1	0	0.05	0	NO	0
65	Minor	65	69	63.887	0.013	0.3	0.45	0	0	CIRCULAR	0.9	0	0	0	1	0	0.05	0	NO	0
66	Minor	76	76B-mid	27.719	0.013	1.29	0	0	0	CIRCULAR	0.3	0	0	0	1					
67	Minor	67	68	91.5	0.013	0.3	0.45	0	0	CIRCULAR	0.45	0	0	0	1	0	0.75	0	NO	0

EPA SWMM Link Table Inputs

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ID	System	From Node	To Node	Length	Roughness	Inlet Offset	Outlet Offset	Initial Flow	Max Flow	Shape	Geom1	Geom2	Geom3	Geom4	Barrels	K Entry	K Exit	K Avg	Flap Gate	Seepage
				[m]		[m]	[m]	[m^3/s]	[m^3/s]											
68	Minor	68	69	18.225	0.013	0.3	0.9	0	0	CIRCULAR	0.45	0	0	0	1	0	0.05	0	NO	0
69	Minor	69	71	60.58	0.013	0.3	0.33	0	0	CIRCULAR	1.05	0	0	0	1	0	0.05	0	NO	0
71	Minor	71	72	17.857	0.013	0.3	0.33	0	0	CIRCULAR	1.05	0	0	0	1	0	0.05	0	NO	0
72	Minor	72	73	66.765	0.013	0.3	0.33	0	0	CIRCULAR	1.05	0	0	0	1	0	0.75	0	NO	0
73	Minor	73	74	40	0.013	0.3	0.45	0	0	CIRCULAR	1.05	0	0	0	1	0	0.05	0	NO	0
74	Minor	74	77	74.574	0.013	0.3	0.527	0	0	CIRCULAR	1.05	0	0	0	1	0	0.75	0	NO	0
76A	Minor	76-Mid	77	70	0.013	0	2.528	0	0	CIRCULAR	0.45	0	0	0	1	0	0.75	0	NO	0
76B	Minor	76B-mid	94	70	0.013	0	1.349	0	0	CIRCULAR	0.3	0	0	0	1	0	0.05	0	NO	0
76-Mid	Minor	76	76-Mid	29.007	0.013	0.843	0	0	0	CIRCULAR	0.45	0	0	0	1					
77	Minor	77	78	6.909	0.013	0.3	0.5	0	0	CIRCULAR	1.05	0	0	0	1	0	0.05	0	NO	0
78	Minor	78	80	67.356	0.013	0.302	0.33	0	0	RECT_CLOSED	1.2	1.8	0	0	1	0	0.05	0	NO	0
80	Minor	80	88	74.444	0.013	0.3	0.33	0	0	RECT_CLOSED	1.2	1.8	0	0	1	0	0.05	0	NO	0
81	Minor	81	82	66	0.013	0.3	0.33	0	0	CIRCULAR	0.375	0	0	0	1	0	0.05	0	NO	0
82	Minor	82	83	31.947	0.013	0.3	0.375	0	0	CIRCULAR	0.375	0	0	0	1	0	0.05	0	NO	0
83	Minor	83	84	15.561	0.013	0.3	0.38	0	0	CIRCULAR	0.45	0	0	0	1	0	0.05	0	NO	0
84	Minor	84	85	49.98	0.013	0.3	0.38	0	0	CIRCULAR	0.525	0	0	0	1	0	0.05	0	NO	0
85	Minor	85	86	17.11	0.013	0.3	0.38	0	0	CIRCULAR	0.525	0	0	0	1	0	0.75	0	NO	0
86	Minor	86	87	67.594	0.013	0.3	0.329	0	0	CIRCULAR	0.6	0	0	0	1	0	0	0	YES	0
87	Minor	87	88	39.488	0.013	0.3	0.959	0	0	CIRCULAR	0.6	0	0	0	1	0	0.05	0	NO	0
89	Minor	89	HW	9.15	0.013	0.3	0	0	0	RECT_CLOSED	1.2	2.4	0	0	1	0	0.75	0	NO	0
90	Minor	90	91	97.5	0.013	0.3	0.375	0	0	CIRCULAR	0.3	0	0	0	1	0	0.5	0.35	NO	0
91	Minor	91	98	98.29	0.013	0.3	3.15	0	0	CIRCULAR	0.375	0	0	0	1	0	0.05	0	NO	0
91B	Minor	88	89	104.296	0.013	0.3	0.38	0	0	RECT_CLOSED	1.2	1.8	0	0	1	0	0.05	0	NO	0
92	Minor	92	93	77	0.013	0.3	0.375	0	0	CIRCULAR	0.525	0	0	0	1	0	0.05	0	NO	0
93	Minor	93	94	80.991	0.013	0.3	1.607	0	0	CIRCULAR	0.6	0	0	0	1	0	0.05	0	NO	0
94	Minor	94	95	76.498	0.013	0.3	0.375	0	0	CIRCULAR	0.75	0	0	0	1	0	0.05	0	NO	0
95	Minor	95	96	75.5	0.013	0.3	0.375	0	0	CIRCULAR	0.825	0	0	0	1	0	0.75	0	NO	0
96	Minor	96	97	76	0.013	0.3	0.33	0	0	CIRCULAR	0.9	0	0	0	1	0	0.05	0	NO	0
97	Minor	97	98	74.242	0.013	0.3	0.3	0	0	CIRCULAR	0.9	0	0	0	1	0	0.05	0	NO	0
98.1	Minor	98	98-Outfall	20	0.013	0	0	0	0	CIRCULAR	0.9	0	0	0	1					
Ext-1	Minor	Ext-1	55	200	0.013	0	0	0	0	CIRCULAR	0.5	0	0	0	1	0	0.05	0	NO	0
Ext-2	Minor	Ext-2	Ext-1	200	0.013	0	0	0	0	CIRCULAR	0.5	0	0	0	1	0	0.05	0	NO	0
Ext-3	Minor	Ext-3	53	200	0.013	0.3	0.3	0	0	CIRCULAR	0.9	0	0	0	1	0	0.05	0	NO	0
Ext-4	Minor	Ext-4	Ext-3	200	0.013	0.3	0.3	0	0	CIRCULAR	0.9	0	0	0	1	0	0.05	0	NO	0
Ext-5	Minor	Ext-5	Ext-4	200	0.013	0.3	0.3	0	0	CIRCULAR	0.9	0	0	0	1					
Ext-6	Minor	Ext-6	Ext-5	200	0.013	0.3	0.3	0	0	CIRCULAR	0.9	0	0	0	1					
Ext-7	Minor	Ext-7	Ext-6	200	0.013	0.3	0.3	0	0	CIRCULAR	0.9	0	0	0	1					
SL1	Major	SN1	SN2	80	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL10	Major	SN10HP	SN15	49.06	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL10.1	Major	SN10	SN10HP	29.42	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL11	Major	SN11	SN12	86.5	0.013	0	0	0	0	IRREGULAR	24ROW	0	0	0	1					
SL12	Major	SN12	SN13	100	0.013	0	0	0	0	IRREGULAR	24ROW	0	0	0	1					
SL13	Major	SN13	SN15	100.09	0.013	0	0	0	0	IRREGULAR	24ROW	0	0	0	1					
SL15	Major	SN15.1	SN16	51.00675	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL15HP	Major	SN15	SN15.1	17.00225	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL16	Major	SN16	SN78	10.337	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL17	Major	SN17	SN17HP	33	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL17.1	Major	SN17HP	SN19	19	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL19	Major	SN19	SN22.1	13.41525	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL19HP	Major	SN22	SN22.1	4.47175	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL2	Major	SN2	SN4.2	56.6055	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL2.1	Major	SN2	SN21	34.5	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL21	Major	SN21	SN22	42.015	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL22	Major	SN22.2	SN27	75.462	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL22HP	Major	SN22	SN22.2	25.154	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL23	Major	SN23	SN24	70.592	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL23.1	Major	SN17	SN23	27.13	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL24	Major	SN24	SN25	7.461	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL25	Major	SN25	SN25HP	31.543	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					

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				(m)		(m)	(m)	(m^3/s)	(m^3/s)											
SL25.1	Major	SN25HP	SN26	29	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL26	Major	SN26	SN27.2	7.63575	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL26HP	Major	SN27	SN27.2	2.54525	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL27	Major	SN27.1	SN28	45.522	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL27HP	Major	SN27	SN27.1	15.174	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL28	Major	SN28	SN30	16.517	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL29	Major	SN29	SN30.3	73.00725	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL29HP	Major	SN30	SN30.3	24.33575	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL2HP	Major	SN4	SN4.2	18.8685	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL3	Major	SN3	SN4	7.725	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL3.1	Major	SN3	SN31	27	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL30	Major	SN30.2	SN37	55.53225	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL30HP	Major	SN30	SN30.2	18.51075	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL31	Major	SN31	SN32	39	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL32	Major	SN32	SN33	96	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL33	Major	SN33.1	SN34	13.51725	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL33HP	Major	SN33	SN33.1	4.50575	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL34	Major	SN34	SN35	57.658	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL35	Major	SN35	SN37	8.265	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL36	Major	SN36	SN37	36.065	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL37	Major	SN37.2	SN42	56.4285	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL37HP	Major	SN37	SN37.2	18.8095	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL38	Major	SN38	SN39	44	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL39	Major	SN39	SN40	93.5	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL4	Major	SN4.1	SN7	56.6055	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL40	Major	SN40	SN41	23.7	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL41	Major	SN41	SN42	56.77	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL42	Major	SN42.1	SN48	57.28875	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL42HP	Major	SN42	SN42.1	19.09625	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL43	Major	SN43	SN44	45	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL44	Major	SN44	SN45	93	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL45	Major	SN45	SN47	71.181	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL47	Major	SN47	SN48.2	6.1875	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL47HP	Major	SN48	SN48.2	2.0625	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL48	Major	SN48.1	SN54	59.46525	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL48HP	Major	SN48	SN48.1	19.82175	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL49	Major	SN49	SN50	45	0.013	0	0	0	0	IRREGULAR	24ROW	0	0	0	1					
SL4HP	Major	SN4	SN4.1	18.8685	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL50	Major	SN50	SN51	91.787	0.013	0	0	0	0	IRREGULAR	24ROW	0	0	0	1					
SL51	Major	SN51	SN52	61.964	0.013	0	0	0	0	IRREGULAR	24ROW	0	0	0	1					
SL52	Major	SN52	SN54	17.615	0.013	0	0	0	0	IRREGULAR	24ROW	0	0	0	1					
SL53	Major	SN53	SN54	36.748	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL54	Major	SN54	SN89.2	63.825	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL54HP	Major	SN89	SN89.2	21.275	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL55	Major	SN55	SN89	35.8	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL57	Major	SN57	SN58	20	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL58	Major	SN58	SN60	74.444	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL58.1	Major	SN58	SN62	8	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL6	Major	SN6	SN7.2	5.79375	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL6.1	Major	SN6	SN38	27	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL60	Major	SN60	SN61	58.162	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL60.1	Major	SN60	SN67	8	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL61	Major	SN61	SN74	16.282	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL62	Major	SN62	SN63	77	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL63	Major	SN63	SN64	23.279	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL64	Major	SN64	SN65	15.462	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL65	Major	SN65	SN69	63.887	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL67	Major	SN67	SN68	91.5	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL68	Major	SN68	SN69.1	13.66875	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					

EPA SWMM Link Table Inputs

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ID	System	From Node	To Node	Length	Roughness	Inlet Offset	Outlet Offset	Initial Flow	Max Flow	Shape	Geom1	Geom2	Geom3	Geom4	Barrels	K Entry	K Exit	K Avg	Flap Gate	Seepage
				[m]		[m]	[m]	[m^3/s]	[m^3/s]											
SL68HP	Major	SN69	SN69.1	4.55625	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL69	Major	SN69	SN71	60.58	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL6HP	Major	SN7	SN7.2	1.93125	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL7	Major	SN7.1	SN10	56.6055	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL71	Major	SN71	SN72	17.857	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL72	Major	SN72	SN73	66.765	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL73	Major	SN73	SN74	40	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL74	Major	SN74.1	SN77	55.9305	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL74HP	Major	SN74	SN74.1	18.6435	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL76A	Major	SN76	SN77.2	64.917	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL76AHP	Major	SN77	SN77.2	34.09	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL76B	Major	SN76B-mid	SN94	70	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL76B-mid	Major	SN76	SN76B-mid	27.719	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL77	Major	SN77	SN78	6.909	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL78	Major	SN78.1	SN80	50.517	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL78HP	Major	SN78	SN78.1	16.839	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL7HP	Major	SN7	SN7.1	18.8685	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL80	Major	SN80	SN88	74.444	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL80.1	Major	SN80	SN81	9	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL81	Major	SN81	SN82	66	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL82	Major	SN82	SN83	31.947	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL83	Major	SN83	SN84	15.561	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL84	Major	SN84	SN85	49.98	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL85	Major	SN85	SN86	17.11	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL86	Major	SN86	SN87	67.594	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL87	Major	SN87	SN88	39.488	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL9	Major	SN9	SN10.2	5.793	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL90	Major	SN90	SN91	97.5	0.013	0	0	0	0	IRREGULAR	25ROW	0	0	0	1					
SL91	Major	SN91	SN98	98.29	0.013	0	0	0	0	IRREGULAR	25ROW	0	0	0	1					
SL91B	Major	SN88.1	SN89	64.14	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL91BHP	Major	SN88	SN88.1	36.71	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL92	Major	SN92	SN93	77	0.013	0	0	0	0	IRREGULAR	24ROW	0	0	0	1					
SL93	Major	SN93	SN94	80.991	0.013	0	0	0	0	IRREGULAR	24ROW	0	0	0	1					
SL94	Major	SN94.1	SN95	57.3735	0.013	0	0	0	0	IRREGULAR	24ROW	0	0	0	1					
SL94HP	Major	SN94	SN94.1	19.1245	0.013	0	0	0	0	IRREGULAR	24ROW	0	0	0	1					
SL95	Major	SN95	SN96	75.5	0.013	0	0	0	0	IRREGULAR	24ROW	0	0	0	1					
SL96	Major	SN96	SN97	76	0.013	0	0	0	0	IRREGULAR	24ROW	0	0	0	1					
SL97	Major	SN97	SN98	74.242	0.013	0	0	0	0	IRREGULAR	24ROW	0	0	0	1					
SL98.1	Major	SN98	SN98-Outfall	20	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SL9HP	Major	SN10	SN10.2	1.931	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SLExt-1	Major	SNExt-1	SN55	400	0.01	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SLExt-2	Major	SNExt-2	SNExt-1	400	0.01	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SLExt-3	Major	SNExt-3	SN53	200	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SLExt-4	Major	SNExt-4	SNExt-3	200	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SLExt-5	Major	SNExt-5	SNExt-4	200	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SLExt-6	Major	SNExt-6	SNExt-5	200	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SLExt-7	Major	SNExt-7	SNExt-6	200	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					
SN15.1	Minor	SN15	SN49	34.9	0.013	0	0	0	0	IRREGULAR	24ROW	0	0	0	1					
SN9.1	Minor	SN9	SN43	27	0.013	0	0	0	0	IRREGULAR	18ROW	0	0	0	1					

EPA SWMM Outlet Table Inputs

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ID	System	From Node	To Node	Offset	Type	Qtable/ Qcoeff	Q Exponent	Gated
				[m]		[m]	[m]	
5	Other	SN88.1	88	0	TABULAR/DEPTH	Fishbone_6		NO
8	Other	SNExt-1	Ext-1	0	TABULAR/DEPTH	Fishbone_2		NO
46	Other	SNExt-2	Ext-2	0	TABULAR/DEPTH	Fishbone_2		NO
108	Other	SNExt-3	Ext-3	0	TABULAR/DEPTH	Fishbone_4		NO
109	Other	SNExt-4	Ext-4	0	TABULAR/DEPTH	Fishbone_2		NO
110	Other	SNExt-5	Ext-5	0	TABULAR/DEPTH	Fishbone_4		NO
111	Other	SNExt-6	Ext-6	0	TABULAR/DEPTH	Fishbone_4		NO
112	Other	SNExt-7	Ext-7	0	TABULAR/DEPTH	Fishbone_4		NO
CBL1	Catch basin	SN1	1	0	TABULAR/DEPTH	Fishbone_4		NO
CBL10	Catch basin	SN10	10	0	TABULAR/DEPTH	Fishbone_2		NO
CBL11	Catch basin	SN11	11	0	TABULAR/DEPTH	Fishbone_4		NO
CBL12	Catch basin	SN12	12	0	TABULAR/DEPTH	Fishbone_4		NO
CBL13	Catch basin	SN13	13	0	TABULAR/DEPTH	Fishbone_4		NO
CBL15	Catch basin	SN15	15	0	TABULAR/DEPTH	Fishbone_2		NO
CBL19	Catch basin	SN19	19	0	TABULAR/DEPTH	Fishbone_2		NO
CBL2	Catch basin	SN2	2	0	TABULAR/DEPTH	Fishbone_3		NO
CBL21	Catch basin	SN21	21	0	TABULAR/DEPTH	Fishbone_1		NO
CBL22	Catch basin	SN22	22	0	TABULAR/DEPTH	Fishbone_3		NO
CBL23	Catch basin	SN23	23	0	TABULAR/DEPTH	Fishbone_4		NO
CBL24	Catch basin	SN24	24	0	TABULAR/DEPTH	Fishbone_2		NO
CBL26	Catch basin	SN26	26	0	TABULAR/DEPTH	Fishbone_2		NO
CBL28	Catch basin	SN28	28	0	TABULAR/DEPTH	Fishbone_2		NO
CBL29	Catch basin	SN29	29	0	TABULAR/DEPTH	Fishbone_4		NO
CBL30	Catch basin	SN30	30	0	TABULAR/DEPTH	Fishbone_2		NO
CBL32	Catch basin	SN32	32	0	TABULAR/DEPTH	Fishbone_2		NO
CBL33	Catch basin	SN33	33	0	TABULAR/DEPTH	Fishbone_2		NO
CBL34	Catch basin	SN34	34	0	TABULAR/DEPTH	Fishbone_2		NO
CBL36	Catch basin	SN36	36	0	TABULAR/DEPTH	Fishbone_2		NO
CBL37	Catch basin	SN37	37	0	TABULAR/DEPTH	Fishbone_2		NO
CBL38	Catch basin	SN38	38	0	TABULAR/DEPTH	Fishbone_2		NO
CBL39	Catch basin	SN39	39	0	TABULAR/DEPTH	Fishbone_2		NO
CBL4	Catch basin	SN4	4	0	TABULAR/DEPTH	Fishbone_2		NO
CBL41	Catch basin	SN41	41	0	TABULAR/DEPTH	Fishbone_2		NO
CBL42	Catch basin	SN42	42	0	TABULAR/DEPTH	Fishbone_2		NO
CBL44	Catch basin	SN44	44	0	TABULAR/DEPTH	Fishbone_2		NO
CBL45	Catch basin	SN45	45	0	TABULAR/DEPTH	Fishbone_4		NO
CBL49	Catch basin	SN49	49	0	TABULAR/DEPTH	Fishbone_2		NO
CBL50	Catch basin	SN50	50	0	TABULAR/DEPTH	Fishbone_3		NO
CBL51	Catch basin	SN51	51	0	TABULAR/DEPTH	Fishbone_2		NO
CBL52	Catch basin	SN52	52	0	TABULAR/DEPTH	Fishbone_2		NO
CBL53	Catch basin	SN53	53	0	TABULAR/DEPTH	Fishbone_2		NO
CBL54	Catch basin	SN54	54	0	TABULAR/DEPTH	Fishbone_4		NO
CBL54-1	Catch basin	SN89.2	54	0	TABULAR/DEPTH	Fishbone_2		NO
CBL57	Catch basin	SN57	57	0	TABULAR/DEPTH	Fishbone_2		NO
CBL58	Catch basin	SN58	58	0	TABULAR/DEPTH	Fishbone_2		NO
CBL60	Catch basin	SN60	60	0	TABULAR/DEPTH	Fishbone_1		NO
CBL63	Catch basin	SN63	63	0	TABULAR/DEPTH	Fishbone_2		NO
CBL65	Catch basin	SN65	65	0	TABULAR/DEPTH	Fishbone_3		NO
CBL68	Catch basin	SN68	68	0	TABULAR/DEPTH	Fishbone_2		NO
CBL69	Catch basin	SN69	69	0	TABULAR/DEPTH	Fishbone_1		NO
CBL7	Catch basin	SN7	7	0	TABULAR/DEPTH	Fishbone_2		NO
CBL72	Catch basin	SN72	72	0	TABULAR/DEPTH	Fishbone_2		NO
CBL74	Catch basin	SN74	74	0	TABULAR/DEPTH	Fishbone_2		NO
CBL76	Catch basin	SN76	76	0	TABULAR/DEPTH	Fishbone_3		NO
CBL78	Catch basin	SN78	78	0	TABULAR/DEPTH	Fishbone_2		NO
CBL80	Catch basin	SN80	80	0	TABULAR/DEPTH	Fishbone_2		NO
CBL82	Catch basin	SN82	82	0	TABULAR/DEPTH	Fishbone_2		NO

EPA SWMM Outlet Table Inputs

Printed on: 2019-03-06

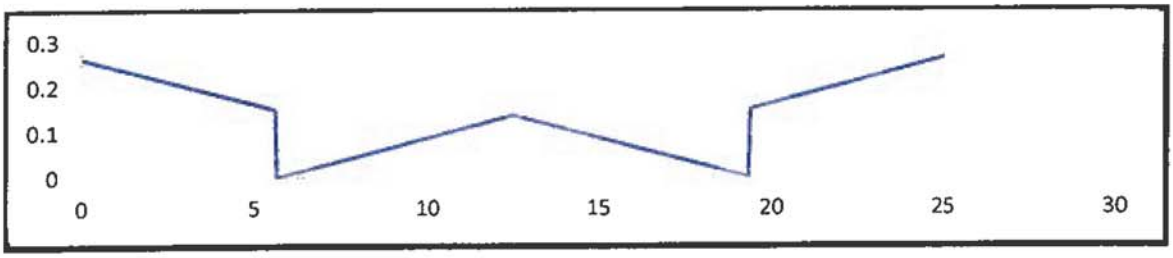
ID	System	From Node	To Node	Offset	Type	Qtable/ Qcoeff	Q Exponent	Gated
				[m]		[m]	[m]	
CBL84	Catch basin	SN84	84	0	TABULAR/DEPTH	Fishbone_2		NO
CBL86	Catch basin	SN86	86	0	TABULAR/DEPTH	Fishbone_1		NO
CBL88	Catch basin	SN88	88	0	TABULAR/DEPTH	Fishbone_2		NO
CBL90	Catch basin	SN90	90	0	TABULAR/DEPTH	Fishbone_6		NO
CBL91	Catch basin	SN91	91	0	TABULAR/DEPTH	Fishbone_4		NO
CBL92	Catch basin	SN92	92	0	TABULAR/DEPTH	Fishbone_2		NO
CBL93	Catch basin	SN93	93	0	TABULAR/DEPTH	Fishbone_2		NO
CBL94	Catch basin	SN94	94	0	TABULAR/DEPTH	Fishbone_2		NO
CBL95	Catch basin	SN95	95	0	TABULAR/DEPTH	Fishbone_2		NO
CBL96	Catch basin	SN96	96	0	TABULAR/DEPTH	Fishbone_3		NO
CBL97	Catch basin	SN97	97	0	TABULAR/DEPTH	Fishbone_2		NO

EPA SWMM Outfall Table Inputs

Printed on: 2019-04-26

ID	System	X*	Y*	Invert Elevation	HGL Type	Stage Data	Gated
		(m)	(m)	(m)			
HW	Outfall	611355.55	4911619.928	253.22	FIXED	255.05	NO
SN98-Outfall	Outfall	610868.76	4911264.523	255.269	FREE		NO
98-Outfall	Outfall	610864.35	4911261.766	249.639	FREE		NO

ROW Name	25ROW
ROW Description	25 m ROW based on BSD-304



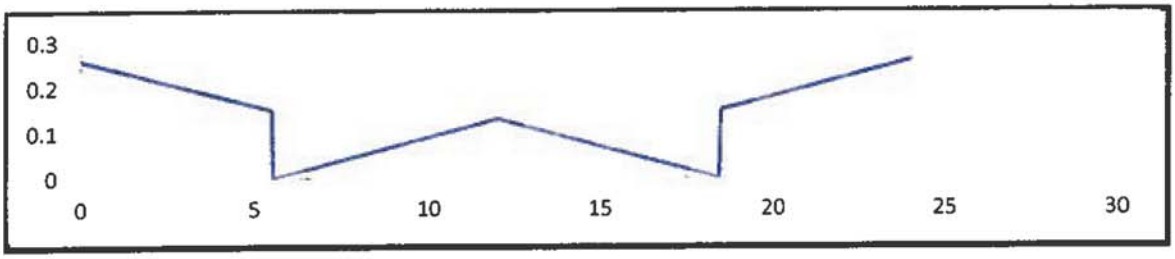
Parametric Values	
ROW Width	25
Left Bank	5.625
Right Bank	5.625
Pavement	13.75
Curb Depth	0.15
Curb Slope	3
Bank Crossfall	0.02
Road Crossfall	0.02

Transect Data		
Position	n	Station
Left Bank	0.025	5.625
Right Bank	0.025	19.375
Channel	0.013	

Modifiers	
Meander	1
Station	1
Elevation	1

Geometric Values		
Point	Station	Elevation
1	0	0.2625
2	5.625	0.15
3	5.675	0
4	12.5	0.1375
5	19.325	0
6	19.375	0.15
7	25	0.2625
8		
9		
10		

ROW Name	24ROW
ROW Description	24m ROW based on BSD-303



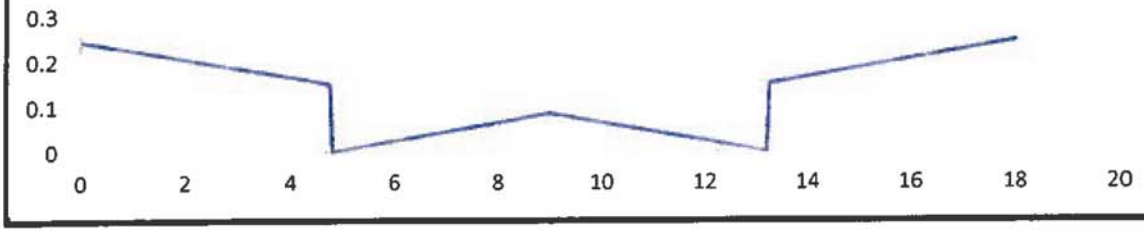
Parametric Values	
ROW Width	24
Left Bank	5.5
Right Bank	5.5
Pavement	13
Curb Depth	0.15
Curb Slope	3
Bank Crossfall	0.02
Road Crossfall	0.02

Transect Data		
Position	n	Station
Left Bank	0.025	5.4
Right Bank	0.025	18.55
Channel	0.013	

Modifiers	
Meander	0
Station	0
Elevation	0

Geometric Values		
Point	Station	Elevation
1	0	0.26
2	5.5	0.15
3	5.55	0
4	12	0.13
5	18.45	0
6	18.5	0.15
7	24	0.26
8		
9		
10		

ROW Name	18ROW
ROW Description	18m ROW based on BSD-301



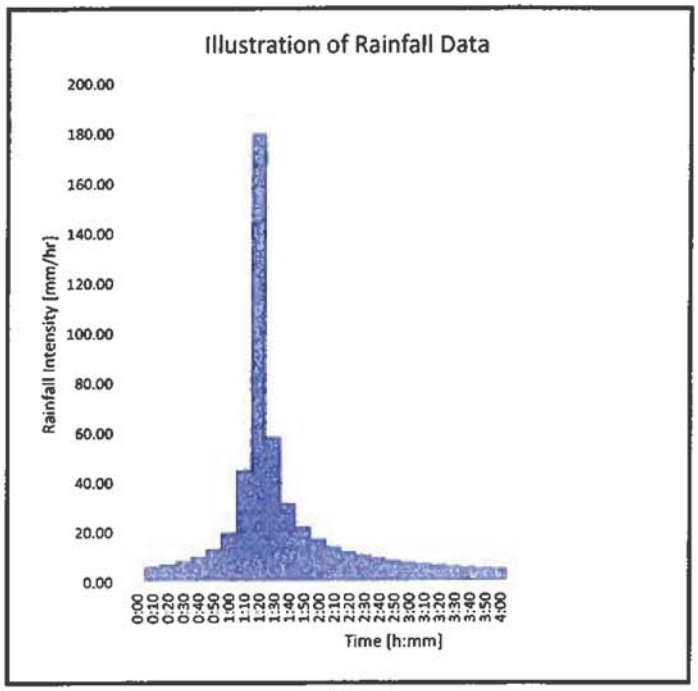
Parametric Values	
ROW Width	18
Left Bank	4.75
Right Bank	4.75
Pavement	8.5
Curb Depth	0.15
Curb Slope	3
Bank Crossfall	0.02
Road Crossfall	0.02

Transect Data		
Position	n	Station
Left Bank	0.025	4.65
Right Bank	0.025	13.35
Channel	0.013	

Modifiers	
Meander	0
Station	0
Elevation	0

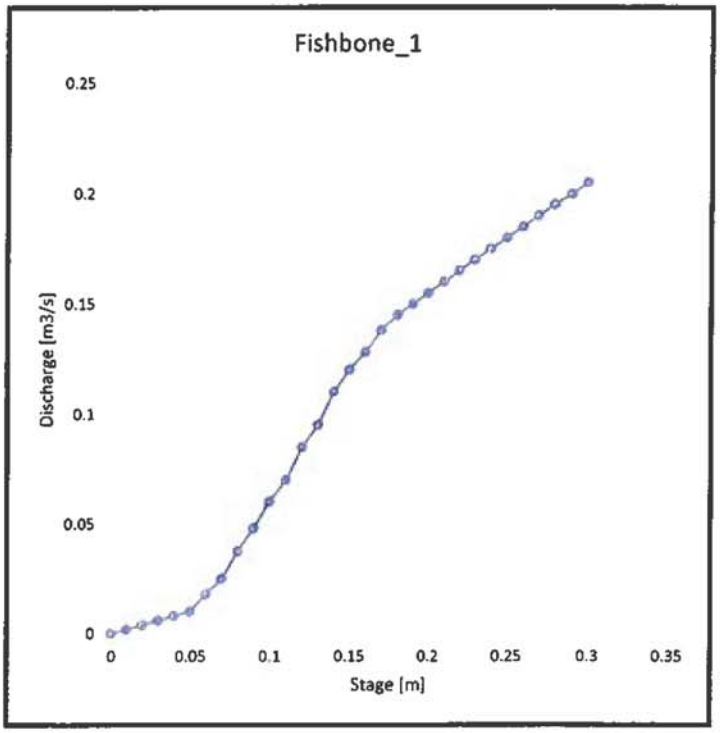
Geometric Values		
Point	Station	Elevation
1	0	0.245
2	4.75	0.15
3	4.8	0
4	9	0.085
5	13.2	0
6	13.25	0.15
7	18	0.245
8		
9		
10		

Storm Name:	Barrie_100YR_4RH_Chicago
Time [h:mm]	Intensity [mm/hr]
0:00	0.00
0:10	6.41
0:20	7.29
0:30	8.52
0:40	10.36
0:50	13.45
1:00	19.96
1:10	45.22
1:20	180.15
1:30	58.54
1:40	31.96
1:50	22.45
2:00	17.52
2:10	14.50
2:20	12.44
2:30	10.94
2:40	9.80
2:50	8.90
3:00	8.16
3:10	7.56
3:20	7.04
3:30	6.60
3:40	6.22
3:50	5.89
4:00	5.59



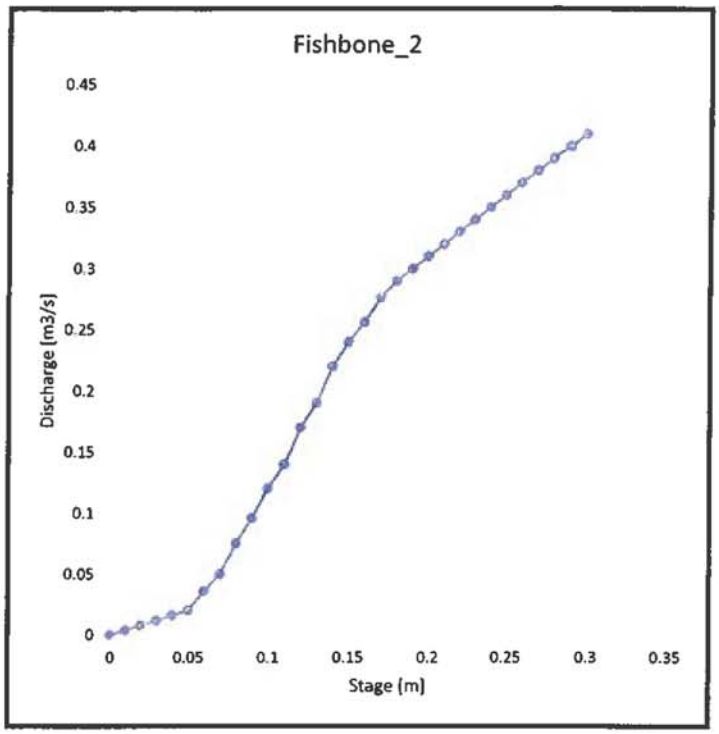
Rating Curve	
Name:	Fishbone_1
Description:	OPSD 400.010

Stage [m]	Discharge [m3/s]
0	0
0.01	0.002
0.02	0.004
0.03	0.006
0.04	0.008
0.05	0.01
0.06	0.018
0.07	0.025
0.08	0.0375
0.09	0.048
0.1	0.06
0.11	0.07
0.12	0.085
0.13	0.095
0.14	0.11
0.15	0.12
0.16	0.128
0.17	0.138
0.18	0.145
0.19	0.15
0.2	0.155
0.21	0.16
0.22	0.165
0.23	0.17
0.24	0.175
0.25	0.18
0.26	0.185
0.27	0.19
0.28	0.195
0.29	0.2
0.3	0.205



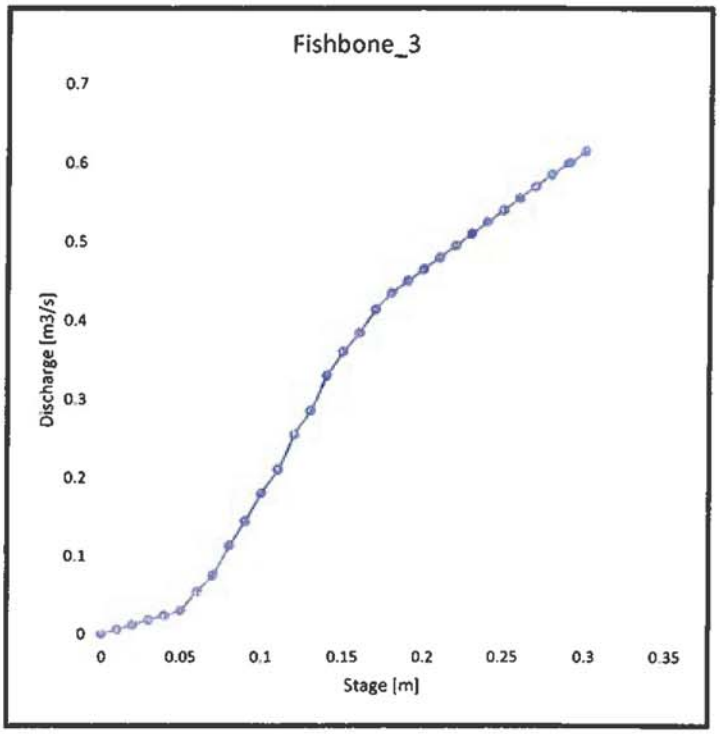
Rating Curve	
Name:	Fishbone_2
Description:	OPSD 400.010

Stage [m]	Discharge [m3/s]
0	0
0.01	0.004
0.02	0.008
0.03	0.012
0.04	0.016
0.05	0.02
0.06	0.036
0.07	0.05
0.08	0.075
0.09	0.096
0.1	0.12
0.11	0.14
0.12	0.17
0.13	0.19
0.14	0.22
0.15	0.24
0.16	0.256
0.17	0.276
0.18	0.29
0.19	0.3
0.2	0.31
0.21	0.32
0.22	0.33
0.23	0.34
0.24	0.35
0.25	0.36
0.26	0.37
0.27	0.38
0.28	0.39
0.29	0.4
0.3	0.41



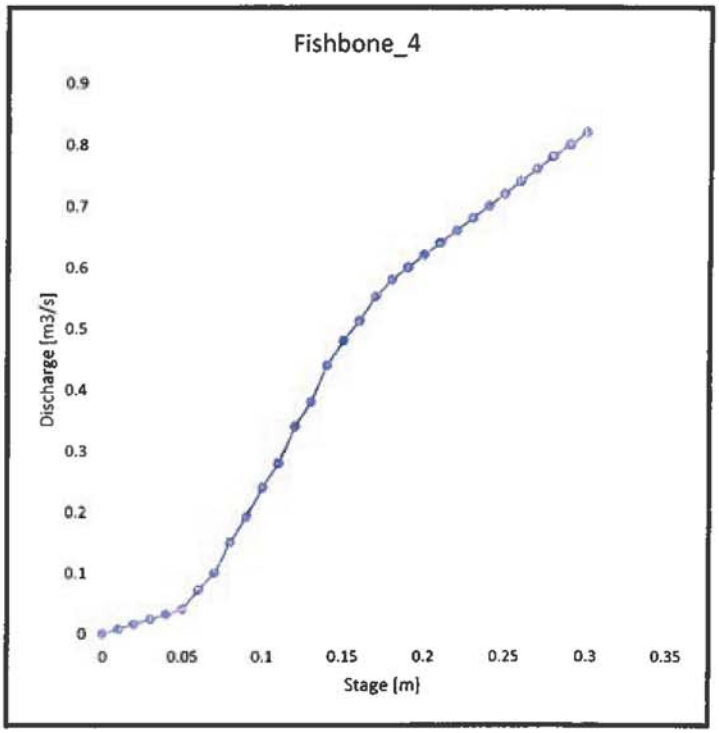
Rating Curve	
Name:	Fishbone_3
Description:	OPSD 400.010

Stage [m]	Discharge [m3/s]
0	0
0.01	0.006
0.02	0.012
0.03	0.018
0.04	0.024
0.05	0.03
0.06	0.054
0.07	0.075
0.08	0.1125
0.09	0.144
0.1	0.18
0.11	0.21
0.12	0.255
0.13	0.285
0.14	0.33
0.15	0.36
0.16	0.384
0.17	0.414
0.18	0.435
0.19	0.45
0.2	0.465
0.21	0.48
0.22	0.495
0.23	0.51
0.24	0.525
0.25	0.54
0.26	0.555
0.27	0.57
0.28	0.585
0.29	0.6
0.3	0.615



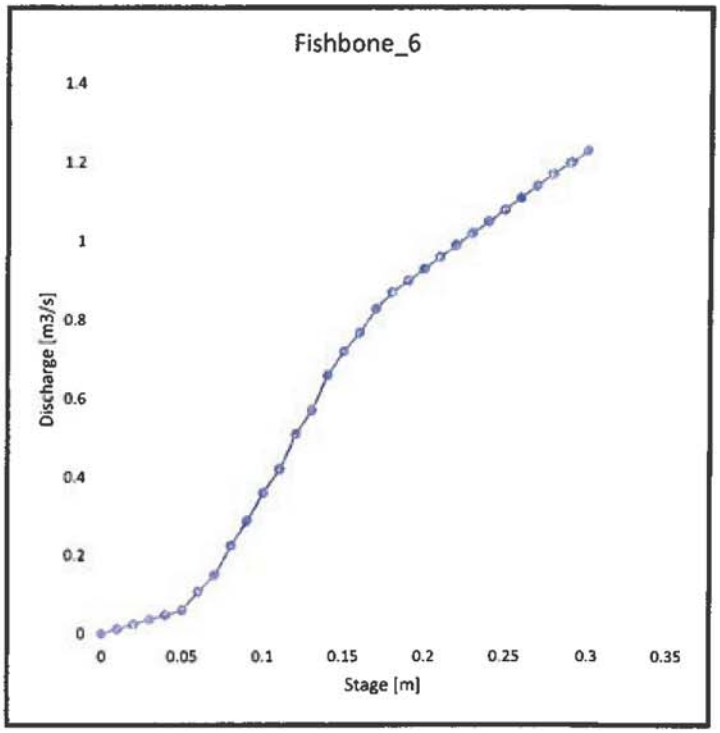
Rating Curve	
Name:	Fishbone_4
Description:	OPSD 400.010

Stage [m]	Discharge [m3/s]
0	0
0.01	0.008
0.02	0.016
0.03	0.024
0.04	0.032
0.05	0.04
0.06	0.072
0.07	0.1
0.08	0.15
0.09	0.192
0.1	0.24
0.11	0.28
0.12	0.34
0.13	0.38
0.14	0.44
0.15	0.48
0.16	0.512
0.17	0.552
0.18	0.58
0.19	0.6
0.2	0.62
0.21	0.64
0.22	0.66
0.23	0.68
0.24	0.7
0.25	0.72
0.26	0.74
0.27	0.76
0.28	0.78
0.29	0.8
0.3	0.82



Rating Curve	
Name:	Fishbone_6
Description:	OPSD 400.010

Stage [m]	Discharge [m3/s]
0	0
0.01	0.012
0.02	0.024
0.03	0.036
0.04	0.048
0.05	0.06
0.06	0.108
0.07	0.15
0.08	0.225
0.09	0.288
0.1	0.36
0.11	0.42
0.12	0.51
0.13	0.57
0.14	0.66
0.15	0.72
0.16	0.768
0.17	0.828
0.18	0.87
0.19	0.9
0.2	0.93
0.21	0.96
0.22	0.99
0.23	1.02
0.24	1.05
0.25	1.08
0.26	1.11
0.27	1.14
0.28	1.17
0.29	1.2
0.3	1.23



Appendix D:
Supporting Documents

Hewitt's Secondary Plan Area Subwatershed Impact Study Lover's, Hewitt's and Sandy Cove Creeks Report Addendum No. 1

Hewitt's Landowner's Group
c/o Bratty and Partners
7501 Keele Street, Suite 200
Vaughan ON L4K 1Y2

R.J. Burnside & Associates Limited
128 Wellington Street West, Suite 301
Barrie ON L4N 8J6 CANADA

November 2017
300032860.0000

Subwatershed Impact Study
Lover's, Hewitt's and Sandy Cove Creeks Report
Addendum No. 1
November 2017

Distribution List

No. of Hard Copies	PDF	Email	Organization Name
1	Yes	Yes	City of Barrie
1	Yes	Yes	Lake Simcoe Region Conservation Authority
1	Yes	Yes	Jones Consulting

Record of Revisions

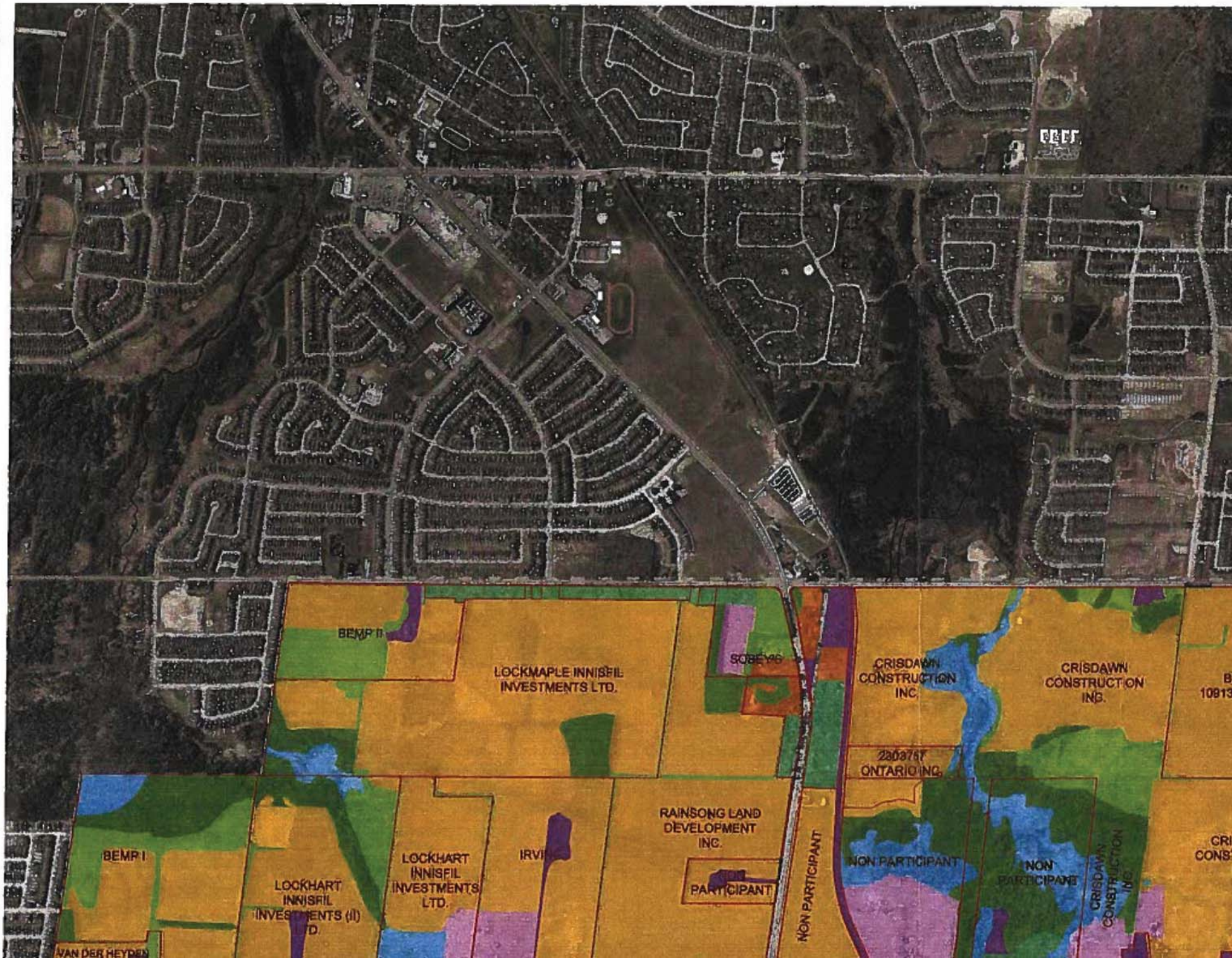
Revision	Date	Description
DRAFT	September 2017	DRAFT Submission for Review
1	November 3, 2017	Submission for Final Approval

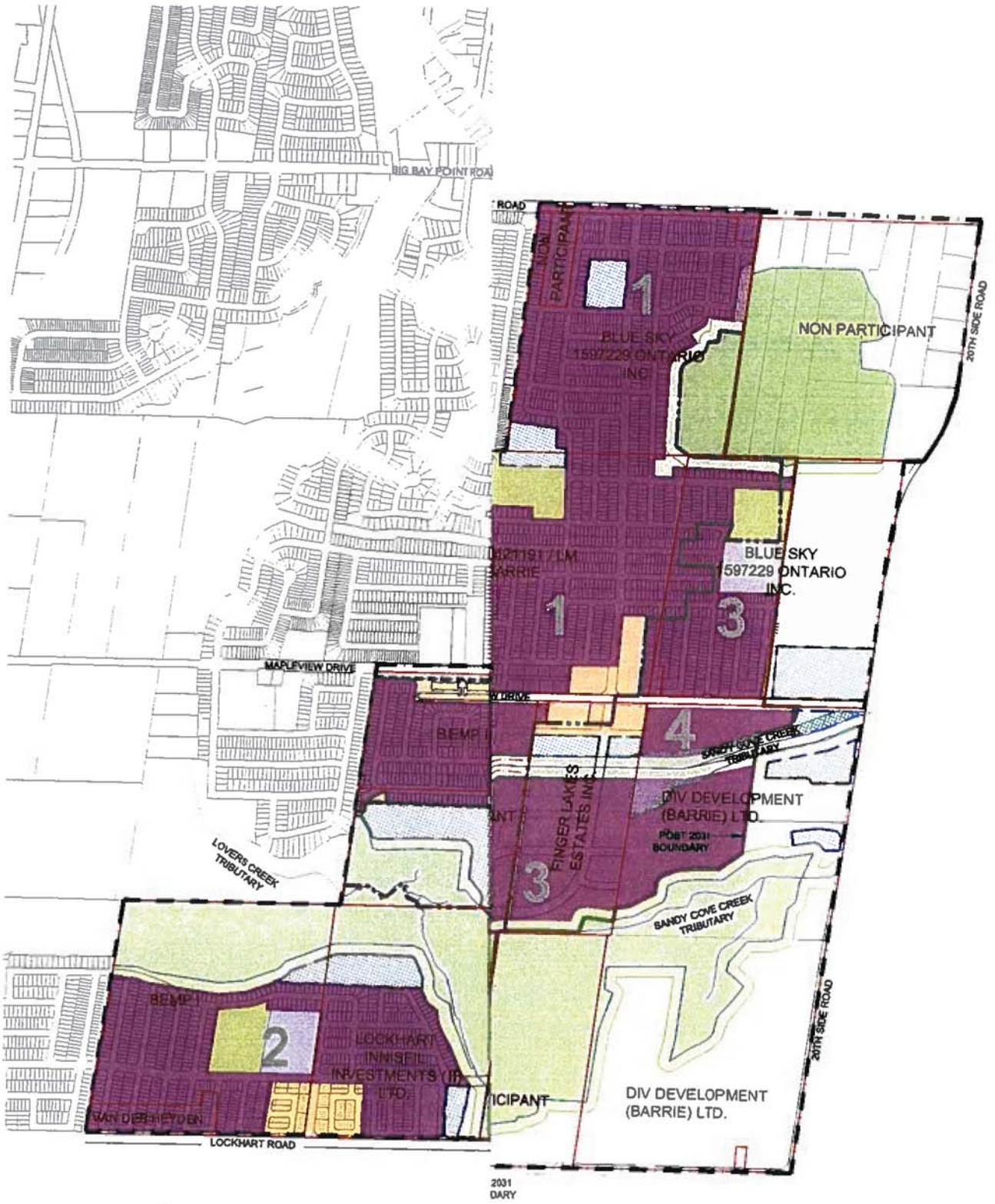
R.J. Burnside & Associates Limited

Report Prepared By:

Clayton Capes, MSc., P.Eng.
Vice President, Land Development
Georgian Bay Area
CC:jm

HEWITT'S CREEK TRIBUTARY
LOCKHART ROAD
LOWER CREEK TRIBUTARY
WILDWOOD ROAD
BIG BAY POINT ROAD
HWY 400
HWY 400
BIG BAY POINT ROAD
MAPLEVIEW DRIVE


BEMP II
LOCKMAPLE INNISFIL INVESTMENTS LTD.
SOBEYS
CRISDAWN CONSTRUCTION INC.
CRISDAWN CONSTRUCTION INC.
2303751 ONTARIO INC.
BEMP I
LOCKHART INNISFIL INVESTMENTS (II) LTD.
LOCKHART INNISFIL INVESTMENTS LTD.
IRVI
RAINSONG LAND DEVELOPMENT INC.
PARTICIPANT
NON PARTICIPANT
NON PARTICIPANT
NON PARTICIPANT
CRISDAWN CONSTRUCTION INC.
VAN DER HEYDEN



BURNSIDE

HEWITT'S SECONDARY PLAN AREA
SUBWATERSHED IMPACT STUDY
PROPOSED LAND USE DESIGNATIONS & PHASING

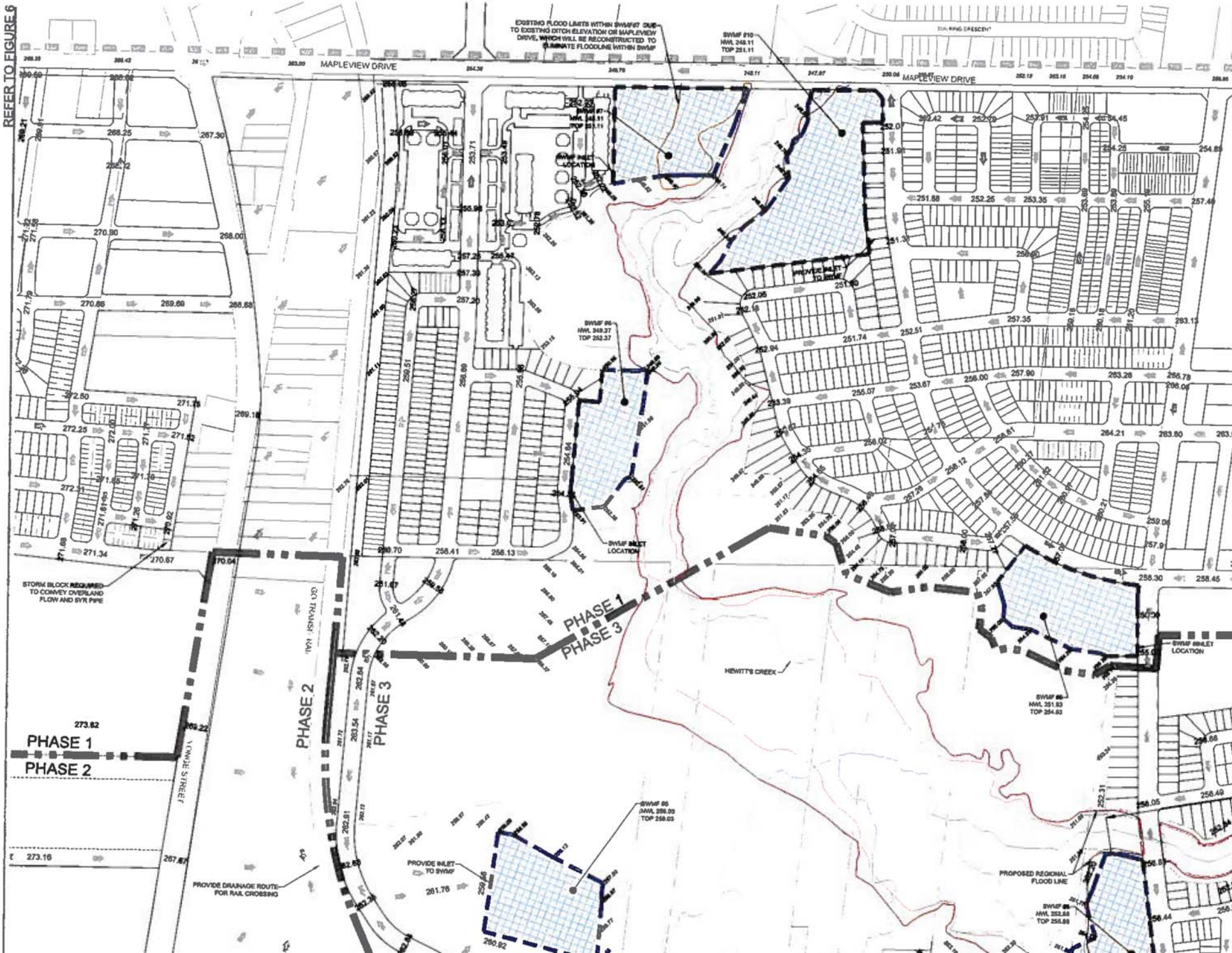
Client: HEWITT'S CREEK LANDOWNERS GROUP INC.

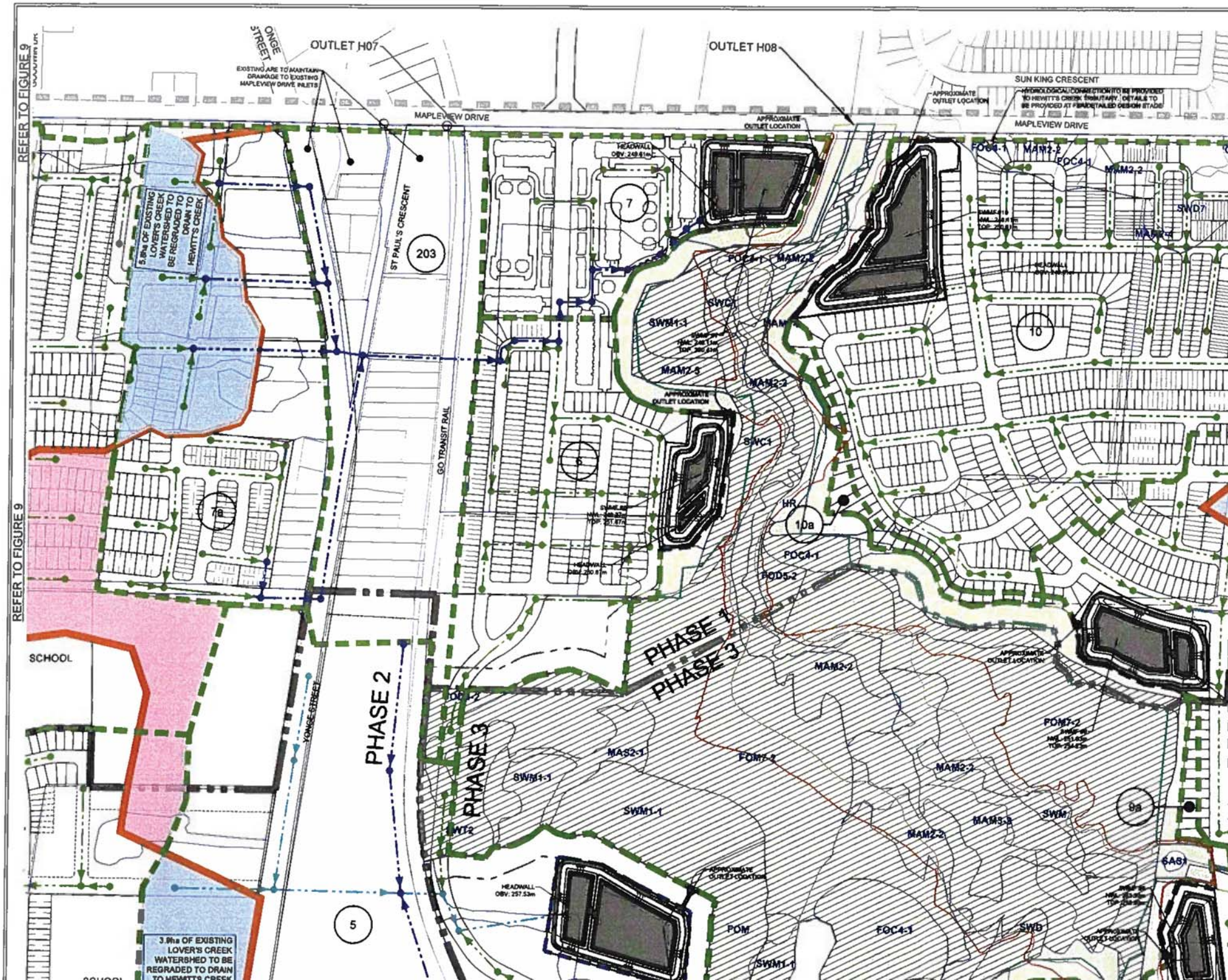
Drawn: BH | Checked: CC | Date: 16/09/07

Scale: H 1:7,500" | Project No. 300032800

FIG 3

OUTER DR
LEVEE RD
115
114
113
112
111
110
104
103
102


REFER TO FIGURE 6
MAPLEVIEW DRIVE
MAPLEVIEW DRIVE
EXISTING FLOOD LIMITS WITHIN SWMF#7 DUE TO EXISTING DITCH ELEVATION OR MAPLEVIEW DRIVE, WHICH WILL BE RECONSTRUCTED TO ELIMINATE FLOODLINE WITHIN SWMF
SWMF #10
NWL 248.11
TOP 251.11
SWMF INLET LOCATION
PROVIDE INLET TO SWMF
SWMF #6
NWL 249.37
TOP 252.37
SWMF INLET LOCATION
STORM BLOCK REQUIRED TO CONVEY OVERLAND FLOW AND 5YR PIPE
PHASE 1
PHASE 3
PHASE 2
PHASE 3
PHASE 1
PHASE 2
HEWITT'S CREEK
SWMF #5
NWL 251.83
TOP 254.83
SWMF INLET LOCATION
SWMF #5
NWL 256.03
TOP 259.03
PROVIDE INLET TO SWMF
PROVIDE DRAINAGE ROUTE FOR RAIL CROSSING
PROPOSED REGIONAL FLOOD LINE
SWMF #8
NWL 253.88
TOP 256.88
VINCE STREET


OUTLET H07
OUTLET H08
YONGE STREET
MAPLEVIEW DRIVE
SUN KING CRESCENT
ST PAUL'S CRESCENT
GO TRANSIT RAIL
YONGE STREET
REFER TO FIGURE 9
REFER TO FIGURE 9
APPROXIMATE OUTLET LOCATION
HEADWALL OBV: 249.61m
HEADWALL OBV: 257.53m
5.8ha OF EXISTING LOVER'S CREEK WATERSHED TO BE REGRADED TO DRAIN TO HEWITT'S CREEK
3.8ha OF EXISTING LOVER'S CREEK WATERSHED TO BE REGRADED TO DRAIN TO HEWITT'S CREEK
SCHOOL
PHASE 2
PHASE 3
PHASE 1
PHASE 3
SWM1-1
SWC1
MAM2-2
MAM2-3
MAS2-1
FOM7-2
FOC4-1
FOD5-2
POM
MAM5-3
SWD
HR
7
8
9a
10
10a
203
5

REFER TO FIGURE 10
REFER TO FIGURE 10
OUTLET H09
OUTLET H10
SUCCESSION CRES
UNICORN LN
MAGNA CARTA ROAD
DIANA WAY
MAPLEVIEW DRIVE
APPROXIMATE OUTLET LOCATION
HEADWALL OBV: 254.71m
HEADWALL OBV: 252.43m
OUTLET PIPE TO CONNECT TO EXISTING TOTAL CAPTURE DICB & 675ø STORM SEWER
SWMF #15
NWL: 258.00m
TOP: 260.50m
PARK
HEADWALL OBV: 259.80m
12.3m OF EXISTING NEWTON CREEK WATERSHED TO BE REGRADED TO DRAIN TO SANDY COVE CREEK
PHASE 1
PHASE 3
PHASE 4
CUM-1
SWMF #12
NWL: 250.93m
TOP: 253.23m
FOD3-1
SWM4
SWM3
SCHOOL
PARK
PROPOSED CHANNEL TO CONVEY DRAINAGE TO SWMF #17
SWMF #13 INLET LOCATION
HEADWALL OBV: 246.50
SWMF #13 INLET LOCATION
HEADWALL OBV: 252.80m
12
13
13a
14
14EXT
15a
17
17a
18
18a
204
205

SIS Section 3.8.3, pages 36 & 37 – Higher Resolution Excerpts from the DSWMMP

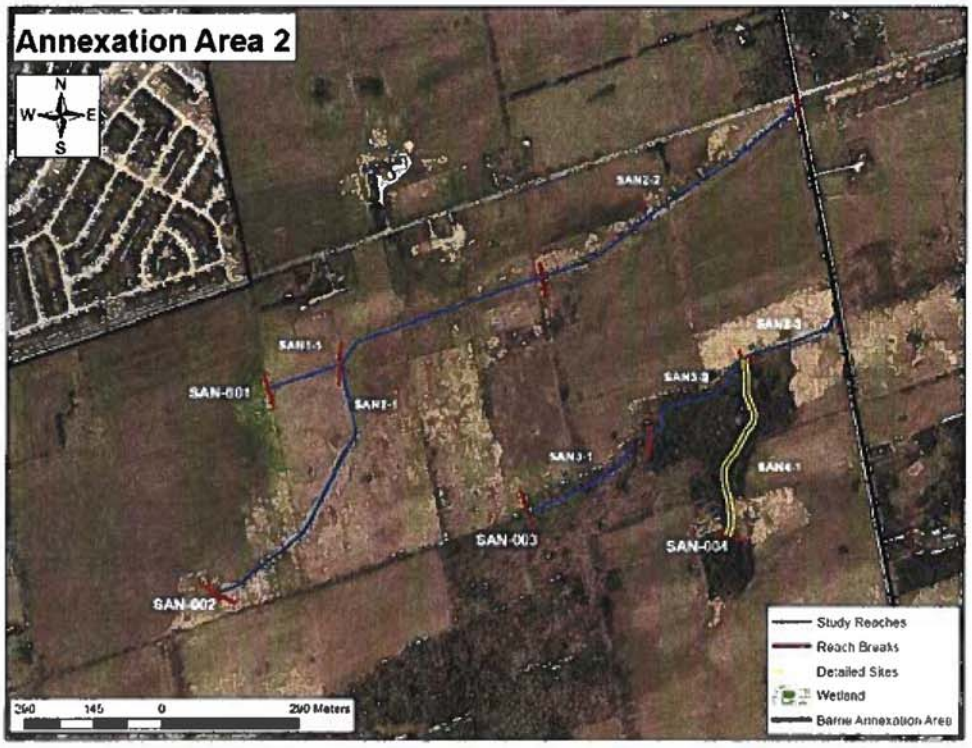


Figure C5 – Reach delineations for Sandy Cove Creek in Annex Area 2.

In the post-development condition the contributing area has been reduced to 0.3 ha, and the proposed peak flows have been reduced dramatically. The maximum discharge in this location is 0.04 cms in the 100 year event.

5.4.7.3 Sandy Cove Creek

Table 13 Sandy Cove Creek, Proposed Condition Modelling Results

Sandy Cove Creek Proposed Model Summary		24 - Year SCS					
	Area(ha)	2 - Year	5 - Year	10 - Year	25 - Year	50 - Year	100 - Year
RJB Allowable Unitary Discharge Rate ($m^3/s/ha$)		0.002	0.008	0.015	0.024	0.032	0.040
Catchment 11 Total Allowable Discharge (m^3/s)	*36.3*	*0.07*	*0.29*	*0.54*	*0.87*	*1.16*	*1.45*
Uncontrolled Flows to SWMF 11 (m^3/s)	36.3	3.22	4.82	6.00	7.51	8.67	9.85
Proposed Flows from SWMF 11 (m^3/s)		0.04	0.08	0.22	0.51	0.79	1.10
Catchment 11 Total Proposed Discharge (m^3/s)		*0.04*	*0.08*	*0.22*	*0.51*	*0.79*	*1.10*
Catchment 12 Total Allowable Discharge (m^3/s)	*9.6*	*0.02*	*0.08*	*0.14*	*0.23*	*0.31*	*0.39*
Uncontrolled Flows to SWMF 12 (m^3/s)	9.6	0.88	1.34	1.70	2.14	2.47	2.81
Proposed Flows from SWMF 12 (m^3/s)		0.01	0.03	0.09	0.18	0.26	0.35
Catchment 12 Total Proposed Discharge (m^3/s)		*0.01*	*0.03*	*0.09*	*0.18*	*0.26*	*0.35*
Catchment 13 Total Allowable Discharge (m^3/s)	*27.2*	*0.05*	*0.22*	*0.41*	*0.65*	*0.87*	*1.09*
Uncontrolled Flows to SWMF 13 (m^3/s)	26.8	2.02	3.12	3.95	4.95	5.72	6.49
Proposed Flows from SWMF 13 (m^3/s)		0.03	0.12	0.21	0.35	0.47	0.61
Uncontrolled Flows to SWMF 13a (m^3/s)	0.4	0.00	0.01	0.06	0.08	0.10	0.12
Catchment 13 Total Proposed Discharge (m^3/s)	*27.2*	*0.03*	*0.13*	*0.27*	*0.43*	*0.57*	*0.73*
Catchment 14 Total Allowable Discharge (m^3/s)	*42.4*	*0.08*	*0.34*	*0.64*	*1.02*	*1.36*	*1.70*
Uncontrolled Flows to SWMF 14 (m^3/s)	42.4	3.32	5.04	6.36	7.99	9.25	10.52
Proposed Flows from SWMF 14 (m^3/s)		0.06	0.11	0.28	0.61	0.91	1.25
Catchment 14 Total Proposed Discharge (m^3/s)		*0.06*	*0.11*	*0.28*	*0.61*	*0.91*	*1.25*
Catchment 17 Total Allowable Discharge (m^3/s)	*5.6*	*0.01*	*0.04*	*0.08*	*0.13*	*0.18*	*0.22*
Uncontrolled Flows to SWMF 17 (m^3/s)	5.2	0.51	0.78	1.00	1.26	1.46	1.66
Proposed Flows from SWMF 17 (m^3/s)		0.01	0.01	0.01	0.01	0.02	0.03
[A]Uncontrolled Flows to SWMF 17a (m^3/s)	0.4	0.00	0.06	0.09	0.12	0.14	0.16
Catchment 17 Total Proposed Discharge (m^3/s)	*5.6*	*0.01*	*0.07*	*0.10*	*0.13*	*0.16*	*0.19*
Catchment 18 Total Allowable Discharge (m^3/s)	*4.3*	*0.01*	*0.03*	*0.06*	*0.10*	*0.14*	*0.17*
Uncontrolled Flows to SWMF 18 (m^3/s)	2.7	0.26	0.42	0.53	0.66	0.76	0.86
Proposed Flows from SWMF 18 (m^3/s)		0.01	0.01	0.02	0.04	0.06	0.08
Uncontrolled Flows to SWMF 18a (m^3/s)	1.7	0.00	0.01	0.02	0.04	0.05	0.07
Catchment 18 Total Proposed Discharge (m^3/s)	*4.3*	*0.01*	*0.02*	*0.04*	*0.08*	*0.11*	*0.15*
Discharge to Existing Subdivisions							
Catchment 206 Discharge to Big Bay Point[B]							
Allowable Flows to Big Bay Point (m^3/s)	*1.39*	0.00	0.01	0.02	0.03	0.04	0.06
Post-Dev. Catchment 206 Flows to Big Bay Point (m^3/s)	**1.39**	**0.00**	**0.03**	**0.17**	**0.26**	**0.33**	**0.40**

Notes
A - Catchment 17a requires LID controls to meet the total unitary discharge rates for the 5 and 10 year design storms
B - Discharge is to NHS area which flows overland to Big Bay Point Drive at 20th Sideroad

Catchment 11 & 11B/SWMF#11

SWMF#11 is proposed to be located in the southeast corner of the Phase 1 Bulut lands, at the head of the southern limb of Sandy Cove Creek. The July 2015 OMB decision identified the start of Sandy Cove Creek to be at the eastern edge of the Bulut lands, with the 30 m buffer of the Creek extending west into the Bulut lands and into the SWMF

block. A SWMF was requested in this general location as part of the DSWMMP in order to maintain base flow for the upper reaches of Sandy Cove Creek.

This Catchment also includes 5.7 ha of land south of Mapleview, and 6 ha north of Mapleview which previously drained into the Hewitt's Creek watershed under the existing condition. In exchange, 6.4 ha of area south of Mapleview, which previously drained to Sandy Cove Creek, will drain to Hewitt's Creek under the proposed condition. Compensation in other Catchments brings the net difference closer to the target of 2%.

This SWMF has been designed to also accommodate runoff from the SW corner of the LM Barrie development (7.05 ha) on the north side of Mapleview Drive. A 100 year capture pipe will be required to convey the peak runoff under Mapleview Drive and through the Bulut lands.

The majority of the catchment area consists of residential development with the remainder consisting of the institutional school block drainage which is not being directed to SWMF #10. There is also the opportunity to collect drainage from the Mapleview Drive ROW via the 100 year capture pipe and direct the flow into the SWMF, however additional P removal and infiltration to meet LSRCA guidelines should be provided within the ROW. We have not included any part of the external ROW runoff in the digital model to SWMF#11 at this time, as the majority of this area receives quality control treatment from the existing OGS at Hewitt's Creek.

The preliminary design for SWMF#11 was provided to Burnside by the owner's consultant and is currently proposed to be oriented in a generally north-south direction. The design has incorporated the recent LSRCA allowance that portions of the pond grading could extent into the buffer, with the bottom of the pond sitting outside the buffer.

The SWMF and block are adequately sized for the contributing area and there is currently an opportunity to reduce the facility size within the block or to reconfigure the shape to allow for alternative SWMF designs. There may also be an opportunity to stretch the facility and block in a north-south direction and potentially reorganize the lot configuration to allow for lots on the west side of the SWMF and reduce the number on the north side of the facility.

Catchment 12/SWMF#12

SWMF#12 is proposed to be located in the Phase 3 lands of the Finger Lakes Development between the south side of Mapleview Drive and Sandy Cove Creek in an area of relatively steep grades sloping away from Mapleview Drive. The intent of the facility is to provide treatment for the Phase 1 portions of the non-participating landowner to the west of the Finger Lakes property and for the Phase 1 and Phase 3 lands (north of Sandy Cove Creek) Finger Lakes property.

The final DSWMMP stormwater requirements representing quality, erosion and flood controls forming the unitary discharge rates were combined in the end of pipe SWMF while the volumetric components for flood and erosion were summed.

Table 4.4.15: End-of-Pipe Stormwater Management Requirements[1,3]

Subwatershed	Reach	Outlet Node	Cumulative Unitary Storage Rate (m^3/imp. ha)				Unitary Discharge Rate (m^3/s/ha)			
			Erosion Control	Flood Control[2]			Erosion Control	Flood Control		
				5 Yr	25 Yr	100 Yr		5 Yr	25 Yr	100 Yr
Bear Creek	BEA1	9001	410	850	1000	1300	0.0012	0.007	0.013	0.030
	BEA2	9005	440	1030	1280	1580	0.0012	0.007	0.013	0.030
Thornton Creek	THO1	9024	430	920	1070	1420	0.0011	0.007	0.013	0.025
	THO2	9017	370	860	960	1310	0.0013	0.009	0.018	0.036
Lover's Creel	LOV2	9251	400	850	1050	1300	0.0011	0.010	0.020	0.050
	LOV4	9142	400	1000	1250	1400	0.0012	0.007	0.012	0.027
	LOV6	9201	400	900	1050	1350	0.0013	0.007	0.013	0.030
	LOV8	9350	460	1060	1310	1510	0.0012	0.007	0.012	0.027
Hewitts Creek	-	9140	450	900	1050	1300	0.0006	0.007	0.013	0.030
Sandy Cove Creek	SAN2	9284	310	760	835	1235	0.0010	0.010	0.020	0.040
	SAN3	9281	320	770	845	1245	0.0011	0.010	0.020	0.040

Note: [1] Water quality: Volumetric requirements for permanent pool storage are in addition to storage provided here and are to be provided in accordance with Ministry of the Environment Enhanced Level treatment.
[2] Includes erosion control volume
[3] Volumes do not include LID

Utilizing the information provided in Appendix A of the DSWMMP, unitary discharge rates for the existing condition 2-100 year 24 hour SCS Type II storm were recalculated for the three Creeks for comparison and reference to the revised PCSWMM model.

Volumetric requirements were based on the LSRCA guidelines and MOECC SWM guidelines. The PCSWMM results were compared to the DSWMMP where possible (see Section 5.3.3.5 for additional model comparisons and modelling results).

We have reviewed and updated the DSWMMP findings (as per the DSWMMP recommendations in Section 4.4.5) based on the additional information available since the completion of that Report.

The prime objective of the stormwater design within the SIS is to mitigate the impact of stormwater runoff (peak and volume) to receiving water ways and to promote a more natural water balance by promoting infiltration where possible. In order to achieve this objective post development peak flows are required to match pre development peak flows for the 2 through 100 year event. In addition safe conveyance of the regional storm event to the Creeks will also be required.

Quantity control has been initially analyzed on a discreet storm basis (24 hour SCA Type II and Chicago 4 hour) assuming the sole use of a traditional wet stormwater management facility which will present a worst case scenario for the size and footprint of the proposed stormwater management facilities. A continuous data set representing 12 years of precipitation and climate data was also run for the traditional wet SWMF to

noor kamran

From: Tekeste Araya
Sent: August 12, 2019 3:02 PM
To: Nick Millington
Cc: Amanda Kellett; Bryan Stanton; Alky Poulias; Hacik Tozcu; Koryun Shahbikian; noor kamran
Subject: RE: Sandy Cove Creek natural Channel Design - Terms of Reference for Detailed Design

Hi Nick,
Thank you for your prompt response.

Regards,

Tekeste Araya
Project Manager
Schaeffers Consulting Engineers
(905) 738-6100 Ext. 255

From: Nick Millington <nmillington@tathameng.com>
Sent: August 12, 2019 2:52 PM
To: Tekeste Araya <taraya@schaeffers.com>
Cc: Amanda Kellett <akellett@tathameng.com>; Bryan Stanton <bstanton@tathameng.com>; Alky Poulias <a.poulias@sympatico.ca>; Hacik Tozcu <HTozcu@schaeffers.com>; Koryun Shahbikian <kshahbikian@schaeffers.com>; noor kamran <nkamran@schaeffers.com>
Subject: RE: Sandy Cove Creek natural Channel Design - Terms of Reference for Detailed Design

Hello Tekeste,

Please find attached our first engineering submission for the Sandy Cove Creek Re-alignment project.

Based on the provided design, the flood elevations at the most upstream cross section (1800) immediately downstream of the Bulut SWM pond are:

2-yr	251.95
5-yr	252.20
10-yr	252.21
25-yr	252.38
50-yr	252.52
100-yr	252.65
Regional	253.54

We are currently updating the model and design to address LSRCA comments. The flood elevations above are likely slightly conservative, as if anything, we anticipate these flood elevations may decrease based on model revisions.

Please let us know if any of these elevations present an issue to your pond design.

Feel free to give me a call if you wish to discuss.

Regards,
Nick

Nick Millington, B.E.Sc., P.Eng
Project Manager

Tatham Engineering Limited

1595 Clark Blvd.
Brampton, ON L6T 4V1, CANADA
T: 1.905.793.9800 • EXP.com

Technical Memorandum

To:	Koryun Shahbikian, LLM, M.Eng., P.Eng., PMP Schaeffer & Associates Limited		
Date:	October 4, 2019	**Memo No.:**	Response to comments – SWMP subdrain system evaluation
Project Name:	883 Mapleview Drive East, Barrie, Ontario	**Project No.:**	BRM-00055075-E0
Prepared By:	Leigh Knegt, P.Eng.		
Subject:	Response to Comments Geotechnical Considerations Storm Water Management Pond Filtration Media		

EXP Services Inc. (EXP) was retained by 1091369 Ontario Inc. (883 Mapleview Drive) to provide hydrogeological and geotechnical engineering services in support of detailed design for the SWMP of the proposed development located at 883 Mapleview Drive East in Barrie, Ontario.

It is EXP understanding that the Draft plan submission resulted in some comments from agencies (LSRCA, City of Barrie) related to SWM pond long term maintenance that requires hydrogeological and geotechnical review.

This technical memorandum presents results of the review of the SWM Pond drawings prepared by Schaeffer & Associates Limited dated January 11, 2019 (received September 26, 2019) and EXP additional analysis required in support of the SWMP design from the hydrogeological and geotechnical stand points.

Materials Reviewed:

- SWM -6 drawing - SWM POND Drainage Blanket Plan, prepared by Schaeffers Consulting Engineers dated January 11, 2019;
- SWM -3 drawing - SWM POND Sections 1-1 to 4-4, prepared by Schaeffers Consulting Engineers dated January 11, 2019;
- SWM -3 drawing - SWM POND Sections 5 - 5 to 8 – 8, prepared by Schaeffers Consulting Engineers dated January 11, 2019.

Agencies Concerns:

- *The project needs to clarify and demonstrate that we will not have uplift in normal operational condition when the permanent pool is full of water and the sand filter is there. Please check and demonstrate in your response that what we have is sufficient for normal operational condition or if we need to put extra thick layer of Weight such as clay or other material to counter affect the uplift. This is addressed in a separate memo.*

- *The project needs to prove them that the subdrain under the impervious layer of the pond is sufficiently sized and spaced to convey the groundwater during the maintenance time to the sump pump Manhole, where the sump pump will drain this water to lower the uplift pressure during maintenance. For all ponds, this information and calculation is provided by soil and hydrogeology expert. We just reflect those requirements on our drawings so the contractor will construct the pond. Currently, LSRCA is looking for this calculation and information. we can specify the pump discharge based on your required flow to lower the uplift pressure. This is addressed in a separate memo.*

- *LSRCA is concerned that having deep water over the filter bed will increase the compaction and reduce the percolation. You have responded to this question, but I think you need to be more elaborative and provide some calculations. For instance, use of term "should not", will not convince them. Is there any way that you can provide more supportive calculation and discussion in this regard? For instance, we can tell you 90% of time during the year, the water depth will be how much? the depth of 100 yr flow will be how much? we can provide this information. they also want you to spec the filter material. This is good since you can engineer the material and ensure the impact is minimized. The issue is the MOE guideline recommended maximum depth of water over the filtration bed to be 1m. our 100yr depth is more than that. Addressed below.*

Compaction of Filter Media:

It EXP's understanding that the LSRCA is concerned that the height of water over the top of the filter media will result in compaction of the filter media, reducing the infiltration capacity of the filter media over time. Based on the design drawings provided, EXP understands that rainfall events greater than the 2-year event will result

in more than 1.0 m of water over the top of the filter media, with the 100-year storm resulting in approximately 2.0 m of water over the filter media.

Since at a water depth of 2.0m depth, the total static force applied to the sand filter material is approximately 20 kPa, and the forces are static in nature and relatively short lived, the potential for compaction to occur is minimal. While static loads can apply compactive forces, they typically need to be fairly large to be effective. Large ride-on compaction equipment exerts 500 to 8500 kPa of pressure while smaller walk-behind equipment exerts 50 to 200 kPa of pressure. In addition, they use vibration to increase the compactive effort that they apply. Since the force applied by the water is static in nature and is considerably smaller than the loadings typically used to achieve effective compaction, the compactive effect from the water will be minimal and not very effective.

While the risk of compaction from the depth of water above the filter media is minimal, it can be further reduced by the use of a filter medium that is naturally resistant to compaction, such as the material that is specified for Class 4 septic filter beds. This sand is defined as being comprised of particles ranging is size between the limits of:

- an effective size between 0.25 mm with a uniformity coefficient of not less than 3.5,
- an effective size of 2.5 mm with a uniformity coefficient of not greater than 1.5, and
- having a uniformity coefficient not greater than 4.5.

This specification results in a material that has a limited amount of fines and is generally of particles of a similar size. Materials with these characteristics are naturally resistant to compaction.

A non-woven filter cloth (such as Terrafix 270R) should be placed along the interface between the sand filter and the underlying drainage stone layer to prevent the sand filter medium from flowing into the voids of the stone layer, thereby reducing its effectiveness. The surface of the sand medium will also require periodic maintenance to ensure that the surface of the filter medium does not become plugged with silt from the stormwater.

We trust that the above information is satisfactory. Should you have any questions, please do not hesitate to contact this office.

Sincerely,

Exp Services Inc.

Leigh Knegt, P.Eng.
Manager
Earth and Environmental Services

Cc: Alky Poulias, PDC Inc.

Noor Kamran, Schaeffer & Associates Limited

Hacik Tozcu, Schaeffer & Associates Limited

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Technical Memorandum

To:	Koryun Shahbikian, LLM, M.Eng., P.Eng., PMP Schaeffer & Associates Limited		
Date:	October 4, 2019	**Memo No.:**	Response to comments – SWMP subdrain system evaluation
Project Name:	883 Mapleview Drive East, Barrie, Ontario	**Project No.:**	BRM-00055075-E0
Prepared By:	Nataliya Tkach, P.Geo., PMP, P.Eng. Francois Chartier, M.Sc.,P.Geo.		
Subject:	Response to Comments Hydrogeological Review Storm Water Management Pond		

EXP Services Inc. (EXP) was retained by 1091369 Ontario Inc. (883 Mapleview Drive) to provide hydrogeological and geotechnical engineering services in support of detailed design for the SWMP of the proposed development located at 883 Mapleview Drive East in Barrie, Ontario.

It is EXP understanding that the Draft plan submission resulted in some comments from agencies (LSRCA, City of Barrie) related to SWM pond long term maintenance that requires hydrogeological review.

This technical memorandum presents results of the review of the SWM Pond drawings prepared by Schaeffer & Associates Limited dated January 11, 2019 (received September 26, 2019) and EXP additional analysis required in support of the SWMP design from the hydrogeological stand point.

Materials Reviewed:

- SWM -6 drawing - SWM POND Drainage Blanket Plan, prepared by Schaeffers Consulting Engineers dated January 11, 2019;
- SWM -3 drawing - SWM POND Sections 1-1 to 4-4, prepared by Schaeffers Consulting Engineers dated January 11, 2019;
- SWM -3 drawing - SWM POND Sections 5 - 5 to 8 – 8, prepared by Schaeffers Consulting Engineers dated January 11, 2019.

Agencies Concerns:

- *The project needs to clarify and demonstrate that we will not have uplift in normal operational condition when the permanent pool is full of water and the sand filter is there. Please check and demonstrate in your response that what we have is sufficient for normal operational condition or if we need to put extra thick layer of Weight such as clay or other material to counter affect the uplift.*

- *The project needs to prove them that the subdrain under the impervious layer of the pond is sufficiently sized and spaced to convey the groundwater during the maintenance time to the sump pump Manhole, where the sump pump will drain this water to lower the uplift pressure during maintenance. For all ponds, this information and calculation is provided by soil and hydrogeology expert. We just reflect those requirements on our drawings so the contractor will construct the pond. Currently, LSRCA is looking for this calculation and information. we can specify the pump discharge based on your required flow to lower the uplift pressure.*

Hydrogeological Considerations:

To address agencies concerns noted above from the hydrogeological stand point, EXP had reviewed information provided. Based on the SWM pond drawings review, it is our understanding the underside of the base of the SWM pond is founded at approximately elevation 249.66 in the south (filtration bay) and 249.78 in the north (forebay) at the lowest points.

Where there is a permanent pool, the proposed water level is at approximate elevation 253 masl. The measured groundwater level in this area is approximately 254,19 masl, as measured in one well installed in a pond area (BH2) in November 2017 (Preliminary Hydrogeological Investigation, December 21, 2017). Therefore, the sub-drain system would be required for the SWM pond. This is consistent with regional data available (ORMGP, partners portal) that suggests that water table in the SWMP area is at approximate elevation of 154.4 masl.

If permanent pond areas will be emptied for maintenance, then a sub-drain drainage system (FDS) will also be required below the liner for depressurization of artesian conditions and to address the uplift pressures during the SWMP maintenance periods. The sub-drain system can be inactive when the SWMP pond is performing and it is full. For FDS that do not require permanent drainage, this can be achieved by connecting the foundation drain to a manhole where a temporary sump pump can be activated to drain the FDS during maintenance.

It should be noted that BHs 30, 31, 32, and 33 (EXP, 2017) are located in the pond area, which show that the invert of the pond will be in the sand deposit with only 1 slug test done in the pond (5 in total across the site). As per the hydrogeological report dated December 21, 2017, slug tests were completed in five monitoring wells distributed across the site (Table 3-1 extracted from hydrogeological report)

A summary of the hydraulic conductivity (K) value estimated from the SWRT is provided in Table 3-2.

Table 3-1: Summary of Hydraulic Conductivity Testing

Monitoring Well	Well Depth (mbgs)	Screen Interval (mbgs)		Soil Formation Screened	Estimated Hydraulic Conductivity (m/s)
		from	to		
BH 6	13.5	10.5	13.5	Sand	4.6×10^{-5}
BH 12	6.6	3.6	6.6	Sand	4.0×10^{-6}
BH 19	14.1	11.1	14.1	Silty Sand Till to Sand	9.7×10^{-7}
BH 28	7	4	7	Silty Sand Till to Sand	6.7×10^{-6}
BH 32	12.4	10.9	12.4	Sand	1.6×10^{-6}
				Highest K estimate for	4.6×10^{-5}
				Geometric Mean Estimate for	1.4×10^{-5}

Long-Term Dewatering Rate Assessment

To estimate the groundwater flow to the proposed sub-drain system below the SWMP liner, the Dupuit equation for steady linear flow to both sides of a partially-penetrating excavation through an unconfined aquifer resting on a horizontal impervious surface was used to obtain a flow rate estimate, is expressed as follows:

$$Q_w = \left[0.73 + 0.23\left(\frac{P}{H}\right)\right] xK(H^2 - h^2)/Lo$$

Where:

Qw = Rate of pumping (m^3/sec)

x = Length of excavation (m)

P = Depth of penetration of drainage (m)

K = Hydraulic conductivity (m/sec)

H = Head beyond the influence of pumping (static groundwater elevation) (m)

h = Head above base of the water-bearing zone at the excavation (m)

Lo = Distance of Influence (Ro/2) (m)

The calculation for the estimated flow to the future sub-drain system is provided in Attachment 1. The dewatering target for the foundation drainage system is taken as 0.5 m below the lowest SWMP liner elevation.

Please note that the foundation drain analysis will provide a preliminary flow rate estimate. Actual flow rate measurements of the sump discharge, once it is built, will be required to confirm these flow rates.

Radius of Influence

The radius of influence (ROI) for the construction dewatering was calculated based on the Sichardt equation. This equation is used to predict the distance at which the drawdown resulting from pumping is negligible. This empirical formula was developed to provide representative flow rates using the steady state flow dewatering equations, as discussed below.

The estimated radius of influence (Ro) of pumping based on the Sichardt formula is described as follows:

$$R_o = C(H - h)\sqrt{(K)}$$

Where:

Ro= Estimated radius of influence (m)

H = Head in aquifer (static water level or saturated depth) (m)

h = Dynamic water level (m)

K = Hydraulic Conductivity (m/sec)

C = Constant (3,000)

The calculations for radius of influence are provided in Attachment 1.

Preliminary Sub-Drain Flow Rate Estimate

Based on the assumptions provided in sections above, the results of the preliminary sub-drain discharge volume estimate are summarized in Table 1-1. Please note that this estimate is an indication of average discharge volumes. Since some portions of the pond will be completed in a sand unit, the high K value was considered in evaluation of flow rates into a sub-drain system. This volume must be confirmed once the sub-drain system is operational. Seasonal and daily fluctuations are expected. These estimates may be affected by hydrogeological conditions beyond those encountered at the time of hydrogeological investigation (EXP, 2017), fluctuations in groundwater regimes, surrounding site alterations, and existing and future infrastructures.

Table 1-1 Summary of Long-Term Discharge Flow Rate

Flow Rate	**Peak Dewatering Flow Rate Including Safety Factor of 1.5 (m^3/day)**	
Flow into Sub-drain system SWMP	160 (rounded) (low K-value)	1,100 (rounded) (high K-value)

Intermittent cycling of sump pumps and seasonal fluctuation in groundwater regimes should be considered for pump specifications. A safety factor was applied to the flow rate to accommodate the variability in seasonal water level fluctuations.

It is noted that these estimates are considered preliminary. Additionally, please note that this preliminary estimate of sub-drain discharge volumes is based on the assumptions outlined in this memorandum, and that any variations in hydrogeological conditions beyond those encountered as part of previous preliminary hydrogeological investigation may significantly influence the sub-drain discharge volumes. As a result, the exact volume discharged will be confirmed once the system is operational. It is recommended that once the sub-drain system is in place, that a flow meter be installed at the sump (s) to record daily discharge volumes to provide more representative estimates during the commissioning stage of the system.

Post-Development MECP Water Taking Permit

In accordance with the Ontario Water Resources Act, if the water taking for the construction dewatering will be more than 50 m^3/day, application for a Category 3 Permit to Take Water (PTTW) would be required from the MECP.

Based on the dewatering estimate that might reach up to 1,100 m^3/day for SWMP sub-drain system, a Category 3 Permit to Take Water (PTTW) would be required to facilitate the post-development phase.

We trust that the above information is satisfactory. Should you have any questions, please do not hesitate to contact this office.

Sincerely,

Exp Services Inc.

Nataliya Tkach, P. Geo., PMP, P.Eng.
Senior Hydrogeologist
Environmental Services

Francois Cartier, M.Sc., P. Geo.
Head of Hydrogeology
Environmental Services

Attachments:

1- Long Term Flow Rate Calculation

Cc: Alky Poulias, PDC Inc.

Noor Kamran, Schaeffer & Associates Limited

Hacik Tozcu, Schaeffer & Associates Limited

Attachment 1: Long-Term Flow Rate to Sub-Drain System

883 Mapleview Drive East, Barrie, ON

BAR-00055075-A0

Table F-1: Flow from Under-Slab Drain System

Parameters	Symbols	Unit	SWMP	SWMP
Geological Formation	-	-	overburden (high K)	overburden (low K)
Ground Elevation	-	mASL	257.50	257.50
Highest Groundwater Elevation	-	mASL	255.00	255.00
Top of the Water-Bearing Zone	-	mASL	255.00	255.00
Base of the Water-Bearing Zone	-	mASL	248.50	248.50
Height of Static Water Table Above the Base of the Water-Bearing Zone	H	m	6.50	6.50
Dewatered Elevation Target	-	mASL	249.00	249.00
Height of Target Water Level Above the Base of Water-Bearing Zone	h_w	m	0.50	0.50
Hydraulic Conductivity	K	m/s	4.60E-05	9.70E-07
Length of Excavation	-	m	185.00	185.00
Width of Excavation	-	m	100.00	100.00
Method to Calculate Radius of Influence	-	-	Sichardt	Sichardt
Radius of Influence from Sides of Excavation	Ro	m	122	18
Distance to Linear Source from Sides of excavation	Lo=Ro/2	m	61	9
Dewatering Flow Rate (unconfined linear flow component)	Q	m^3/day	734	107
Factor of Safety	fs	-	1.5	1.5
Dewatering Flow Rate (multiplied by factor of safety)	Q.fs	m^3/day	1102	160

Notes:

mASL - meters above sea level

Analytical Solution for Estimating Plane Flow from an Unconfined Aquifer to a Patially-Penetrating Excavation

$$Q_w = \left[0.73 + 0.23\left(\frac{P}{H}\right)\right] Kx \frac{H^2 - {h_w}^2}{L_o}$$

(Based on the Dupuit Equation)

Where:

Q_w = Flow rate per unit length of excavation (m^3/s)

P = Depth of penetration of the excavation below the original water table (m)

K = Hydraulic conductivity (m/s)

H = Height of static water table above base of water-bearing zone (m)

h_w = Height of target water level above the base of water-bearing zone (m)

L_o=Distance of Influence (m)

February 11, 2019

1091369 Ontario Inc.
5423 Fallingbrook Drive
Mississauga, ON
L5V 1P7

Attn: Mr. Steve Bulut

Via stevebulut@yahoo.com

Re: *BRM-00055075-D0*

883 Mapleview Drive East, Barrie, Ontario
Infiltration Rate Assessment
Low Impact Development for 25 mm Retention

Dear Mr. Bulut:

EXP Services Inc. (EXP) is pleased to provide 1091369 Ontario Inc. this Infiltration Rate Assessment for the proposed Low Impact Development (LID) measures at 883 Mapleview Drive East in Barrie, Ontario (hereinafter referred to as the 'Site'). The Site location plan is shown on Figure 1.

Exp previously completed geotechnical and hydrogeological investigations at the Site (EXP, 2017). The information collected from the previous investigations will be used in the current assessment.

It is our understanding that the LIDs proposed at different locations across the site. It is further understood that an average infiltration rate for the subject site is required in support of 25 mm volumetric retention storm water management purposes (LSRCA requirement).

The following work program was completed in preparation of this Infiltration Rate Assessment Report:

- Complete the infiltration rate assessment based on previously completed hydraulic conductivity testing (desk top evaluation);
- Address questions and concerns provided in email from Schaffers Consulting Engineers (February 5, 2019); and
- Prepare a summary letter report.

1 Previous Hydraulic Conductivity Testing

Hydraulic conductivity testing completed as part of the previous hydrogeological investigation reported under separate cover (EXP, 2017) was used to complete an infiltration rate evaluation of the Site. Single Well Response Tests (SWRTs) were carried out on November 24 and November 28, 2017 at the following monitoring well locations: BH 6, BH 12, BH 19, BH 28, and BH 32. The borehole/monitoring well plan can be found in Figure 2.

The stratigraphy encountered at the site, as revealed in the boreholes, generally comprised surficial topsoil and ploughed soil, followed by silty sand till and sand deposits. Isolated deposits of clayey silt, silty sand, silt and gravelly sand were also encountered. Table 1 below shows the summary of hydraulic conductivity (K) testing conducted on the Site as well as the soil formation each well was screened in, as it relates to

the geodetic survey. It is noted that all wells on Site are at least partially screened in the lower sand unit encountered below silty sand till.

Table 1: Summary of Hydraulic Conductivity Testing

Monitoring Well	Approximate Ground Surface Elevation (masl)	Well Depth (mbgs)	Approximate Screen Interval (mbgs) (masl)		Soil Formation Screened	Estimated Hydraulic Conductivity (m/s)
			from	to		
BH 6	260.75	13.5	10.5 250.28	13.5 247.28	Sand	4.6×10^{-5}
BH 12	255.60	6.7	3.7 251.88	6.7 248.88	Sand	4.0×10^{-6}
BH 19	263.22	14.9	11.9 251.32	14.9 248.32	Silty Sand Till to Sand	9.7×10^{-7}
BH 28	256.07	7.0	4.0 252.07	7.0 249.07	Silty Sand Till to Sand	6.7×10^{-6}
BH 32	253.19	11.1	9.6 243.59	11.1 242.14	Sand	1.6×10^{-6}
					Highest K estimate for	4.6×10^{-5}
					Geometric Mean Estimate for	1.4×10^{-5}

Notes:

mbgs – meters below ground surface;

masl – meters above sea level

SWRT provides estimates of K for the geological formation in the immediate zone surrounding the well screen. As shown in Table 1, the highest K-value is estimated to be 4.6×10^{-5} m/s and the geometric mean of the K-values is estimated to be 1.4×10^{-5} m/s.

As per Low Impact Development (LID) Stormwater Management Planning and Design Guide, Appendix C, CVC – TRCA, 2010, each of estimated hydraulic conductivities were correlated to infiltration rates based on the approximate relationship shown in Table 2 below.

Table 2: Approximate Relationships Between Hydraulic Conductivity, Percolation Time and Infiltration Rate

Hydraulic Conductivity, Kfs (cm/s)	Percolation Time, T (min/cm)	Infiltration Rate, 1/T (mm/hr)
0.1	2	300
0.01	4	150
0.001	8	75
0.0001	12	50
0.00001	20	30
0.000001	50	12

The calculated infiltration rates for each of the respective hydraulic conductivities for each well are shown in Table 3.

Table 3: Summary of Infiltration Rate Assessment Results

Monitoring Well	Measured Average K (cm/sec)	Infiltration Rate (mm/hr)	Design Infiltration Rate	
			Factor of Safety	*Design Infiltration Rate with Safety Factor Applied (mm/hr)
BH 6	4.6×10^{-3}	129	3.5	37
BH 12	4.0×10^{-4}	67	3.5	19
BH 19	9.7×10^{-5}	46	2.5	18
BH 28	6.7×10^{-4}	77	3.5	22
BH 32	1.6×10^{-4}	53	3.5	15

Notes: *Safety Factor of 2.5 to 3.5 was applied to calculate the design infiltration rate (Low Impact Development (LID) Stormwater Management Planning and Design Guide, CVC – TRCA, 2010, Appendix C).

cm/s – centimetres per second;

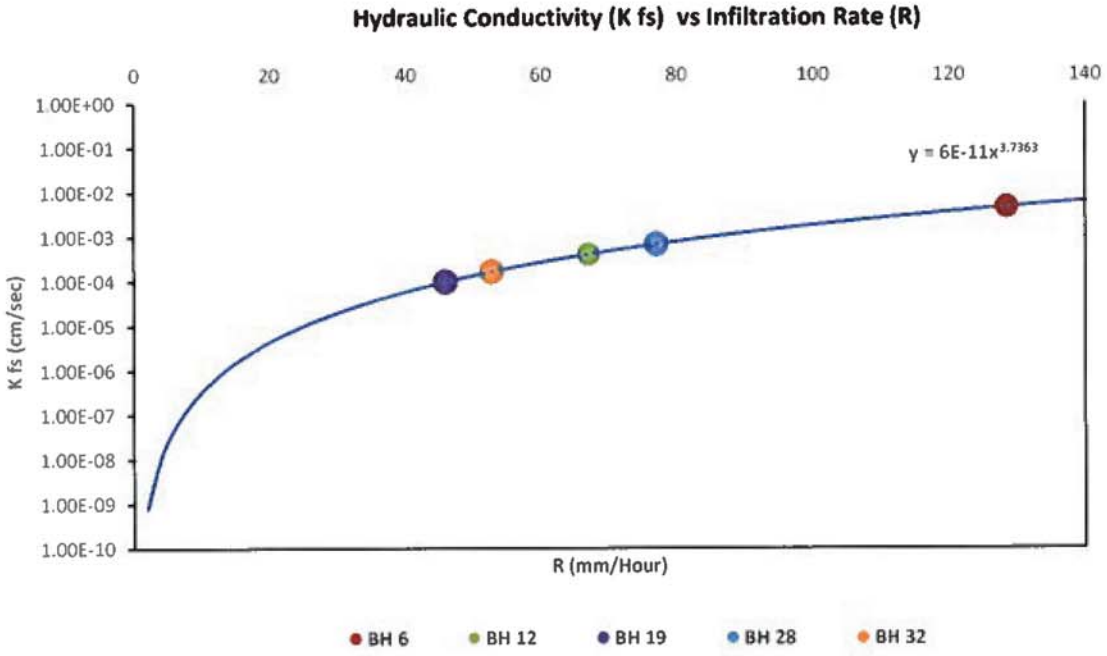
mm/hr– millimeters per hour

Based on the hydraulic conductivity testing results, the infiltration rate for the tested soil layer at representative intervals range from approximately 46 mm/hr at BH 19 to 129 mm/hr at BH 6. Using the measured infiltration rate and a safety factor of 2.5 to 3.5 (Low Impact Development (LID) Stormwater Management Planning and Design Guide, Appendix C, CVC – TRCA, 2010), the design infiltration rate varies from approximately 15 (BH 32) to 37 (BH 6) mm/hr.

The minimum design infiltration rate is the same as minimum MECP design infiltration rates required for Stormwater Management (SWM) measures (15 mm/hr).

Figure 3 below presents the approximate correlation between the measured hydraulic conductivity based on the SWRT results and infiltration rate.

Figure 3 Hydraulic Conductivity vs Infiltration Rate



2 Water Level Monitoring

Water levels were observed in monitoring wells on the date of completion of each well and on November 23, 24, and 28 2017. A summary of all static water level data as it relates to the geodetic survey is summarized in Table 4 below.

Table 4: Groundwater Elevation Summary

Monitoring Well ID	Ground Surface Elevation (masl)	Stick Up (+)	Approximate Full Well Depth (mbgs)	Depth	23-Nov-17	24-Nov-17	28-Nov-17
BH 6	260.75	0.988	13.5	mbTOP	6.17	6.15	6.15
				mbgs	5.18	5.16	5.16
				masl	255.57	255.59	255.59
BH 12	255.60	0.808	6.7	mbTOP	0.86	0.87	0.87
				mbgs	0.05	0.06	0.06
				masl	255.55	255.54	255.54

Monitoring Well ID	Ground Surface Elevation (masl)	Stick Up (+)	Approximate Full Well Depth (mbgs)	Depth	23-Nov-17	24-Nov-17	28-Nov-17
BH 19	263.22	0.903	14.9	mbTOP	8.74	8.76	8.76
				mbgs	7.84	7.86	7.86
				masl	255.38	255.36	255.36
BH 28	256.07	1.103	7.0	mbTOP	1.09	1.10	1.10
				mbgs	-0.02	0.00	0.00
				masl	256.09	256.07	256.07
BH 32	253.19	2.234	11.1	mbTOP			1.23
				mbgs	-	-	-1.00
				masl	-	-	254.19

Notes:

mbgs – meters below ground surface;

masl – meters above sea level

The groundwater levels recorded in the monitoring wells ranged from approximately 7.8 m below ground surface to 1.0 m above existing ground surface. The groundwater in the wet sand deposit is under artesian pressures. The groundwater elevations ranged from 254.19 meters above sea level (masl) measured on November 23, 2017 at BH32 to 256.09 masl measured on November 28, 2017 at BH28. A summary of all static water level data as it relates to the geodetic survey is summarized in Table 1 (enclosed).

3 Questions / Concerns

Two main questions/concerns were posed in the February 5, 2019 email from Schaffers Consulting Engineers ('Engineers'):

Question #1:

To confirm the percolation rates as well as the depth and location that the tests have been done. From the results provided on page 7 of Hydrogeology report, it looks to me that majority of the tests are done in sandy layer which is below the silty sand till layer.

The concern that Engineers have is the following:

- *Percolation rate based on SIS for this area is 1 mm/hr.*
- *The percolation rates for our neighbors' property is low as well and sub layers change in some areas within our neighbours property. They might have tight soil in some areas.*

This is important since suddenly, it changes all design concept for this development and makes it LID haven area.

Response:

The results of the hydrogeological investigation suggest that the stratigraphy encountered at the site generally consists of surficial topsoil and ploughed soil, followed by silty sand till and sand deposits. Isolated deposits of clayey silt, silty sand, silt and gravelly sand were also encountered. It is also noted that all wells on site were installed at least partially in the lower sand unit encountered below silty sand till..

However, the available grainsize analysis results for the soil sample of sandy silt till (SA5) collected between 3.0 and 3.6 mbgs (~Elev 257.9-257.3) at BH24 during geotechnical investigation (Appendix C, EXP, 2017) suggests that the K value is approximately 4.9×10^{-3} cm/s. Based on this, the calculated infiltration rate is approximately 131 mm/hr. After applying the safety factor of 3.5, the calculated design infiltration rate is approximately 37 mm/hr. It should be noted that upon completion of the borehole the not stabilized water level was observed at approximately 2.70 mbgs (~Elev. 258.17) at BH24 location on October 17, 2017.

Since no hydraulic conductivity testing is available for silty sand till layer at subsurface and due to lack of monitoring wells and testing completed in this unit, in-situ infiltration testing is recommended to be completed to measure the site specific infiltration rate and confirm depth to water table for the subsurface soil.

Question #2:

'It looks that all monitoring wells went down and entered into sandy layer. Engineers are wondering if we had shallower monitoring wells within the Silty Sand Till layer, still the ground water would be similarly high as it is right now. Specially this is important in SWM pond area. Based on the current water level information, the bottom of SWM pond is bellow water level and we have to rely on filtration LIDs only for that area'.

Response:

As mentioned in our response to the previous question no well was installed completely within the subsurface silty sand till. Groundwater elevations across the site range between 254.19 meters above sea level (masl) measured on November 23, 2017 at BH32 to 256.09 masl measured on November 28, 2017 at BH28. However, the ground elevation of the site varies significantly. It should be noted that water levels in both BH 28 and BH 32 monitoring wells were observed at or above the ground surface in November 2017. This suggests artesian conditions at these locations. The artesian conditions further suggest that the confined conditions are present in these areas. Due to the artesian conditions encountered on-site, there is potential for basal heave that should be reviewed by a geotechnical engineer prior to excavation. Additional infiltration testing is recommended to measure the in-situ infiltration rates in silty sand till layer and to confirm depth to water table.

4 Conclusions and Recommendations

The previous geotechnical and hydrogeological investigations completed at the Site (EXP, 2017) were reviewed to evaluate grain size distributions available, confirm well screen formation, hydraulic

conductivities, and water levels. Subsequently infiltration rates and design infiltration rates were calculated for each monitoring well location on Site. The following summary of conclusions and recommendations are provided as follows:

- Each monitoring well was partially to completely screened in the lower sand unit with BH 19 and BH 28 partially screened in the overlying silty sand till unit.
- Five (5) SWRTs were conducted during the hydrogeological investigation. The highest K-value is estimated to be 4.6×10^{-5} m/s with the geometric mean of 1.4×10^{-5} m/s.
- Based on SWRT results, infiltration rates and design infiltration rates were calculated. Infiltration rates ranged from 46 mm/hr at BH 19 (~Elev. 248.32) to 129 mm/hr at BH 6 (~Elev. 247.28) while design infiltration rates ranged from 15 (BH 32) to (BH 6) 37 mm/hr at after applying a safety factor of 2.5 to 3.5.
- Based on the available grainsize analysis for sandy silt till (BH24 SA5) collected between 3.0 and 3.6 mbgs (~Elev 257.9-257.3), the K value is approximately 4.9 x 10-3 cm/s. The calculated infiltration rate is approximately 131 mm/hr and the calculated design infiltration rate is approximately 37 mm/hr (with safety factor 3.5).
- Ground water elevations across the site range between 254.19 masl or 1.00 meter above the ground surface (mags) measured on November 23, 2017 at BH32 to 256.09 masl or 0.02 mags measured on November 28, 2017 at BH28. It is noted that the existing ground elevation of the site varies significantly (EXP, 2017).
- The potential for basal heave due to artesian conditions encountered should be reviewed by a geotechnical engineer prior to excavation.
- Additional infiltration testing is recommended to measure the in-situ infiltration rates in silty sand till layer and to confirm depth to water table.

We trust that the above information is satisfactory. Should you have any queries, please do not hesitate to contact this office.

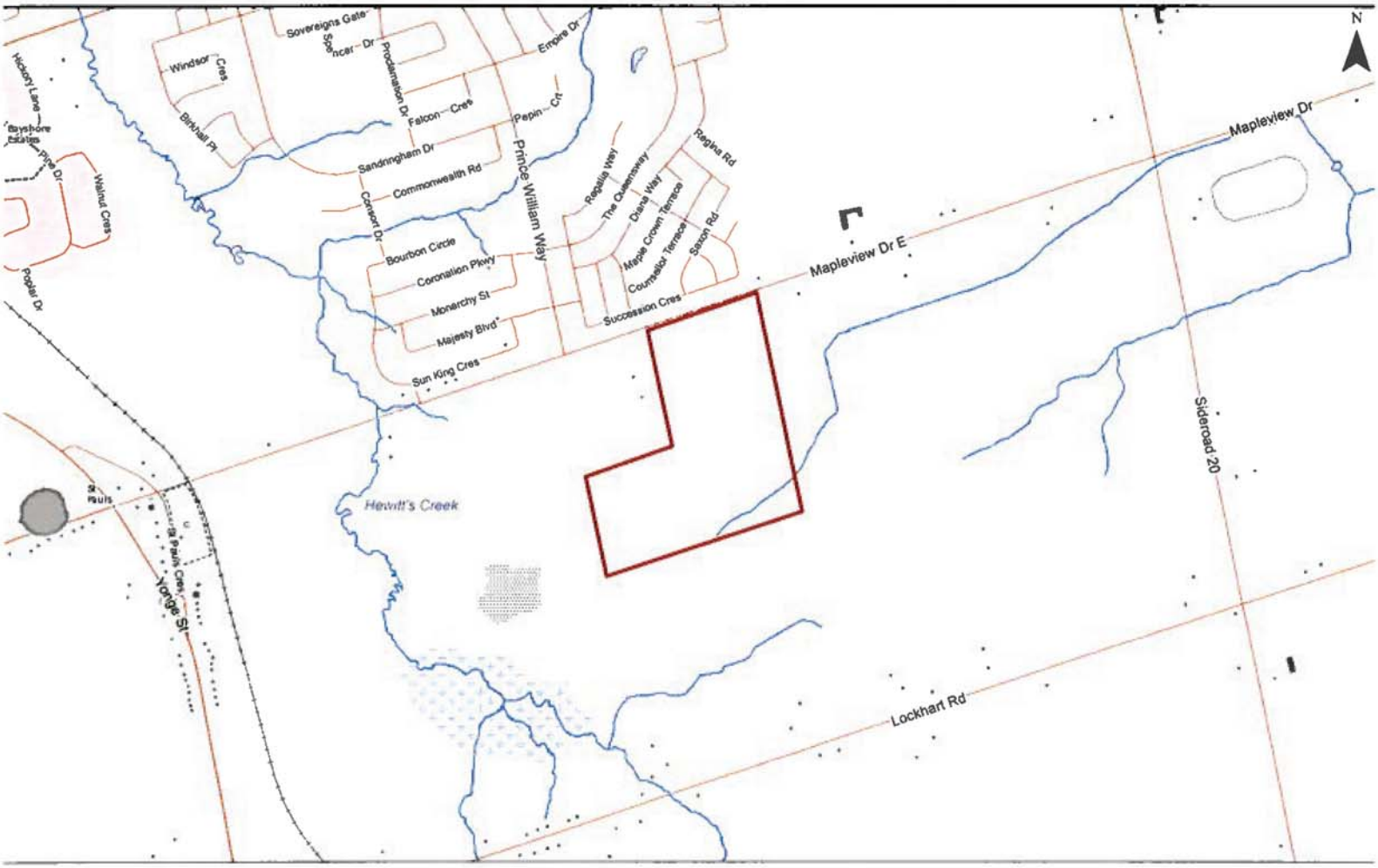
Sincerely,
EXP Services Inc.

Tomson Hecky, M.Sc.
Groundwater Scientist
Environmental Services

Nataliya Tkach, P. Eng., P.Geo., PMP
Senior Hydrogeologist
Environmental Services

Attachments
Figures:
Figure 1 – Site Location Plan
Figure 2 – Borehole/Monitoring Well Plan

Figures



Legend

Approximate Site Boundary

EXP Services Inc. 1595 Clark Boulevard Brampton, ON, L6T 4V1 Phone +1 905 793 9800 Fax +1 905 793 0641	PROJECT TITLE INFILTRATION RATE ASSESSMENT 883 MAPLEVIEW DRIVE EAST BARRIE, ONTARIO	DRAWING TITLE SITE LOCATION PLAN	SRM-0005075-00	AC
			AS NOTED	TH
			NOVEMBER 2017	1

EXP Services Inc.
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LEGEND

- APPROXIMATE SITE BOUNDARY
- BOREHOLE LOCATION (EXP, 2017)
- BOREHOLE / MONITORING WELL LOCATION (EXP, 2017)

TITLE AND LOCATION

BOREHOLE / MONITORING WELL LOCATION PLAN
INFILTRATION RATE ASSESSMENT
883 MAPLEVIEW DRIVE EAST, BARRIE, ONTARIO

PROJECT NO. BAR-00055075-D0	DRN. TH
SCALE AS NOTED	CHK. JF
DATE DECEMBER 2017	FIG. 2

Preliminary Hydrogeological Investigation

883 Mapleview Drive East, Barrie, ON

Client:
1091369 Ontario Inc.
5423 Fallingbrook Drive
Missassauga, ON L5V 1P7

Attn: Mr. Steve Bulut

Project Number:
BAR-00055075-A0

Prepared By:
exp Services Inc.
1595 Clark Boulevard
Brampton, ON L6T 4V1

Date Submitted:
December 21, 2017

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1 Introduction

1.1 Project Description

Exp Services Inc. (**exp**) was retained by 1091369 Ontario Inc. to prepare a Preliminary Hydrogeological Investigation Report associated with the proposed development located at 883 Mapleview Drive East, Barrie Ontario (hereinafter referred to as the 'Site').

The Site is currently undeveloped and located on the south side of Mapleview Dr. E, approximately 1.2 km west of 20th Sideroad. It is our understanding that the development plan consists of a residential development, including one (1) storm water management pond. The development will be provided with municipal roads and services, including sewers and watermains. The Site occupies an area of approximately 32 hectares (~80 acres). The Site location plan is shown on Figure 1.

1.2 Project Objectives

The main objectives of the Hydrogeological Investigation are to:

- Establish the local hydrogeological settings within the Site;
- Access groundwater quality; and
- Prepare a Preliminary Hydrogeological Investigation Report.

1.3 Scope of Work

To achieve the investigation objectives, **exp** completed the following scope of work:

- A Review available geological and hydrogeological information for the Site;
- A drilling program consisting of thirty-three (33) geotechnical boreholes, advanced to depths ranging between approximately 6.0 and 12.0 meters below grade, in conjunction with our geotechnical investigation
- Five (5) boreholes completed as part of the Geotechnical Investigations instrumented with a monitoring well (50 mm diameter) installed in accordance with Ontario Regulation 903 for subsequent monitoring and testing purposes;
- Monitoring wells were screened within the upper aquifer, which based on preliminary review of MOECC Well records for the area is estimated to be about 12 to 15m below grade
- Developed monitoring wells installed by **exp** during the Geotechnical Investigations, and conduct Single Well Response Tests (SWRT) on the noted wells to assess the hydraulic conductivity of the saturated water-bearing zones at the Site;
- Completed three (3) rounds of groundwater level measurements in all installed monitoring wells;

- Collect three (3) groundwater sample for analysis of Ontario Drinking Water Standards (ODWS) parameters including cation and anion scan, dissolved metals, nitrogen species (nitrate; nitrite; ammonia), phosphorous, and chloride.
- Conduct single well response tests (SWRT's) in all five (5) monitoring wells.
- Carried out a private well survey of all properties within a 500 meter radius of the site
- Evaluated the information collected during the field investigation program, including borehole geological information, SWRT results, groundwater level measurements and groundwater water quality data;
- Prepared site plans, geological maps and cross-sections, as well as groundwater contour maps for the Site; and,
- Prepared a Preliminary Hydrogeological Investigation Report.

1.4 Review of Previous Reports

The following reports were reviewed as part of this Hydrogeological Investigation:

- *Geotechnical Investigation, Proposed Residential Development,* 883 Mapleview Drive East, Barrie, Ontario, prepared for 1091369 Ontario Inc., **EXP**, November 29, 2017.

2 Hydrogeological Setting

2.1 Regional Setting

2.1.1 Regional Physiography

The Site is located within a physiographic region known as the Peterborough Drumlin Field and the physiographic landform known as the Till Plains (Drumlinized).

The Till Plains stretch between Georgian Bay in the north and Lake Ontario in the south. The Peterborough Drumlin Field is primarily composed of sporadic deposits of sand and gravel overlain by surficial silt and clay in low areas and underlain by bedrock (reference).

2.1.2 Regional Geology and Hydrogeology

The surficial (Quaternary) geology can be described as Till consisting of stone-poor, sandy silt to silty sand derived from glaciolacustrine deposits or shale (Ministry of Northern Development and Mines, 2012). The surficial geology of the Site and surrounding areas is shown on Figure 2.

Bedrock of the region straddles the boundary between Middle Ordovician Lindsay and Verulam Formation which are both primarily composed of limestone with interbeds of Shale (Ministry of Northern Development and Mines, 2012).

Regional groundwater flow across the area is expected to be directed northeast toward Lake Simcoe. Local deviation from the regional groundwater flow path may occur in response to changes in topography and/or soils, as well as the presence of surface water features and/or existing subsurface infrastructure.

2.1.3 Existing Water Well Survey

Well Records from the MOECC Water Well Record (WWR) Database were reviewed to determine the number of water wells present within a 500 m radius of the Site boundaries.

The MOECC WWR database indicated thirteen (13) records within a 500 m radius of the Site.

The database indicated that no well is located within the Site perimeter. Of the remaining wells located off-Site eight (8) are shown as water supply wells, three (3) are shown as abandoned, one (1) is shown as monitoring or test hole and one (1) is shown as unknown. All the recorded wells are approximately located at two-hundred-ninety-seven (297) m or greater from the Site centroid.

The reported water levels ranged from depths of 4.6 mbgs to 99.1 mbgs. The properties in the vicinity of the Site are apparently serviced by the municipal water supply.

The locations of the MOECC WWR within 500 m of the Site are shown on Figure 3. A summary of the WWR is included in Appendix A.

2.2 Site Setting

2.2.1 Site Topography

The Site is located within a nonurbanized land use setting.

The topography is considered relatively flat, a gradual slope to the southeast towards an artificial water-course dug on the adjacent property to the east.

2.2.2 Local Surface Water Features

There is one local surface water feature located west of the Site known as Hewitt's Creek. This feature is approximately located 600 meters east of the Site. The largest surface water feature near to the Site is Lake Simcoe, which is located approximately 2.8 km north of the Site. A small unnamed drainage feature is located in the southeast portion of the Site (Figure 1)

2.2.3 Local Geology and Hydrogeology

Based on the results of the Geotechnical Investigations, a brief description of the general surficial geology at the Site, in order of depth, is summarized in the following sections. The borehole/monitoring well location plan is shown on Figure 4 and the borehole logs are presented in Appendix B. The inferred geological cross-sections are presented in Figures 5 and 6.

The detailed profiles encountered in each borehole and the results of laboratory moisture are indicated on the attached borehole logs (Appendix B). It should be noted that the soil boundaries indicated on the borehole logs are inferred from non-continuous sampling and observations during drilling. These boundaries are intended to reflect transition zones for the purpose of the hydrogeological studyand should not be interpreted as exact planes of geological change. The "Notes on Sample Description" preceding the borehole logs are an integral part of and should be read in conjunction with this report.

The stratigraphy encountered at the site, as revealed in the boreholes, generally comprised surficial topsoil and ploughed soil, followed by silty sand till and sand deposits. Isolated deposits of clayey silt, silty sand, silt and gravelly sand were also encountered.

A brief description of the soil profiles follows.

Topsoil / Ploughed Soil

A surficial layer of topsoil 180 to 400 mm thick was encountered in all Boreholes. However, given use of the property for agricultural purposes disturbed (ploughed) soil should be expected to typical ploughing depths of up to 600 to 800 mm.

It should be noted that topsoil and disturbed (ploughed) soil measurements were carried out at the borehole locations only and could differ at other locations on the site. Consequently, topsoil and disturbed (ploughed) soil quantities should not be established from the information provided at the borehole locations. If required, a more detailed test pit program should be carried out to more accurately quantify the amount of topsoil and disturbed (ploughed) soil to be removed for construction purposes.

Silty Sand Till

One of two predominant soil deposit at this site is glacial silty sand till. A silty sand till deposit was encountered in all of the boreholes (typically directly underneath the topsoil) with the exception of Borehole 9. The till contained trace to some gravel, trace to some clay and was embedded with occasional cobbles and boulders. These deposits existed in a loose to very dense state of compactness. Moisture contents of the silty sand till deposit ranged from 5 to 31 %, but were typically about 7 to 13%. Boreholes BH4, BH13, BH16, BH20, BH23, BH25-BH27 and BH29 all terminated in this deposit.

Sand

The other predominate soil type encountered at the site is sand. The sand deposits were typically encountered underneath the till deposits described above. The sand was fine to medium grained, contained trace to some silt and trace to some gravel. The sand was typically the terminal deposit encountered in the boreholes, with the exceptions detailed in the till section above and Borehole BH9. The compactness condition of the sand varied from very loose to very dense but was typically dense to very dense. Moisture contents ranged from 2 to 21%, but were typically around 11 to 20%.

Silty Sand

In Boreholes BH9, BH25 and BH26, near surface deposits of silty sand were encountered, extending to a depth of approximately 1.5 m below existing grades. It typically contained trace gravel and was reddish brown in colour. These deposits existed in a very loose to loose state of compactness. Moisture contents of these moist to wet deposits varied from 2 to 4%.

Silt

An isolated silt deposit was encountered in Borehole BH22. It contained some clay, trace sand. The silt typically had a very stiff to hard consistency. Moisture contents of the wet silt ranged from 20 to 24%.

Gravelly Sand

A seam of gravelly sand was encountered within the till deposit in Borehole BH23, extending from 1.4 to 2.5 m below existing grade. The gravelly sand contained trace silt and had a compactness condition that ranged from compact to dense. Moisture contents of the gravelly sand ranged from 9 to 10%.

Clayey Silt

Boreholes BH30 and BH32 a 1.2 to 1.5 meter thick clayey silt deposit was encountered, below the topsoil in BH30 and as a seam within the till deposit in BH32. The consistency of these deposits was firm to stiff and the moisture contents ranged from 13 to 29%.

3 Background

3.1 Monitoring Well Details

As part of the previous and current investigations a total of five (5) of the thirty-three (33) geotechnical boreholes advanced on the Site were instrumented with 50 mm diameter monitoring in BH6, BH12, BH19, BH28 and BH32. Each monitoring well was instrumented with 3 m well screens with the exception of BH 32 which was instrumented with a 1.5 m screen. The depth of completion ranged from 6.6 mbgs to 13.5 mbgs.

The monitoring well locations are shown on Figure 4. The borehole logs for each monitoring well utilized for this investigation are presented in Appendix B.

3.2 Water Level Monitoring

Water levels were observed in monitoring wells on the date of completion of each well and on November 23, 24, and 28 2017. A summary of all static water level data as it relates to the geodetic survey is summarized in Table 1 (enclosed).

The groundwater levels recorded in the monitoring wells ranged from approximately 7.8 m below ground surface to 1.0 m above existing ground surface. The groundwater in the wet sand deposit is under artesian pressures. The groundwater elevations ranged from 254.19 meters above sea level (masl) measured on November 23, 2017 at BH32 to 256.09 masl measured on November 28, 2017 at BH28. A summary of all static water level data as it relates to the geodetic survey is summarized in Table 1 (enclosed).

The interpreted groundwater flow maps are presented in Figure 7. Based on the obtained water level measurements on November 28, 2017, the inferred directions of groundwater flows is interpreted to be approximately north-northwest towards Lake Simcoe. It is noted that water levels at BH32 reported groundwater levels above ground surface indicative of artesian conditions; additional monitoring at this well location would confirm these conditions.

3.3 Hydraulic Conductivity Testing

Five (5) Single Well Response Tests (SWRT's) were completed on monitoring wells, including BH6, BH12, BH19, BH28, and BH32, on November 24 and 28 of 2017.

The static water level within the monitoring well was measured prior to the start of testing. In advance of performing SWRT, the monitoring well underwent development to remove fine grained sediments introduced into the screen following the well construction. The development process involved purging of the monitoring well to induce the flow of fresh formation water through the screen. The monitoring well was later permitted to fully recover prior to performing SWRT.

Hydraulic conductivity value was calculated from the SWRT data as per the Hvorslev solution included in the AQTESOLV Pro Version 4.50.002 software package. The semi-log plot for drawdown versus time is included in Appendix C.

A summary of the hydraulic conductivity (K) value estimated from the SWRT is provided in Table 3-2.

Table 3-1: Summary of Hydraulic Conductivity Testing

Monitoring Well	Well Depth (mbgs)	Screen Interval (mbgs)		Soil Formation Screened	Estimated Hydraulic Conductivity (m/s)
		from	to		
BH 6	13.5	10.5	13.5	Sand	4.6×10^{-5}
BH 12	6.6	3.6	6.6	Sand	4.0×10^{-6}
BH 19	14.1	11.1	14.1	Silty Sand Till to Sand	9.7×10^{-7}
BH 28	7	4	7	Silty Sand Till to Sand	6.7×10^{-6}
BH 32	12.4	10.9	12.4	Sand	1.6×10^{-6}
				Highest K estimate for	4.6×10^{-5}
				Geometric Mean Estimate for	1.4×10^{-5}

SWRT provides estimates of K for the geological formation in the immediate zone surrounding the well screen. As shown in Table 3-2, the highest K-value is estimated to be 4.6×10^{-5} m/s and the geometric mean of the K-values is estimated to be 1.4×10^{-5} m/s.

3.4 Groundwater Quality

To assess the suitability for discharge of pumped groundwater to the Barrie Sanitary and Storm Sewers during dewatering activities, one (1) groundwater sample was collected from monitoring well BH32 on November 24, 2017 and compared against the Barrie Sanitary and Storm Sewer By-law Criteria. Two (2) additional samples collected from BH12 and BH19 and submitted for general chemistry parameters (RCAp) Prior to collecting the water samples, approximately three (3) standing well volumes of groundwater were purged from the noted well.

The sample was collected unfiltered and placed into pre-cleaned laboratory-supplied vials and/or bottles provided with analytical test group specific preservatives, as required. Dedicated nitrile gloves were used during sample handling. The groundwater samples were submitted to an independent laboratory named Maxxam Analytics Inc., in Mississauga, Ontario, for analysis.

The laboratory CofA shows that all parameters were detected at concentrations below Sanitary and Strom Sewer By-Law limits.

Analytical results are provided in Appendix D.

It should also be noted that, during construction, it is anticipated that TSS levels and associated contaminants (for example Metals), in the pumped groundwater may remain above the by-Law limits.

Therefore, it is recommended that a suitable treatment method be implemented (filtration or decantation facilities and/ or any other applicable treatment system) during construction dewatering activities.

Approval to discharge water to municipal sewer system during construction will be required from the City of Barrie prior to any discharge.

If treatment systems are considered, the specifications of the treatment system(s) will need to be provided/adjusted by the treatment specialist/process engineer during the pre-design and commissioning stage of the system.

4 Private Well Survey

As part of the Preliminary Hydrogeological Investigation **exp** completed a baseline residential water well survey within 500 m of the Site. In accordance with the City of Barrie requirements, a well survey questionnaire is required to be completed and documented prior to the construction of the development. The baseline residential well survey was done following the procedures and protocols established by the City of Barrie and to satisfy the above noted scope of work for this investigation.

4.1 Door to Door Well Condition Survey

To verify results of the MOECC WWR search, a baseline residential water well (door to door) survey was completed on October 31st, 2017. To begin the survey, introductory letters were prepared and delivered to residences in the study area. The letter explained the purpose of the study and requested residents voluntarily provide any information they possessed regarding their private well.

During the survey, **exp** staff visited each house within 500 m of the site and, if a resident was home, interviewed the resident and completed the well survey to document the current condition and use of their well(s). The survey included questions about the wells (e.g. type of well, location, age, depth, etc.), the quantity of water (static water level). If no one was home or residents declined to be interviewed, a copy of the well survey letter and water well survey forms were left at each location, and the resident was requested to contact **exp** for survey completion.

A total of twenty-three (23) properties were visited during the door-to-door survey, resulting in five (5) completed baseline surveys (22%). However more well surveys may be completed following the submission of this report, and will be provided under a separate cover once completed.

Appendix E presents the completed water well surveys.

Table 4-1: Summary of Private Well Survey Results

No	House Number	Street Name	Questionnaire Delivered	Questionnaire Completed
1	820	Mapleview Drive East	X	
2	826	Mapleview Drive East	X	
3	843	Mapleview Drive East	X	✓
4	932	Mapleview Drive East	X	
5	953	Mapleview Drive East	X	

6	969	Mapleview Drive East	X	
7	1080	Lockhart Road	X	
8	1000	Lockhart Road	X	
9	968	Lockhart Road	X	✓
10	960	Lockhart Road	X	
11	912	Lockhart Road	X	
12	894	Lockhart Road	X	
13	864	Lockhart Road	X	
14	856	Lockhart Road	X	
15	850	Lockhart Road	X	
16	830	Lockhart Road	X	
17	822	Lockhart Road	X	
18	818	Lockhart Road	X	
19	812	Lockhart Road	X	✓
20	808	Lockhart Road	X	
21	802	Lockhart Road	X	✓
22	780	Lockhart Road	X	
23	798	Lockhart Road	X	✓

5 Construction Dewatering

Based on artesian conditions encountered at the Site (BH32) and high hydraulic conductivities calculated from SWRTs (4.6×10^{-5} m/s at BH6) conducted at the Site, and soil types, construction dewatering will mostly likely be required for the installation of buried services and Stormwater Management Pond. It is noted that a MOECC Water Taking Permit (PTTW or EASR) will most likely be required for construction dewatering. Dewatering estimates can be provided once details for the buried services is available. Additionally, due to the artesian conditions encountered on-site, potential for basal heave should be reviewed by a geotechnical engineer prior to excavation.

6 Conclusions and Recommendations

Based on the findings of the Hydrogeological Investigation, the following summary of conclusions and recommendations are provided:

- Borehole logs show the predominate soil types are Sand and Silty Sand Till occurring in all boreholes with exception of BH9. Additionally, SWRT preformed at the Site returned relatively high K-values with a maximum of 4.6×10^{-5} m/s at BH6 and geometric mean of 1.4×10^{-5} m/s for all five (5) monitoring wells. BH32 exhibited flowing artesian conditions with a measure groundwater elevation over a meter above ground surface while BH29 exhibited slightly artesian conditions with groundwater elevations measured to be the same as ground elevation.
- Based on artesian conditions encountered at the Site (BH32) and high hydraulic conductivities calculated from SWRTs (4.6×10^{-5} m/s at BH6) conducted at the Site, and soil types, construction dewatering will mostly likely be required for the installation of buried services and Stormwater Management Pond. It is noted that a MOECC Water Taking Permit (PTTW or EASR) will most likely be required for construction dewatering. Dewatering estimates can be provided once details for the buried services is available. Additionally, due to the artesian conditions encountered on-site, potential for basal heave should be reviewed by a geotechnical engineer prior to excavation.
- The laboratory CofA from the groundwater samples show that all parameters were detected at concentrations below Sanitary and Strom Sewer By-Law limits.
- Distribution of the Private Well Survey Questionnaire produced only two (2) responses submitted to the Brampton EXP office at the time of writing this report. More responses may continue to be submitted to both Brampton and Barrie offices.
- It should be noted that, during construction and in post construction, it is anticipated that TSS levels and associated contaminants (for example, Total Metals) in the pumped groundwater may remain elevated and may continue to exceed the By-Law limits. Therefore, it is recommended that a suitable treatment method be implemented during construction dewatering activities.
- All monitoring wells should be decommissioned when they are no longer required as per O.Reg. 903.

It should be noted that the comments and recommendations in this report are based on the assumption that the present design concept described throughout the report will proceed to construction and that the report should be reviewed in its entirety. Any changes to the design concept may result in a modification to the recommendations provided in this report.

7 Limitations

This report is based on a limited investigation designed to provide information to support an assessment of the current hydrogeological conditions within the study area. The conclusions and recommendations presented within this report reflect Site conditions existing at the time of the assessment. **exp** must be contacted immediately if any unforeseen Site conditions are experienced during the dewatering activities. This will allow **exp** to review the new findings and provide appropriate recommendations to allow the construction to proceed in a timely and cost-effective manner.

Our undertaking at **exp**, therefore, is to perform our work within limits prescribed by our clients, with the usual thoroughness and competence of the geoscience/engineering profession. No other warranty or representation, either expressed or implied, is included or intended in this report.

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We trust that this information is satisfactory for your purposes. Should you have any questions or comments, please do not hesitate to contact this office.

Sincerely,

exp Services Inc.

PROFESSIONAL GEOSCIENTIST
FRANCOIS CHARTIER
PRACTISING MEMBER
2270
ONTARIO

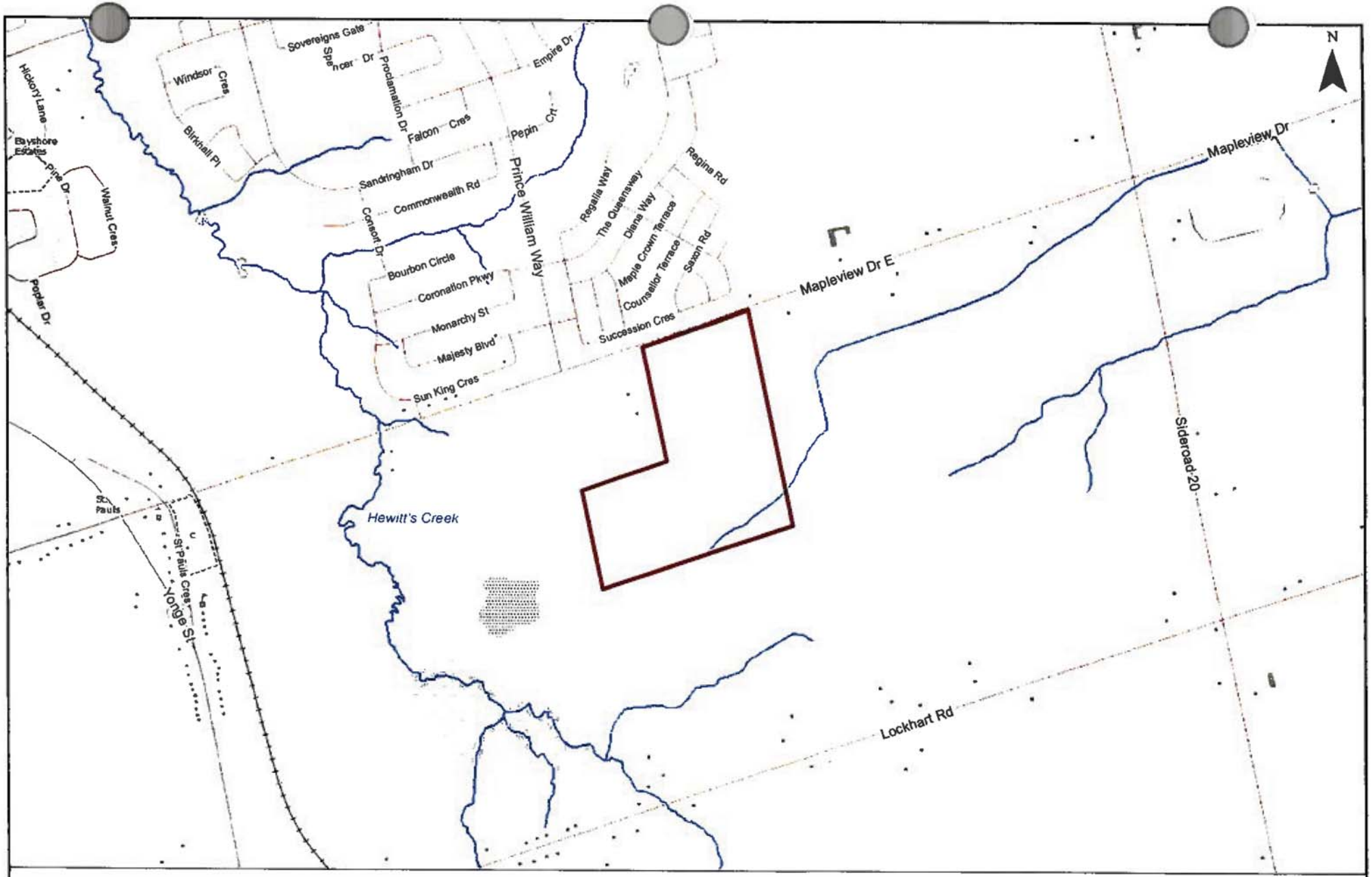
Tomson Hecky, M.Sc.
Groundwater Scientist
Environmental Services

Francois Chartier, M.Sc., P.Geo.
Head of Hydrogeology Group
Environmental Services

References

Geotechnical Investigation, Proposed Residential Development, 883 Mpaleview Drive East, Barrie, Ontario, prepared for 1091369 Ontario Inc., **EXP**, November 29, 2017.

Figures



Legend

Approximate Site Boundary

0 100 200 400 600 800 1,000 m

EXP Services Inc.
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Fax: +1.905.793.0641

PROJECT TITLE:
HYDROGEOLOGICAL INVESTIGATION
883 MAPLEVIEW DRIVE EAST
BARRIE, ONTARIO

DRAWING TITLE:
SITE LOCATION PLAN

PROJECT No.: BRM-00044669-J0	DWN: AC
SCALE: AS NOTED	CHKD: TH
DATE: NOVEMBER 2017	DWG. No.: 1

Legend

- Approximate Site Boundary
- 20: Organic deposits
- 9b: Coarse-textured glaciolacustrine deposits (Littoral-foreshore deposits)
- 8a: Fine-textured glaciolacustrine deposits
- 6: Ice-contact stratified deposits (fine sand to gravel)
- 5b: Stone-poor, carbonate-derived silty to sandy till

0 50 100 200 300 400 500 m

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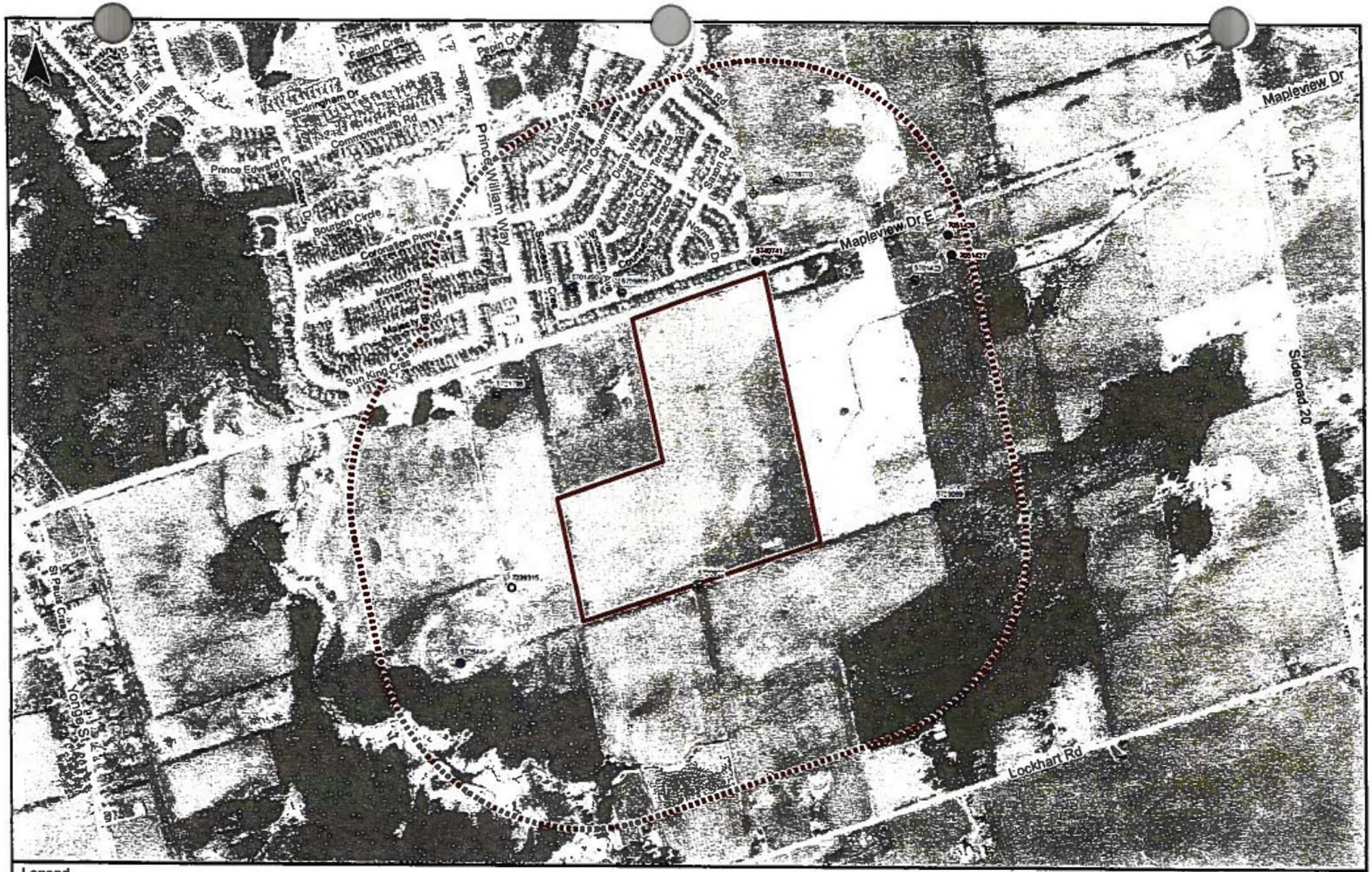
PROJECT TITLE:
HYDROGEOLOGICAL INVESTIGATION
883 MAPLEVIEW DRIVE EAST
BARRIE, ONTARIO

DRAWING TITLE:
SURFICIAL GEOLOGY

PROJECT No.: BAR-00055075-A0	DWN: AC
SCALE: AS NOTED	CHKD: TH
DATE: NOVEMBER 2017	APP'D: 2



Legend

- Approximate Site Boundary
- 500 m Zone
- Monitoring Well / Test Hole
- Water Supply Well
- Unclassified / Unfinished Well
- Abandoned Well

0 100 200 300 400 500 m

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PROJECT TITLE:
HYDROGEOLOGICAL INVESTIGATION
883 MAPLEVIEW DRIVE EAST
BARRIE, ONTARIO

DRAWING TITLE:
MOECC WATER WELL RECORDS MAP

PROJECT No.: BAR-00055075-A0	DWN: AC
SCALE: AS NOTED	CHKD: TH
DATE: NOVEMBER 2017	DWG. No.: 3

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LEGEND:

- APPROXIMATE SITE BOUNDARY
- BOREHOLE LOCATION (EXP, 2017)
- BOREHOLE / MONITORING WELL LOCATION (EXP, 2017)
- A-A' CROSS SECTION A-A' (SEE FIGURE 5)
- B-B' CROSS SECTION B-B' (SEE FIGURE 6)

TITLE AND LOCATION:

BOREHOLE / MONITORING WELL LOCATION PLAN

HYDROGEOLOGICAL INVESTIGATION
883 MAPLEVIEW DRIVE EAST, BARRIE, ONTARIO

PROJECT NO	DWN.
BAR-00055075-A0	TH
SCALE: AS NOTED	CK: JF
DATE: DECEMBER [illegible]	FIG NO. 4

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VERTICAL SCALE: AS SHOWN

HORIZONTAL SCALE:

50 0 50 100 150 m

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LEGEND:

- TOPSOIL
- SAND
- SILT
- CLAYEY SILT
- SILTY SAND TILL

GROUNDWATER ELEVATION AS MEASURED ON NOVEMBER 28, 2017

TITLE AND LOCATION:

CROSS SECTION A-A'

HYDROGEOLOGICAL INVESTIGATION
883 MAPLEVIEW DRIVE EAST,
BARRIE, ONTARIO

PROJECT NO: BAR-00055075-A0	DWN: TH
SCALE: AS NOTED	CK: JF
DATE: DECEMBER 2017	FIG. NO: 5

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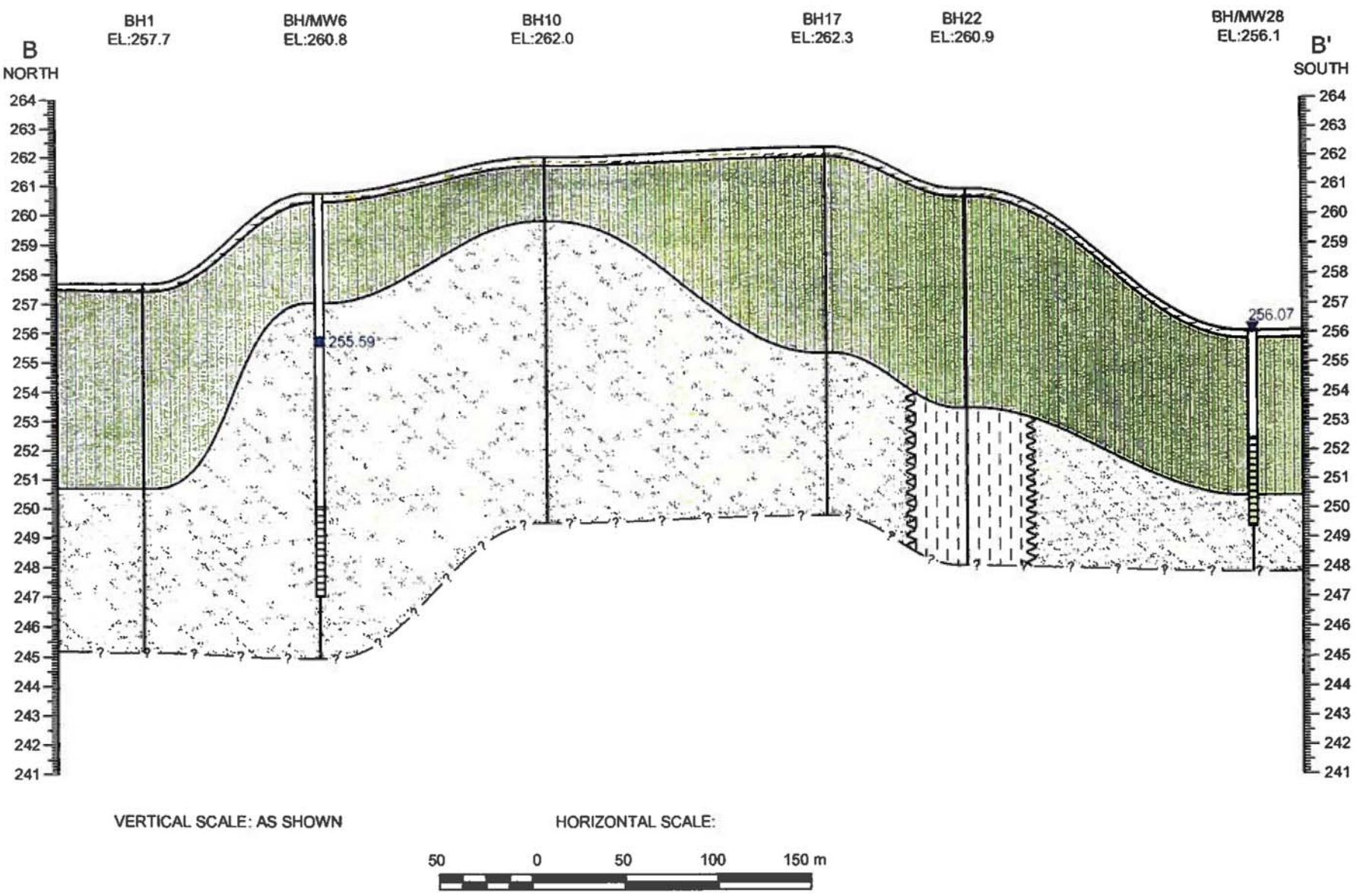

VERTICAL SCALE: AS SHOWN

HORIZONTAL SCALE:

50 0 50 100 150 m

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LEGEND:

- TOPSOIL
- SAND
- SILT
- SILTY SAND TILL

GROUNDWATER ELEVATION AS MEASURED ON NOVEMBER 28, 2017

TITLE AND LOCATION:

CROSS SECTION B-B'

HYDROGEOLOGICAL INVESTIGATION
883 MAPLEVIEW DRIVE EAST, BARRIE, ONTARIO

PROJECT NO.	DWN
BAR-00055075-A0	TH
SCALE: AS NOTED	CK: JF
DATE: DECEMBER	FIG NO: 6

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LEGEND:

- APPROXIMATE SITE BOUNDARY
- BOREHOLE LOCATION (EXP, 2017)
- BOREHOLE / MONITORING WELL LOCATION (EXP, 2017)
- GROUNDWATER CONTOURS
- [XX XX] GROUNDWATER ELEVATION AS MEASURED ON NOVEMBER 28, 2017
- GROUNDWATER FLOW DIRECTION

TITLE AND LOCATION:

GROUNDWATER CONTOURS

HYDROGEOLOGICAL INVESTIGATION
883 MAPLEVIEW DRIVE EAST, BARRIE, ONTARIO

PROJECT NO: BAR-00055075-A0	DWN: TH
SCALE: AS NOTED	CK: JF
DATE: DECEMBER 2017	FIG. NO: 7

Appendix A:
MOECC WWR Summary Table

WELL ID	EASTING	NORTHING	BOREHOLE ID	DATE COMPLETED	OFF SITE STREET	CITY	DISTANCE TO SITE CENTROID (m)	WATER FOUND (m)	USE DESCRIPTION	FINAL STATUS
5701423	611656	4912110	10379316	9/15/1965			684	9.1	Livestock	Water Supply
5701490	610823	4912083	10379383	12/10/1958			512	99.1	Domestic	Water Supply
5705608	610944	4912073	10383490	6/18/1968			441	13.7	Domestic	Water Supply
5720922	611126	4911376	10398548	6/26/1986			297	9.4	Domestic	Water Supply
5721796	610640	4911827	10399420	4/29/1987			514	4.6	Domestic	Water Supply
5723059	611705	4911568	10400670	11/23/1987			585	13.4	Domestic	Water Supply
5725449	610550	4911182	10403044	8/8/1989			760	43.3	Domestic	Water Supply
5738770	611327	4912344	11107665	4/10/2004	1640 MAPLEVIEW DRIVE EAST	INNISFIL	699	55.0	Domestic	Water Supply
5740741	611272	4912152	11556798	5/18/2006	MOLSON PARK DR & PRINCE (MAPLE COURT SBDIV)RICHARD	BARRIE	500		Not Used	Abandoned-Other
7051426	611739	4912217	23051426	7/15/2007	1657 MAPLEVIEW DR.	Innisfil	817		Not Used	Abandoned-Other
7051427	611747	4912170	23051427	9/15/2007	1657 MAPLEVIEW DR	INNISFIL	792		Not Used	Abandoned-Other
7239315	610675	4911365	1005319420	4/7/2014			549			
7239317	611266	4912314	1005319430	4/7/2014	MAPLEVIEW DR E	Barrie	655		Test Hole	Monitoring and Test Hole

Appendix B:
Borehole Logs

Log of Borehole BH1

Project No. BAR-00055075-A0 | Figure No. 2

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

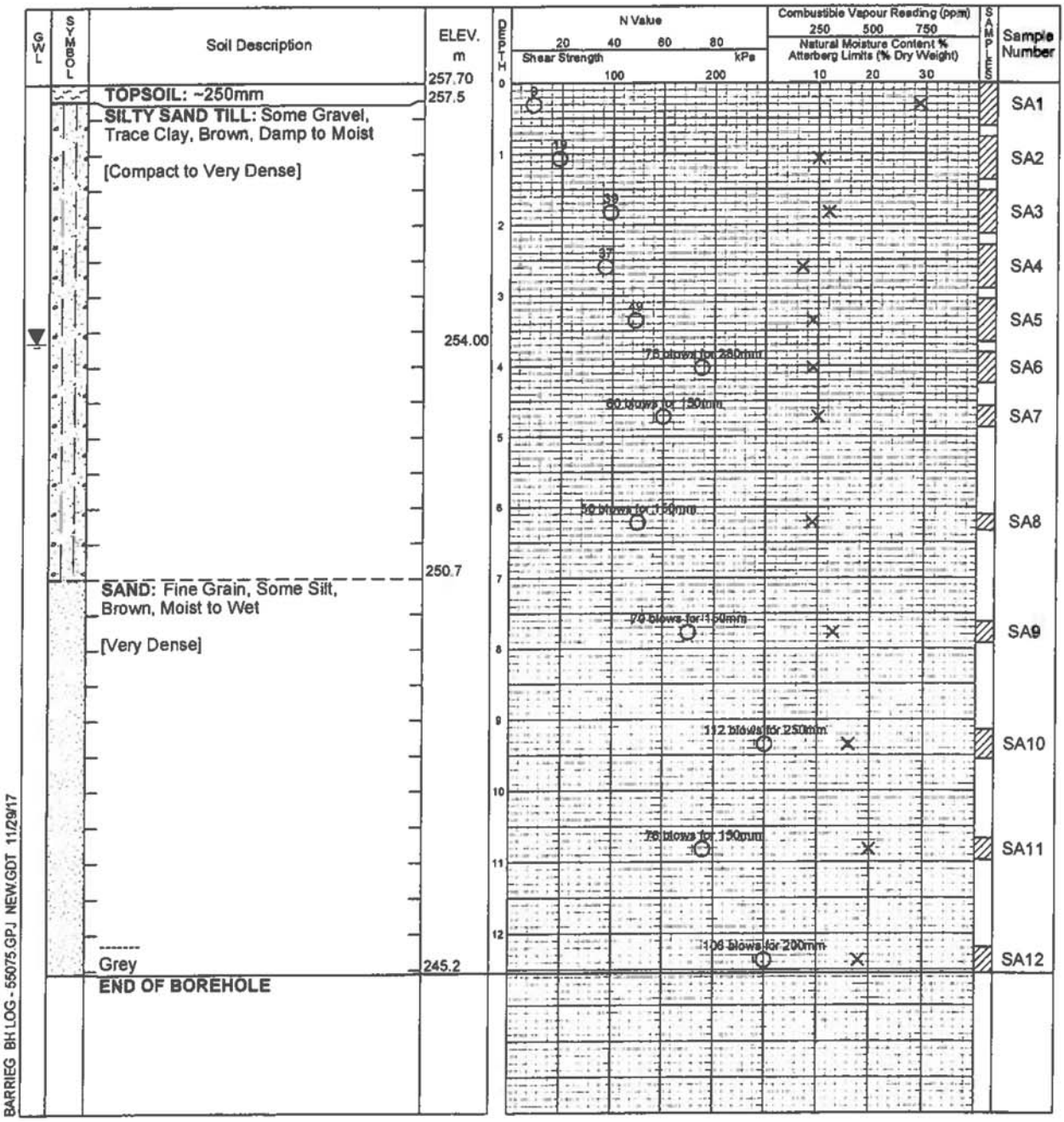
Date Drilled: October 13, 2017

Drill Type: Hollow Stem Augers

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer



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Borehole data requires interpretation assistance from Exp before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	3.7	4.6

Log of Borehole BH2

Project No. BAR-00055075-A0

Figure No. 3

Project: Geotechnical Investigation

Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

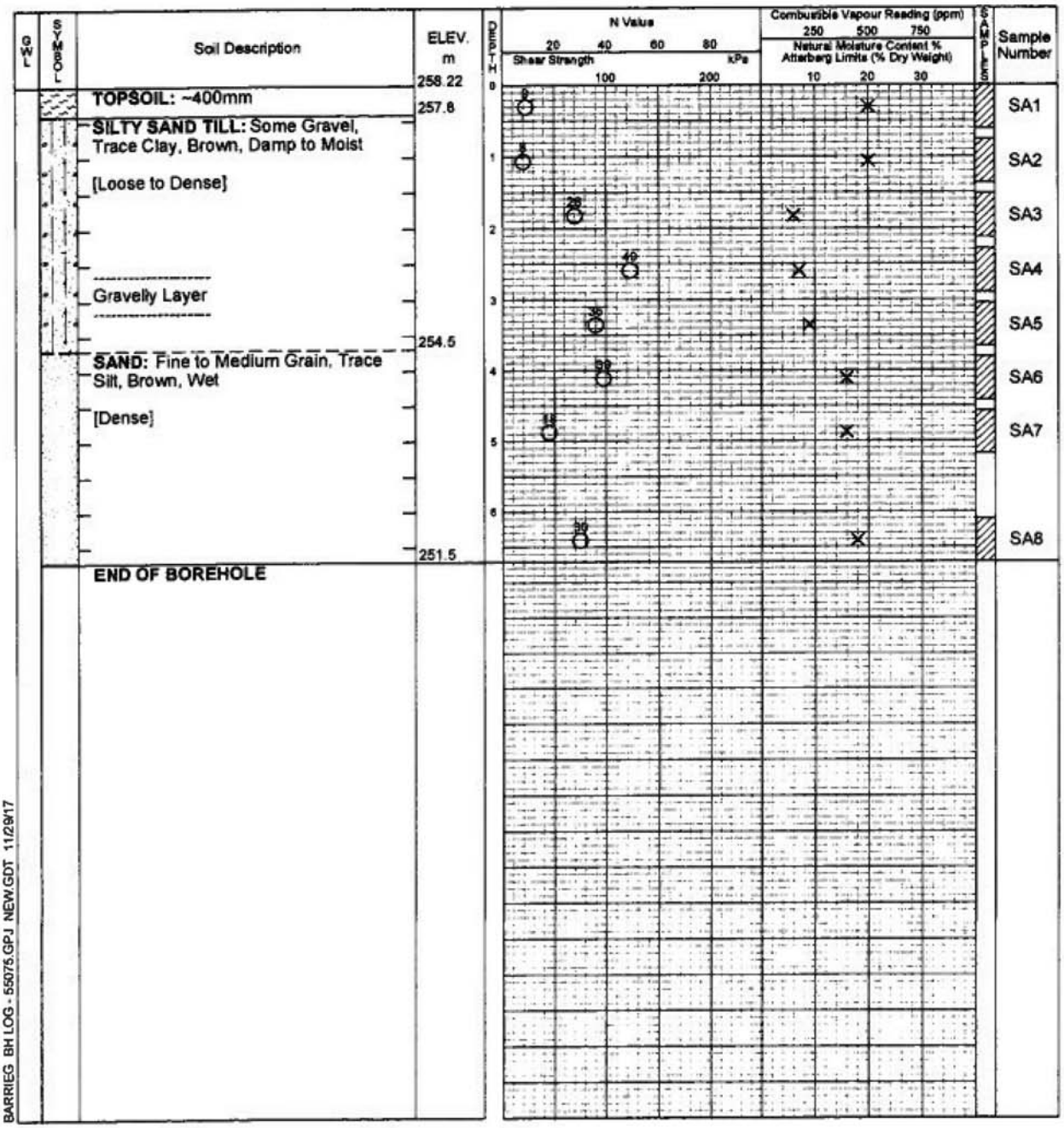
Date Drilled: October 16, 2017

Drill Type: Hollow Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



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See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	3.1	3.1

Log of Borehole BH3

Project No. BAR-00055075-A0 | Figure No. 4

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

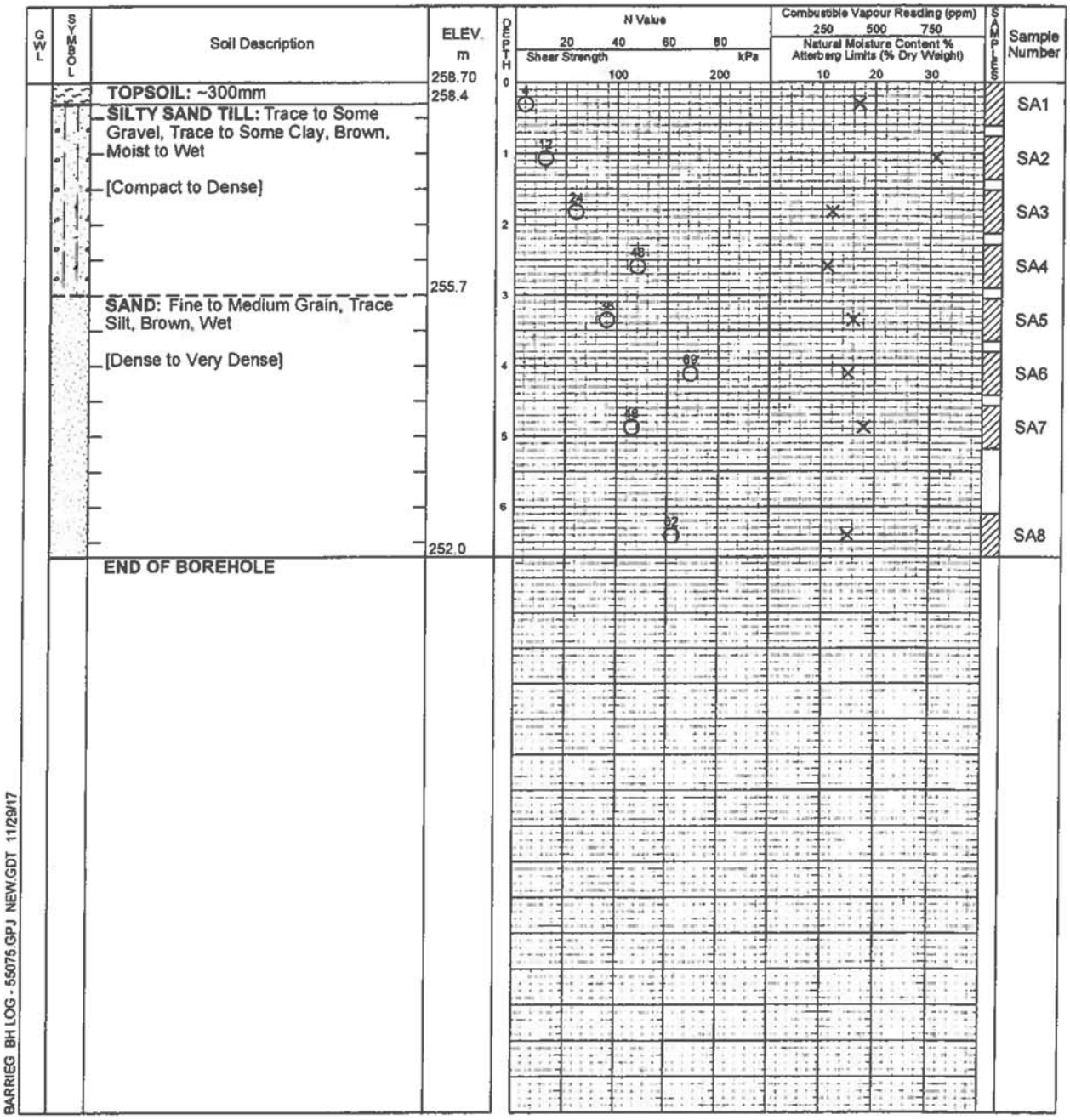
Date Drilled: October 16, 2017

Drill Type: Hollow Stem Augers

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer



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Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	3.1	3.1

Log of Borehole BH4

Project No. BAR-00055075-A0

Figure No. 5

Project: Geotechnical Investigation

Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

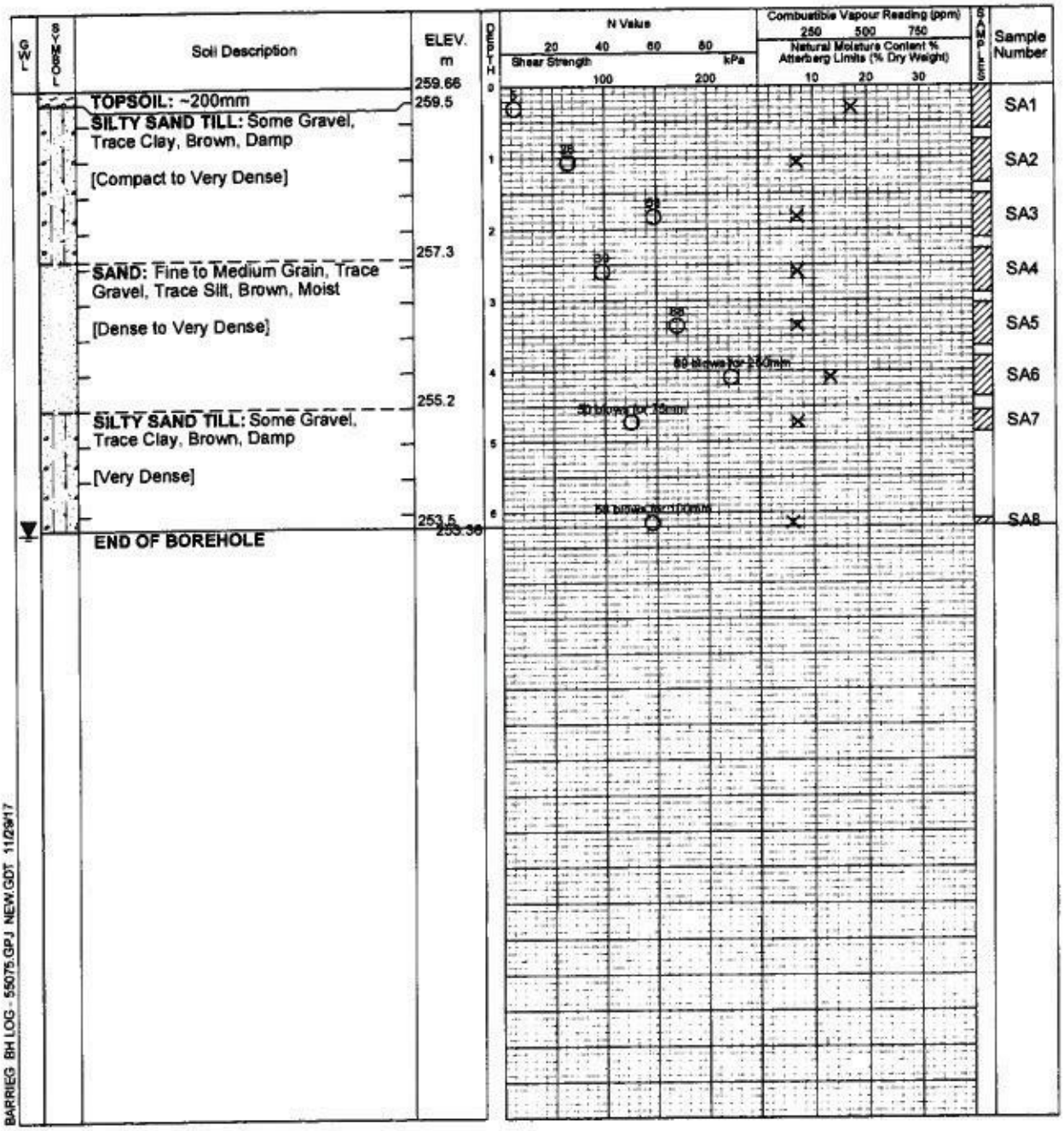
Date Drilled: October 16, 2017

Drill Type: Hollow Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



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See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	6.3	Open

Log of Borehole BH5

Project No. BAR-00055075-A0 | Figure No. 6

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

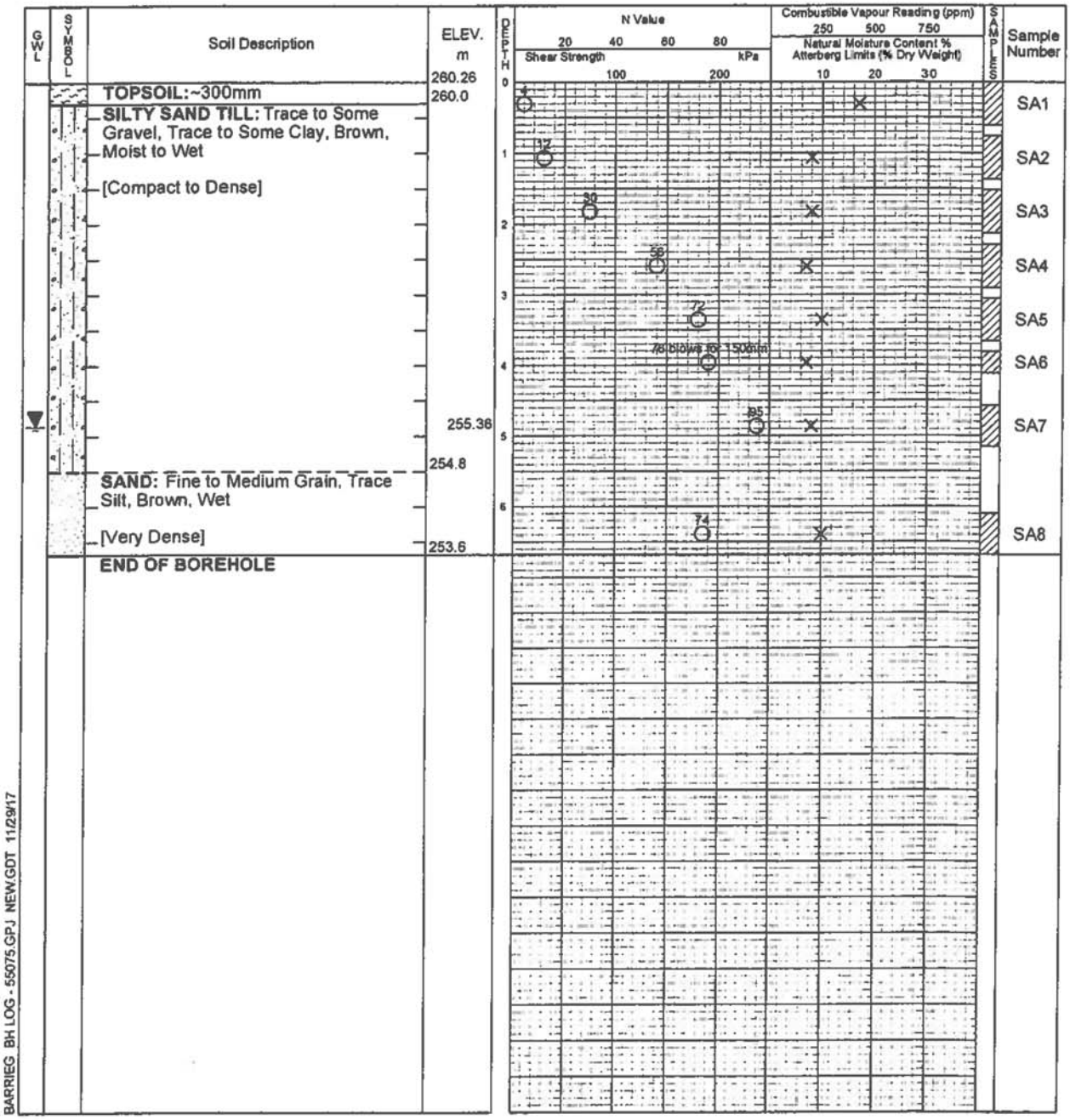
Date Drilled: October 16, 2017

Drill Type: Hollow Stem Augers

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer



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Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	4.9	5.3

Log of Borehole BH6

Project No. BAR-00055075-A0

Figure No. 7

Project: Geotechnical Investigation

Sheet No. 1 of 2

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

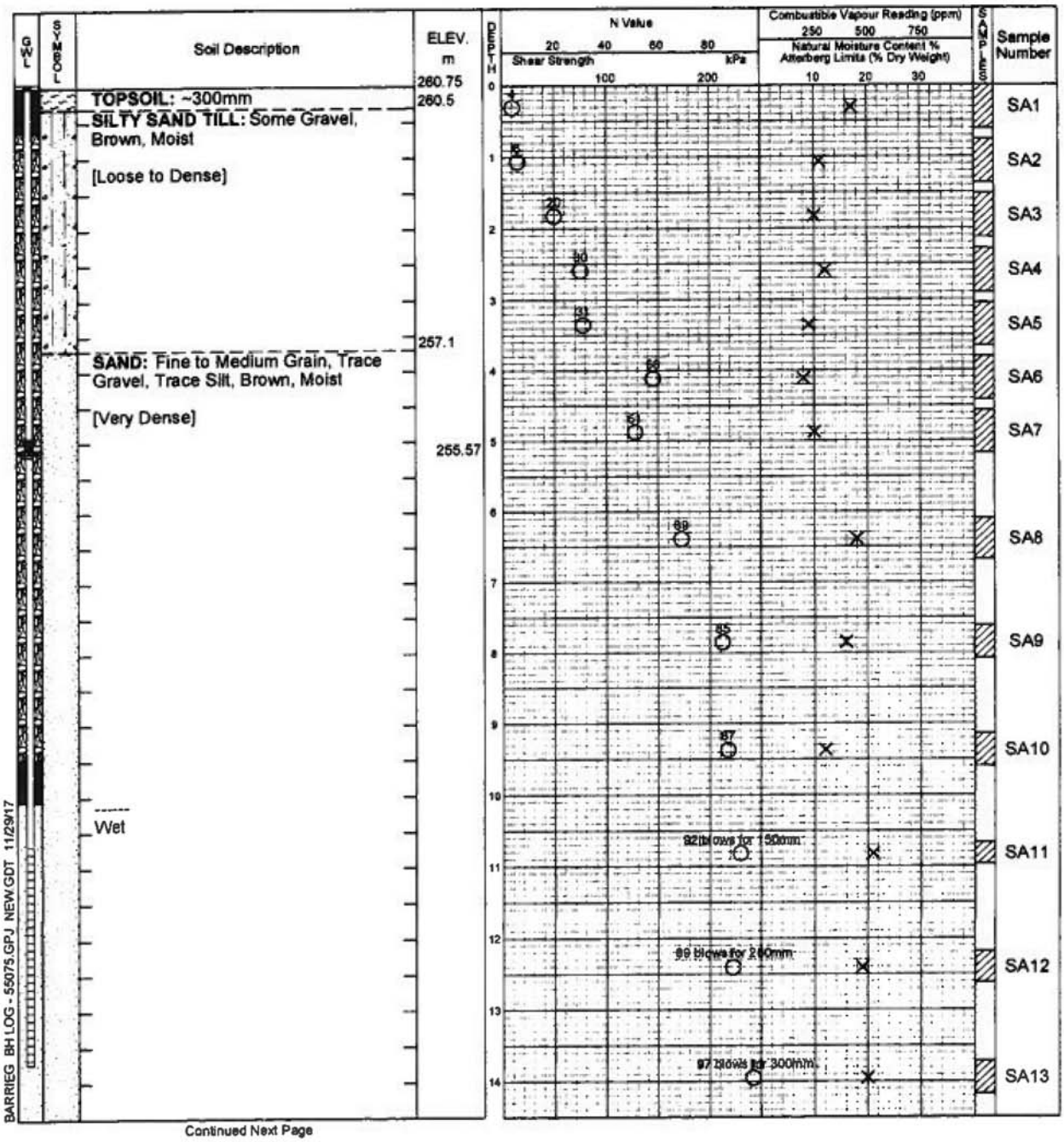
Date Drilled: October 16, 2017

Drill Type: Hollow Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



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Continued Next Page

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Borehole data requires interpretation assistance from Exp before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	5.1	7.6
Nov. 23, 2017	5.18	

Log of Borehole BH6

Project No. BAR-00055075-A0 Figure No. 7

Project: Geotechnical Investigation Sheet No. 2 of 2

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Sample Number
			246.25		20 40 60 80 / 100 200	250 500 750 / 10 20 30		
		Some Silt, Fine Grain	245.0	15				SA14
		END OF BOREHOLE						

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Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	5.1	7.6
Nov. 23, 2017	5.18	

Log of Borehole BH7

Project No. BAR-00055075-A0

Figure No. 8

Project: Geotechnical Investigation

Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

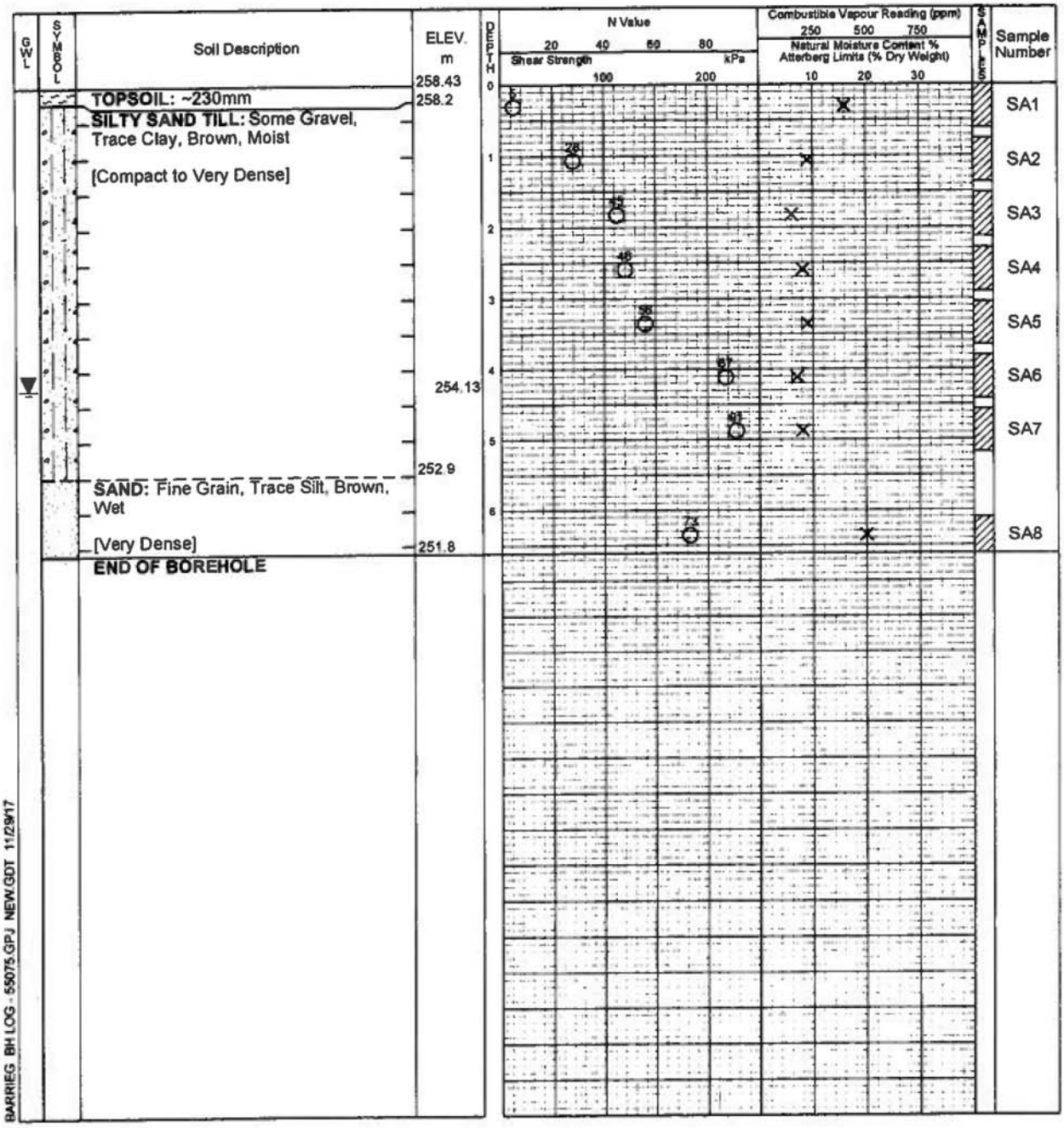
Date Drilled: October 16, 2017

Drill Type: Hollow Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



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See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	4.3	5.2

Log of Borehole BH8

Project No. BAR-00055075-A0 | Figure No. 9

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

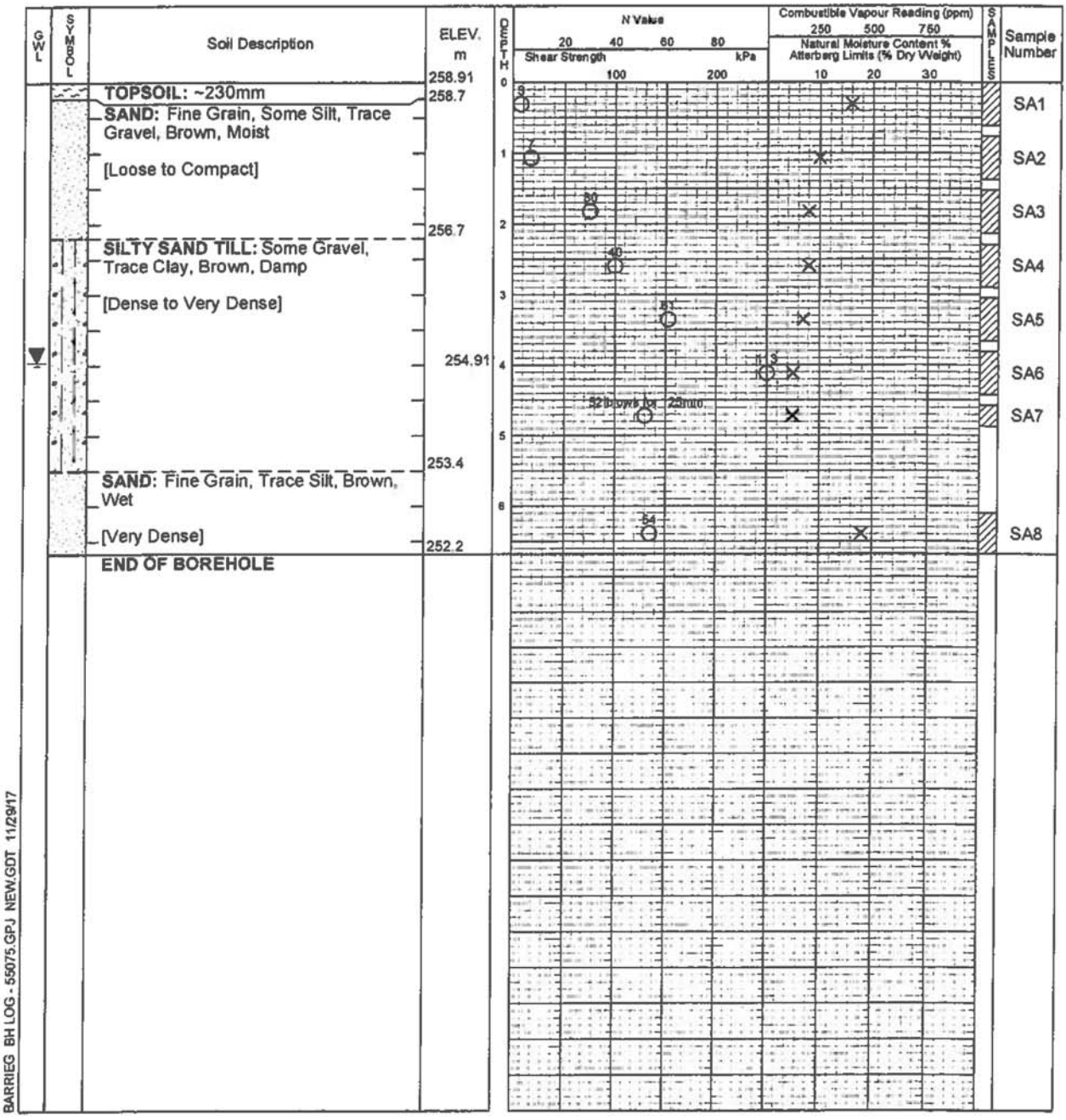
Date Drilled: October 16, 2017

Drill Type: Hollow Stem Augers

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer



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Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	4.0	4.9

Log of Borehole BH9

Project No. BAR-00055075-A0

Figure No. 10

Project: Geotechnical Investigation

Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

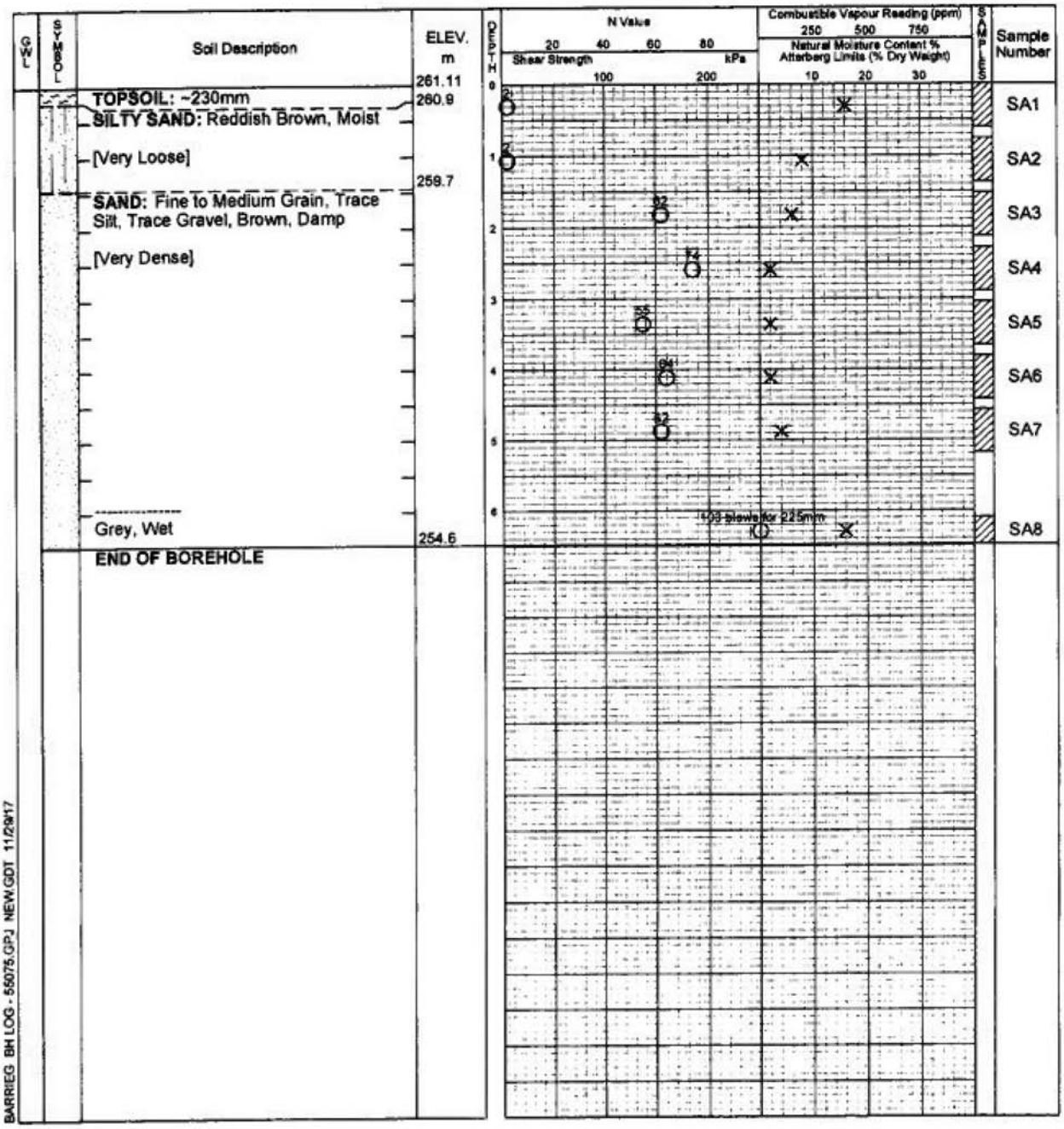
Date Drilled: October 16, 2017

Drill Type: Hollow Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



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Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	5.8

Log of Borehole BH10

Project No. BAR-00055075-A0 | Figure No. 11

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

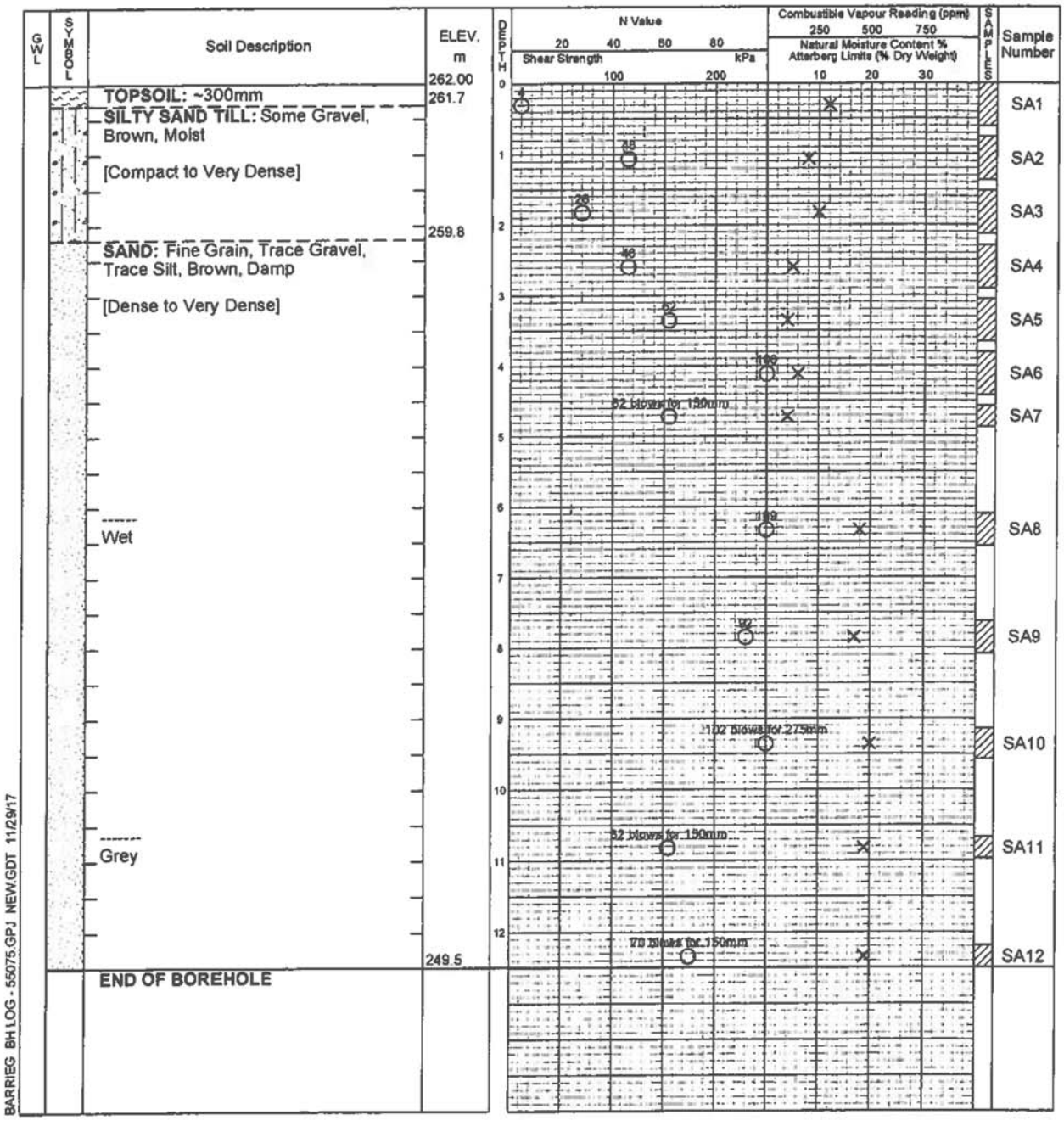
Date Drilled: October 13, 2017

Drill Type: Hollow Stem Augers

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer



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f: +1.705.734.6224

Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	5.8

Log of Borehole BH11

Project No. BAR-00055075-A0

Figure No. 12

Project: Geotechnical Investigation

Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

Date Drilled: October 17, 2017

Drill Type: Solid Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value 20 40 60 80 / Shear Strength kPa 100 200	Combustible Vapour Reading (ppm) 250 500 750 / Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30	SAMPLES	Sample Number
		TOPSOIL: ~300mm	258.85 258.6	0				SA1
		SILTY SAND TILL: Some Gravel, Brown, Moist [Compact to Dense]		1	37			SA2
				2	47			SA3
			256.7		36			SA4
		SAND: Fine Grain, Trace Gravel, Trace Silt, Brown, Moist [Dense to Very Dense]		3	42			SA5
		Wet		4	45			SA6
				5	61			SA7
			252.2	6	80			SA8
		END OF BOREHOLE						

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Borehole data requires interpretation assistance from Exp before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	6.6

Log of Borehole BH12

Project No. BAR-00055075-A0 | Figure No. 13

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

Date Drilled: October 25, 2017

Drill Type: Hollow Stem Augers

Datum: Geodetic

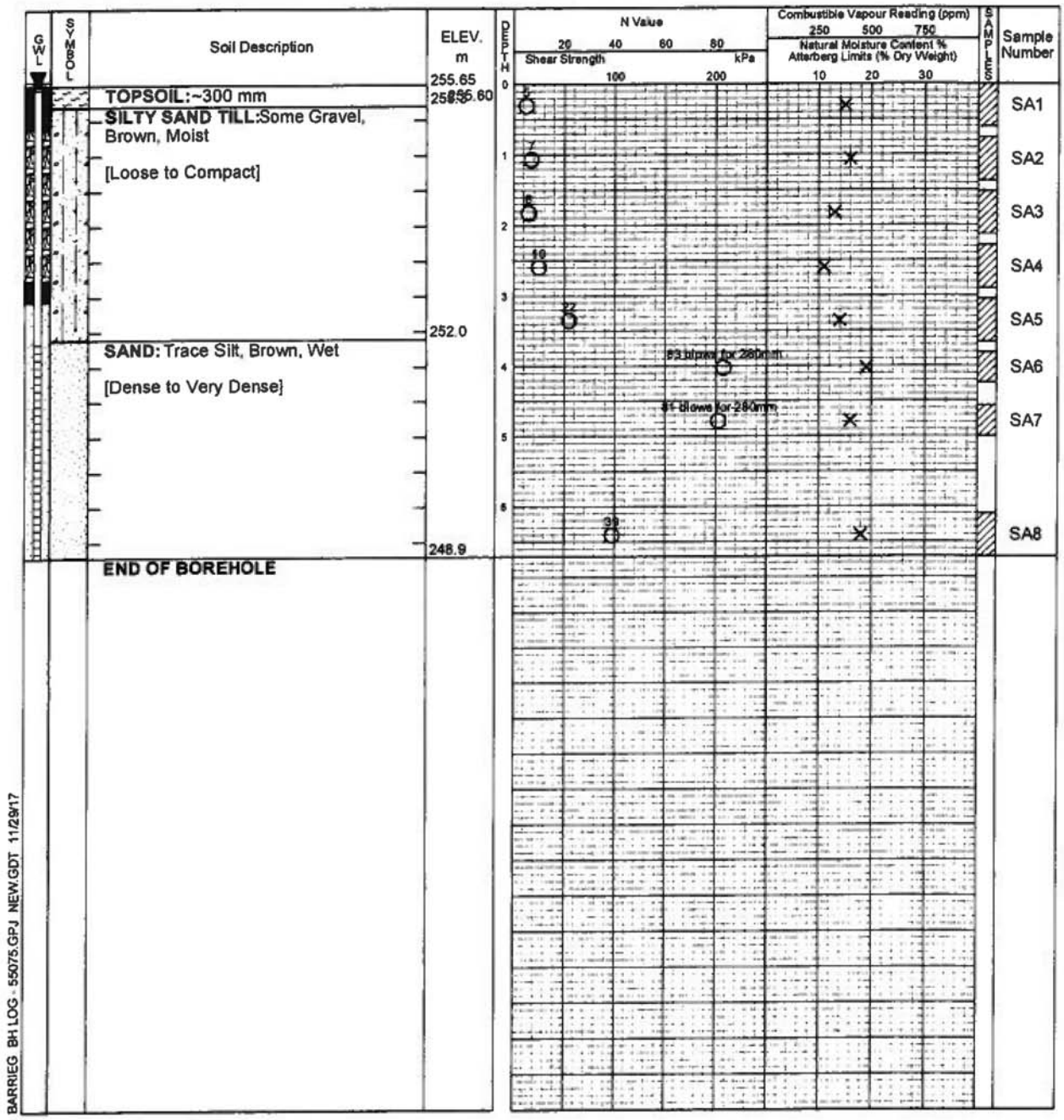
Auger Sample | Combustible Vapour Reading

SPT (N) Value | Natural Moisture

Dynamic Cone Test | Plastic and Liquid Limit

Shelby Tube | Undrained Triaxial at % Strain at Failure

Field Vane Test | Penetrometer



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Borehole data requires interpretation assistance from Exp before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	0.5	-
Nov. 23, 2017	0.05	

Log of Borehole BH13

Project No. BAR-00055075-A0 | Figure No. 14

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

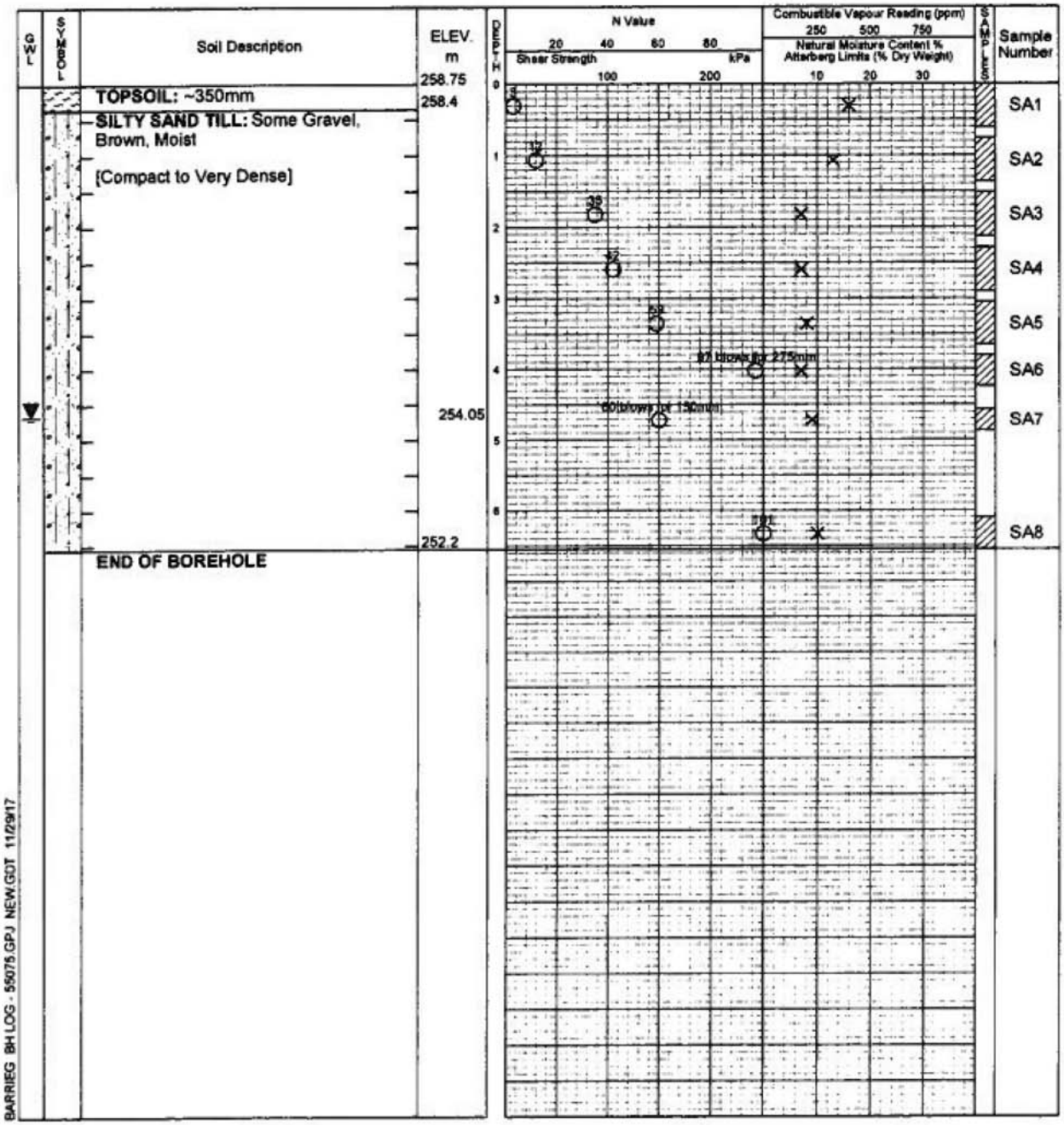
Date Drilled: October 17, 2017

Drill Type: Solid Stem Augers

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer



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Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	4.7	5.2

Log of Borehole BH14

Project No. BAR-00055075-A0 | Figure No. 15

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

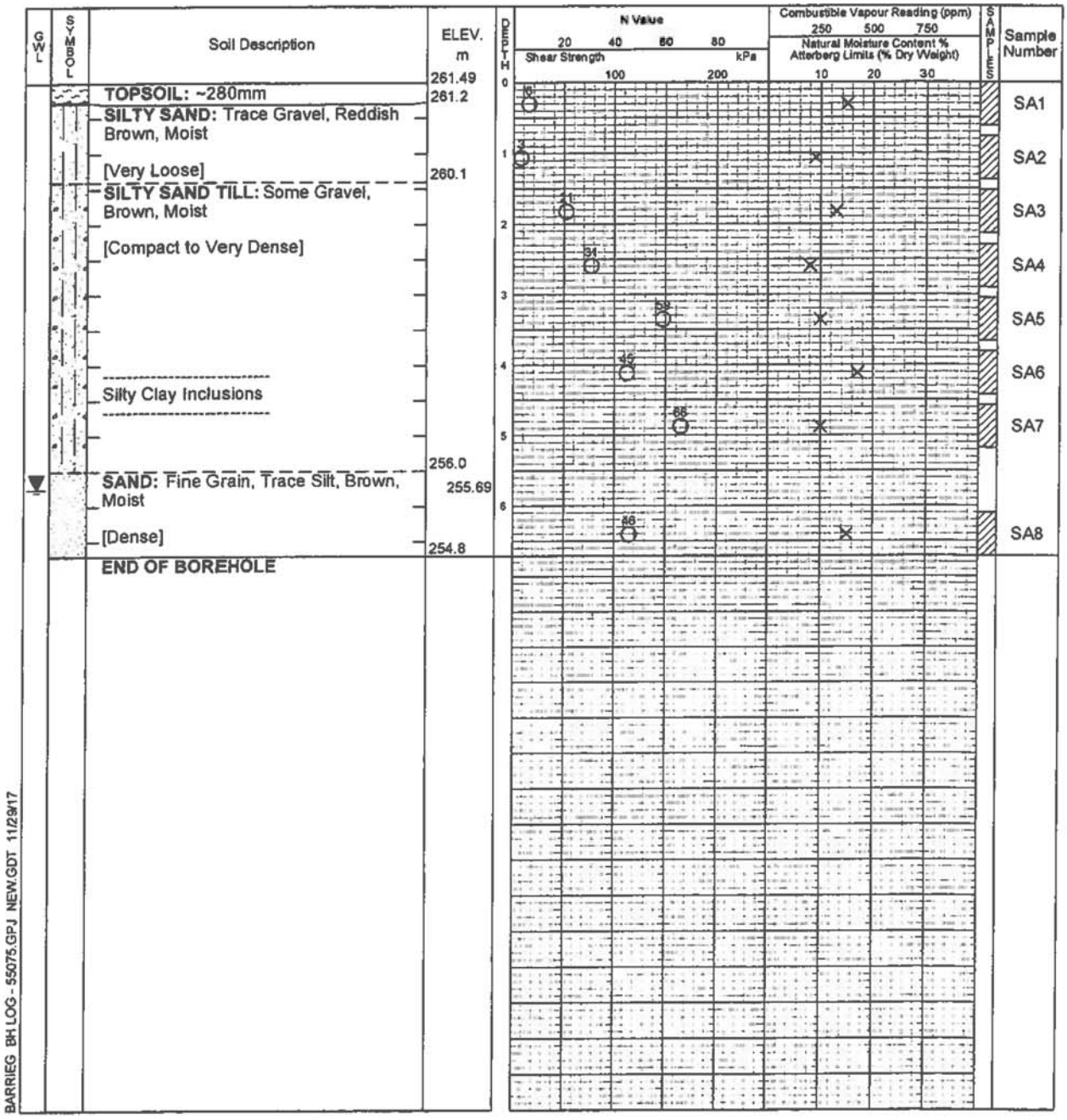
Date Drilled: October 17, 2017

Drill Type: Solid Stem Augers

Datum: Geodetic

Auger Sample ⊠ | SPT (N) Value ○ ▨ | Dynamic Cone Test —— | Shelby Tube ■ | Field Vane Test S

Combustible Vapour Reading □ | Natural Moisture × | Plastic and Liquid Limit ⊢—○ | Undrained Triaxial at % Strain at Failure ⊕ | Penetrometer ▲



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Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	5.8	6.7

Log of Borehole BH15

Project No. BAR-00055075-A0

Project: Geotechnical Investigation

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

Date Drilled: October 18, 2017

Drill Type: Solid Stem Augers

Datum: Geodetic

Figure No. 16

Sheet No. 1 of 1

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH
			256.06	0
		TOPSOIL: ~250mm	255.8	
		SILTY SAND TILL: Some Gravel, Brown, Moist [Compact]		1
				2
				3
			252.3	
		SAND: Fine Grain, Trace Gravel, Trace Silt, Brown, Moist [Compact to Dense]		4
				5
				6
			249.4	
		END OF BOREHOLE		

N Value: 20 40 60 80
Shear Strength: 100 200 kPa
Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30

SAMPLES	Sample Number
	SA1
	SA2
	SA3
	SA4
	SA5
	SA6
	SA7
	SA8

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Borehole data requires interpretation assistance from Exp before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)

Log of Borehole BH16

Project No. BAR-00055075-A0 | Figure No. 17

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

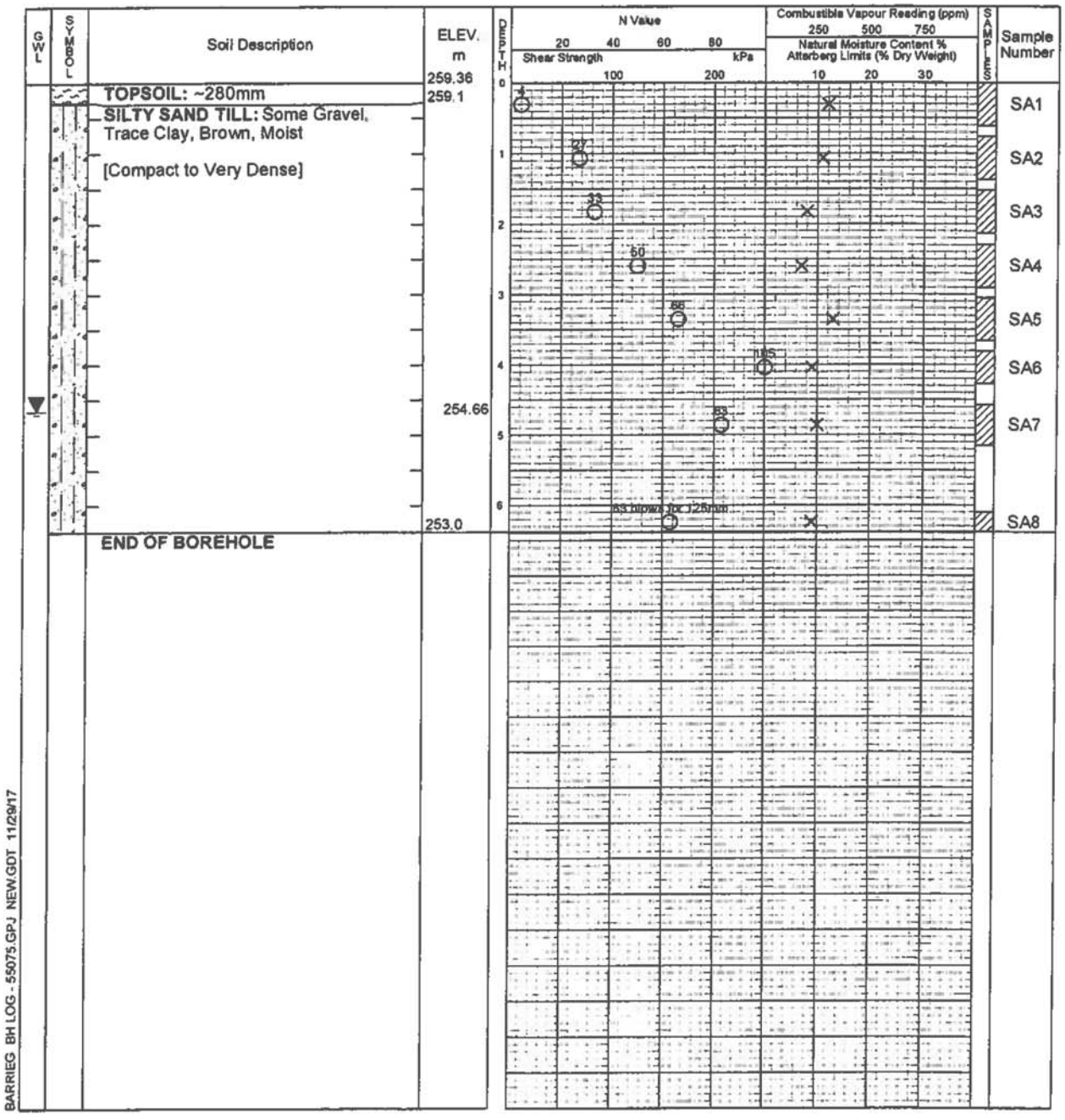
Date Drilled: October 17, 2017

Drill Type: Solid Stem Augers

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer



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Borehole data requires interpretation assistance from Exp before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	4.7	4.9

Log of Borehole BH17

Project No. BAR-00055075-A0 | Figure No. 18

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

Date Drilled: October 19, 2017

Drill Type: Hollow Stem Augers

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value / Shear Strength (kPa)	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Sample Number
		TOPSOIL: ~300mm	262.34 262.0	0	5			SA1
		SILTY SAND TILL: Some Gravel, Brown, Moist [Compact to Very Dense]		1	19			SA2
				2	33			SA3
				3	40			SA4
				4	82			SA5
				5	117			SA6
				6	85 blows for 280mm			SA7
▼			256.84	7	83 blows for 50mm			SA8
		SAND: Fine Grain, Trace Gravel, Trace Silt, Brown, Moist [Very Dense]	255.3	8	131			SA9
		Wet		9	89			SA10
				10				
				11	82			SA11
				12	90 blows for 280mm			SA12
		END OF BOREHOLE	249.8					

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Borehole data requires interpretation assistance from Exp before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	5.5	7.0

Log of Borehole BH18

Project No. BAR-00055075-A0 | Figure No. 19

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

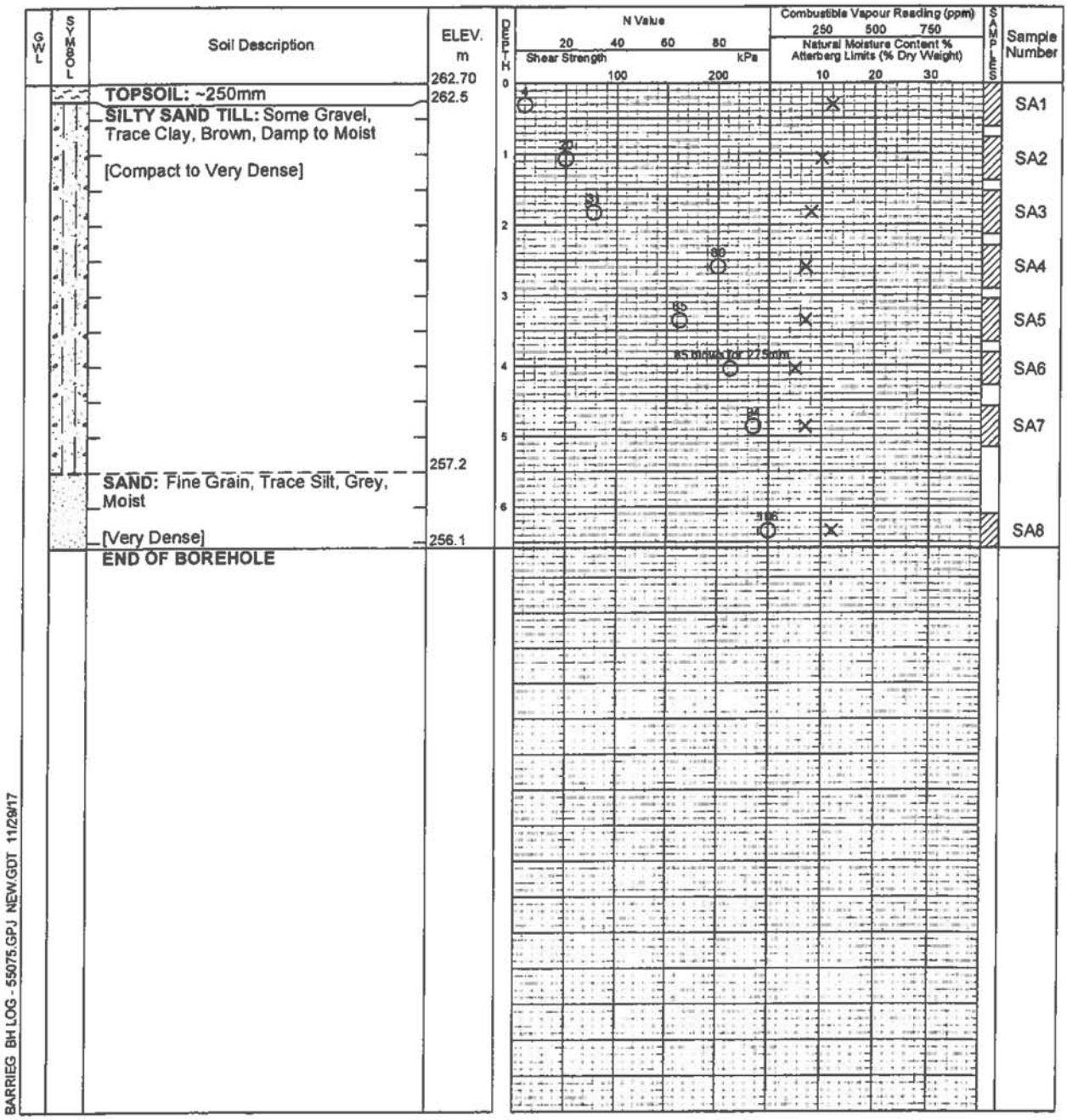
Date Drilled: October 17, 2017

Drill Type: Solid Stem Augers

Datum: Geodetic

Auger Sample ⊠ | SPT (N) Value ○ ▨ | Dynamic Cone Test — | Shelby Tube ■ | Field Vane Test S

Combustible Vapour Reading □ | Natural Moisture × | Plastic and Liquid Limit ⊢—○ | Undrained Triaxial at % Strain at Failure ⊕ | Penetrometer ▲



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Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	6.5

Log of Borehole BH19

Project No. BAR-00055075-A0

Project: Geotechnical Investigation

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

Date Drilled: October 24, 2017

Drill Type: Hollow Stem Augers

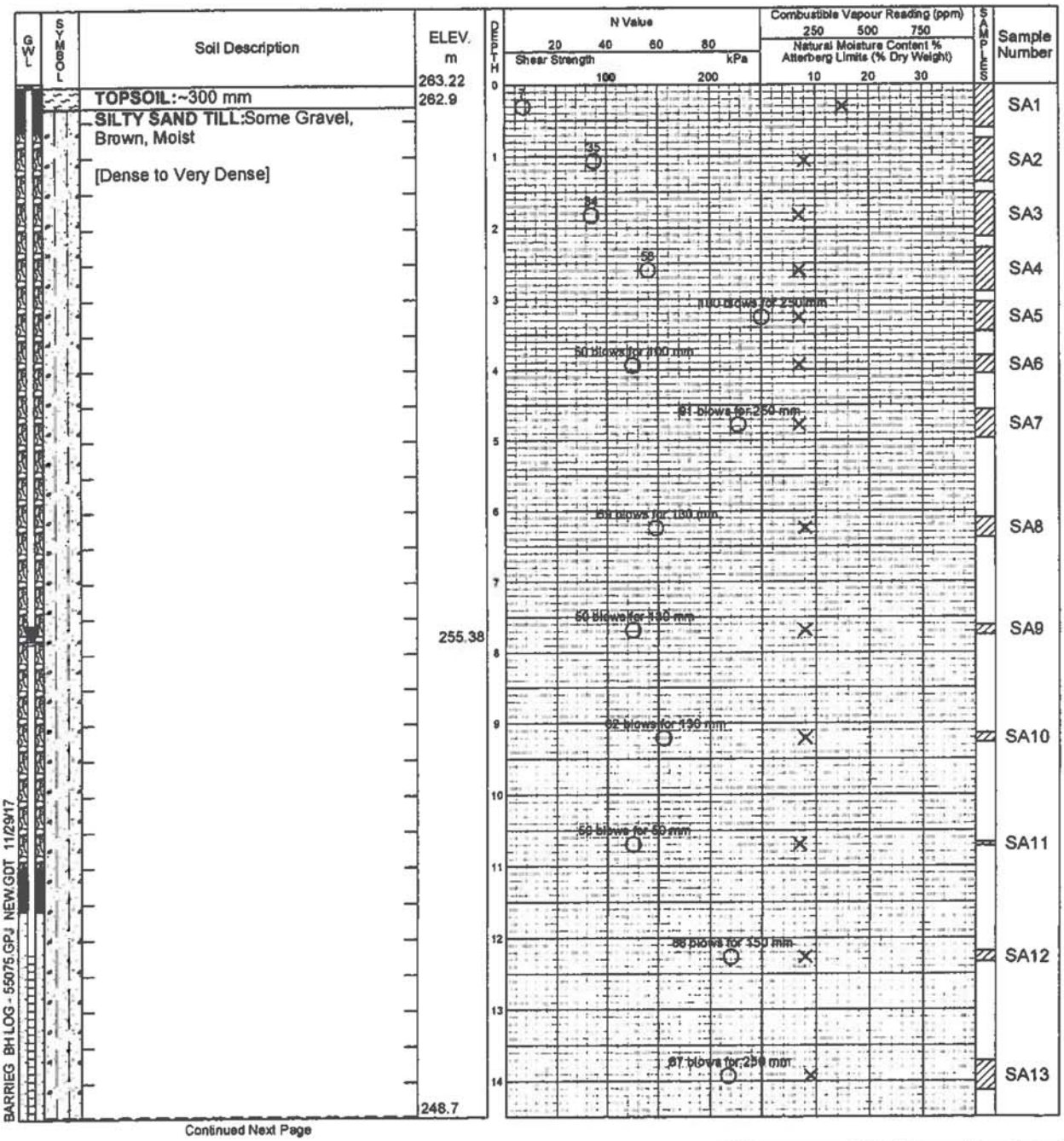
Datum: Geodetic

Figure No. 20

Sheet No. 1 of 2

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



Continued Next Page

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Borehole data requires interpretation assistance from Exp before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	13.72
Nov. 23, 2017	7.84	

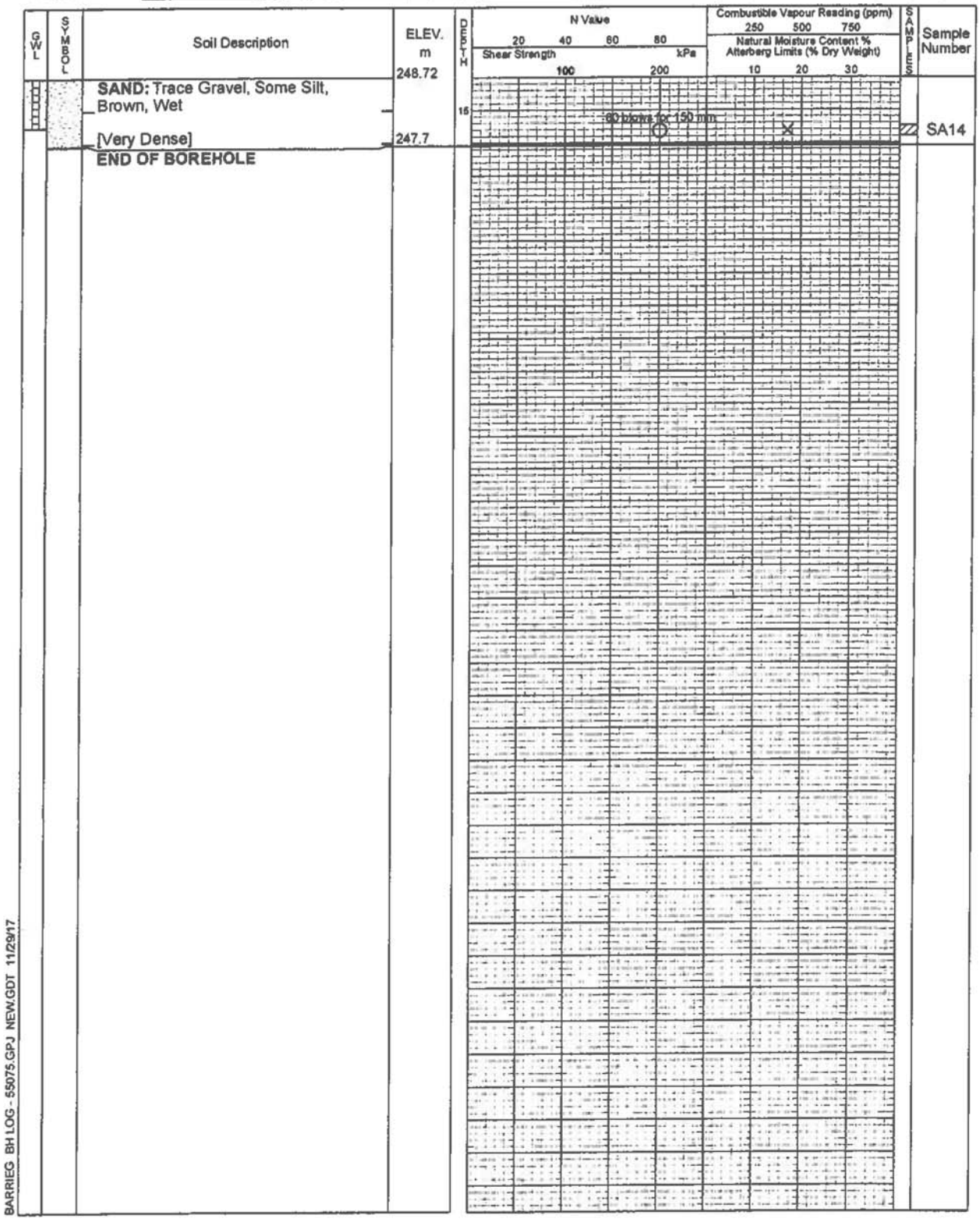
Log of Borehole BH19

Project No. BAR-00055075-A0

Figure No. 20

Project: Geotechnical Investigation

Sheet No. 2 of 2



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Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	13.72
Nov. 23, 2017	7.84	

Log of Borehole BH20

Project No. BAR-00055075-A0

Project: Geotechnical Investigation

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

Date Drilled: October 18, 2017

Drill Type: Hollow Stem Augers

Datum: Geodetic

Figure No. 21

Sheet No. 1 of 1

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value (20 40 60 80) / Shear Strength kPa (100 200)	Combustible Vapour Reading (ppm) (250 500 750) / Natural Moisture Content % Atterberg Limits (% Dry Weight) (10 20 30)	SAMPLES	Sample Number
		TOPSOIL: ~300mm	263.75	0				
		SILTY SAND TILL: Some Gravel, Trace Clay, Brown, Damp [Compact to Very Dense]	263.5	1	50/75 mm			SA1
				2	50/125 mm			SA2
				3	28			SA3
				4	38			SA4
				5	64			SA5
				6	50/100 mm			SA6
								SA7
			257.0		32			SA8
		END OF BOREHOLE						

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Borehole data requires interpretation assistance from Exp before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	6.7

Log of Borehole BH21

Project No. BAR-00055075-A0 | Figure No. 22

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

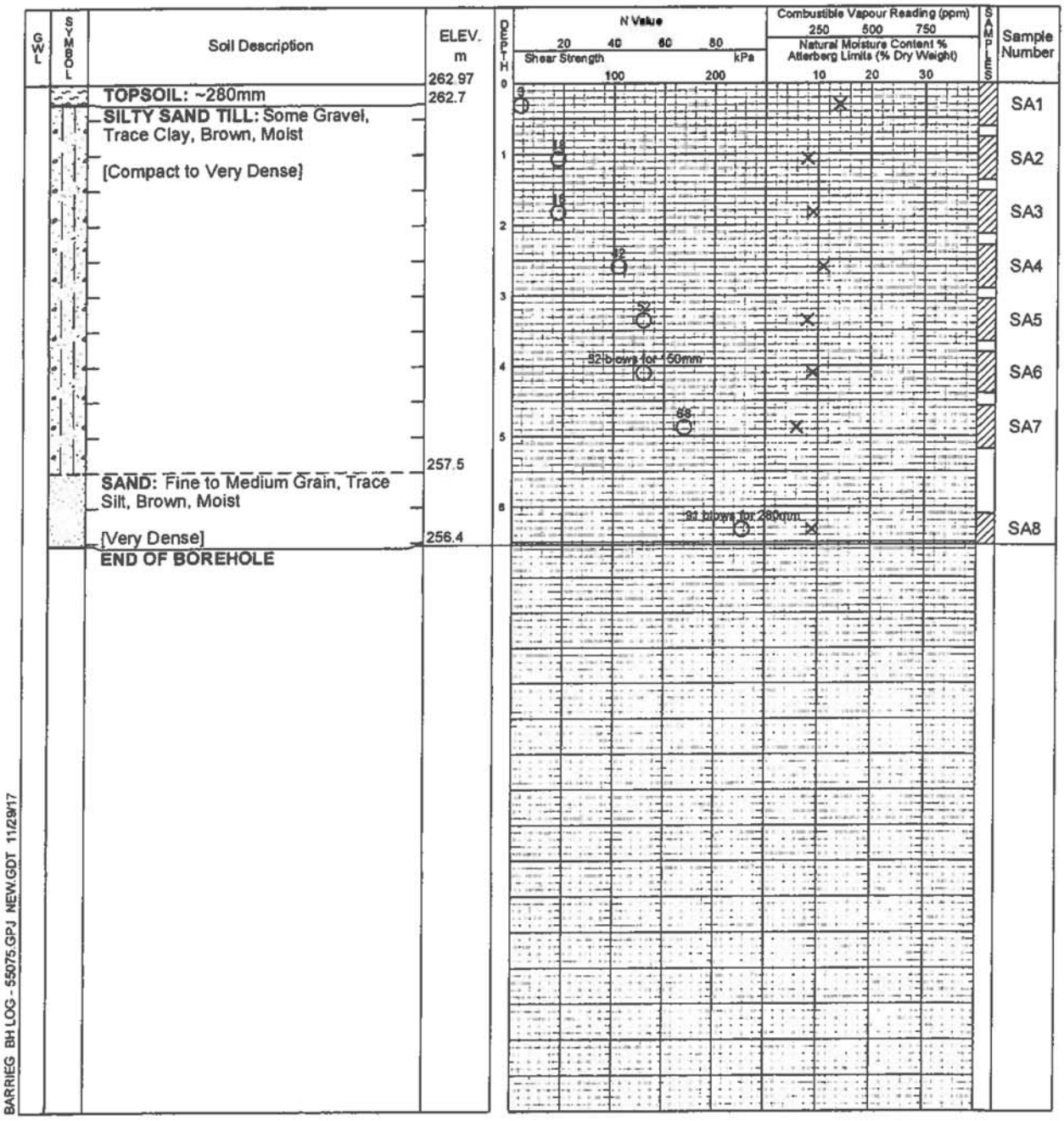
Date Drilled: October 17, 2017

Drill Type: Solid Stem Augers

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer



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Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	6.5

Log of Borehole BH22

Project No. BAR-00055075-A0

Figure No. 23

Project: Geotechnical Investigation

Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

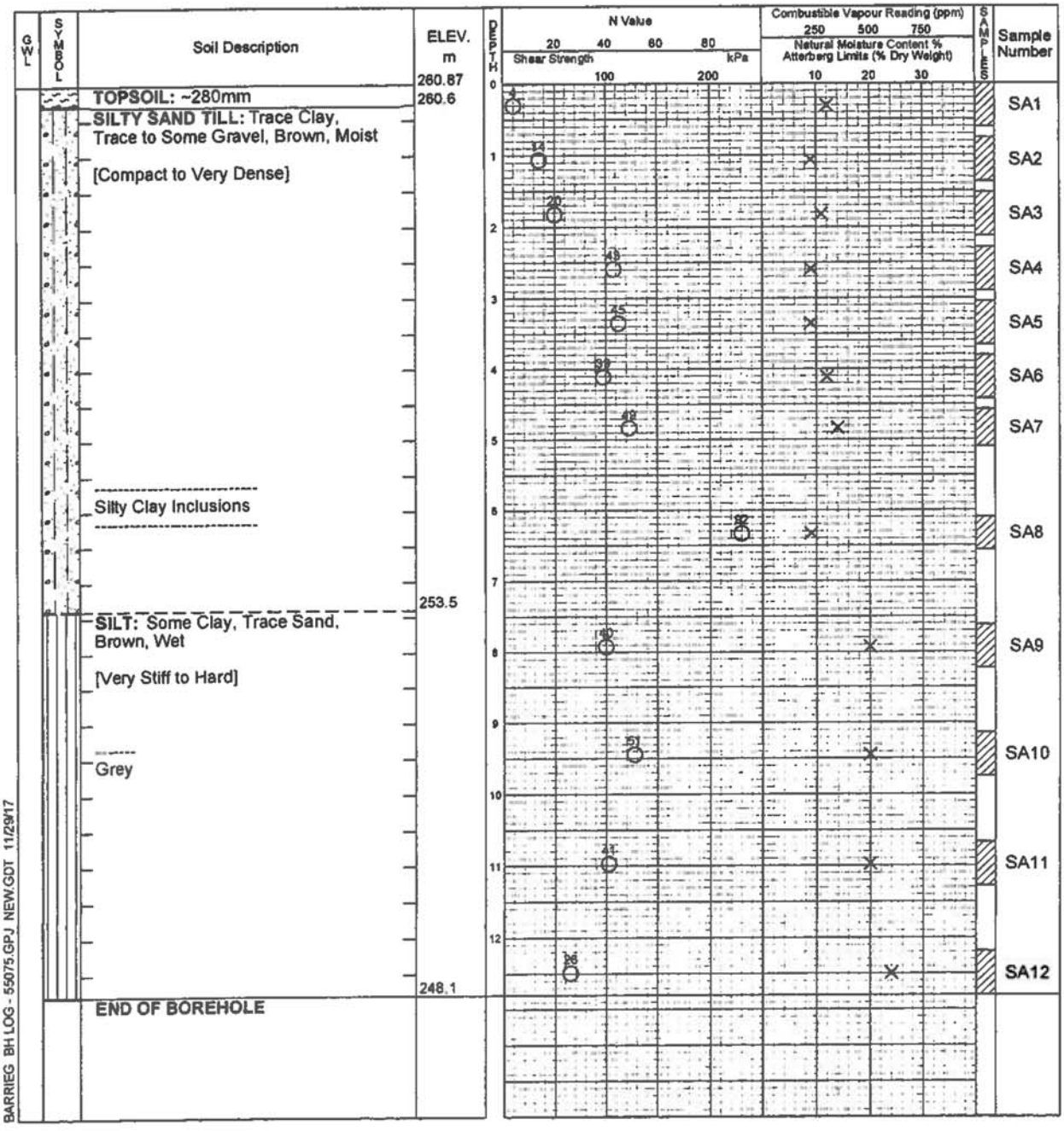
Date Drilled: October 19, 2017

Drill Type: Hollow Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



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Borehole data requires interpretation assistance from Exp before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	6.9

Log of Borehole BH33

Project No. BAR-00055075-A0

Project: Geotechnical Investigation

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

Date Drilled: October 25, 2017

Drill Type: Hollow Stem Augers

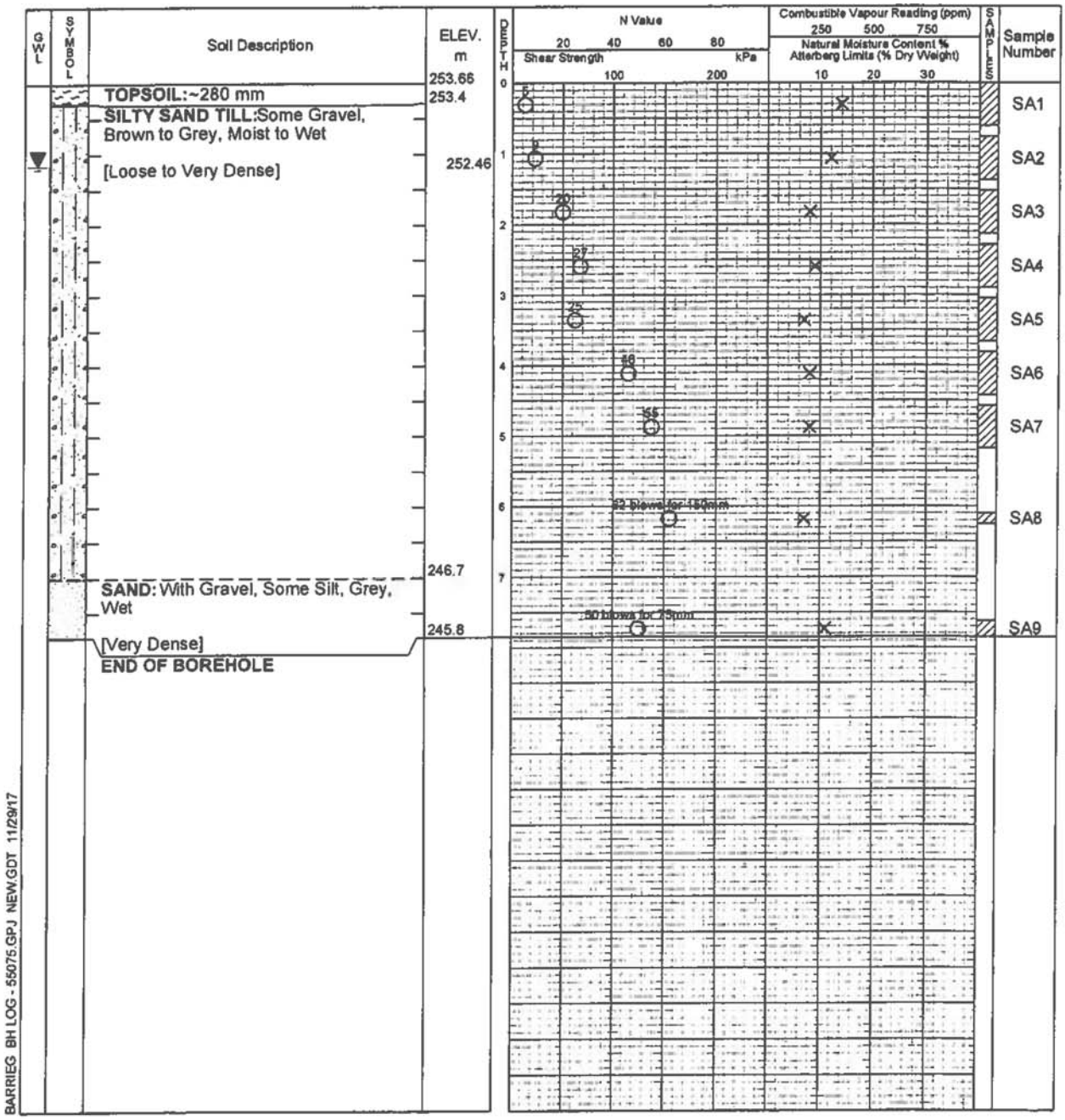
Datum: Geodetic

Figure No. 34

Sheet No. 1 of 1

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



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Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	1.2	2.1

Log of Borehole BH23

Project No. BAR-00055075-A0

Project: Geotechnical Investigation

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

Date Drilled: October 17, 2017

Drill Type: Solid Stem Augers

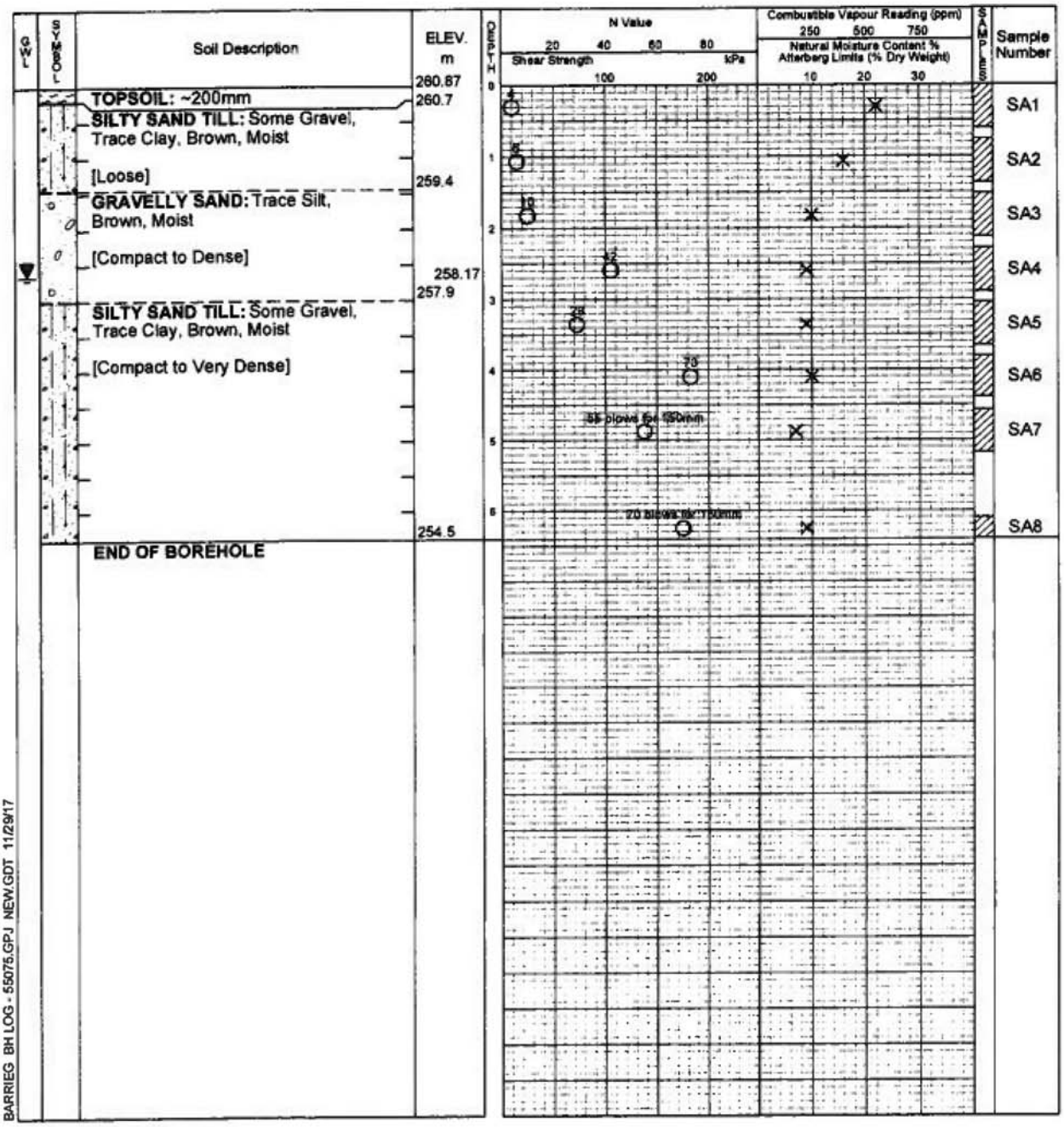
Datum: Geodetic

Figure No. 23

Sheet No. 1 of 1

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



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Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	2.7	2.9

Log of Borehole BH24

Project No. BAR-00055075-A0 | Figure No. 25

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

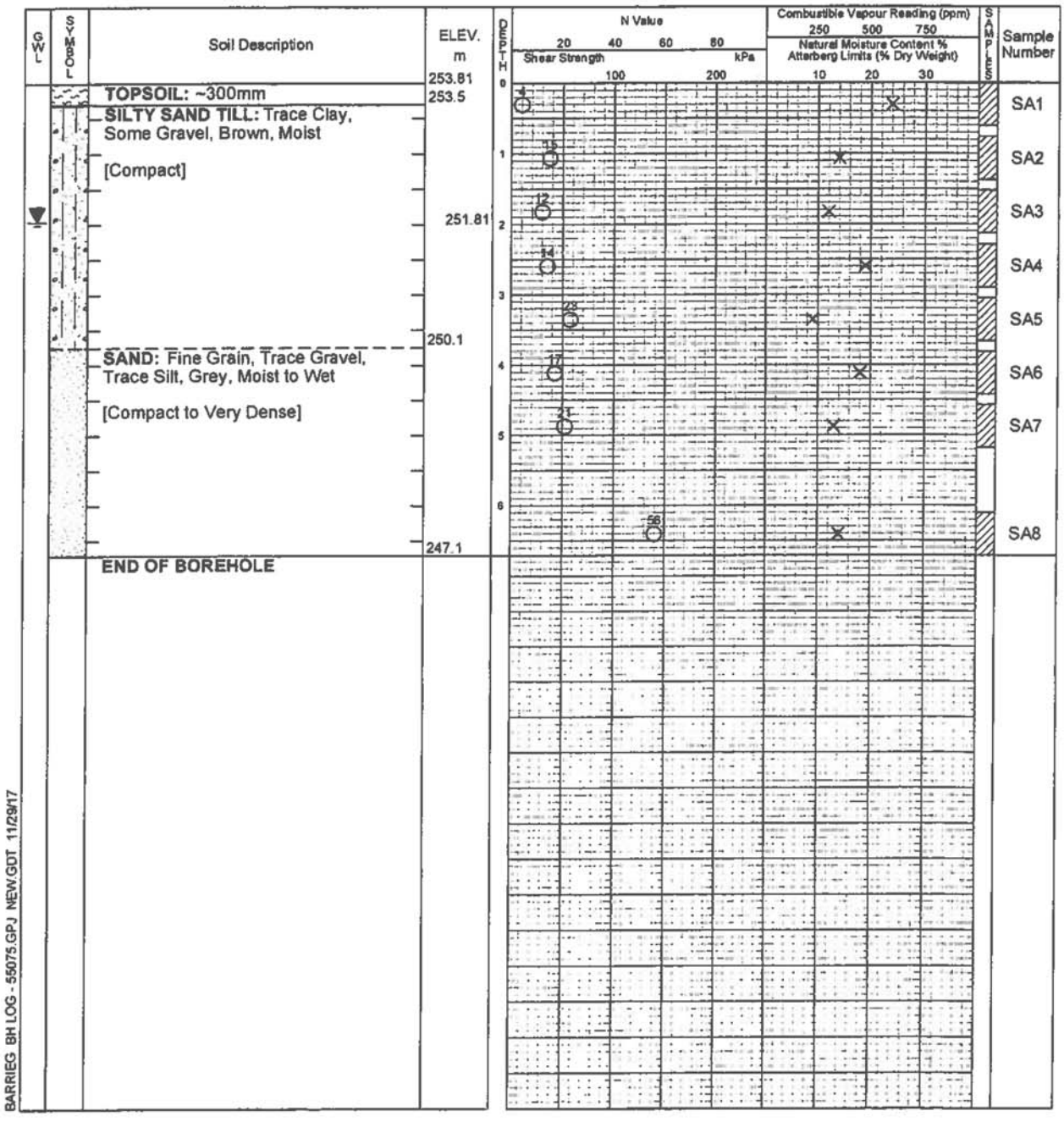
Date Drilled: October 18, 2017

Drill Type: Hollow Stem Augers

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer



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Borehole data requires interpretation assistance from Exp before use by others.

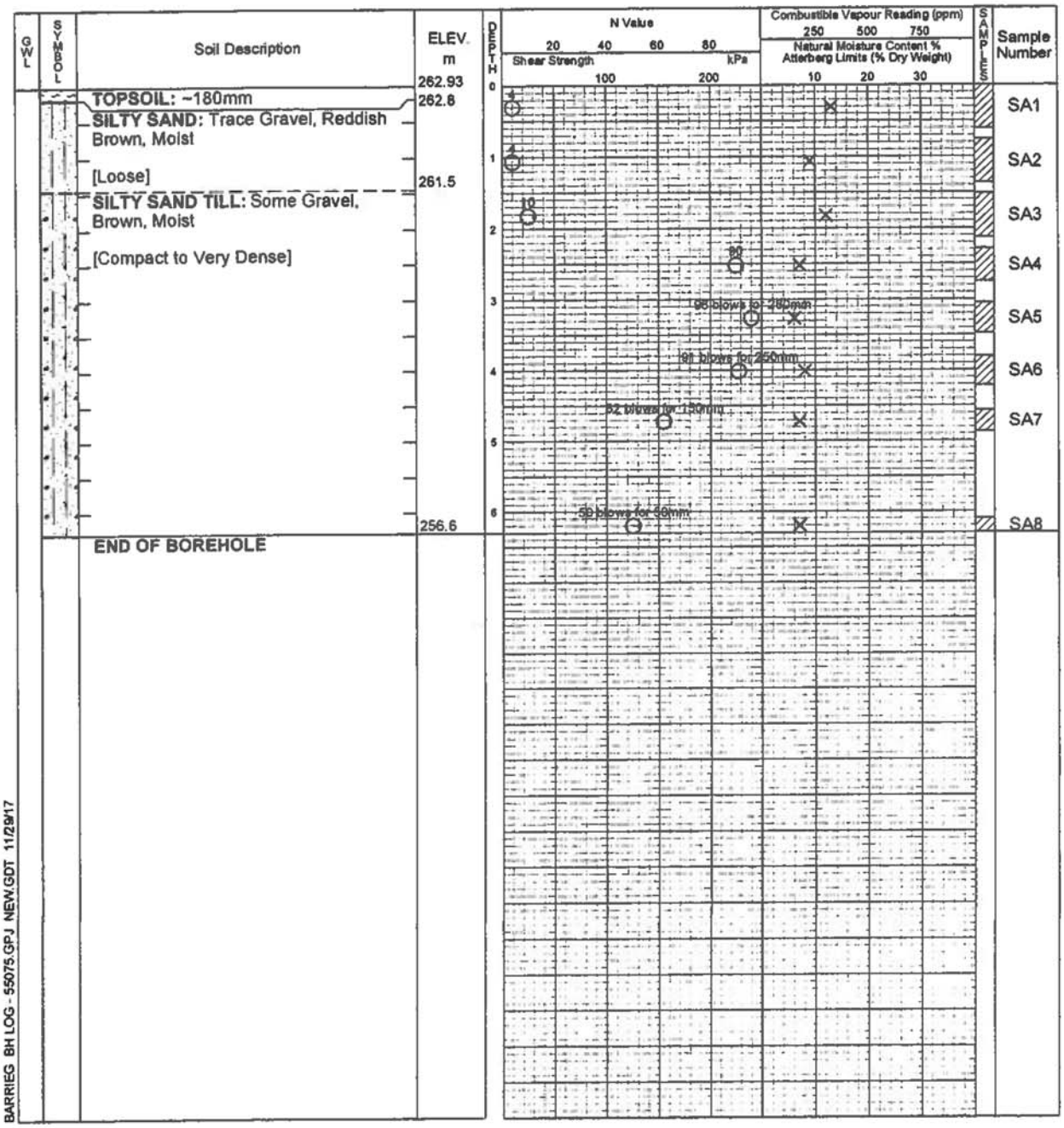
See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	2.0	4.6

Log of Borehole BH25

Project No. BAR-00055075-A0
Figure No. 26
Project: Geotechnical Investigation
Sheet No. 1 of 1
City/ Municipality: Barrie
Location: 883 Mapleview Drive East
Date Drilled: October 18, 2017
Drill Type: Solid Stem Augers
Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test
Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



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Borehole data requires interpretation assistance from Exp before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	6.3

Log of Borehole BH26

Project No. BAR-00055075-A0 | Figure No. 27

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

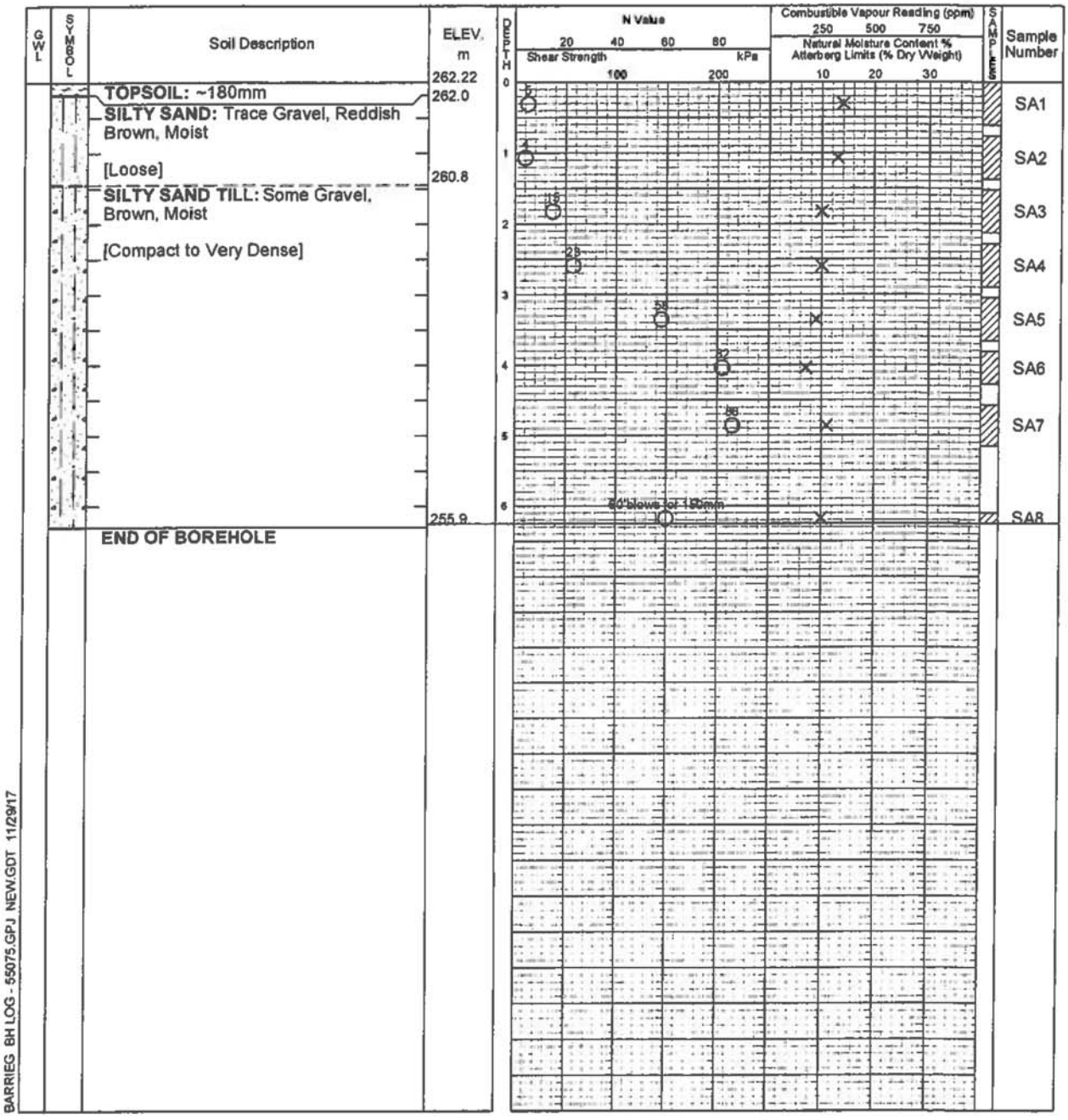
Date Drilled: October 18, 2017

Drill Type: Solid Stem Augers

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer



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f: +1.705.734.6224

Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	6.2

Log of Borehole BH27

Project No. BAR-00055075-A0

Figure No. 28

Project: Geotechnical Investigation

Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

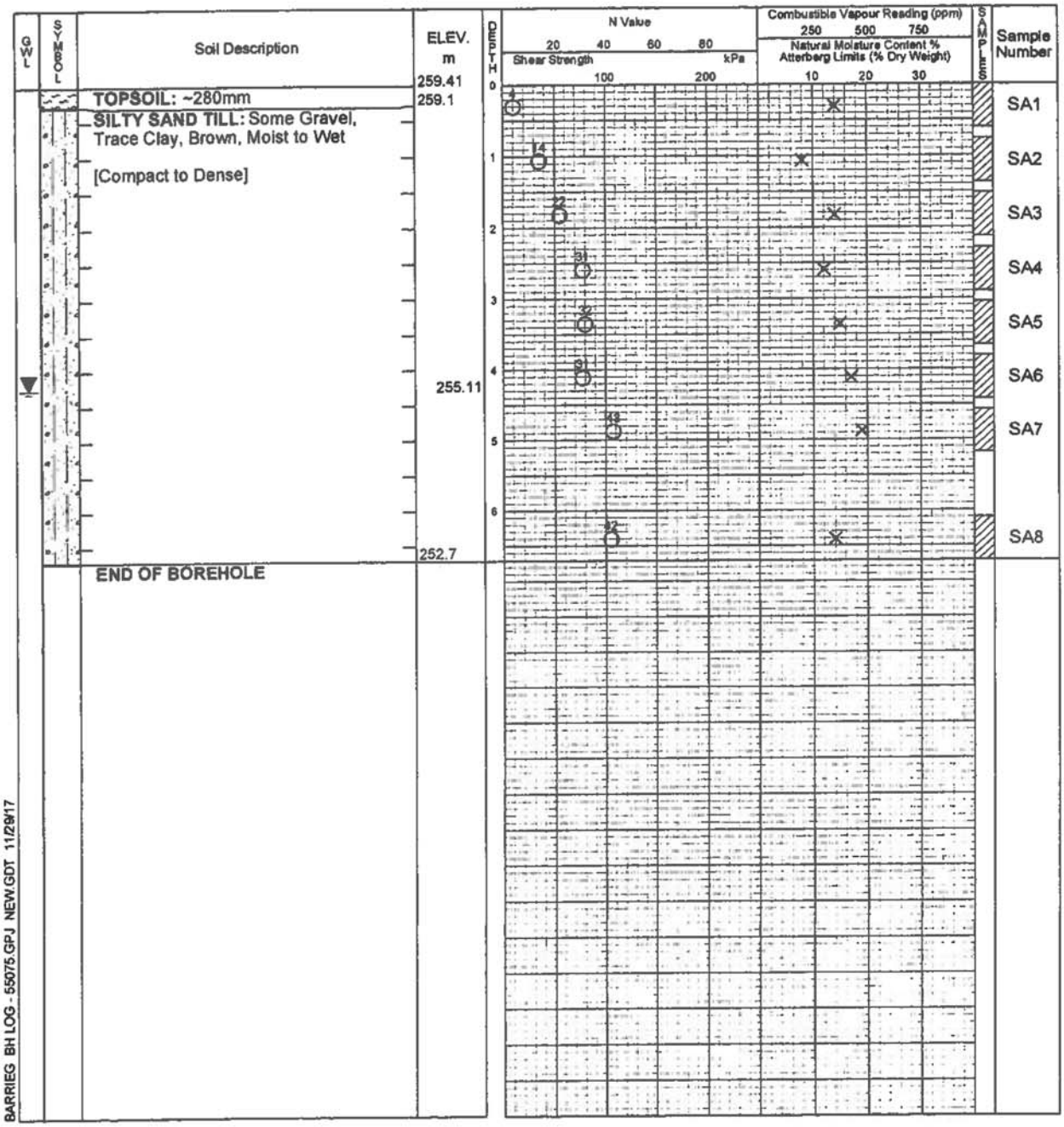
Date Drilled: October 18, 2017

Drill Type: Solid Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



BARRIEG BH LOG - 55075.GPJ NEW.GDT 11/29/17

exp. Services Inc.
14 Cedar Pointe Drive
Barrie, ON L4N 5R7
t: +1.705.734.6222
f: +1.705.734.6224

Borehole data requires interpretation assistance from Exp before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	4.3	5.5

Log of Borehole BH28

Project No. BAR-00055075-A0 | Figure No. 29

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

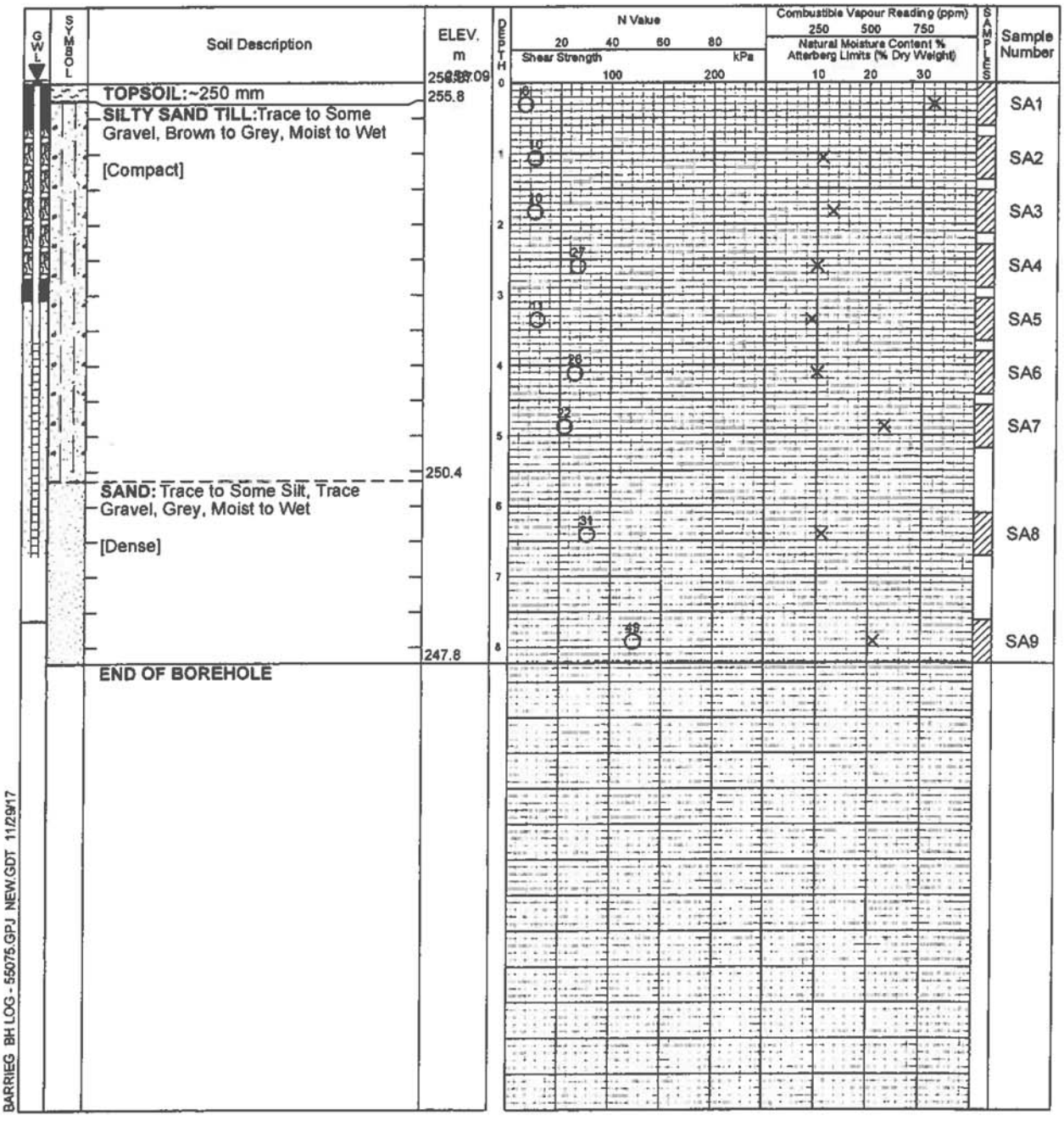
Date Drilled: October 24, 2017

Drill Type: Hollow Stem Augers

Datum: Geodetic

Auger Sample ⊠
SPT (N) Value ○ ▨
Dynamic Cone Test ——
Shelby Tube ■
Field Vane Test ✙ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit ⊢—○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲



BARRIEG BH LOG - 55075.GPJ NEW.GDT 11/29/17

exp. Services Inc.
14 Cedar Pointe Drive
Barrie, ON L4N 5R7
t: +1.705.734.6222
f: +1.705.734.6224

Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	2.3	-
Nov. 23, 2017	-0.02	

Log of Borehole BH29

Project No. BAR-00055075-A0 | Figure No. 30

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

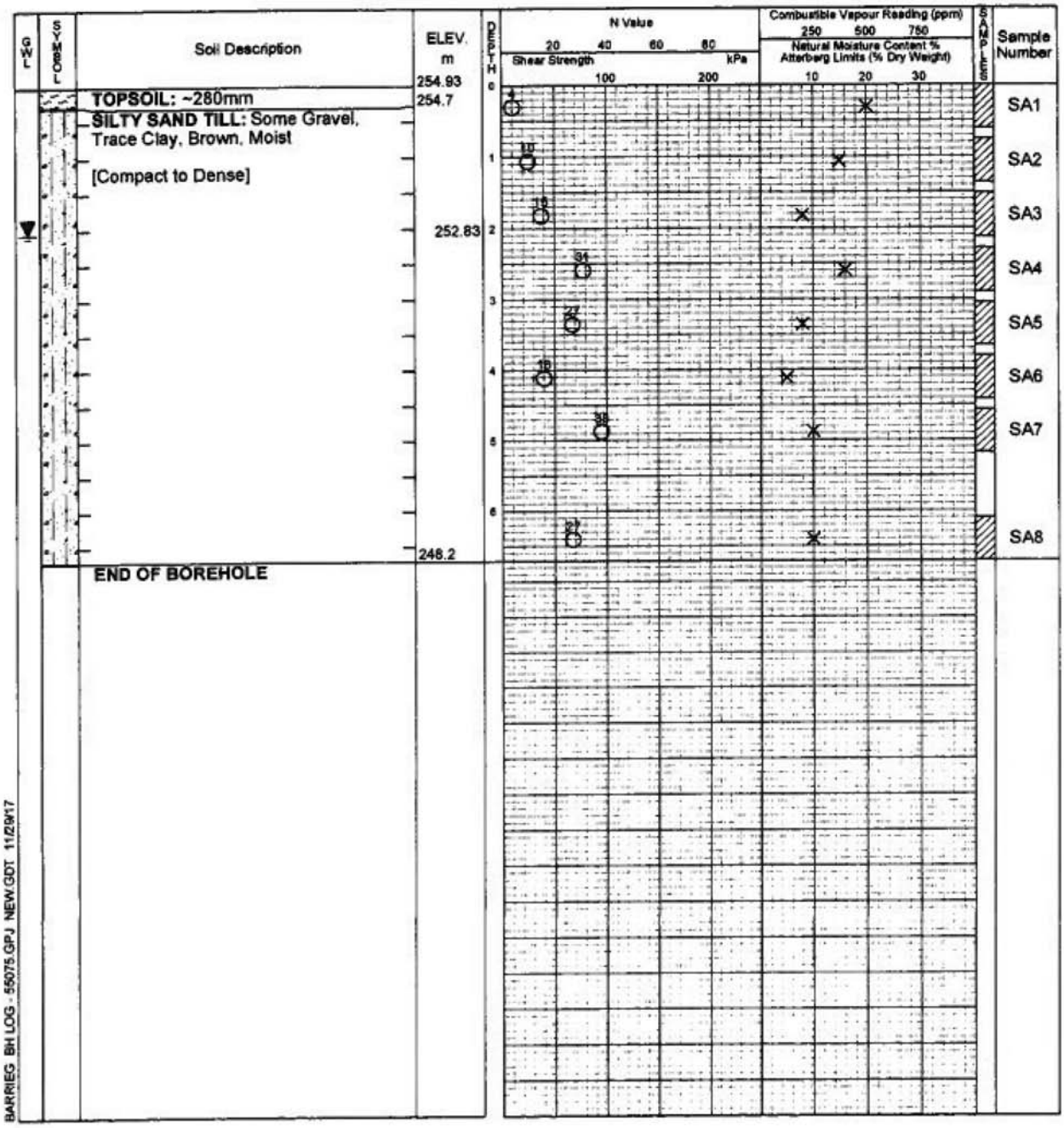
Date Drilled: October 19, 2017

Drill Type: Hollow Stem Augers

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer



BARRIEG BH LOG - 55075.GPJ NEW.GDT 11/29/17

exp. Services Inc.
14 Cedar Pointe Drive
Barrie, ON L4N 5R7
t: +1.705.734.6222
f: +1.705.734.6224

Borehole data requires interpretation assistance from Exp before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	2.1	5.5

Log of Borehole BH30

Project No. BAR-00055075-A0 | Figure No. 31

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

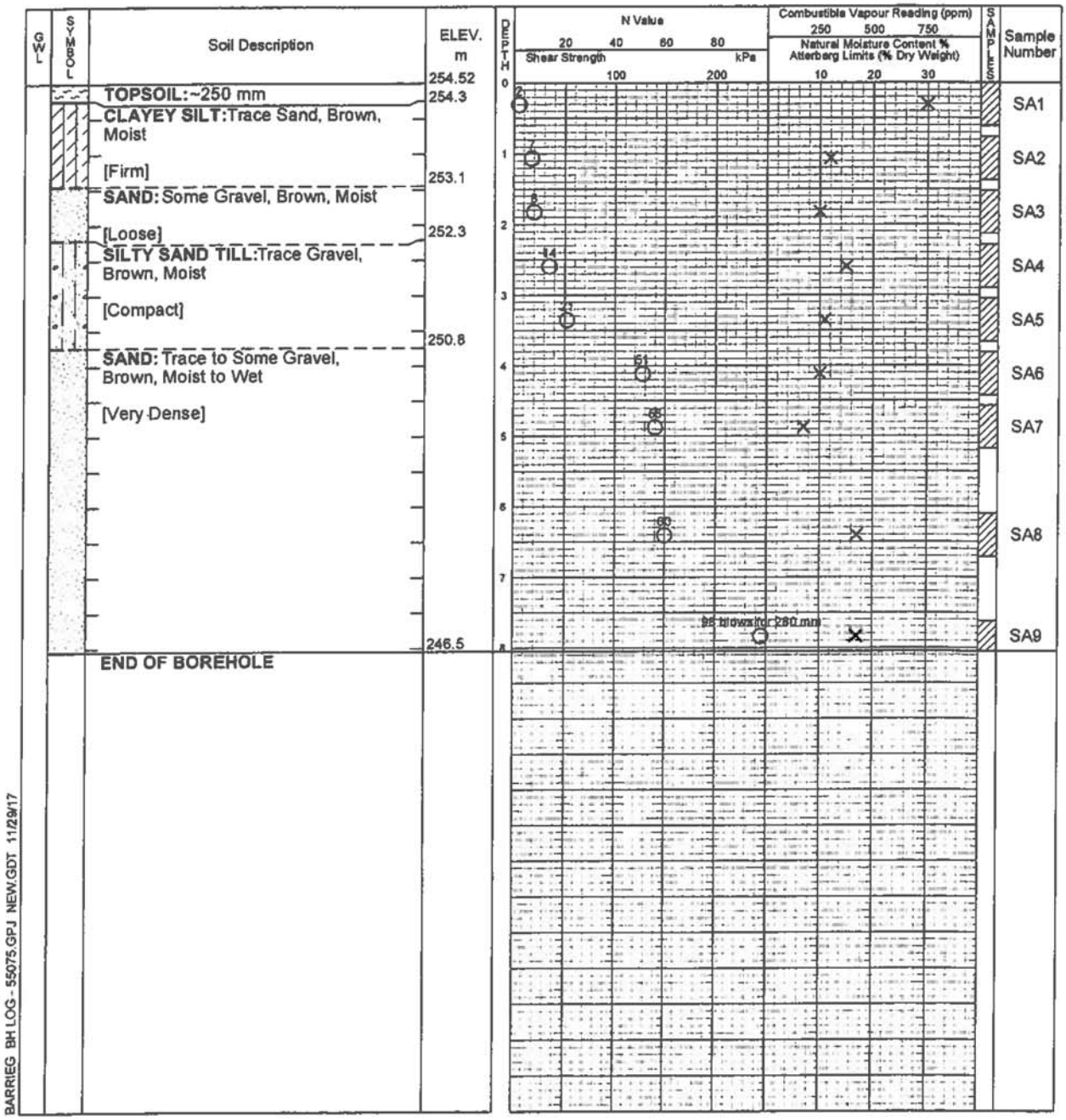
Date Drilled: October 26, 2017

Drill Type: Hollow Stem Augers

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer



exp. Services Inc.
14 Cedar Pointe Drive
Barrie, ON L4N 5R7
t: +1.705.734.6222
f: +1.705.734.6224

Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	1.52	3.35

Log of Borehole BH31

Project No. BAR-00055075-A0

Figure No. 32

Project: Geotechnical Investigation

Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

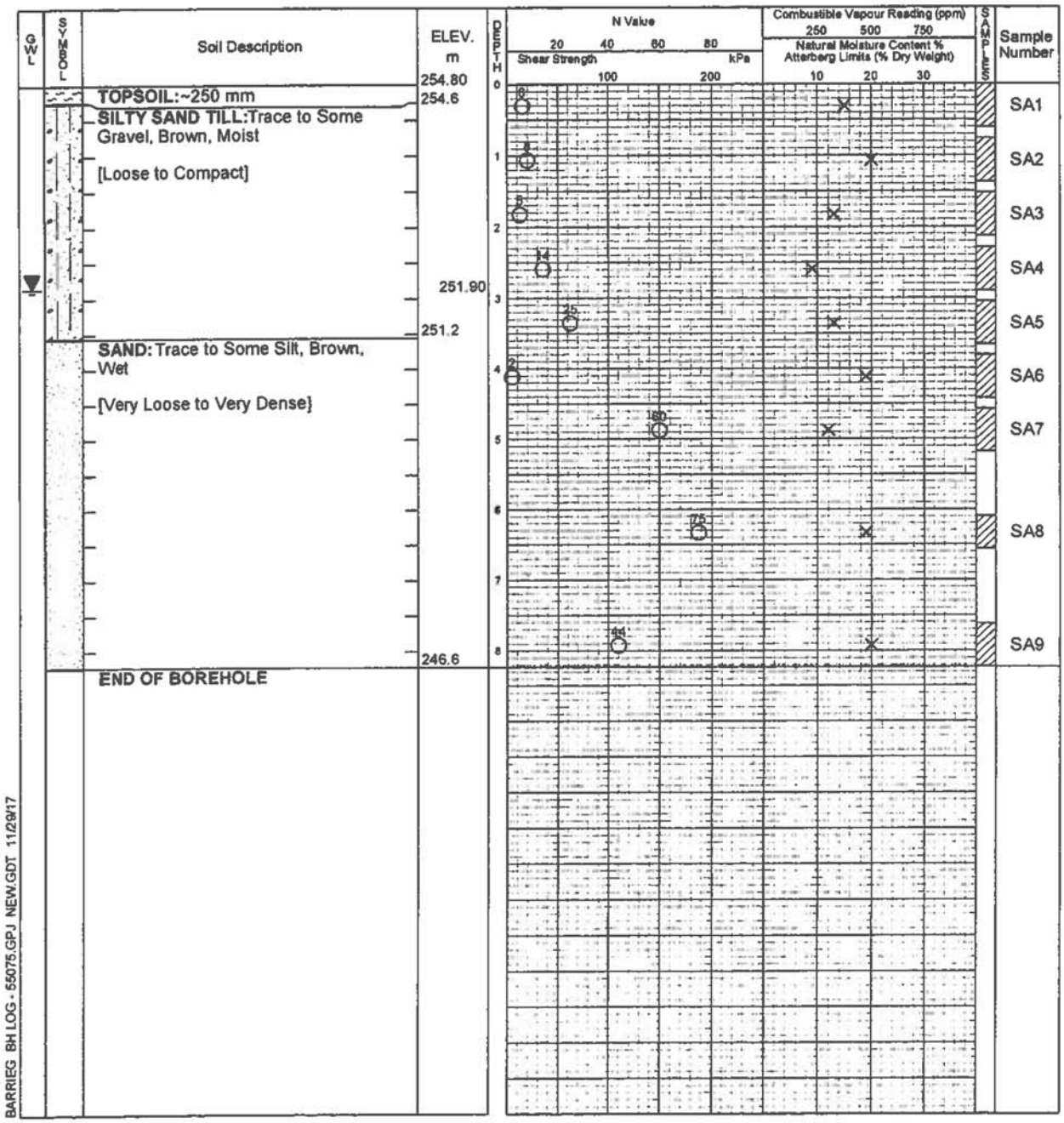
Date Drilled: October 25, 2017

Drill Type: Hollow Stem Augers

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test ——
Shelby Tube ■
Field Vane Test S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit ⊢—○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲



BARRIEG BH LOG - 55075.GPJ NEW.GDT 11/29/17

exp. Services Inc.
14 Cedar Pointe Drive
Barrie, ON L4N 5R7
t: +1.705.734.6222
f: +1.705.734.6224

Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Comption	2.9	3.7

Log of Borehole BH32

Project No. BAR-00055075-A0 | Figure No. 33

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

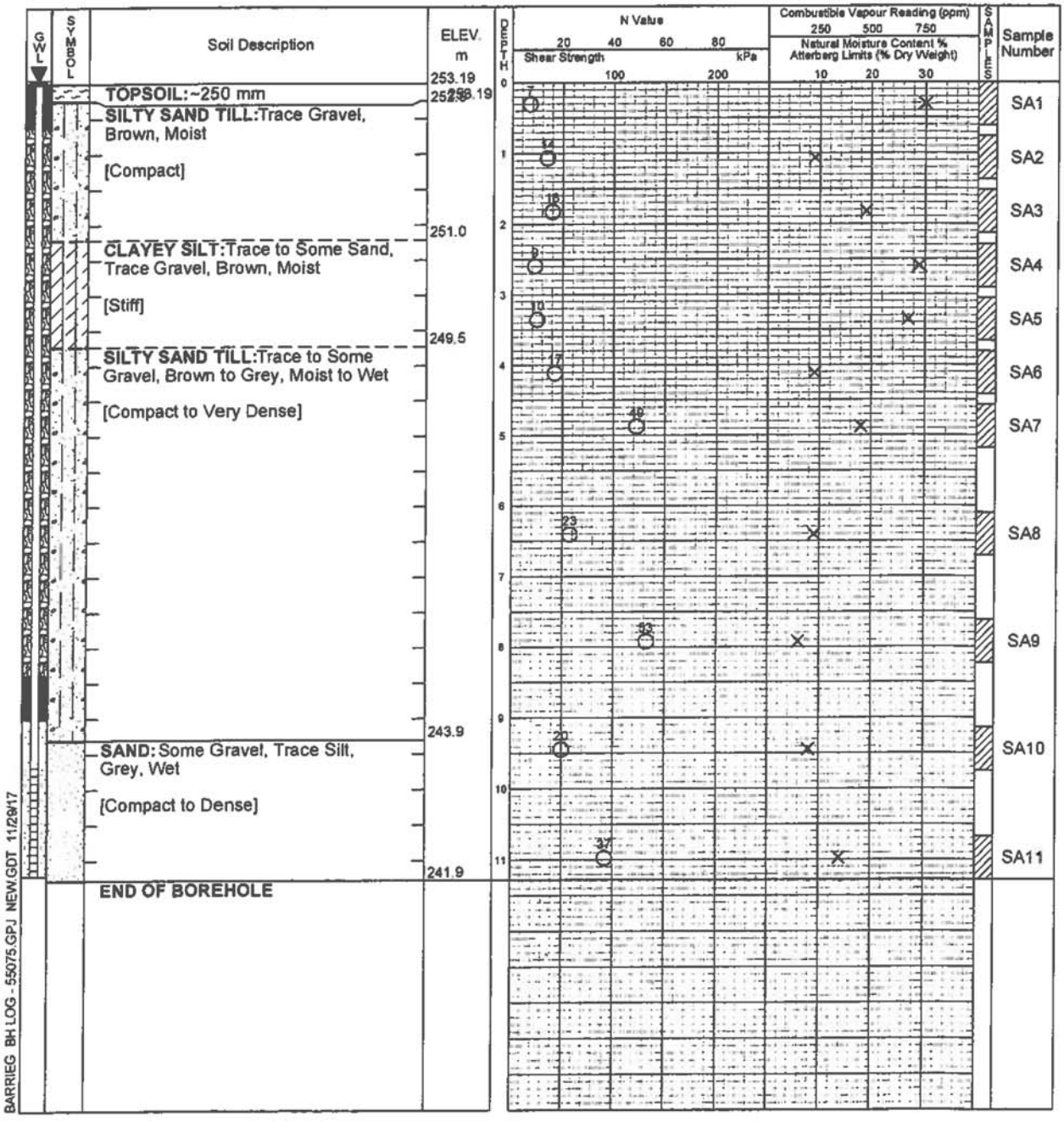
Date Drilled: October 26, 2017

Drill Type: Hollow Stem Augers

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer



BARRIEG BH LOG - 55075.GPJ NEW.GDT 11/29/17

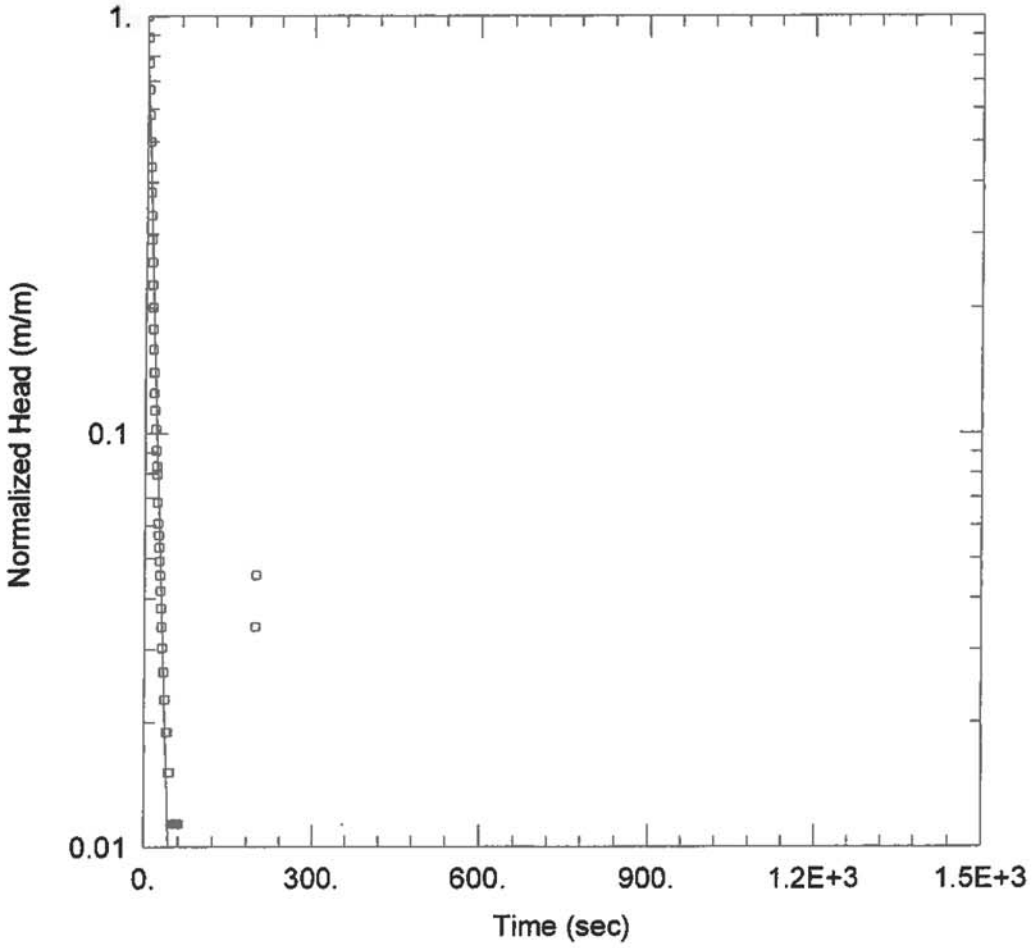
exp. Services Inc.
14 Cedar Pointe Drive
Barrie, ON L4N 5R7
t: +1.705.734.6222
f: +1.705.734.6224

Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion Nov. 23, 2017	9.75 Artesian	10.67

Appendix C:
SWRT Procedures and Results



FALLING HEAD - SWRT - BH 6

Data Set: I:\...\BH 6.aqt
Date: 12/05/17 Time: 10:36:12

PROJECT INFORMATION

Company: exp Services Inc
Client: 1091369 Ontario Inc.
Project: BAR-00055075-A0
Location: 883 Mapleview Road East
Test Well: BH 6
Test Date: November 23, 2017

AQUIFER DATA

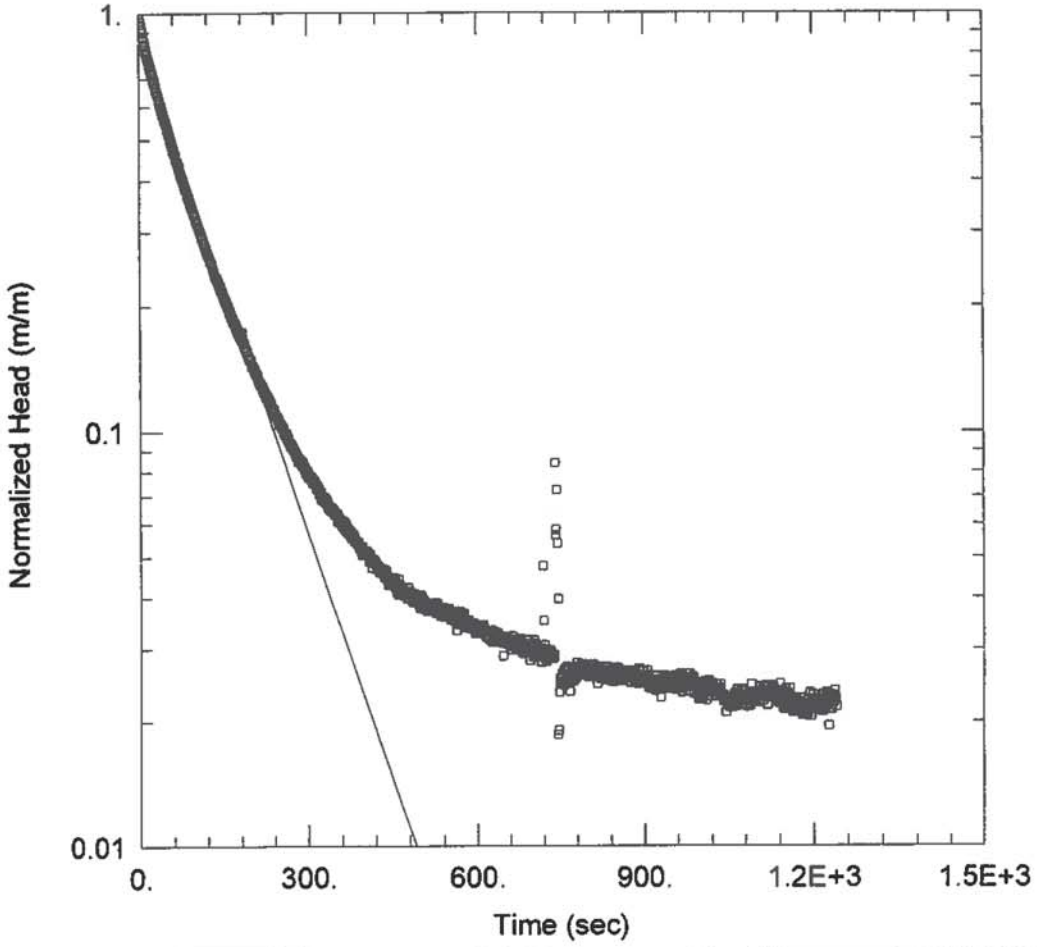
Saturated Thickness: 7.33 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH 6)

Initial Displacement: 0.792 m
Total Well Penetration Depth: 3. m
Casing Radius: 0.0254 m
Static Water Column Height: 7.33 m
Screen Length: 3. m
Well Radius: 0.1016 m

SOLUTION

Aquifer Model: Confined
Solution Method: Hvorslev
K = 4.55E-5 m/sec
y0 = 0.6771 m



FALLING HEAD - SWRT - BH 12

Data Set: I:\...\BH 12.aqt
Date: 12/05/17 Time: 10:44:59

PROJECT INFORMATION

Company: exp Services Inc
Client: 1091369 Ontario Inc
Project: BAR-00055075-A0
Location: 883 Mapleview Road East
Test Well: BH 12
Test Date: November 23, 2017

AQUIFER DATA

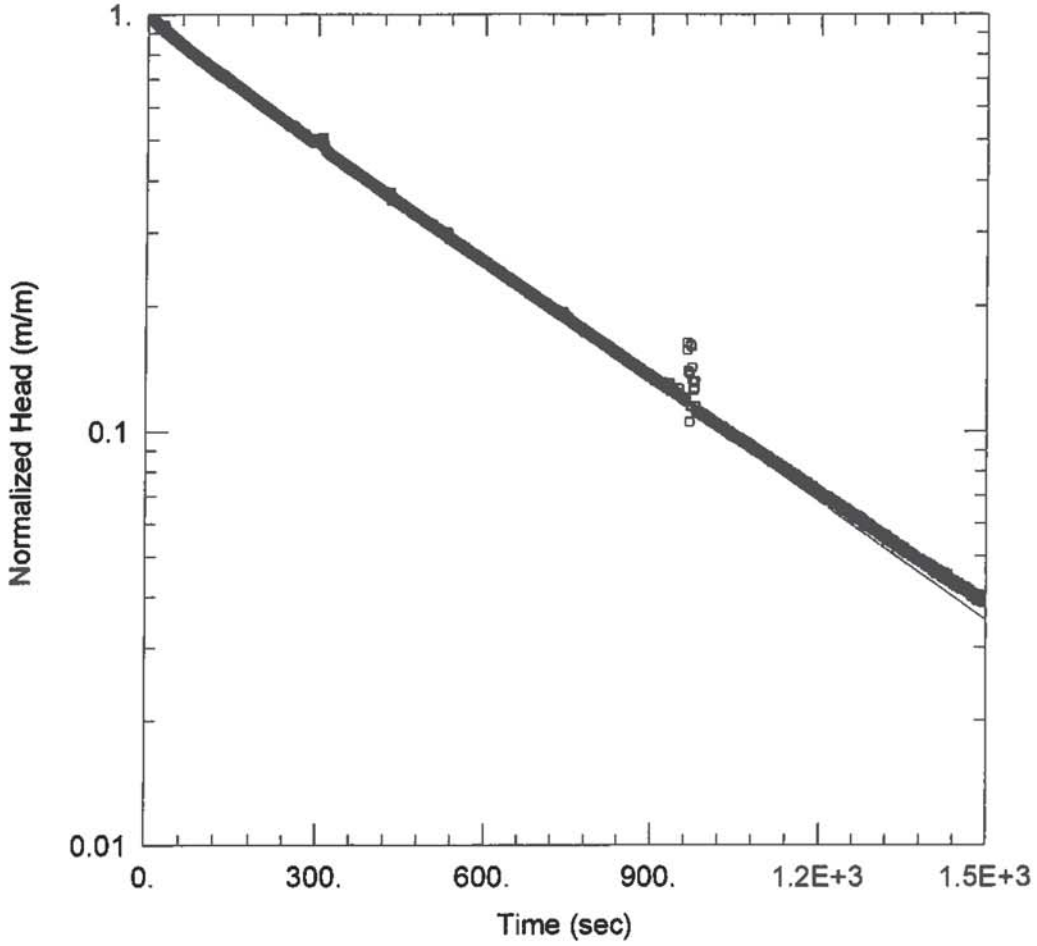
Saturated Thickness: 6.55 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH 12)

Initial Displacement: 0.8599 m
Total Well Penetration Depth: 6.55 m
Casing Radius: 0.0254 m
Static Water Column Height: 6.55 m
Screen Length: 3. m
Well Radius: 0.1016 m

SOLUTION

Aquifer Model: Confined
Solution Method: Hvorslev
K = 4.0E-6 m/sec
y0 = 0.7584 m



FALLING HEAD - SWRT - BH 19

Data Set: I:\...\BH 19.aqt
Date: 11/27/17 Time: 13:57:31

PROJECT INFORMATION

Company: exp Services Inc
Client: 1091369 Ontario Inc
Project: BAR-00055075-A0
Location: 883 Mapleview Road East
Test Well: BH 19
Test Date: November 24, 2017

AQUIFER DATA

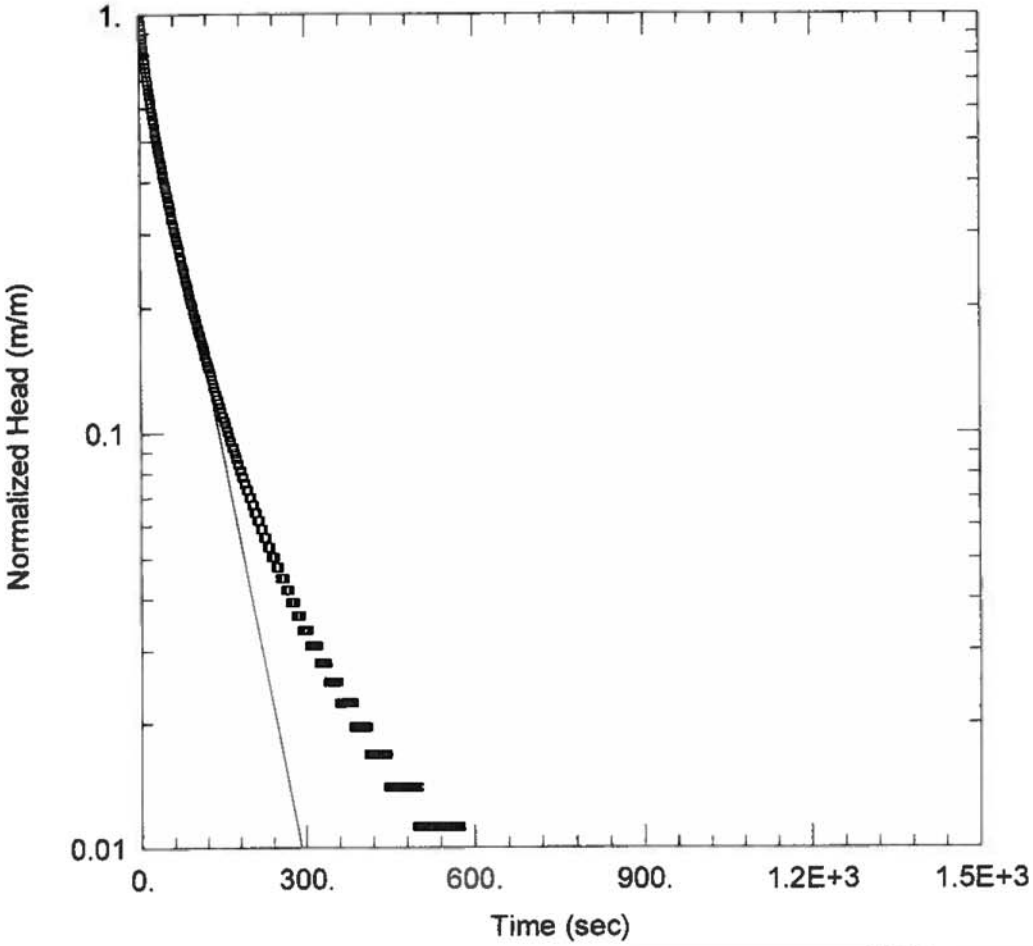
Saturated Thickness: 6.24 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH 19)

Initial Displacement: 1.541 m
Total Well Penetration Depth: 6.24 m
Casing Radius: 0.0254 m
Static Water Column Height: 6.24 m
Screen Length: 3. m
Well Radius: 0.1016 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 9.67E-7 m/sec
y0 = 1.474 m



FALLING HEAD - SWRT - BH 28

Data Set: I:\...\BH 28.aqt
Date: 11/27/17 Time: 13:57:12

PROJECT INFORMATION

Company: exp Services Inc
Client: 1091369 Ontario Inc
Project: BAR-00055075-A0
Location: 883 Mapleview Road East
Test Well: BH 28
Test Date: November 24, 2017

AQUIFER DATA

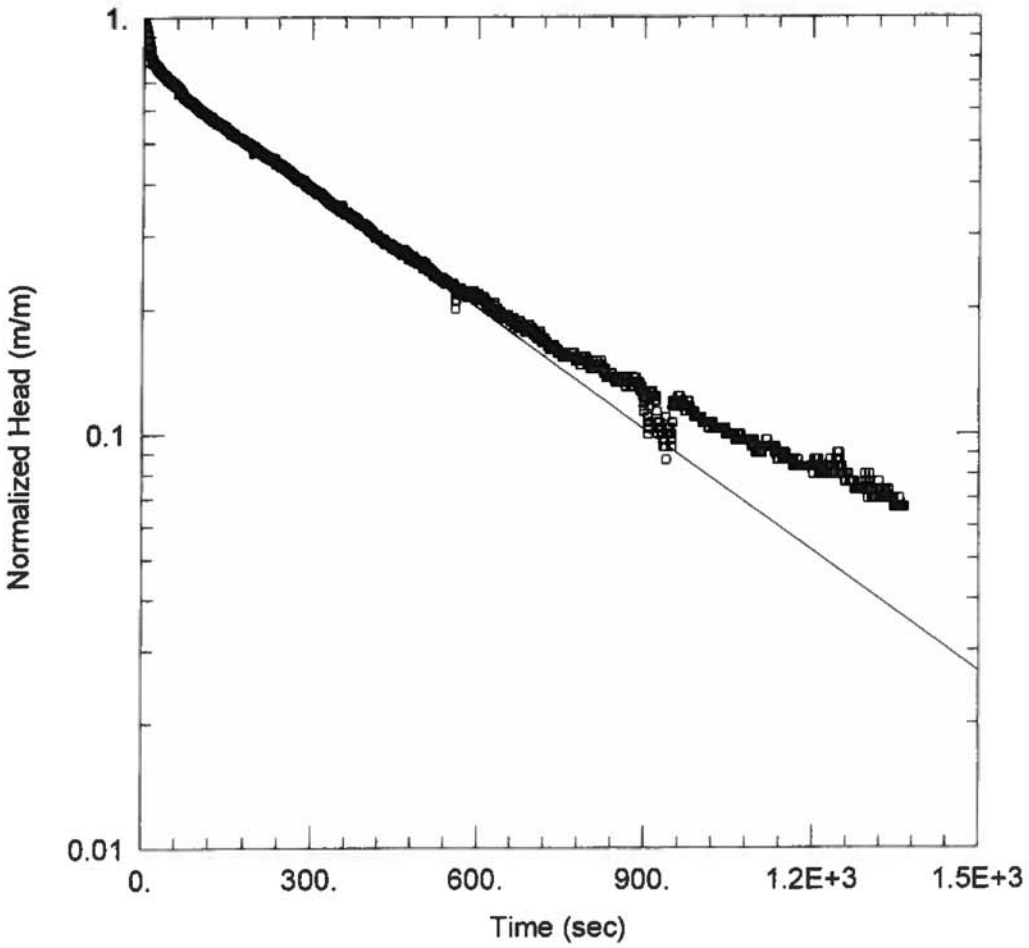
Saturated Thickness: 7. m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH 28)

Initial Displacement: 1.071 m
Total Well Penetration Depth: 7. m
Casing Radius: 0.0254 m
Static Water Column Height: 0. m
Screen Length: 3. m
Well Radius: 0.1016 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 6.72E-6 m/sec
y0 = 0.9304 m



FALLING HEAD - SWRT - BH 32

Data Set: I:\...\BH 32.aqt
Date: 12/05/17 Time: 12:16:06

PROJECT INFORMATION

Company: exp Services Inc
Client: 1091369 Ontario Inc
Project: BAR-00055075-A0
Location: 883 Mapleview Road East
Test Well: BH 32
Test Date: November 28, 2017

AQUIFER DATA

Saturated Thickness: 12.3 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH 32)

Initial Displacement: 0.9 m
Total Well Penetration Depth: 12.3 m
Casing Radius: 0.0254 m
Static Water Column Height: 12.3 m
Screen Length: 1.5 m
Well Radius: 0.1016 m

SOLUTION

Aquifer Model: Confined
Solution Method: Hvorslev
K = 1.636E-6 m/sec
y0 = 0.6988 m

Appendix D:
Groundwater Analysis and Laboratory Certificates of Analysis

Maxxam
A Bureau Veritas Group Company

Your P.O. #: ENV-BAR
Your Project #: BAR-00055075-A0
Site Location: 883 MAPLEVIEW
Your C.O.C. #: 617369-06-01

Attention:Francois Chartier

exp Services Inc
1595 Clark Blvd
Brampton, ON
L6T 4V1

Report Date: 2017/12/11
Report #: R4906323
Version: 2 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7Q6326
Received: 2017/11/24, 19:46

Sample Matrix: Water
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Sewer Use By-Law Semivolatile Organics	1	2017/11/28	2017/11/29	EPA 8270 CAM SOP 00301	EPA 8270 m
Alkalinity	1	N/A	2017/11/29	CAM SOP-00448	SM 22 2320 B m
Alkalinity	1	N/A	2017/11/30	CAM SOP-00448	SM 22 2320 B m
Carbonate, Bicarbonate and Hydroxide	1	N/A	2017/11/30	CAM SOP-00102	APHA 4500-CO2 D
Carbonate, Bicarbonate and Hydroxide	1	N/A	2017/12/01	CAM SOP-00102	APHA 4500-CO2 D
Biochemical Oxygen Demand (BOD)	1	2017/11/28	2017/12/03	CAM SOP-00427	SM 22 5210B m
Chloride by Automated Colourimetry	3	N/A	2017/11/29	CAM SOP-00463	EPA 325.2 m
Chemical Oxygen Demand	1	N/A	2017/11/30	CAM SOP-00416	SM 22 5220 D m
Conductivity	1	N/A	2017/11/29	CAM SOP-00414	SM 22 2510 m
Conductivity	1	N/A	2017/11/30	CAM SOP-00414	SM 22 2510 m
Total Cyanide	1	2017/11/28	2017/11/29	CAM SOP-00457	OMOE E3015 5 m
Dissolved Organic Carbon (DOC) (1)	2	N/A	2017/11/28	CAM SOP-00446	SM 22 5310 B m
Fluoride	1	2017/11/29	2017/12/01	CAM SOP-00449	SM 22 4500-F C m
Hardness (calculated as CaCO3)	2	N/A	2017/11/29	CAM SOP 00102/00408/00447	SM 2340 B
Mercury in Water by CVAA	1	2017/11/30	2017/11/30	CAM SOP-00453	EPA 7470A m
Lab Filtered Metals by ICPMS	2	2017/11/28	2017/11/29	CAM SOP-00447	EPA 6020B m
Total Metals Analysis by ICPMS	1	N/A	2017/11/29	CAM SOP-00447	EPA 6020B m
Ion Balance (% Difference)	1	N/A	2017/11/30		
Ion Balance (% Difference)	1	N/A	2017/12/01		
Anion and Cation Sum	1	N/A	2017/11/30		
Anion and Cation Sum	1	N/A	2017/12/01		
Neutral Chlorinated in Water by GC/ECD	1	2017/11/29	2017/12/01	CAM SOP-00317	EPA 8121 m
Total Ammonia-N	2	N/A	2017/12/01	CAM SOP-00441	EPA GS I-2522-90 m
Nitrate (NO3) and Nitrite (NO2) in Water (2)	2	N/A	2017/11/29	CAM SOP-00440	SM 22 4500-NO3I/NO2B
Animal and Vegetable Oil and Grease	1	N/A	2017/12/01	CAM SOP-00326	EPA1664B m,SM5520B m
Total Oil and Grease	1	2017/12/01	2017/12/01	CAM SOP-00326	EPA1664B m,SM5520A m
pH	1	N/A	2017/11/29	CAM SOP-00413	SM 4500H+ B m
pH	1	N/A	2017/11/30	CAM SOP-00413	SM 4500H+ B m
pH	1	N/A	2017/12/01	CAM SOP-00413	SM 4500H+ B m

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam
A Bureau Veritas Group Company

Your P.O. #: ENV-BAR
Your Project #: BAR-00055075-A0
Site Location: 883 MAPLEVIEW
Your C.O.C. #: 617369-06-01

Attention:Francois Chartier

exp Services Inc
1595 Clark Blvd
Brampton, ON
L6T 4V1

Report Date: 2017/12/11
Report #: R4906323
Version: 2 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7Q6326
Received: 2017/11/24, 19:46

Sample Matrix: Water
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Phenols (4AAP)	1	N/A	2017/11/28	CAM SOP-00444	OMOE E3179 m
Orthophosphate	2	N/A	2017/11/29	CAM SOP-00461	EPA 365.1 m
Sat. pH and Langelier Index (@ 20C)	1	N/A	2017/11/30		
Sat. pH and Langelier Index (@ 20C)	1	N/A	2017/12/01		
Sat. pH and Langelier Index (@ 4C)	1	N/A	2017/11/30		
Sat. pH and Langelier Index (@ 4C)	1	N/A	2017/12/01		
Sulphate by Automated Colourimetry	3	N/A	2017/11/29	CAM SOP-00464	EPA 375.4 m
Sulphide	1	N/A	2017/11/29	CAM SOP-00455	SM 22 4500-S G m
Total Dissolved Solids (TDS calc)	1	N/A	2017/11/30		
Total Dissolved Solids (TDS calc)	1	N/A	2017/12/01		
Total Kjeldahl Nitrogen in Water	1	2017/11/29	2017/11/30	CAM SOP-00938	OMOE E3516 m
Total PAHs (Barrie Sewer By-law) (3)	1	N/A	2017/11/30	CAM SOP - 00301	EPA 8270 m
Mineral/Synthetic O & G (TPH Heavy Oil) (4)	1	2017/12/01	2017/12/01	CAM SOP-00326	EPA1664B m,SM5520F m
Total Suspended Solids	1	2017/11/28	2017/11/29	CAM SOP-00428	SM 22 2540D m
Volatile Organic Compounds in Water	1	N/A	2017/11/29	CAM SOP-00226	EPA 8260C m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam 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.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam 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 Maxxam, unless otherwise agreed in writing.

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.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam
A Bureau Veritas Group Company

Your P.O. #: ENV-BAR
Your Project #: BAR-00055075-A0
Site Location: 883 MAPLEVIEW
Your C.O.C. #: 617369-06-01

Attention:Francois Chartier

exp Services Inc
1595 Clark Blvd
Brampton, ON
L6T 4V1

Report Date: 2017/12/11
Report #: R4906323
Version: 2 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7Q6326
Received: 2017/11/24, 19:46

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.
(3) Total PAHs include only those PAHs specified in the sewer use by-by-law.
(4) Note: TPH (Heavy Oil) is equivalent to Mineral / Synthetic Oil & Grease

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Deepthi Shaji, Project Manager
Email: dshaji@maxxam.ca
Phone# (905)817-5700 Ext:5807

==========

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B7Q6326
Report Date: 2017/12/11

exp Services Inc
Client Project #: BAR-00055075-A0
Site Location: 883 MAPLEVIEW
Your P.O. #: ENV-BAR
Sampler Initials: JL

BARRIE SANITARY SEWER BYLAW (2012-172)

Maxxam ID				FPZ290			FPZ290		
Sampling Date				2017/11/24 11:30			2017/11/24 11:30		
COC Number				617369-06-01			617369-06-01		
	UNITS	Criteria	Criteria-2	BH32	RDL	QC Batch	BH32 Lab-Dup	RDL	QC Batch
Calculated Parameters									
Total Animal/Vegetable Oil and Grease	mg/L	150	-	ND	0.50	5285908			
Inorganics									
Total BOD	mg/L	300	15	ND	2.0	5288731			
Total Chemical Oxygen Demand (COD)	mg/L	600	-	ND	4.0	5291149			
Fluoride (F-)	mg/L	10	-	ND	0.10	5291581			
Total Kjeldahl Nitrogen (TKN)	mg/L	100	-	0.13	0.10	5291261			
pH	pH	6.0:9.5	6.0:9.5	8.08		5291585			
Phenols-4AAP	mg/L	0.1	-	ND	0.0010	5288835			
Total Suspended Solids	mg/L	350	15	10	10	5288269			
Dissolved Sulphate (SO4)	mg/L	1500	-	39	1.0	5289216			
Sulphide	mg/L	1	-	ND	0.020	5288505			
Total Cyanide (CN)	mg/L	1.2	-	ND	0.0050	5287537	ND	0.0050	5287537
Dissolved Chloride (Cl)	mg/L	1500	-	2.8	1.0	5289209			
Petroleum Hydrocarbons									
Total Oil & Grease	mg/L	-	-	ND	0.50	5295067			
Total Oil & Grease Mineral/Synthetic	mg/L	15	-	ND	0.50	5295083			
Metals									
Mercury (Hg)	mg/L	0.01	-	ND	0.0001	5292135			
Semivolatile Organics									
1-Methylnaphthalene	ug/L	-	-	ND	0.3	5288563			
2-Methylnaphthalene	ug/L	-	-	ND	0.3	5288563			
Acenaphthene	ug/L	-	-	ND	0.3	5288563			
Acenaphthylene	ug/L	-	-	ND	0.3	5288563			
Fluorene	ug/L	-	-	ND	0.3	5288563			
Naphthalene	ug/L	-	-	ND	0.3	5288563			
Phenanthrene	ug/L	-	-	ND	0.2	5288563			

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
Criteria: The City of Barrie Discharges to Sanitary Sewers By Law 2012-172
Criteria-2: The City of Barrie Discharges to Storm Sewers By Law 2012-172
ND = Not detected

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A Bureau Veritas Group Company

Maxxam Job #: B7Q6326
Report Date: 2017/12/11

exp Services Inc
Client Project #: BAR-00055075-A0
Site Location: 883 MAPLEVIEW
Your P.O. #: ENV-BAR
Sampler Initials: JL

BARRIE SANITARY SEWER BYLAW (2012-172)

Maxxam ID				FPZ290			FPZ290		
Sampling Date				2017/11/24 11:30			2017/11/24 11:30		
COC Number				617369-06-01			617369-06-01		
	UNITS	Criteria	Criteria-2	BH32	RDL	QC Batch	BH32 Lab-Dup	RDL	QC Batch
Anthracene	ug/L	-	-	ND	0.2	5288563			
Fluoranthene	ug/L	-	-	ND	0.2	5288563			
Pyrene	ug/L	-	-	ND	0.2	5288563			
Benzo(a)anthracene	ug/L	-	-	ND	0.2	5288563			
Chrysene	ug/L	-	-	ND	0.2	5288563			
Benzo(b/j)fluoranthene	ug/L	-	-	ND	0.2	5288563			
Benzo(k)fluoranthene	ug/L	-	-	ND	0.2	5288563			
Benzo(a)pyrene	ug/L	-	-	ND	0.2	5288563			
Indeno(1,2,3-cd)pyrene	ug/L	-	-	ND	0.2	5288563			
Dibenz(a,h)anthracene	ug/L	-	-	ND	0.2	5288563			
Benzo(g,h,i)perylene	ug/L	-	-	ND	0.2	5288563			
Calculated Parameters									
Total PAHs	ug/L	-	-	ND	0.92	5286701			
Volatile Organics									
Benzene	ug/L	10	-	ND	0.10	5287471			
1,2-Dichlorobenzene	ug/L	50	-	ND	0.20	5287471			
1,4-Dichlorobenzene	ug/L	80	-	ND	0.20	5287471			
Ethylbenzene	ug/L	60	-	ND	0.10	5287471			
Methylene Chloride(Dichloromethane)	ug/L	90	-	ND	0.50	5287471			
1,1,2,2-Tetrachloroethane	ug/L	60	-	ND	0.20	5287471			
Tetrachloroethylene	ug/L	60	-	ND	0.10	5287471			
Toluene	ug/L	20	-	ND	0.20	5287471			
Trichloroethylene	ug/L	50	-	ND	0.10	5287471			
p+m-Xylene	ug/L	-	-	0.14	0.10	5287471			
o-Xylene	ug/L	-	-	ND	0.10	5287471			
Total Xylenes	ug/L	300	-	0.14	0.10	5287471			

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
Criteria: The City of Barrie Discharges to Sanitary Sewers By Law 2012-172
Criteria-2: The City of Barrie Discharges to Storm Sewers By Law 2012-172
ND = Not detected

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Maxxam Job #: B7Q6326
Report Date: 2017/12/11

exp Services Inc
Client Project #: BAR-00055075-A0
Site Location: 883 MAPLEVIEW
Your P.O. #: ENV-BAR
Sampler Initials: JL

BARRIE SANITARY SEWER BYLAW (2012-172)

Maxxam ID				FPZ290			FPZ290		
Sampling Date				2017/11/24 11:30			2017/11/24 11:30		
COC Number				617369-06-01			617369-06-01		
	UNITS	Criteria	Criteria-2	BH32	RDL	QC Batch	BH32 Lab-Dup	RDL	QC Batch
Pesticides & Herbicides									
Hexachlorobenzene	ug/L	0.1	-	ND	0.050	5291079			
Surrogate Recovery (%)									
2,4,6-Tribromophenol	%	-	-	89		5288563			
2-Fluorobiphenyl	%	-	-	76		5288563			
D14-Terphenyl (FS)	%	-	-	95		5288563			
D5-Nitrobenzene	%	-	-	87		5288563			
D8-Acenaphthylene	%	-	-	80		5288563			
1,3,5-Tribromobenzene	%	-	-	98		5291079			
2,4,5,6-Tetrachloro-m-xylene	%	-	-	68		5291079			
Decachlorobiphenyl	%	-	-	80		5291079			
Hexabromobenzene	%	-	-	97		5291079			
4-Bromofluorobenzene	%	-	-	102		5287471			
D4-1,2-Dichloroethane	%	-	-	101		5287471			
D8-Toluene	%	-	-	99		5287471			

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
Criteria: The City of Barrie Discharges to Sanitary Sewers By Law 2012-172
Criteria-2: The City of Barrie Discharges to Storm Sewers By Law 2012-172
ND = Not detected

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Maxxam Job #: B7Q6326
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exp Services Inc
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Site Location: 883 MAPLEVIEW
Your P.O. #: ENV-BAR
Sampler Initials: JL

BARRIE STORM SEWER BYLAW (2012-172)

Maxxam ID				FPZ290		
Sampling Date				2017/11/24 11:30		
COC Number				617369-06-01		
	UNITS	Criteria	Criteria-2	BH32	RDL	QC Batch
Metals						
Total Aluminum (Al)	ug/L	50000	-	5700	5.0	5290041
Total Antimony (Sb)	ug/L	5000	-	ND	0.50	5290041
Total Arsenic (As)	ug/L	1000	-	ND	1.0	5290041
Total Barium (Ba)	ug/L	5000	-	210	2.0	5290041
Total Bismuth (Bi)	ug/L	5000	-	ND	1.0	5290041
Total Cadmium (Cd)	ug/L	700	1	ND	0.10	5290041
Total Chromium (Cr)	ug/L	2000	80	9.4	5.0	5290041
Total Cobalt (Co)	ug/L	5000	-	3.1	0.50	5290041
Total Copper (Cu)	ug/L	2000	10	7.7	1.0	5290041
Total Iron (Fe)	ug/L	50000	-	7600	100	5290041
Total Lead (Pb)	ug/L	700	50	3.2	0.50	5290041
Total Manganese (Mn)	ug/L	5000	-	220	2.0	5290041
Total Molybdenum (Mo)	ug/L	5000	-	1.2	0.50	5290041
Total Nickel (Ni)	ug/L	2000	50	7.2	1.0	5290041
Total Phosphorus (P)	ug/L	-	-	270	100	5290041
Total Selenium (Se)	ug/L	1000	-	ND	2.0	5290041
Total Silver (Ag)	ug/L	400	-	ND	0.10	5290041
Total Tin (Sn)	ug/L	5000	-	4.7	1.0	5290041
Total Vanadium (V)	ug/L	5000	-	11	0.50	5290041
Total Zinc (Zn)	ug/L	2000	40	21	5.0	5290041

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: The City of Barrie Discharges to Sanitary Sewers By Law 2012-172
Criteria-2: The City of Barrie Discharges to Storm Sewers By Law 2012-172
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Maxxam Job #: B7Q6326
Report Date: 2017/12/11

exp Services Inc
Client Project #: BAR-00055075-A0
Site Location: 883 MAPLEVIEW
Your P.O. #: ENV-BAR
Sampler Initials: JL

RCAP - COMPREHENSIVE (LAB FILTERED)

Maxxam ID				FPZ291			FPZ291		
Sampling Date				2017/11/24 13:00			2017/11/24 13:00		
COC Number				617369-06-01			617369-06-01		
	UNITS	Criteria	Criteria-2	BH19	RDL	QC Batch	BH19 Lab-Dup	RDL	QC Batch
Calculated Parameters									
Anion Sum	me/L	-	-	4.70	N/A	5286698			
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	-	170	1.0	5286007			
Calculated TDS	mg/L	-	-	260	1.0	5286485			
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	-	1.7	1.0	5286007			
Cation Sum	me/L	-	-	4.28	N/A	5286698			
Hardness (CaCO3)	mg/L	-	-	180	1.0	5285780			
Ion Balance (% Difference)	%	-	-	4.65	N/A	5286037			
Langelier Index (@ 20C)	N/A	-	-	0.536		5286699			
Langelier Index (@ 4C)	N/A	-	-	0.286		5286700			
Saturation pH (@ 20C)	N/A	-	-	7.48		5286699			
Saturation pH (@ 4C)	N/A	-	-	7.73		5286700			
Inorganics									
Total Ammonia-N	mg/L	-	-	0.28	0.050	5291361			
Conductivity	umho/cm	-	-	450	1.0	5288326			
Dissolved Organic Carbon	mg/L	-	-	7.3	0.50	5287544			
Orthophosphate (P)	mg/L	-	-	ND	0.010	5289235			
pH	pH	6.0:9.5	6.0:9.5	8.01		5288329			
Dissolved Sulphate (SO4)	mg/L	1500	-	24	1.0	5289230			
Alkalinity (Total as CaCO3)	mg/L	-	-	170	1.0	5288319			
Dissolved Chloride (Cl)	mg/L	1500	-	14	1.0	5289227			
Nitrite (N)	mg/L	-	-	0.751	0.010	5289135			
Nitrate (N)	mg/L	-	-	4.69	0.10	5289135			
Nitrate + Nitrite (N)	mg/L	-	-	5.44	0.10	5289135			
Metals									
Dissolved Aluminum (Al)	ug/L	50000	-	6.2	5.0	5288282	5.8	5.0	5288282

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
Criteria: The City of Barrie Discharges to Sanitary Sewers By Law 2012-172
Criteria-2: The City of Barrie Discharges to Storm Sewers By Law 2012-172
N/A = Not Applicable
ND = Not detected

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Maxxam Job #: B7Q6326
Report Date: 2017/12/11

exp Services Inc
Client Project #: BAR-00055075-A0
Site Location: 883 MAPLEVIEW
Your P.O. #: ENV-BAR
Sampler Initials: JL

RCAP - COMPREHENSIVE (LAB FILTERED)

Maxxam ID				FPZ291			FPZ291		
Sampling Date				2017/11/24 13:00			2017/11/24 13:00		
COC Number				617369-06-01			617369-06-01		
	UNITS	Criteria	Criteria-2	BH19	RDL	QC Batch	BH19 Lab-Dup	RDL	QC Batch
Dissolved Antimony (Sb)	ug/L	5000	-	ND	0.50	5288282	0.55	0.50	5288282
Dissolved Arsenic (As)	ug/L	1000	-	ND	1.0	5288282	ND	1.0	5288282
Dissolved Barium (Ba)	ug/L	5000	-	24	2.0	5288282	23	2.0	5288282
Dissolved Beryllium (Be)	ug/L	-	-	ND	0.50	5288282	ND	0.50	5288282
Dissolved Boron (B)	ug/L	-	-	140	10	5288282	140	10	5288282
Dissolved Cadmium (Cd)	ug/L	700	1	ND	0.10	5288282	ND	0.10	5288282
Dissolved Calcium (Ca)	ug/L	-	-	49000	200	5288282	49000	200	5288282
Dissolved Chromium (Cr)	ug/L	2000	80	ND	5.0	5288282	ND	5.0	5288282
Dissolved Cobalt (Co)	ug/L	5000	-	ND	0.50	5288282	ND	0.50	5288282
Dissolved Copper (Cu)	ug/L	2000	10	4.0	1.0	5288282	4.1	1.0	5288282
Dissolved Iron (Fe)	ug/L	50000	-	ND	100	5288282	ND	100	5288282
Dissolved Lead (Pb)	ug/L	700	50	ND	0.50	5288282	ND	0.50	5288282
Dissolved Magnesium (Mg)	ug/L	-	-	13000	50	5288282	13000	50	5288282
Dissolved Manganese (Mn)	ug/L	5000	-	32	2.0	5288282	34	2.0	5288282
Dissolved Molybdenum (Mo)	ug/L	5000	-	19	0.50	5288282	20	0.50	5288282
Dissolved Nickel (Ni)	ug/L	2000	50	ND	1.0	5288282	ND	1.0	5288282
Dissolved Phosphorus (P)	ug/L	-	-	ND	100	5288282	ND	100	5288282
Dissolved Potassium (K)	ug/L	-	-	3300	200	5288282	3300	200	5288282
Dissolved Selenium (Se)	ug/L	1000	-	ND	2.0	5288282	ND	2.0	5288282
Dissolved Silicon (Si)	ug/L	-	-	5400	50	5288282	5400	50	5288282
Dissolved Silver (Ag)	ug/L	400	-	ND	0.10	5288282	ND	0.10	5288282
Dissolved Sodium (Na)	ug/L	-	-	15000	100	5288282	15000	100	5288282
Dissolved Strontium (Sr)	ug/L	-	-	160	1.0	5288282	150	1.0	5288282
Dissolved Thallium (Tl)	ug/L	-	-	ND	0.050	5288282	ND	0.050	5288282
Dissolved Titanium (Ti)	ug/L	-	-	ND	5.0	5288282	ND	5.0	5288282
Dissolved Uranium (U)	ug/L	-	-	0.37	0.10	5288282	0.38	0.10	5288282
Dissolved Vanadium (V)	ug/L	5000	-	0.60	0.50	5288282	ND	0.50	5288282

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
Criteria: The City of Barrie Discharges to Sanitary Sewers By Law 2012-172
Criteria-2: The City of Barrie Discharges to Storm Sewers By Law 2012-172
ND = Not detected

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Maxxam Job #: B7Q6326
Report Date: 2017/12/11

exp Services Inc
Client Project #: BAR-00055075-A0
Site Location: 883 MAPLEVIEW
Your P.O. #: ENV-BAR
Sampler Initials: JL

RCAP - COMPREHENSIVE (LAB FILTERED)

Maxxam ID				FPZ291			FPZ291		
Sampling Date				2017/11/24 13:00			2017/11/24 13:00		
COC Number				617369-06-01			617369-06-01		
	UNITS	Criteria	Criteria-2	BH19	RDL	QC Batch	BH19 Lab-Dup	RDL	QC Batch
Dissolved Zinc (Zn)	ug/L	2000	40	ND	5.0	5288282	ND	5.0	5288282

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
Criteria: The City of Barrie Discharges to Sanitary Sewers By Law 2012-172
Criteria-2: The City of Barrie Discharges to Storm Sewers By Law 2012-172
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Your P.O. #: ENV-BAR
Sampler Initials: JL

RCAP - COMPREHENSIVE (LAB FILTERED)

Maxxam ID				FPZ292		
Sampling Date				2017/11/24 13:10		
COC Number				617369-06-01		
	UNITS	Criteria	Criteria-2	BH12	RDL	QC Batch
Calculated Parameters						
Anion Sum	me/L	-	-	5.67		5286698
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	-	230	1.0	5286007
Calculated TDS	mg/L	-	-	310	1.0	5286485
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	-	1.6	1.0	5286007
Cation Sum	me/L	-	-	5.26	N/A	5286698
Hardness (CaCO3)	mg/L	-	-	250	1.0	5285780
Ion Balance (% Difference)	%	-	-	3.74	N/A	5286037
Langelier Index (@ 20C)	N/A	-	-	0.734		5286699
Langelier Index (@ 4C)	N/A	-	-	0.485		5286700
Saturation pH (@ 20C)	N/A	-	-	7.14		5286699
Saturation pH (@ 4C)	N/A	-	-	7.39		5286700
Inorganics						
Total Ammonia-N	mg/L	-	-	ND	0.050	5291361
Conductivity	umho/cm	-	-	520	1.0	5290858
Dissolved Organic Carbon	mg/L	-	-	1.7	0.50	5287544
Orthophosphate (P)	mg/L	-	-	ND	0.010	5289235
pH	pH	6.0:9.5	6.0:9.5	7.87		5290857
Dissolved Sulphate (SO4)	mg/L	1500	-	7.4	1.0	5289230
Alkalinity (Total as CaCO3)	mg/L	-	-	230	1.0	5290853
Dissolved Chloride (Cl)	mg/L	1500	-	8.0	1.0	5289227
Nitrite (N)	mg/L	-	-	ND	0.010	5289135
Nitrate (N)	mg/L	-	-	8.30	0.10	5289135
Nitrate + Nitrite (N)	mg/L	-	-	8.30	0.10	5289135
Metals						
Dissolved Aluminum (Al)	ug/L	50000	-	ND	5.0	5288282
Dissolved Antimony (Sb)	ug/L	5000	-	ND	0.50	5288282

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: The City of Barrie Discharges to Sanitary Sewers By Law 2012-172
Criteria-2: The City of Barrie Discharges to Storm Sewers By Law 2012-172
N/A = Not Applicable
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Client Project #: BAR-00055075-A0
Site Location: 883 MAPLEVIEW
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Sampler Initials: JL

RCAP - COMPREHENSIVE (LAB FILTERED)

Maxxam ID				FPZ292		
Sampling Date				2017/11/24 13:10		
COC Number				617369-06-01		
	UNITS	Criteria	Criteria-2	BH12	RDL	QC Batch
Dissolved Arsenic (As)	ug/L	1000	-	ND	1.0	5288282
Dissolved Barium (Ba)	ug/L	5000	-	41	2.0	5288282
Dissolved Beryllium (Be)	ug/L	-	-	ND	0.50	5288282
Dissolved Boron (B)	ug/L	-	-	33	10	5288282
Dissolved Cadmium (Cd)	ug/L	700	1	ND	0.10	5288282
Dissolved Calcium (Ca)	ug/L	-	-	81000	200	5288282
Dissolved Chromium (Cr)	ug/L	2000	80	ND	5.0	5288282
Dissolved Cobalt (Co)	ug/L	5000	-	ND	0.50	5288282
Dissolved Copper (Cu)	ug/L	2000	10	ND	1.0	5288282
Dissolved Iron (Fe)	ug/L	50000	-	ND	100	5288282
Dissolved Lead (Pb)	ug/L	700	50	ND	0.50	5288282
Dissolved Magnesium (Mg)	ug/L	-	-	12000	50	5288282
Dissolved Manganese (Mn)	ug/L	5000	-	ND	2.0	5288282
Dissolved Molybdenum (Mo)	ug/L	5000	-	2.3	0.50	5288282
Dissolved Nickel (Ni)	ug/L	2000	50	ND	1.0	5288282
Dissolved Phosphorus (P)	ug/L	-	-	ND	100	5288282
Dissolved Potassium (K)	ug/L	-	-	2200	200	5288282
Dissolved Selenium (Se)	ug/L	1000	-	ND	2.0	5288282
Dissolved Silicon (Si)	ug/L	-	-	6000	50	5288282
Dissolved Silver (Ag)	ug/L	400	-	ND	0.10	5288282
Dissolved Sodium (Na)	ug/L	-	-	4500	100	5288282
Dissolved Strontium (Sr)	ug/L	-	-	140	1.0	5288282
Dissolved Thallium (Tl)	ug/L	-	-	ND	0.050	5288282
Dissolved Titanium (Ti)	ug/L	-	-	ND	5.0	5288282
Dissolved Uranium (U)	ug/L	-	-	0.42	0.10	5288282
Dissolved Vanadium (V)	ug/L	5000	-	ND	0.50	5288282
Dissolved Zinc (Zn)	ug/L	2000	40	ND	5.0	5288282

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: The City of Barrie Discharges to Sanitary Sewers By Law 2012-172
Criteria-2: The City of Barrie Discharges to Storm Sewers By Law 2012-172
ND = Not detected

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Maxxam Job #: B7Q6326
Report Date: 2017/12/11

exp Services Inc
Client Project #: BAR-00055075-A0
Site Location: 883 MAPLEVIEW
Your P.O. #: ENV-BAR
Sampler Initials: JL

TEST SUMMARY

Maxxam ID: FPZ290
Sample ID: BH32
Matrix: Water

Collected: 2017/11/24
Shipped:
Received: 2017/11/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Sewer Use By-Law Semivolatile Organics	GC/MS	5288563	2017/11/28	2017/11/29	Kathy Horvat
Biochemical Oxygen Demand (BOD)	DO	5288731	2017/11/28	2017/12/03	Frank Zhang
Chloride by Automated Colourimetry	KONE	5289209	N/A	2017/11/29	Alina Dobreanu
Chemical Oxygen Demand	SPEC	5291149	N/A	2017/11/30	Viorica Rotaru
Total Cyanide	SKAL/CN	5287537	2017/11/28	2017/11/29	Xuanhong Qiu
Fluoride	ISE	5291581	2017/11/29	2017/12/01	Neil Dassanayake
Mercury in Water by CVAA	CV/AA	5292135	2017/11/30	2017/11/30	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5290041	N/A	2017/11/29	Prempal Bhatti
Neutral Chlorinated in Water by GC/ECD	GC/ECD	5291079	2017/11/29	2017/12/01	Joy Zhang
Animal and Vegetable Oil and Grease	BAL	5285908	N/A	2017/12/01	Automated Statchk
Total Oil and Grease	BAL	5295067	2017/12/01	2017/12/01	Mansoor Ahmed
pH	AT	5291585	N/A	2017/12/01	Neil Dassanayake
Phenols (4AAP)	TECH/PHEN	5288835	N/A	2017/11/28	Zahid Soikot
Sulphate by Automated Colourimetry	KONE	5289216	N/A	2017/11/29	Alina Dobreanu
Sulphide	ISE/S	5288505	N/A	2017/11/29	Tahir Anwar
Total Kjeldahl Nitrogen in Water	SKAL	5291261	2017/11/29	2017/11/30	Rajni Tyagi
Total PAHs (Barrie Sewer By-law)	CALC	5286701	N/A	2017/11/30	Automated Statchk
Mineral/Synthetic O & G (TPH Heavy Oil)	BAL	5295083	2017/12/01	2017/12/01	Mansoor Ahmed
Total Suspended Solids	BAL	5288269	2017/11/28	2017/11/29	Bansari Ray
Volatile Organic Compounds in Water	P&T/MS	5287471	N/A	2017/11/29	Dina Wang

Maxxam ID: FPZ290 Dup
Sample ID: BH32
Matrix: Water

Collected: 2017/11/24
Shipped:
Received: 2017/11/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Cyanide	SKAL/CN	5287537	2017/11/28	2017/11/29	Xuanhong Qiu

Maxxam ID: FPZ291
Sample ID: BH19
Matrix: Water

Collected: 2017/11/24
Shipped:
Received: 2017/11/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5288319	N/A	2017/11/29	Neil Dassanayake
Carbonate, Bicarbonate and Hydroxide	CALC	5286007	N/A	2017/11/30	Automated Statchk
Chloride by Automated Colourimetry	KONE	5289227	N/A	2017/11/29	Alina Dobreanu
Conductivity	AT	5288326	N/A	2017/11/29	Neil Dassanayake
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5287544	N/A	2017/11/28	Anastasia Hamanov
Hardness (calculated as CaCO3)		5285780	N/A	2017/11/29	Automated Statchk
Lab Filtered Metals by ICPMS	ICP/MS	5288282	2017/11/28	2017/11/29	Matthew Ritenburg
Ion Balance (% Difference)	CALC	5286037	N/A	2017/11/30	Automated Statchk
Anion and Cation Sum	CALC	5286698	N/A	2017/11/30	Automated Statchk
Total Ammonia-N	LACH/NH4	5291361	N/A	2017/12/01	Charles Opoku-Ware

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Maxxam Job #: B7Q6326
Report Date: 2017/12/11

exp Services Inc
Client Project #: BAR-00055075-A0
Site Location: 883 MAPLEVIEW
Your P.O. #: ENV-BAR
Sampler Initials: JL

TEST SUMMARY

Maxxam ID: FPZ291
Sample ID: BH19
Matrix: Water

Collected: 2017/11/24
Shipped:
Received: 2017/11/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5289135	N/A	2017/11/29	Chandra Nandlal
pH	AT	5288329	N/A	2017/11/29	Neil Dassanayake
Orthophosphate	KONE	5289235	N/A	2017/11/29	Alina Dobreanu
Sat. pH and Langelier Index (@ 20C)	CALC	5286699	N/A	2017/11/30	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	5286700	N/A	2017/11/30	Automated Statchk
Sulphate by Automated Colourimetry	KONE	5289230	N/A	2017/11/29	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5286485	N/A	2017/11/30	Automated Statchk

Maxxam ID: FPZ291 Dup
Sample ID: BH19
Matrix: Water

Collected: 2017/11/24
Shipped:
Received: 2017/11/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Lab Filtered Metals by ICPMS	ICP/MS	5288282	2017/11/28	2017/11/29	Matthew Ritenburg

Maxxam ID: FPZ292
Sample ID: BH12
Matrix: Water

Collected: 2017/11/24
Shipped:
Received: 2017/11/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5290853	N/A	2017/11/30	Neil Dassanayake
Carbonate, Bicarbonate and Hydroxide	CALC	5286007	N/A	2017/12/01	Automated Statchk
Chloride by Automated Colourimetry	KONE	5289227	N/A	2017/11/29	Alina Dobreanu
Conductivity	AT	5290858	N/A	2017/11/30	Neil Dassanayake
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5287544	N/A	2017/11/28	Anastasia Hamanov
Hardness (calculated as CaCO3)		5285780	N/A	2017/11/29	Automated Statchk
Lab Filtered Metals by ICPMS	ICP/MS	5288282	2017/11/28	2017/11/29	Matthew Ritenburg
Ion Balance (% Difference)	CALC	5286037	N/A	2017/12/01	Automated Statchk
Anion and Cation Sum	CALC	5286698	N/A	2017/12/01	Automated Statchk
Total Ammonia-N	LACH/NH4	5291361	N/A	2017/12/01	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5289135	N/A	2017/11/29	Chandra Nandlal
pH	AT	5290857	N/A	2017/11/30	Neil Dassanayake
Orthophosphate	KONE	5289235	N/A	2017/11/29	Alina Dobreanu
Sat. pH and Langelier Index (@ 20C)	CALC	5286699	N/A	2017/12/01	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	5286700	N/A	2017/12/01	Automated Statchk
Sulphate by Automated Colourimetry	KONE	5289230	N/A	2017/11/29	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5286485	N/A	2017/12/01	Automated Statchk

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GENERAL COMMENTS

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

Package 1	3.0°C

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

exp Services Inc
Client Project #: BAR-00055075-A0
Site Location: 883 MAPLEVIEW
Your P.O. #: ENV-BAR
Sampler Initials: JL

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5287471	4-Bromofluorobenzene	2017/11/29	103	70 - 130	105	70 - 130	101	%				
5287471	D4-1,2-Dichloroethane	2017/11/29	100	70 - 130	101	70 - 130	100	%				
5287471	D8-Toluene	2017/11/29	101	70 - 130	101	70 - 130	101	%				
5288563	2,4,6-Tribromophenol	2017/11/29			95	10 - 130	69	%				
5288563	2-Fluorobiphenyl	2017/11/29			63	30 - 130	79	%				
5288563	D14-Terphenyl (FS)	2017/11/29			104	30 - 130	96	%				
5288563	D5-Nitrobenzene	2017/11/29			88	30 - 130	95	%				
5288563	D8-Acenaphthylene	2017/11/29			76	30 - 130	79	%				
5291079	1,3,5-Tribromobenzene	2017/12/01			97	30 - 130	99	%				
5291079	2,4,5,6-Tetrachloro-m-xylene	2017/12/01			64	30 - 130	73	%				
5291079	Decachlorobiphenyl	2017/12/01			73	30 - 130	82	%				
5291079	Hexabromobenzene	2017/12/01			90	30 - 130	95	%				
5287471	1,1,2,2-Tetrachloroethane	2017/11/29	121	70 - 130	113	70 - 130	ND, RDL=0.20	ug/L	NC	30		
5287471	1,2-Dichlorobenzene	2017/11/29	101	70 - 130	101	70 - 130	ND, RDL=0.20	ug/L	NC	30		
5287471	1,4-Dichlorobenzene	2017/11/29	103	70 - 130	103	70 - 130	ND, RDL=0.20	ug/L	NC	30		
5287471	Benzene	2017/11/29	108	70 - 130	108	70 - 130	ND, RDL=0.10	ug/L	NC	30		
5287471	Ethylbenzene	2017/11/29	101	70 - 130	102	70 - 130	ND, RDL=0.10	ug/L	NC	30		
5287471	Methylene Chloride(Dichloromethane)	2017/11/29	111	70 - 130	101	70 - 130	ND, RDL=0.50	ug/L	NC	30		
5287471	o-Xylene	2017/11/29	101	70 - 130	101	70 - 130	ND, RDL=0.10	ug/L	NC	30		
5287471	p+m-Xylene	2017/11/29	104	70 - 130	105	70 - 130	ND, RDL=0.10	ug/L	NC	30		
5287471	Tetrachloroethylene	2017/11/29	100	70 - 130	102	70 - 130	ND, RDL=0.10	ug/L	NC	30		
5287471	Toluene	2017/11/29	102	70 - 130	102	70 - 130	ND, RDL=0.20	ug/L	NC	30		
5287471	Total Xylenes	2017/11/29					ND, RDL=0.10	ug/L	NC	30		
5287471	Trichloroethylene	2017/11/29	98	70 - 130	102	70 - 130	ND, RDL=0.10	ug/L	NC	30		
5287537	Total Cyanide (CN)	2017/11/29	100	80 - 120	102	80 - 120	ND, RDL=0.0050	mg/L	NC	20		
5287544	Dissolved Organic Carbon	2017/11/28	97	80 - 120	100	80 - 120	ND, RDL=0.50	mg/L	0.64	20		
5288269	Total Suspended Solids	2017/11/29					ND, RDL=10	mg/L	NC	25	97	85 - 115
5288282	Dissolved Aluminum (Al)	2017/11/29	104	80 - 120	99	80 - 120	ND, RDL=5.0	ug/L	7.1	20		
5288282	Dissolved Antimony (Sb)	2017/11/29	110	80 - 120	99	80 - 120	ND, RDL=0.50	ug/L	9.3	20		

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QUALITY ASSURANCE REPORT(CONT'D)

exp Services Inc
Client Project #: BAR-00055075-A0
Site Location: 883 MAPLEVIEW
Your P.O. #: ENV-BAR
Sampler Initials: JL

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5288282	Dissolved Arsenic (As)	2017/11/29	106	80 - 120	95	80 - 120	ND, RDL=1.0	ug/L	NC	20		
5288282	Dissolved Barium (Ba)	2017/11/29	108	80 - 120	99	80 - 120	ND, RDL=2.0	ug/L	3.5	20		
5288282	Dissolved Beryllium (Be)	2017/11/29	107	80 - 120	98	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5288282	Dissolved Boron (B)	2017/11/29	109	80 - 120	97	80 - 120	ND, RDL=10	ug/L	1.3	20		
5288282	Dissolved Cadmium (Cd)	2017/11/29	105	80 - 120	96	80 - 120	ND, RDL=0.10	ug/L	NC	20		
5288282	Dissolved Calcium (Ca)	2017/11/29	NC	80 - 120	94	80 - 120	ND, RDL=200	ug/L	0.067	20		
5288282	Dissolved Chromium (Cr)	2017/11/29	105	80 - 120	94	80 - 120	ND, RDL=5.0	ug/L	NC	20		
5288282	Dissolved Cobalt (Co)	2017/11/29	103	80 - 120	93	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5288282	Dissolved Copper (Cu)	2017/11/29	106	80 - 120	98	80 - 120	ND, RDL=1.0	ug/L	2.5	20		
5288282	Dissolved Iron (Fe)	2017/11/29	105	80 - 120	95	80 - 120	ND, RDL=100	ug/L	NC	20		
5288282	Dissolved Lead (Pb)	2017/11/29	100	80 - 120	93	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5288282	Dissolved Magnesium (Mg)	2017/11/29	103	80 - 120	94	80 - 120	ND, RDL=50	ug/L	1.7	20		
5288282	Dissolved Manganese (Mn)	2017/11/29	106	80 - 120	96	80 - 120	ND, RDL=2.0	ug/L	6.3	20		
5288282	Dissolved Molybdenum (Mo)	2017/11/29	108	80 - 120	97	80 - 120	ND, RDL=0.50	ug/L	4.6	20		
5288282	Dissolved Nickel (Ni)	2017/11/29	102	80 - 120	93	80 - 120	ND, RDL=1.0	ug/L	NC	20		
5288282	Dissolved Phosphorus (P)	2017/11/29	110	80 - 120	105	80 - 120	ND, RDL=100	ug/L	NC	20		
5288282	Dissolved Potassium (K)	2017/11/29	105	80 - 120	96	80 - 120	ND, RDL=200	ug/L	0.59	20		
5288282	Dissolved Selenium (Se)	2017/11/29	102	80 - 120	93	80 - 120	ND, RDL=2.0	ug/L	NC	20		
5288282	Dissolved Silicon (Si)	2017/11/29	100	80 - 120	92	80 - 120	ND, RDL=50	ug/L	0.98	20		
5288282	Dissolved Silver (Ag)	2017/11/29	102	80 - 120	93	80 - 120	ND, RDL=0.10	ug/L	NC	20		
5288282	Dissolved Sodium (Na)	2017/11/29	103	80 - 120	94	80 - 120	ND, RDL=100	ug/L	0.99	20		
5288282	Dissolved Strontium (Sr)	2017/11/29	104	80 - 120	93	80 - 120	ND, RDL=1.0	ug/L	2.2	20		
5288282	Dissolved Thallium (Tl)	2017/11/29	99	80 - 120	91	80 - 120	ND, RDL=0.050	ug/L	NC	20		
5288282	Dissolved Titanium (Ti)	2017/11/29	105	80 - 120	95	80 - 120	ND, RDL=5.0	ug/L	NC	20		
5288282	Dissolved Uranium (U)	2017/11/29	100	80 - 120	91	80 - 120	ND, RDL=0.10	ug/L	2.4	20		
5288282	Dissolved Vanadium (V)	2017/11/29	106	80 - 120	94	80 - 120	ND, RDL=0.50	ug/L	19	20		
5288282	Dissolved Zinc (Zn)	2017/11/29	104	80 - 120	94	80 - 120	ND, RDL=5.0	ug/L	NC	20		
5288319	Alkalinity (Total as CaCO3)	2017/11/29			97	85 - 115	ND, RDL=1.0	mg/L	0.69	20		

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QUALITY ASSURANCE REPORT(CONT'D)

exp Services Inc
Client Project #: BAR-00055075-A0
Site Location: 883 MAPLEVIEW
Your P.O. #: ENV-BAR
Sampler Initials: JL

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5288326	Conductivity	2017/11/29			101	85 - 115	ND, RDL=1.0	umho/cm	0.17	25		
5288329	pH	2017/11/29			102	98 - 103			0.31	N/A		
5288505	Sulphide	2017/11/29	91	80 - 120	91	80 - 120	ND, RDL=0.020	mg/L	7.5	20		
5288563	1-Methylnaphthalene	2017/11/29			77	30 - 130	ND, RDL=0.3	ug/L	33	40		
5288563	2-Methylnaphthalene	2017/11/29			73	30 - 130	ND, RDL=0.3	ug/L	32	40		
5288563	Acenaphthene	2017/11/29			86	30 - 130	ND, RDL=0.3	ug/L	34	40		
5288563	Acenaphthylene	2017/11/29			84	30 - 130	ND, RDL=0.3	ug/L	34	40		
5288563	Anthracene	2017/11/29			95	30 - 130	ND, RDL=0.2	ug/L	16	40		
5288563	Benzo(a)anthracene	2017/11/29			103	30 - 130	ND, RDL=0.2	ug/L	5.5	40		
5288563	Benzo(a)pyrene	2017/11/29			100	30 - 130	ND, RDL=0.2	ug/L	7.2	40		
5288563	Benzo(b/j)fluoranthene	2017/11/29			106	30 - 130	ND, RDL=0.2	ug/L	7.5	40		
5288563	Benzo(g,h,i)perylene	2017/11/29			102	30 - 130	ND, RDL=0.2	ug/L	5.0	40		
5288563	Benzo(k)fluoranthene	2017/11/29			92	30 - 130	ND, RDL=0.2	ug/L	11	40		
5288563	Chrysene	2017/11/29			106	30 - 130	ND, RDL=0.2	ug/L	6.7	40		
5288563	Dibenz(a,h)anthracene	2017/11/29			102	30 - 130	ND, RDL=0.2	ug/L	5.4	40		
5288563	Fluoranthene	2017/11/29			110	30 - 130	ND, RDL=0.2	ug/L	8.3	40		
5288563	Fluorene	2017/11/29			93	30 - 130	ND, RDL=0.3	ug/L	33	40		
5288563	Indeno(1,2,3-cd)pyrene	2017/11/29			101	30 - 130	ND, RDL=0.2	ug/L	7.7	40		
5288563	Naphthalene	2017/11/29			69	30 - 130	ND, RDL=0.3	ug/L	29	40		
5288563	Phenanthrene	2017/11/29			99	30 - 130	ND, RDL=0.2	ug/L	17	40		
5288563	Pyrene	2017/11/29			112	30 - 130	ND, RDL=0.2	ug/L	7.7	40		
5288731	Total BOD	2017/12/03					ND, RDL=2.0	mg/L	NC	25	103	80 - 120
5288835	Phenols-4AAP	2017/11/28	96	80 - 120	95	80 - 120	ND, RDL=0.0010	mg/L	NC	20		
5289135	Nitrate (N)	2017/11/29	94	80 - 120	100	80 - 120	ND, RDL=0.10	mg/L	3.4	20		
5289135	Nitrite (N)	2017/11/29	103	80 - 120	103	80 - 120	ND, RDL=0.010	mg/L	8.3	20		
5289209	Dissolved Chloride (Cl)	2017/11/29	105	80 - 120	103	80 - 120	ND, RDL=1.0	mg/L	2.7	20		
5289216	Dissolved Sulphate (SO4)	2017/11/29	101	75 - 125	102	80 - 120	ND, RDL=1.0	mg/L	NC	20		

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QUALITY ASSURANCE REPORT(CONT'D)

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Sampler Initials: JL

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5289227	Dissolved Chloride (Cl)	2017/11/29	101	80 - 120	103	80 - 120	ND, RDL=1.0	mg/L	1.4	20		
5289230	Dissolved Sulphate (SO4)	2017/11/29	110	75 - 125	104	80 - 120	ND, RDL=1.0	mg/L	0.91	20		
5289235	Orthophosphate (P)	2017/11/29	95	75 - 125	100	80 - 120	ND, RDL=0.010	mg/L	NC	25		
5290041	Total Aluminum (Al)	2017/11/29	94	80 - 120	94	80 - 120	ND, RDL=5.0	ug/L	12	20		
5290041	Total Antimony (Sb)	2017/11/29	104	80 - 120	105	80 - 120	ND, RDL=0.50	ug/L				
5290041	Total Arsenic (As)	2017/11/29	95	80 - 120	98	80 - 120	ND, RDL=1.0	ug/L				
5290041	Total Barium (Ba)	2017/11/29	91	80 - 120	93	80 - 120	ND, RDL=2.0	ug/L				
5290041	Total Bismuth (Bi)	2017/11/29	98	80 - 120	97	80 - 120	ND, RDL=1.0	ug/L				
5290041	Total Cadmium (Cd)	2017/11/29	99	80 - 120	100	80 - 120	ND, RDL=0.10	ug/L	NC	20		
5290041	Total Chromium (Cr)	2017/11/29	91	80 - 120	93	80 - 120	ND, RDL=5.0	ug/L	NC	20		
5290041	Total Cobalt (Co)	2017/11/29	93	80 - 120	95	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5290041	Total Copper (Cu)	2017/11/29	93	80 - 120	93	80 - 120	ND, RDL=1.0	ug/L	4.1	20		
5290041	Total Iron (Fe)	2017/11/29	NC	80 - 120	98	80 - 120	ND, RDL=100	ug/L	1.4	20		
5290041	Total Lead (Pb)	2017/11/29	99	80 - 120	98	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5290041	Total Manganese (Mn)	2017/11/29	NC	80 - 120	93	80 - 120	ND, RDL=2.0	ug/L	2.0	20		
5290041	Total Molybdenum (Mo)	2017/11/29	95	80 - 120	94	80 - 120	ND, RDL=0.50	ug/L	0.22	20		
5290041	Total Nickel (Ni)	2017/11/29	94	80 - 120	97	80 - 120	ND, RDL=1.0	ug/L	1.9	20		
5290041	Total Phosphorus (P)	2017/11/29	99	80 - 120	97	80 - 120	ND, RDL=100	ug/L				
5290041	Total Selenium (Se)	2017/11/29	99	80 - 120	99	80 - 120	ND, RDL=2.0	ug/L				
5290041	Total Silver (Ag)	2017/11/29	95	80 - 120	95	80 - 120	ND, RDL=0.10	ug/L				
5290041	Total Tin (Sn)	2017/11/29	100	80 - 120	100	80 - 120	ND, RDL=1.0	ug/L				
5290041	Total Vanadium (V)	2017/11/29	92	80 - 120	94	80 - 120	ND, RDL=0.50	ug/L				
5290041	Total Zinc (Zn)	2017/11/29	96	80 - 120	98	80 - 120	ND, RDL=5.0	ug/L	9.9	20		
5290853	Alkalinity (Total as CaCO3)	2017/11/30			96	85 - 115	ND, RDL=1.0	mg/L	0.038	20		
5290857	pH	2017/11/30			101	98 - 103			1.8	N/A		
5290858	Conductivity	2017/11/30			100	85 - 115	ND, RDL=1.0	umho/cm	0.41	25		
5291079	Hexachlorobenzene	2017/12/01			76	50 - 130	ND, RDL=0.050	ug/L	6.4	40		
5291149	Total Chemical Oxygen Demand (COD)	2017/11/30	105	80 - 120	100	80 - 120	ND, RDL=4.0	mg/L	NC	20		

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Maxxam Job #: B7Q6326
Report Date: 2017/12/11

QUALITY ASSURANCE REPORT(CONT'D)

exp Services Inc
Client Project #: BAR-00055075-A0
Site Location: 883 MAPLEVIEW
Your P.O. #: ENV-BAR
Sampler Initials: JL

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5291261	Total Kjeldahl Nitrogen (TKN)	2017/11/30	96	80 - 120	97	80 - 120	ND, RDL=0.10	mg/L	NC	20	108	80 - 120
5291361	Total Ammonia-N	2017/12/01	99	80 - 120	101	85 - 115	ND, RDL=0.050	mg/L	NC	20		
5291581	Fluoride (F-)	2017/12/01	107	80 - 120	101	80 - 120	ND, RDL=0.10	mg/L	0.47	20		
5291585	pH	2017/12/01			101	98 - 103			0.31	N/A		
5292135	Mercury (Hg)	2017/11/30	104	75 - 125	99	80 - 120	ND, RDL=0.0001	mg/L	NC	20		
5295067	Total Oil & Grease	2017/12/01			99	85 - 115	ND, RDL=0.50	mg/L	1.1	25		
5295083	Total Oil & Grease Mineral/Synthetic	2017/12/01			93	85 - 115	ND, RDL=0.50	mg/L	4.1	25		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

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).

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mi Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam
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Maxxam Job #: B7Q6326
Report Date: 2017/12/11

exp Services Inc
Client Project #: BAR-00055075-A0
Site Location: 883 MAPLEVIEW
Your P.O. #: ENV-BAR
Sampler Initials: JL

VALIDATION SIGNATURE PAGE

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

Cristina Carriere

Cristina Carriere, Scientific Service Specialist

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Maxxam Job #: B7Q6326
Report Date: 2017/12/11

exp Services Inc
Client Project #: BAR-00055075-A0
Site Location: 883 MAPLEVIEW
Your P.O. #: ENV-BAR
Sampler Initials: JL

Exceedence Summary Table – Barrie Sanitary Sewer

Result Exceedences

Sample ID	Maxxam ID	Parameter	Criteria	Result	DL	Units
No Exceedences						

The exceedence summary table is for information purposes only and should not be considered a comprehensive listing or statement of conformance to applicable regulatory guidelines.

Exceedence Summary Table – Barrie Storm Sewer

Result Exceedences

Sample ID	Maxxam ID	Parameter	Criteria	Result	DL	Units
No Exceedences						

The exceedence summary table is for information purposes only and should not be considered a comprehensive listing or statement of conformance to applicable regulatory guidelines.

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Your P.O. #: ENV-BAR
Your Project #: MB7Q6326
Site#: 883 MAPLEVIEW
Site Location: BAR-00055075-A0
Your C.O.C. #: B7Q6326-M058-01-01

Attention:Deepthi Shaji
MAXXAM ANALYTICS
CAMPOBELLO
6740 CAMPOBELLO ROAD
MISSISSAUGA, ON
CANADA L5N 2L8

Report Date: 2017/12/05
Report #: R2486681
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7A6096
Received: 2017/11/29, 08:30

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Elements by ICPMS Digested LL (total)	1	2017/12/01	2017/12/04	BBY7SOP-00003,	BCLM2005,EPA6020bR2m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam 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.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam 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 Maxxam, unless otherwise agreed in writing.

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.
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.

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Your P.O. #: ENV-BAR
Your Project #: MB7Q6326
Site#: 883 MAPLEVIEW
Site Location: BAR-00055075-A0
Your C.O.C. #: B7Q6326-M058-01-01

Attention:Deepthi Shaji
MAXXAM ANALYTICS
CAMPOBELLO
6740 CAMPOBELLO ROAD
MISSISSAUGA, ON
CANADA L5N 2L8

Report Date: 2017/12/05
Report #: R2486681
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7A6096
Received: 2017/11/29, 08:30

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Dan Woolger, Project Manager
Email: dwoolger@maxxam.ca
Phone# (604) 734 7276

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Maxxam
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Maxxam Job #: B7A6096
Report Date: 2017/12/05

MAXXAM ANALYTICS
Client Project #: MB7Q6326
Site Location: BAR-00055075-A0
Your P.O. #: ENV-BAR
Sampler Initials: JL

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		SO7381		
Sampling Date		2017/11/24 11:30		
COC Number		B7Q6326-M058-01-01		
	UNITS	BH32 (FPZ290)	RDL	QC Batch
Total Metals by ICPMS				
Total Gold (Au)	ug/L	<0.10	0.10	8849086
Total Platinum (Pt)	ug/L	<0.10	0.10	8849086
RDL = Reportable Detection Limit				

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Maxxam Job #: B7A6096
Report Date: 2017/12/05

MAXXAM ANALYTICS
Client Project #: MB7Q6326
Site Location: BAR-00055075-A0
Your P.O. #: ENV-BAR
Sampler Initials: JL

TEST SUMMARY

Maxxam ID: SO7381
Sample ID: BH32 (FPZ290)
Matrix: Water

Collected: 2017/11/24
Shipped:
Received: 2017/11/29

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Elements by ICPMS Digested LL (total)	ICP/CRCM	8849086	2017/12/01	2017/12/04	Andrew An

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Maxxam Job #: B7A6096
Report Date: 2017/12/05

MAXXAM ANALYTICS
Client Project #: MB7Q6326
Site Location: BAR-00055075-A0
Your P.O. #: ENV-BAR
Sampler Initials: JL

GENERAL COMMENTS

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

Package 1	-1.3°C

Results relate only to the items tested.

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Maxxam Job #: B7A6096
Report Date: 2017/12/05

QUALITY ASSURANCE REPORT

MAXXAM ANALYTICS
Client Project #: MB7Q6326
Site Location: BAR-00055075-A0
Your P.O. #: ENV-BAR
Sampler Initials: JL

			Method Blank	
QC Batch	Parameter	Date	Value	UNITS
8849086	Total Gold (Au)	2017/12/04	<0.10	ug/L
8849086	Total Platinum (Pt)	2017/12/04	<0.10	ug/L

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

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Maxxam Job #: B7A6096
Report Date: 2017/12/05

MAXXAM ANALYTICS
Client Project #: MB7Q6326
Site Location: BAR-00055075-A0
Your P.O. #: ENV-BAR
Sampler Initials: JL

VALIDATION SIGNATURE PAGE

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

Rob Reinert, B.Sc., Scientific Specialist

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MaxXam

24-Nov-17 19:46
Deepthi Shaji
B7Q6326
KES ENV-1398

INVOICE TO		REPORT TO:		PROJECT INFORMATION:	
Company Name	#30554 exp Services Inc	Company Name		B45887	
Contact	Central Services	Attention		P.O. #	
Address	1595 Clark Blvd	Address		Project	
	Brampton ON L6T 4V1			Project Name	
Tel	(905) 793-9800 x (905) 793-0641 x	Tel	Fax	Site #	
Email	Karen.Burke@exp.com	Email		Sampled By	S.C.

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE MAXXAM DRINKING WATER CHAIN OF CUSTODY

Regulation 153 (2011)	Other Regulations	Special Instructions
☐ 1 ☐ Res/Park ☐ Medium/Fine ☐ 2 ☐ Ind/Comm ☐ Coarse ☐ Table ☐ Agri ☐ Per RSC ☐ 3	☐ CCME ☐ Sanitary Sewer Bylaw ☐ Reg 558 ☐ Storm Sewer Bylaw ☐ MISA Municipality ☐ PWQO ☐ Other	

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

				Matrix	Metals / Hg / Cr VI - Field Filtered (please circle)
				GW	
				GW	
				GW	
				GW	
				GW	
				GW	
				GW	
				GW	
				GW	
				GW	

ANALYSIS REQUESTED (PLEASE BE SPECIFIC):

Turnaround Time (TAT) Required

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 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
	17/11/24		[illegible]	2017/11/24	19 46

jars used and not submitted

Laboratory Use Only
Time Sensitive: 2/2.5 °C on Receipt
Custody Seal Present: Yes ✓ No
Intact: Yes ✓ No

* 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: Maxxam Yellow: Client

Maxxam Analytics International Corporation o/a Maxxam Analytics

Maxxam
A Bureau Veritas Group Company

Your Project #: B7Q6326
Your C.O.C. #: B7Q6326-M400-01-01

Attention:SUBCONTRACTOR

MAXXAM ANALYTICS INC.
MISSISSAUGA CAMPO
6740 Campobello Rd
MISSISSAUGA, ON
Canada L5N 2L8

Report Date: 2017/12/11
Report #: R2342673
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B771297
Received: 2017/11/29, 08:45

Sample Matrix: GROUND WATER
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Primary Reference
Total Extractable Elements by ICP-MS***	1	2017/12/06	2017/12/06	STL SOP-00006	MA.200–Mét. 1.2 R5 m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam 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.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam 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 Maxxam, unless otherwise agreed in writing.

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.
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.
Note: RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

*** This analysis is not subject to MDDELCC accreditation.

889 Montée de Liesse, Ville St-Laurent, Québec, Canada H4T 1P5 Tel: (514) 448-9001 Fax: (514) 448-9199 Ligne sans frais : 1-877-4MAXXAM (462-9926)

Maxxam
A Bureau Veritas Group Company

Your Project #: B7Q6326
Your C.O.C. #: B7Q6326-M400-01-01

Attention:SUBCONTRACTOR

MAXXAM ANALYTICS INC.
MISSISSAUGA CAMPO
6740 Campobello Rd
MISSISSAUGA, ON
Canada L5N 2L8

Report Date: 2017/12/11
Report #: R2342673
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B771297
Received: 2017/11/29, 08:45

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Sophie Retailleau, Project Manager
Email: SRetailleau@maxxam.ca
Phone# (514) 448-9001

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Maxxam
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Maxxam Job #: B771297
Report Date: 2017/12/11

MAXXAM ANALYTICS INC.
Client Project #: B7Q6326
Sampler Initials: JL

TOTAL EXTRACTABLE METALS (GROUND WATER)

Maxxam ID		EX3649		
Sampling Date		2017/11/24 11:30		
COC Number		B7Q6326-M400-01-01		
	Units	FPZ290-BH32	RDL	QC Batch
METALS ICP-MS				
Rhodium (Rh)	ug/L	<0.80	0.80	1865111

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

2017/12/11 16:52

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GENERAL COMMENTS

TOTAL EXTRACTABLE METALS (GROUND WATER)

Please note that the results have not been corrected for QC recoveries nor for the method blank results.
Reported detection limits are modified according to the volume of sample received.
Reported detection limits are multiplied by dilution factors used for sample analysis.

Results relate only to the items tested.

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Maxxam
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Maxxam Job #: B771297
Report Date: 2017/12/11

MAXXAM ANALYTICS INC.
Client Project #: B7Q6326
Sampler Initials: JL

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units	QC Limits
1865111	FS	Spiked Blank	Rhodium (Rh)	2017/12/06		100	%	70 - 130
1865111	FS	Method Blank	Rhodium (Rh)	2017/12/06	<0.50		ug/L	

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.

889 Montée de Liesse, Ville St-Laurent, Québec, Canada H4T 1P5 Tel: (514) 448-9001 Fax: (514) 448-9199 Ligne sans frais : 1-877-4MAXXAM (462-9926)

Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B771297
Report Date: 2017/12/11

MAXXAM ANALYTICS INC.
Client Project #: B7Q6326
Sampler Initials: JL

VALIDATION SIGNATURE PAGE

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

Jonathan Fauvel, B.Sc, Chimiste, Supervisor, Inorganics

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2017/12/11 16:52

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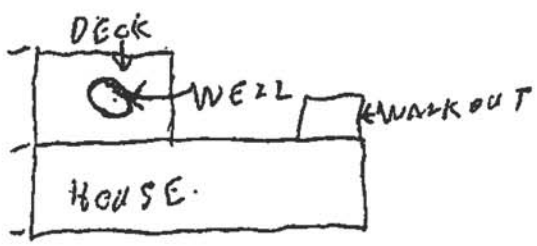
Appendix E:
Completed Well Survey Questionnaires

WELL SURVEY QUESTIONNAIRE
(please select the appropriate box)

☐ ***Agree to Provide Well Information***

I hereby disclose the following information to **exp Services Inc.** regarding the well on the subject property (noted below) and in doing so, acknowledge that the monitoring results may be available to the public on request.

Name	GEORGE VANNISPEN		
Address	802 LOCKHART ROAD BARRIE, ONT. L9J0B6		
Phone	705·436 2169		
Existing well	☐ No wells present at the address noted above ☑ Yes – please refer to requested details below		
Location of Well (Describe location, in reference to existing buildings or structures. If preferred, you can provide a sketch on the back of this page)			
Depth of Well	35 FEET	**Date Drilled** (estimate, if not known)	APPOX 1955
Type of Well: (Dug/Bored or Drilled)	DUG WELL	**Static Water Level**	25 FEET.
Do you have Municipal water?	☑ No ☐ Yes – if yes, is the well still being used?		

☐ ***Decline to Provide Well Information***

I choose not to provide information regarding onsite well (s) to **EXPServices Inc.** at the following address: _____.

George Vannispen
Owner's Signature

DEC 6/2017
Date

Please return to:

Jodi Fountain
EXP Services Inc.
14 Cedar Pointe Drive, Unit 1510
Barrie, ON L4N 5R7

Fax: 705-719-1109

E-mail: jodi.fountain@exp.com
(please include **WELL SURVEY** in subject line).

WELL SURVEY QUESTIONNAIRE
(please select the appropriate box)

☐ ***Agree to Provide Well Information***

I hereby disclose the following information to **exp Services Inc.** regarding the well on the subject property (noted below) and in doing so, acknowledge that the monitoring results may be available to the public on request.

Name	FRANK + MARY DELUCA		
Address	812 LOCKHART RD.		
Phone	905- 775- 0655		
Existing well	☐ No wells present at the address noted above ☒ Yes – please refer to requested details below		
Location of Well (Describe location, in reference to existing buildings or structures. If preferred, you can provide a sketch on the back of this page)	Well is located in front of dwelling		
Depth of Well		**Date Drilled** (estimate, if not known)	1978 79
Type of Well: (Dug/Bored or Drilled)	Dug	**Static Water Level**	
Do you have Municipal water?	☒ No ☐ Yes – if yes, is the well still being used?		

☐ ***Decline to Provide Well Information***

I choose not to provide information regarding onsite well (s) to **EXPServices Inc.** at the following address: _____.

M Deluca
Owner's Signature

Nov 26/2017
Date

Please return to:

Jodi Fountain
EXP Services Inc.
14 Cedar Pointe Drive, Unit 1510
Barrie, ON L4N 5R7

Fax: 705-719-1109

E-mail: jodi.fountain@exp.com
(please include **WELL SURVEY** in subject line).

WELL SURVEY QUESTIONNAIRE
(please select the appropriate box)

☑ ***Agree to Provide Well Information***

I hereby disclose the following information to **exp Services Inc.** regarding the well on the subject property (noted below) and in doing so, acknowledge that the monitoring results may be available to the public on request.

Name	JANICE KIRKHAM		
Address	798 LOCKHART RD, BARRIE, ON L9J 0B6		
Phone	705-436-7829		
Existing well	☐ No wells present at the address noted above ☑ Yes – please refer to requested details below		
Location of Well (Describe location, in reference to existing buildings or structures. If preferred, you can provide a sketch on the back of this page)	- JUST TO THE RIGHT OF THE ~~BACK~~ FRONT YARD PATIO IF YOU ARE FACING ~~NORTH~~ SOUTH ~~(SEE ATTACHED SKETCH)~~ (SEE BACK)		
Depth of Well	50-100 ft ?	**Date Drilled** (estimate, if not known)	1984 or 1985 ?
Type of Well: (Dug/Bored or Drilled)	Drilled	**Static Water Level**	?
Do you have Municipal water?	☑ No ☐ Yes – if yes, is the well still being used?		

☐ ***Decline to Provide Well Information***

I choose not to provide information regarding onsite well (s) to **EXPServices Inc.** at the following address: _____.

Janice Kirkham
Owner's Signature

Nov. 30/17
Date

Please return to:

Jodi Fountain
EXP Services Inc.
14 Cedar Pointe Drive, Unit 1510
Barrie, ON L4N 5R7

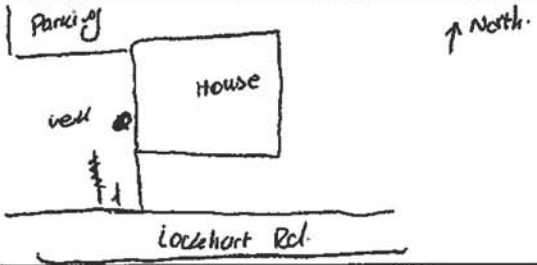
Fax: 705-719-1109

E-mail: jodi.fountain@exp.com
(please include **WELL SURVEY** in subject line).

WELL SURVEY QUESTIONNAIRE
(please select the appropriate box)

☑ ***Agree to Provide Well Information***

I hereby disclose the following information to **exp Services Inc.** regarding the well on the subject property (noted below) and in doing so, acknowledge that the monitoring results may be available to the public on request.

Name	RICHARD BARR		
Address	968 Lockhart Rd		
Phone	BARRIE		
Existing well	☐ No wells present at the address noted above ☑ Yes – please refer to requested details below		
Location of Well (Describe location, in reference to existing buildings or structures. If preferred, you can provide a sketch on the back of this page)			
Depth of Well	44 Feet	**Date Drilled** (estimate, if not known)	1991
Type of Well: (Dug/Bored or Drilled)	Drilled well 6" pipe	**Static Water Level**	
Do you have Municipal water?	☑ No ☐ Yes – if yes, is the well still being used?	14 gal pipe in the, flow = 5 gal/min	

☐ ***Decline to Provide Well Information***

I choose not to provide information regarding onsite well (s) to **EXPServices Inc.** at the following address: _____.

Richard Barr
Owner's Signature

Nov 24/17
Date

Please return to:

Jodi Fountain
EXP Services Inc.
14 Cedar Pointe Drive, Unit 1510
Barrie, ON L4N 5R7

Fax: 705-719-1109

E-mail: jodi.fountain@exp.com
(please include **WELL SURVEY** in subject line).

WELL SURVEY QUESTIONNAIRE
(please select the appropriate box)

☐ ***Agree to Provide Well Information***

I hereby disclose the following information to **exp Services Inc.** regarding the well on the subject property (noted below) and in doing so, acknowledge that the monitoring results may be available to the public on request.

Name			
Address	843 Mapleview Drive.		
Phone			
Existing well	☐ No wells present at the address noted above ☐ Yes – please refer to requested details below		
Location of Well (Describe location, in reference to existing buildings or structures. If preferred, you can provide a sketch on the back of this page)			
Depth of Well		**Date Drilled** (estimate, if not known)	
Type of Well: (Dug/Bored or Drilled)		**Static Water Level**	
Do you have Municipal water?	☐ No ☑ Yes – if yes, is the well still being used?		

☐ ***Decline to Provide Well Information***

I choose not to provide information regarding onsite well (s) to **EXPServices Inc.** at the following address: _____.

Owner's Signature

24 Nov 2017
Date

Please return to:

Jodi Fountain
EXP Services Inc.
14 Cedar Pointe Drive, Unit 1510
Barrie, ON L4N 5R7

Fax: 705-719-1109

E-mail: jodi.fountain@exp.com
(please include **WELL SURVEY** in subject line).

Proposed Residential Development

Geotechnical Investigation
883 Mapleview Drive East, Barrie, Ontario

Project Number
BAR-00055075-A0

Prepared By:

EXP Services Inc.
14 Cedar Pointe Drive, Unit 1510
Barrie, ON L4N 5R7
Canada

Date Submitted
November 29, 2017

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1. Introduction

This report presents the results of a geotechnical investigation carried out for a proposed residential development at 883 Mapleview Drive East in Barrie, Ontario. Concurrently with this work, EXP has undertaken the Hydrogeological Investigation (reported under separate cover) to provide details regarding the groundwater conditions at the site and its associated impacts on the proposed development. This site encompasses a parcel of land approximately 30 hectares (~74.5 acres) in size. The work was authorized by Mr. Steve Bulut of 1091369 Ontario Inc.

The project involves the design and construction of residential dwellings together with the necessary municipal infrastructure such as roads, sewers, water and other services including one (1) stormwater management pond.

The purpose of the geotechnical investigation was to determine the subsurface soil and groundwater conditions at the site and, based on this information, to provide an engineering report with geotechnical recommendations pertaining to the design and construction of the proposed residential development.

The comments and recommendations given in this report are based on the assumption that the above-described design concept will proceed into construction. If changes are made either in the design phase or during construction, this office must be retained to review these modifications. The result of this review may be a modification of our recommendations or it may require additional field or laboratory work to check whether the changes are acceptable from a geotechnical viewpoint.

2. Site Description

The site is located on the south side of Mapleview Drive East and is comprised of a portion of the municipal address 883, in Barrie, Ontario, as shown on Figure 1. The site occupies an area of approximately 30 hectares (~74.5 acres).

The majority of the site consists of an open farm field, partially covered in soya beans upon commencement of the investigation. The site generally slopes downward towards the southeast where wetland with areas of standing water was located.

3. Fieldwork

The field work consisted of advancement of thirty-tree (33) sampled boreholes designated Boreholes 1 to 33. 50 mm diameter monitoring wells were installed in Boreholes 6, 12, 19, 28 and 32. The fieldwork was carried out between October 13 to 26, 2017. The thirty-three (33) sampled boreholes were drilled to depths of approximately 6.1 to 15.8 m below existing grades at the approximate locations shown on the attached Borehole Location Plan (Figure 1).

The boreholes were advanced using continuous flight solid and hollow stem auger equipment owned and operated by a specialist drilling contractor. In each borehole, samples were recovered using conventional split spoon equipment in conjunction with the standard penetration test method.

Water levels were observed in the open boreholes during the course of the fieldwork and in monitoring wells as described earlier for subsequent groundwater level measurement, testing and sampling for hydrogeological purposes.

The fieldwork was supervised throughout by an EXP Services Inc. (EXP) geotechnical technologists who directed the drilling and sampling operations, prepared borehole logs, made groundwater observations during and upon completion of drilling, and processed the recovered samples. In the laboratory, the samples were classified as to their olfactory, visual and textural characteristics. Natural moisture content and density tests were carried out for selected recovered samples, with results presented on the Log of Borehole sheets.

The locations of the boreholes were established in the field by EXP, using a differential GPS survey instrument. The top of borehole elevations (Geodetic) were also obtained by EXP at the same time as boreholes were laid out. The survey information was referenced to the NAD 83 datum.

4. Laboratory Testing

The laboratory testing program comprised the following:

- Moisture content on all recovered soil samples, with results presented on the Log of Borehole sheets.
  - Grain Size Analysis on the following five (5) selected soil samples:
  - BH1 SS12 Borehole 1 – 12.0 to 12.4 m depth
  - BH6 SS11 Borehole 6 – 10.5 to 10.8 m depth
  - BH13 SS5 Borehole 13 – 3.0 to 3.6 m depth
  - BH22 SS11 Borehole 22 – 10.5 to 11.1 m depth
  - BH23 SS5 Borehole 23 – 3.0 to 3.6 m depth

See Figures 35 and 36 in the appendices for full results.

5. Subsurface Conditions

The detailed profiles encountered in each borehole and the results of laboratory moisture are indicated on the attached borehole logs (Figures 2 through 34). It should be noted that the soil boundaries indicated on the borehole logs are inferred from non-continuous sampling and observations during drilling. These boundaries are intended to reflect transition zones, for the purpose of geotechnical design and should not be interpreted as exact planes of geological change. The "Notes on Sample Description" preceding the borehole logs are an integral part of and should be read in conjunction with this report.

The stratigraphy encountered at the site, as revealed in the boreholes, generally comprised surficial topsoil and ploughed soil, followed by silty sand till and sand deposits. Isolated deposits of clayey silt, silty sand, silt and gravelly sand were also encountered.

A brief description of the soil profiles follows.

Topsoil / Ploughed Soil

A surficial layer of topsoil 180 to 400 mm thick was encountered in all Boreholes. However, given use of the property for agricultural purposes disturbed (ploughed) soil should be expected to typical ploughing depths of up to 600 to 800 mm.

It should be noted that topsoil and disturbed (ploughed) soil measurements were carried out at the borehole locations only and could differ at other locations on the site. Consequently, topsoil and disturbed (ploughed) soil quantities should not be established from the information provided at the borehole locations. If required, a more detailed test pit program should be carried out to more accurately quantify the amount of topsoil and disturbed (ploughed) soil to be removed for construction purposes.

Silty Sand Till

One of two predominant soil deposit at this site is glacial silty sand till. A silty sand till deposit was encountered in all of the boreholes (typically directly underneath the topsoil) with the exception of Borehole 9. The till contained trace to some gravel, trace to some clay and was embedded with occasional cobbles and boulders. These deposits existed in a loose to very dense state of compactness. Moisture contents of the silty sand till deposit ranged from 5 to 31 %, but were typically about 7 to 13%. Boreholes BH4, BH13, BH16, BH20, BH23, BH25-BH27 and BH29 all terminated in this deposit.

Grain size analysis on two (2) silty sand till samples were completed, the grain size distributions are summarized in the following table:

Table 1: Particle Size Distribution Summary

Borehole No. / Sample No.	Depth Interval below Grade (m)	Elevation Interval (m)	Percentage		
			Gravel	Sand	Silt & Clay
BH13 SS5	3.0 – 3.6	255.2 – 255.8	15	55	30
BH23 SS5	3.0 – 3.6	257.3 – 257.9	16	72	12

Sand

The other predominate soil type encountered at the site is sand. The sand deposits were typically encountered underneath the till deposits described above. The sand was fine to medium grained, contained trace to some silt and trace to some gravel. The sand was typically the terminal deposit encountered in the boreholes, with the exceptions detailed in the till section above and Borehole BH9. The compactness condition of the sand varied from very loose to very dense but was typically dense to very dense. Moisture contents ranged from 2 to 21%, but were typically around 11 to 20%.

Grain size analysis on two (2) sand samples were completed, the grain size distributions are summarized in the following table:

Table 2: Particle Size Distribution Summary

Borehole No. / Sample No.	Depth Interval below Grade (m)	Elevation Interval (m)	Percentage		
			Gravel	Sand	Silt & Clay
BH1 SS12	12.0 – 12.4	245.3 – 245.7	0	83	17
BH6 SS11	10.5 – 10.8	250.0 – 250.3	0	83	17

Silty Sand

In Boreholes BH9, BH25 and BH26, near surface deposits of silty sand were encountered, extending to a depth of approximately 1.5 m below existing grades. It typically contained trace gravel and was reddish brown in colour. These deposits existed in a very loose to loose state of compactness. Moisture contents of these moist to wet deposits varied from 2 to 4%.

Silt

An isolated silt deposit was encountered in Borehole BH22. It contained some clay, trace sand. The silt typically had a very stiff to hard consistency. Moisture contents of the wet silt ranged from 20 to 24%.

Grain size analysis on one (1) silt sample was completed, the grain size distribution is summarized in the following table:

Table 3: Particle Size Distribution Summary

Borehole No. / Sample No.	Depth Interval below Grade (m)	Elevation Interval (m)	Percentage		
			Gravel	Sand	Silt & Clay
BH22 SS11	10.5 – 11.1	249.8 – 250.4	0	3	97

Gravelly Sand

A seam of gravelly sand was encountered within the till deposit in Borehole BH23, extending from 1.4 to 2.5 m below existing grade. The gravelly sand contained trace silt and had a compactness condition that ranged from compact to dense. Moisture contents of the gravelly sand ranged from 9 to 10%.

Clayey Silt

Boreholes BH30 and BH32 a 1.2 to 1.5 metre thick clayey silt deposit was encountered, below the topsoil in BH30 and as a seam within the till deposit in BH32. The consistency of these deposits was firm to stiff and the moisture contents ranged from 13 to 29%.

Groundwater

Groundwater conditions were observed in the open boreholes during the course of the fieldwork and in the monitoring wells installed at five (5) selected borehole locations for subsequent groundwater measurements. Detailed groundwater conditions are presented in the hydrogeological study which will be submitted under separate cover. This information is summarized below.

Upon completion of drilling, Boreholes BH20, BH21, BH25 and BH26 were open and dry. Upon completion, the groundwater levels in the remaining open boreholes (those without a well installation) varied from 1.2 to 6.9 metres below grade. Groundwater levels were measured in the monitoring wells on November 23, 2017 and were found to vary from 7.84 metres below grade to artesian.

Detailed groundwater information are presented in the Hydrogeological study which will be submitted under separate cover.

The monitoring wells were installed in general accordance with the Ontario Water Resources Act-R.R.O. 1990, Regulation 903 – Amended to O. Reg. 128/03 by CSD, by a licensed well contractor. When the use of the monitoring wells is no longer required, they must be decommissioned in accordance with the procedure outlined in the Ontario Water Resources Act – R.R.O. 1990, Regulation 903 – Amended to O. Reg. 128/03.

6. Engineering Discussion and Recommendations

6.1 General

The project involves the proposed design and construction of several hundred single-family house units together with the necessary municipal infrastructure such as roads and sewers. It is further understood that the preliminary plan calls for a stormwater management pond at the southeast corner of the site. No construction details regarding site services and the pond were made available at the time of this investigation.

Based on the information revealed in the limited boreholes drilled at the site, some construction difficulties should be anticipated due to high groundwater tables recorded in the monitoring wells.

The following subsections provide geotechnical engineering guidelines for the design and construction of the proposed residential development.

6.2 Site Grading

Final site grades have not been established at the time of this investigation. However, it is anticipated that some regrading (i.e. cut and fill operations) will be carried out for the construction of residential dwellings. The following procedures are recommended for the construction of structural fill for building lots and pavement areas, where required.

- All vegetation, topsoil, topsoil-stained and loose/soft native soils should be removed from proposed building and pavement areas. Foundations and slabs associated with the existing farm buildings should be removed and disposed of. All monitoring wells installed for this investigation should also be properly decommissioned.

- The exposed subgrade surface should be proof-rolled with a heavy roller and examined by a geotechnical engineer from EXP. Any soft or loose spots encountered during the process should be sub-excavated and replaced with approved on-site or imported materials, compacted to 100% standard Proctor maximum dry density (SPMDD).

- Low areas can then be brought up to final subgrade level with approved on-site or imported material placed in lifts not exceeding 200 mm per lift and compacted to 100% SPMDD within building areas ("engineered fill") and 95% SPMDD to within 600 mm of final subgrade level and 98% SPMDD for the upper 600 mm in pavement areas. The moisture content of the fill to be placed should be within 2% of its optimum moisture content in order to assure the specified densities can be achieved with reasonable compactive effort. Some of the on-site soils, particularly from the lower elevations, will

require partial drying before they can be properly compacted. Any organic or excessively wet or otherwise deleterious material should not be used for backfilling purposes.

- Fill and cut slopes should not be steeper than three horizontal to one vertical and should be protected from surface erosion.

- All imported borrow fill material from local sources should be free from organic material and foreign objects (i.e. trees, roots, debris, etc.) and should be tested geotechnically by EXP prior to transport to the site. In addition, the chemical quality of the borrow fill material should be assessed by EXP in accordance with applicable soil criteria listed in the Ministry of the Environment and Climate Change (MOECC) Standards (Ontario Regulation 153), dated April 15, 2011.

All excavation, backfilling and compaction operations should be monitored on a full-time basis by qualified geotechnical staff to approve materials and to confirm that the specified degrees of compaction have been obtained.

6.3 Site Servicing

6.3.1 Watermain and Sewer Installation

6.3.1.1 Open Cut Excavation

The sewer and watermain invert levels have not yet been determined at the time of investigation, but based on the specified borehole depths, they are typically expected to extend to depths of approximately 5 to 12 m below existing grades. Based on the results of the investigation, excavation will generally be carried out within the engineered fill and/or the native deposits of silty sand till and sand. Discontinuous deposits of silty sand, gravelly sand and clayey silt will also be encountered in the upper level at some borehole locations.

Saturated conditions from the wet seams and saturated layers in the native deposits will be encountered above the anticipated invert levels throughout the site. The sand deposit is water bearing and may be under sub-artesian to artesian conditions influenced by the underlying aquifer units. Refer to our hydrogeological report for the construction safe excavation depths (SED) at the borehole locations. Excavations extending below the SED should not proceed unless adequate dewatering or depressurization of the aquifer is carried out.

Subject to groundwater control measures discussed in the following sub-section, excavation may be carried out in open cuts using conventional equipment. Side slopes of temporary excavation must conform to the Occupational Health and Safety Act (OHSA) and local regulations. Within the meaning of

OHSA, the silty sand till deposit are classified as Type 3 soil; and the wet/loose granular soils are classified as Type 4 soil, indicating it is necessary to flatten the excavation side slopes to at least three horizontal to one vertical. The wet granular deposits may be classified as Type 3 soil if proposed dewatering is carried out.

Once the final invert levels have been established, it is recommended that several trial excavations (i.e. test pits) be excavated to the proposed invert levels along the sewer alignment in order to further assess the groundwater conditions. Prospective constructors are encouraged to attend in order to evaluate the effectiveness of dewatering using their own equipment.

It should also be noted that occasional boulders were noted within the till deposits and their presence may influence the progress of excavation. Consequently, provisions should be made in the contract documents to cover any delays caused by boulder obstructions.

6.3.1.2 Groundwater Control

The groundwater condition encountered at the site will affect the sewer installation and excavation. In general, the depths of the groundwater levels recorded in the monitoring wells ranged from about 7.8 m below ground surface to 1.0 m above existing ground surface. The groundwater in the wet sand deposit is under artesian pressures. As such, it will be necessary to lower the groundwater and to reduce the hydrostatic pressure by pumping from a series of deep wells in conjunction with vacuum well point dewatering system. Given the size of the site, it would be more practical to carry out the dewatering in sections. The groundwater should be lowered to at least 1.0 m below the base elevations of service trenches and maintenance holes prior to excavation. This will also draw down the groundwater in the area to permit site preparation. The groundwater control system should be installed by a specialist dewatering contractor.

The actual type and spacing of wells should be determined by a specialist dewatering contractor, cognizant of their own equipment and experience. Proposal for dewatering should be reviewed by EXP prior to implementation.

It should also be noted that any temporary construction dewatering that extracts more than 400,000 L per day would be subjected to a Permit to Take Water (PTTW), as regulated by MOECC. If the estimated rates will be more than 50,000 L per day but less than 400,000 L per day, the water taking can be registered under the Environmental Activity and Sector Registry (EASR). Refer to our hydrogeological report for the hydrogeological conditions at the site and the long-term development considerations.

6.3.1.3 Pipe Bedding

It is anticipated that the sewer and watermain pipes will be founded on competent native soils or on engineered fill. Provided adequate groundwater control measures are implemented, no bearing capacity problems are envisaged.

In general, the depths of the granular embankment, bedding and cover for the proposed watermain and sewer pipes should be constructed as per OPSD 802.010 for flexible pipes and OPSD 802.030 or 802.031 Class B for rigid pipes. The granular embankment, bedding and cover may consist of compacted Granular A sand and crushed gravel. Where wet conditions are encountered, 19 mm clear stone may be substituted for Granular A as pipe bedding/embankment. However, the clear stone must be completely wrapped in a geotextile filter fabric to prevent the migration of fines from the surrounding soils, which may result in settlement of the pipes. The chosen geotextile should be compatible with the existing soils on site. It is anticipated Terrafix 270R or similar should suffice.

To prevent groundwater 'wicking', (the diversion of subsurface water through the bedding in sewer trenches), it is recommended seepage collars (i.e. trench plugs) be installed at regular interval (i.e. 100 m maximum spacing or in between maintenance holes) along the pipes to interrupt the water seepage flow. The collars should extend the width of the excavation or at least 0.5 m beyond the outer face of the sewer pipe. In addition, for pipes and maintenance hole structures located below the groundwater table, all the joints should be adequately sealed using a watertight rubberized adhesive membrane (or equivalent) to prevent migration of fines into the pipes or maintenance holes.

The base of the excavations in the competent native soils should remain stable provided adequate groundwater control is implemented and excavations are not left open for extended periods of time and the work is done in accordance with good construction practice. Where the base of the excavations comprises wet sand deposit, the groundwater level should be depressed to at least 1.0 m below the trench base.

The pipe embankment, bedding and cover should be placed in lifts not exceeding 200 mm per lift and compacted to at least 98% SPMDD as per OPSS.MUNI 401. Light equipment may be required to compact the pipe cover and embankment to avoid damaging the pipe. Particular attention should be given to ensure material placed beneath the bottom quadrants of the pipe is adequately compacted. Compaction is not required for the clear stone bedding.

6.3.1.4 Backfilling Operations

Based on the results of the investigation, the majority of the on-site native soils comprised sand and silty sand till and are generally considered suitable for reuse as trench backfill. However, some of these soils

would be wet and will require drying for proper compaction. Any organic or excessively wet or otherwise deleterious material should not be used as trench backfill. Any shortfall of suitable on-site excavated material can be made up with imported clean approved fill or granular material such as Granular B Type I.

With the exception of the sand deposit, the majority of the on-site native soils are not free draining and therefore should not be used where this characteristic is required, or in confined areas. Imported granular material such as sand and gravel conforming to Granular B Type I would also be suitable for these purposes.

In areas where substantial cutting and filling is required, the compaction of the fill should be monitored on a full-time basis by qualified geotechnical personnel.

All backfilling and compaction operations must be closely examined by qualified geotechnical personnel to confirm that uniform compaction to specification requirements is achieved, especially in the vicinity of sewer maintenance holes and catchbasins, near the ends of compaction runs, and in all areas that are not readily accessible to compaction equipment, etc. All backfilling should be placed in lifts not exceeding 200 mm per lift and uniformly compacted to at least 95% SPMDD as per OPSS.MUNI.401. Within the upper 600 mm of road subgrade, the fill material should be compacted to at least 98% SPMDD. Smaller lifts may be required depending on the size of compaction equipment used by the contractor and the moisture content of fill at the time of construction.

To minimize potential problems, backfilling operations should follow closely after excavation so that only minimal length of trench slope is exposed. This will minimize wetting of the subgrade material. Should construction extend to the winter season, particular attention should be given to ensure that frozen material is not used as backfill.

6.4 Residential Dwelling Construction

6.4.1 Foundation Considerations

Soil conditions on the site are considered suitable for construction of single family dwellings. Since final site grades have not yet been established, two (2) foundation schemes are being presented for consideration; namely footings on native soils and footings on engineered fill.

6.4.1.1 Footings on Native Soil

The proposed buildings may be supported on conventional spread and strip footings founded on the compact to very dense sand and/or silty sand till below all existing topsoil and loose soils.

Footings founded on the native sand and/or silty sand till may be designed for a Geotechnical Reaction of 150 kPa at Serviceability Limit States (SLS), subject to adequate groundwater control and inspection during construction. The factored Geotechnical Resistance at Ultimate Limit States (ULS) is 225 kPa. Given the presence of basements it is anticipated that founding levels would be at or below about 2.5 m depth. Based on the results of the investigation, the above-mentioned bearing capacity is generally available at about 2.0 m depth. There are isolate locations where the recommended bearing capacity is located at a greater depth. The following tables show the highest depth at these borehole locations where the above mentioned geotechnical reactions/resistances can be applied, along with the Geotechnical Resistance that is available at 2.5 m depth.

Table 4: Highest Depth at Isolated Borehole Locations Where Recommended Geotechnical Reactions/Resistances is Available Below 2.0 m

Borehole Number	Depth/Elevation (m)
2	2.5/253.2
23	2.5/258.4
25	2.5/260.4
28	2.5/253.6

6.4.1.2 Footings on Engineered Fill

If required, in areas where major filling are present, the proposed buildings may also be supported on footings founded on engineered fill placed over the competent native soils and designed for a Geotechnical Reaction of 150 kPa at S.L.S. and for a factored Geotechnical Resistance of 225 kPa at U.L.S. The engineered fill should be constructed to above the level of the garage footings for the residential structures.

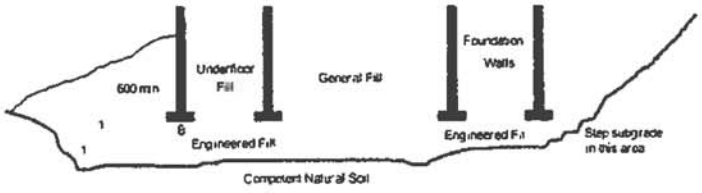
The engineered fill should be constructed by removing all topsoil, topsoil-stained soils, and loose/soft soils down to the competent compact native subgrade. Prior to the placement of engineered fill, the subgrade should be prepared in the manner described in the 'Site Grading' section of this report. The engineered fill should extent at least 3 m beyond the outside edge of exterior footings. The required extent of the engineered fill should be determined based on a known fixed location for the structures and adherence of the conditions outlined above. The boundaries of the 'engineered fill' must be laid out by a surveyor in consultation with engineering staff from EXP.

The engineered fill construction should be monitored on a full-time basis by geotechnical personnel from EXP to examine and approve backfill materials, to evaluate placement operations, and to verify the specified degree of compaction is being achieved uniformly throughout the fill.

Foundations placed on engineered fill comprising native soil from the site - or imported materials - may be designed for an SLS geotechnical reaction of 150 kPa (ULS factored geotechnical resistance of 225 kPa).

Additional comments with regard to engineered fill are as follows:

- The area must be stripped of all topsoil, existing fill material or other deleterious material and proof-rolled. Soft spots must be dug out. The stripped native subgrade must be examined and approved by a geotechnical engineer prior to placement of fill.
- The approved engineered fill must be placed in loose lifts not exceeding 200 mm and compacted to 100% Standard Proctor dry density throughout. Granular fill is preferred.
- Full time geotechnical inspection during placement of engineered fill is required.
- The fill must be placed such that the specified geometry is achieved as follows:



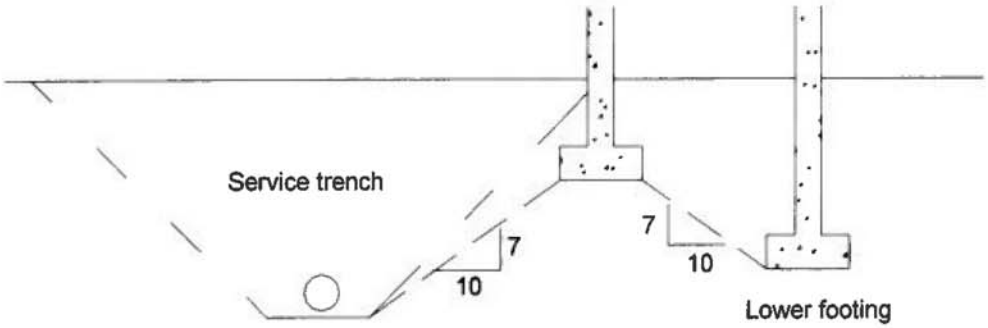
Foundations on Engineered Fill (schematic)

- A minimum footing width of 500 mm (20 inches) is suggested. It is recommended that poured concrete basement walls should be reinforced with 2 – 15M rebars above the footings and below the window sill.
- All excavations must be done in accordance with the Occupational Health and Safety Regulations of Ontario.

N/A	CLIENT: WATERSANDS DEVELOPMENT	exp Services Inc.
SEPTEMBER 2017	PROJECT: PROPOSED WATERSANDS RESIDENTIAL DEVELOPMENT	
LHK		
BAR-00038305-B0	TITLE: ENGINEERED FILL REQUIREMENTS SKETCH	• BUILDINGS • EARTH & ENVIRONMENT • ENERGY • • INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY •
SKETCH 1		

6.4.1.4 Foundations General

Footings which are to be placed at different elevations should be located such that the higher footings are set below a line drawn up at 10 horizontal to 7 vertical from the near edge of the lower footing. This concept should also be applied to excavations for new foundations in relation to existing footings or underground services. This concept is illustrated in the following sketch:



FOOTINGS NEAR SERVICE TRENCHES OR AT DIFFERENT ELEVATIONS

All footings exposed to seasonal freezing conditions should be protected from frost action by at least 1.5 m of soil cover or equivalent insulation, depending on the final design requirements.

The on-site soils are susceptible to disturbance. It is therefore recommended that a concrete skim coat be placed over the founding surface as soon as possible after approval to protect it from disturbance from construction traffic.

The total and differential settlements of well designed and constructed footings placed in accordance with the above recommendations, are expected to be less than 25 mm and 20 mm, respectively.

It should be noted that the recommended bearing capacities have been calculated by EXP from the borehole information for the design stage only. The investigation and comments are necessarily ongoing as new information on underground conditions becomes available. For example, it should be appreciated that modifications to bearing levels may be required if unforeseen subsoil conditions are revealed after the excavation is exposed to full view or if final design decisions differ from those assumed

in this report. For this reason, this office should be retained to review final foundation drawings and to examine footing conditions.

6.4.2 Excavation and Groundwater Control

Excavation for single family dwellings with a basement will extend to about 2.5 m below the final finished grade. Where excavations will be undertaken in water bearing granular deposit and below the groundwater table, the groundwater must be lowered to at least 1.0 m below foundation base elevations prior to construction and be maintained until permanent perimeter and underfloor drainage systems for the structures as may be required, have been installed and commissioned. Where possible, all foundations and basement floors should be placed above the groundwater table and water bearing granular deposit.

Subject to implementation of proper groundwater control measures where required, excavation should be relatively straightforward and must be carried out in accordance with the latest edition of the OHSA and local regulations. For preliminary guidance, side slopes of one vertical to one horizontal may be used, subject to geotechnical inspection. Where loose soil is encountered, it may be necessary to locally flatten the side slopes.

Even with implementation of proper groundwater control measures as required, residual groundwater seepage from trapped pockets in the fill and native soils into the excavation(s) should be anticipated during construction. It should be possible to control and remove residual seepage water entering the excavation(s), using conventional construction dewatering techniques, i.e., pumping from sumps.

It should also be noted that occasional boulders were noted within the till deposits and their presence may influence the progress of excavation. Consequently, provisions should be made in the contract documents to cover any delays caused by boulder obstructions.

6.4.3 Floor Slab Construction and Permanent Drainage

The floor slab may be constructed as a slab-on-grade on a properly prepared subgrade (i.e., on native undisturbed soils or engineered fill). In this regard, all topsoil, loose soils and other obviously unsuitable material should be removed from the entire underfloor area and the exposed subgrade thoroughly proofrolled. Any soft spots detected should be sub-excavated and the area brought up to design grades using approved clean fill in the manner described in the "Site Grading" section of this report.

A 200 mm layer of 19 mm clear stone should be placed between the prepared subgrade and the floor slab to serve as a moisture barrier.

It is recommended that the foundation walls be covered with a bituminous damp-proofing spray and a drainage sheet. In addition, a weeping tile surrounded with 300 mm of 19 mm clear stone and wrapped with a filter cloth should be installed around the perimeter of the basement and connected to a frost-free outlet.

In areas where the subgrade consists of wet/saturated soil (below the groundwater table) or where persistent groundwater seepage is encountered during excavation, underfloor subdrains and sump pump should also be installed. The subdrains should consist of 100 mm diameter perforated pipe surrounded by 150 mm of 19 mm clear stone all wrapped in Terrafix 270R or equivalent. The trench should be backfilled with concrete sand. The drainage system should lead to frost-free sumps inside the structure or to outlets from which the water can be removed. The need for underfloor subdrains should be further assessed upon basement excavation.

6.4.4 Earth Pressure on Subsurface Walls

The lateral earth pressure acting on subsurface walls (i.e., basement walls) may be calculated from the following equation:

$$p = k(\gamma h + q)$$

where:

- p = the pressure in kPa acting against any subsurface wall at depth, h, below the ground surface;
- k = the earth pressure coefficient considered to be appropriate for the subsurface walls, for this case, 0.4;
- γ = the bulk unit weight of the backfill, use 22.0 kN/m^3;
- h = the depth in m below the ground surface at which the pressure, p, is to be computed; and,
- q = the value of any adjacent surcharge in kPa which may be acting close to the wall.

The above expression assumes an effective perimeter tile drain system will be incorporated to prevent the build-up of hydrostatic pressure behind the subsurface wall. All subsurface walls should be waterproofed. To minimize infiltration of surface water, the upper 600 mm of backfill should comprise compacted relatively impervious material sloped away from the structure.

6.4.5 Earthquake Considerations

The recommendations for the geotechnical aspects to determine the earthquake loading are presented below.

6.4.5.1 Subsoil Conditions

The subsoil and groundwater information at this site have been examined in relation to Section 4.1.8.4 of OBC 2012. The subsoil primarily consisted of topsoil, compact to very dense sandy silt till, compact to very dense sand. Discontinuous deposits of very loose silty sand, compact to dense gravelly sand and firm clayey silt will also be encountered in the upper level at some borehole locations. The foundations will be founded on the competent native soils or on engineered fill. The reported N-values for the soils below the anticipated floor slab level ranged from 15 to greater than 50.

There have been no shear wave velocity measurements carried out at this site and therefore, N-values will be used to determine the site classification.

6.5.5.2 Depth of Boreholes

Table 4.1.8.4.A. Site Classification for Seismic Site Response in OBC 2012 indicated that to determine the site classification, the average properties in the top 30 m are to be used. The boreholes at this site were advanced to depths of about 8.0 to 15.8 m.

6.5.5.3 Site Classification

Based on the soil conditions, the Site Class for this site is "C" as per Table 4.1.8.4.A, Site Classification for Seismic Site Response, OBC 2012. It is recommended that shear wave velocity test be carried out to confirm the Site Class for this site.

6.5 Pavement Design and Construction

The pavement subgrade is expected to comprise compacted engineered fill or native sand and silty sand till deposits. Grain Size Analyses of representative near surface soils used to assist in assessment of frost susceptibility are compiled in Appendix C. Based on estimated soil parameters, the frost susceptibility of the anticipated subgrade materials, expected traffic loading, and assuming adequate drainage, the following minimum pavement structure component thicknesses which comply with the City of Barrie Transportation Design Manual are considered satisfactory.

Table 5: Recommended Pavement Structure Thicknesses

Pavement Layer	Compaction Requirements	Local Road	Minor Collector	Major Collector	Driveway
Asphaltic Concrete (OPSS 310 and 1150)	Min. 92 % MRD*	40 mm HL3 60 mm HL8	40 mm HL3 80 mm HL8	40 mm HL3 100 mm HL8**	65 mm HL3**
Granular Base (OPSS 1010 Granular A)	100% SPMDD*	150 mm	150 mm	150 mm	150 mm
Granular Subbase (OPSS 1010 Granular B Type II)	100% SPMDD*	300 mm	400 mm	500 mm	-

* Denotes Maximum Relative Density (ASTM D2041) and Standard Proctor Maximum Dry Density (ASTM D698)
** Placed in two (2) lifts

The foregoing design assumes construction is carried out during dry periods and the subgrade is stable under the load of construction equipment. If construction is carried out during wet weather and heaving or rolling of the subgrade is experienced, additional thickness of subbase course material may be required.

The long-term performance of the pavement structure is highly dependent upon the subgrade support conditions. Stringent construction control procedures should be maintained to ensure uniform subgrade moisture and density conditions are achieved. In addition, the need for adequate drainage cannot be over-emphasized. The finished pavement surface and underlying subgrade should be free of depressions and sloped to provide effective surface drainage toward catchbasins. Surface water should not be allowed to pond adjacent to the outside edges of pavement areas.

Additional comments on the construction of proposed roadways are as follows:

1. As part of the subgrade preparation, proposed roadways should be stripped of topsoil and other obviously unsuitable material. Soft or spongy subgrade areas identified during proofrolling should be subexcavated and replaced with suitable approved backfill. Fill required to raise the grades to design elevations should be organic-free and at a moisture content which will permit compaction to at least 98% SPMDD. The final subgrade surface should be properly shaped and crowned.

2. The location and extent of subdrain required within the paved areas should be reviewed by this office in conjunction with the proposed site grading. In view of the silty nature of the subgrade soils, it is recommended that the subdrains be installed on both sides of the roadways at least 300 m below the granular subbase. This will ensure no water collects in the granular courses which could result in pre-mature pavement failure during the spring thaw. The subdrain should be installed in accordance with BSD-315 Type A.

3. To minimize problems of differential movement between the pavement and catchbasins/sewer maintenance holes due to frost action, backfill around these structures should consist of free-draining granular material. The granular material should be compacted to at least 98% SPMDD with a small tamper to avoid damaging the structures. In addition, catchbasins should be perforated just above the drain and the holes screened with filter cloth.

4. The most severe loading conditions on light-duty pavement areas and the subgrade may occur during construction. Consequently, special provisions such as restricted lanes, half-loads during paving, etc. may be required, especially if construction is carried out during unfavorable weather.

7. Stormwater Management Pond

It is understood that the preliminary plan calls for a stormwater management pond at the southeast corner of the site. Final design of the pond has not been established at the time of the investigation. However, some construction difficulties should be anticipated due to the recorded high groundwater levels.

7.1.1 Excavation and Groundwater Control

Considering the high groundwater levels at the site, extensive groundwater control measures will be required during construction.

Excavation to reach the base elevations of various components of the storm water management facility should be relatively straightforward using conventional hydraulic equipment and must be carried out in accordance with the OHSA and local regulations.

7.1.2 Soil Permeability

In general, the bases and sides of the pond will primarily comprise native silty sand till and sand deposits. These deposits are considered to be relatively pervious and under artesian conditions. As such, the installation of a low permeability liner will be required for the proposed pond.

The low permeability liner may be constructed with a minimum 1 m thick layer of clayey soils conforming to OPSS.MUNI.1205 requirements. Alternatively, a geosynthetic clay liner, such as Bentofix CNSL, or a synthetic liner such as Nilex Geomembrane PVC 40 mil or equivalent may be used. A 300 mm layer of rip-rap should be placed above the liner as an indicator/protective soil cover. The liner should be installed as per manufacturer's guidelines and up to a minimum of 1.0 m above the permanent water level in the pond.

Potential base heave may occur due to hydrostatic uplift pressure from the groundwater in artesian condition or when the pond is emptied for cleaning and maintenance activities. For mitigation of heaving issues due to hydrostatic uplift pressure, installation of underdrainage such as a series of subdrains is recommended.

Refer to our hydrogeological report for the detailed analysis and recommendations for the construction of stormwater management pond.

7.1.3 Pond Grading/Surface Treatment

Any unsuitable materials such as topsoil and loose soil should be removed from the pond base and side slope areas. The side slopes of the pond should be graded at no steeper than four horizontal to one vertical in native soils for long-term stability.

The earth berm around the pond should be constructed with imported clayey soils. The native granular material is not recommended for the construction of the earth berm due to its relatively high permeability and tendency for surface erosion. The imported material should be placed in maximum 300 mm thick lifts and compacted to a minimum of 98% SPMDD. The side slopes should be overgrown with vegetation to minimize surface erosion.

When more detailed conceptual design information is available, EXP would be pleased to provide additional and more specific geotechnical recommendations pertaining to the design and construction of the proposed pond and wetland features. It is also recommended a slope stability analysis and seepage analysis be undertaken once the detail design is completed and the materials confirmed.

8. General Comments

EXP 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 accorded the privilege of making this review, EXP will assume no responsibility for interpretation of the recommendations in the report.

The comments given in this report are intended only for the guidance of design engineers. The number of boreholes required to determine the localized underground conditions between boreholes affecting construction costs, techniques, sequencing, equipment, scheduling, etc. would be 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.

More specific information with respect to the conditions between samples, or the lateral and vertical extent of materials may become apparent during excavation operations. The interpretation of the borehole information must, therefore, be validated during excavation operations. Consequently, during the future development of the property, conditions not observed during this investigation may become apparent; should this occur, EXP should be contacted to assess the situation, and additional testing and reporting may be required. EXP has qualified personnel to provide assistance in regards to future geotechnical and environmental issues related to this property.

Yours truly,

EXP Services Inc.

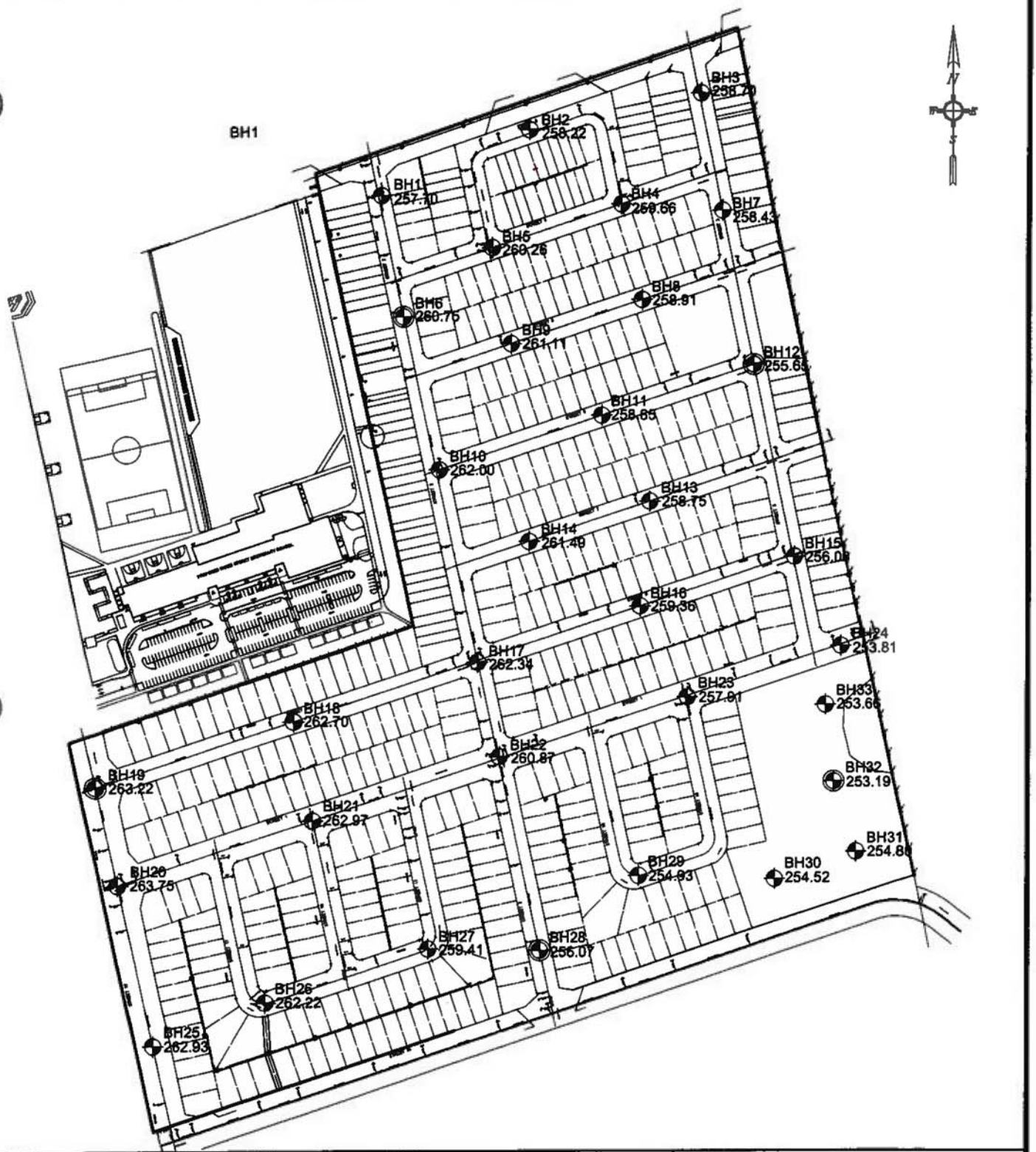
Original Signed By:

Leigh H. Knegt, P.Eng.
Manager, Geotechnical Services
Barrie Office

Original Signed By:

Victor Tam, P.Eng.
Project Manager, Geotechnical Division
Markham Office

Appendix A:
Borehole Location Plan



scale	NTS
date	November 2017
drawn by	JF
project no.	BAR-00055075-A0
	FIGURE 1

CLIENT:

1091369 Ontario Inc.

PROJECT:

883 Mapleview Drive East, Barrie, Ontario

TITLE:

BOREHOLE LOCATION PLAN

LEGEND:

- BH1 257.70 — Borehole Location, Ground Surface Elevation (m)
- BH12 255.65 — Borehole Location with Monitoring Well

Reference: Base plan provided by Schaeffers Consulting Engineers, Jan. 2016

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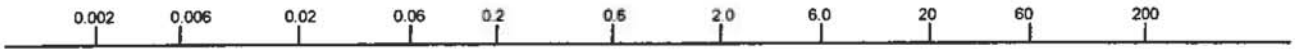
Appendix B:
Borehole Logs

Notes On Sample Descriptions

1. All sample descriptions included in this report follow the Unified Soil Classification System (USCS) as outlined by the Ministry of Transportation. Different classification systems may be used by others; one such system is the International Society for Soil Mechanics and Foundation Engineering (ISSMFE), as outlined in the Canadian Foundation Engineering Manual. Please note that, with the exception of those samples where a grain size analysis has been made, all samples are classified visually. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.

UNIFIED SOIL CLASSIFICATION

CLAY (PLASTIC) TO	FINE	MEDIUM	CRS.	FINE	COARSE
SILT (NONPLASTIC)	SAND			GRAVEL	



EQUIVALENT GRAIN DIAMETER IN MILLIMETRES

ISSMFE SOIL CLASSIFICATION

CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE		

2. Fill: Where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc., none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional geotechnical site investigation.

3. Till: The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (75 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.

Notes On Sample Descriptions

4. The following table gives a description of the soil based on particle sizes. With the exception of those sample where grain size analyses have been performed, all samples are classified visually. The accuracy of visual examination is not sufficient to differentiate between this classification system or exact grain size.

Soil Classification		Terminology	Proportion
Clay and Silt	<0.075 mm		
Sand	0.075 to 4.75 mm	"trace" (e.g. Trace sand)	0% to 10%
Gravel	4.75 to 75 mm	"some" (e.g. Some sand)	10% to 20%
Cobbles	75 to 200 mm	with (e.g. with sand)	20% to 35%
Boulders	>200 mm	and (e.g. and sand)	35% to 50%

For a given material listed as an adjective (e.g. silty sand) means the predominant grain size is sand sized with 30 to 40% silt sized particles.

The compactness of Cohesionless soils and the consistency of the cohesive soils are defined by the following:

Cohesionless Soil		Cohesive Soil		
Compactness	**Standard Penetration Resistance "N" value Blows/ 0.3 m**	**Consistency**	**Undrained Shear Strength (kPa)**	**'N' Values**
Very Loose	0 to 4	Very soft	<12	<2
Loose	4 to 10	Soft	12 to 25	2 to 4
Compact	10 to 30	Firm	25 to 50	4 to 8
Dense	30 to 50	Stiff	50 to 100	8 to 15
Very Dense	Over 50	Very Stiff	100 to 200	15 to 30
		Hard	>200	>30

5. **ROCK CORING**

Where rock drilling was carried out, the term RQD (Rock Quality Designation) is used. The RQD is an indirect measure of the number of fractures and soundless of the rock mass. It is obtained from the rock cores by summing the length of the core covered, counting only those pieces of sound core that are 100 mm or more length. The RQD value is expressed as a percentage and is the ratio of the summed core lengths to the total length of core run. The classification based on the RQD value is given below.

RQD Classification	RQD (%)
Very Poor Quality	<25
Poor Quality	25 to 50
Fair Quality	50 to 75
Good Quality	75 to 90
Excellent Quality	90 to 100

Recovery Designation: $$\% \text{ Recovery} = \frac{\text{Length of Core Per Run}}{\text{Total Length of Run}} \times 100$$

Log of Borehole BH1

Project No. BAR-00055075-A0 | Figure No. 2

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

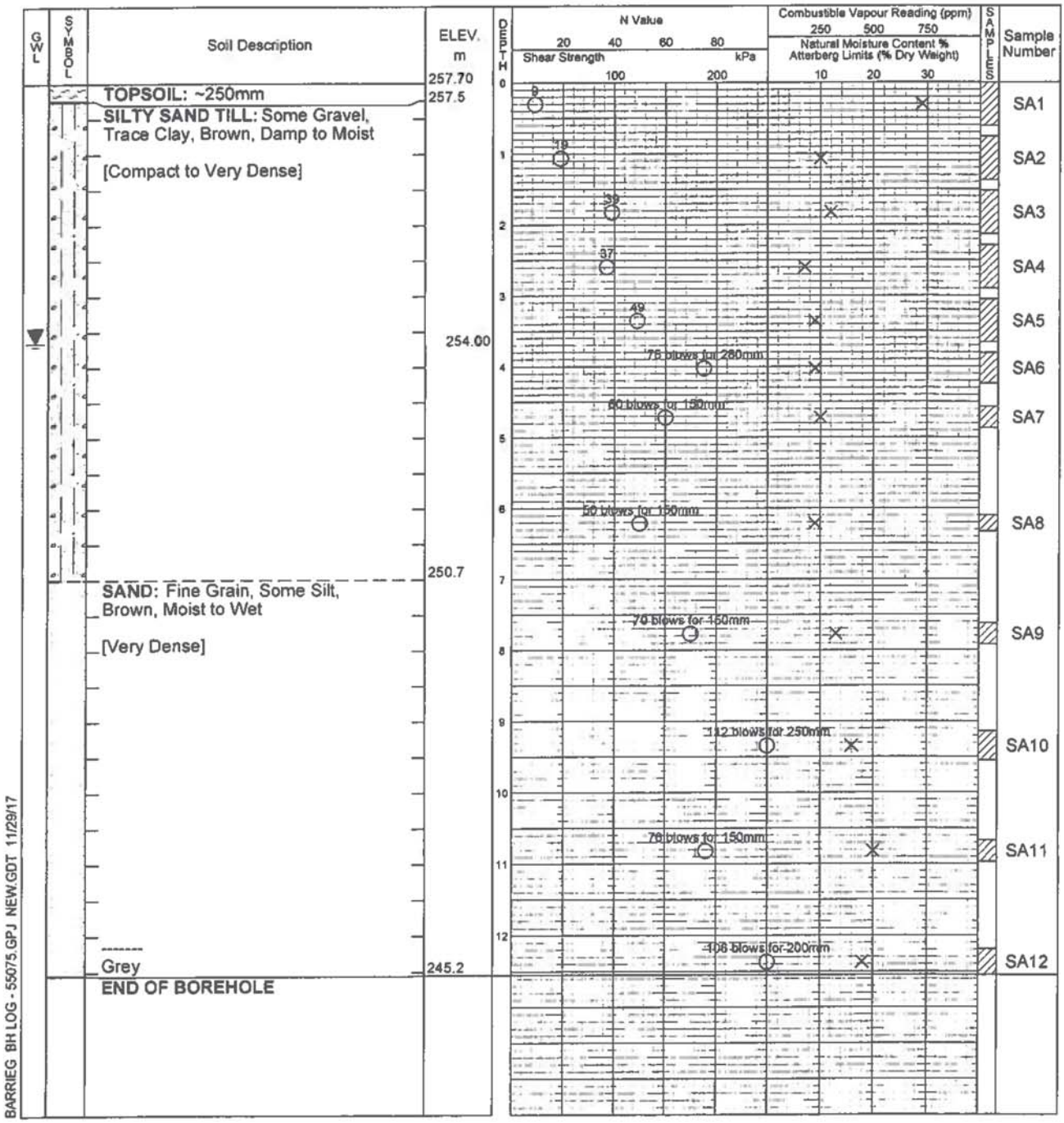
Date Drilled: October 13, 2017

Drill Type: Hollow Stem Augers

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer



BARRIEG BH LOG - 55075.GPJ NEW.GDT 11/29/17

exp. Services Inc.
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Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	3.7	4.6

Log of Borehole BH2

Project No. BAR-00055075-A0 | Figure No. 3

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

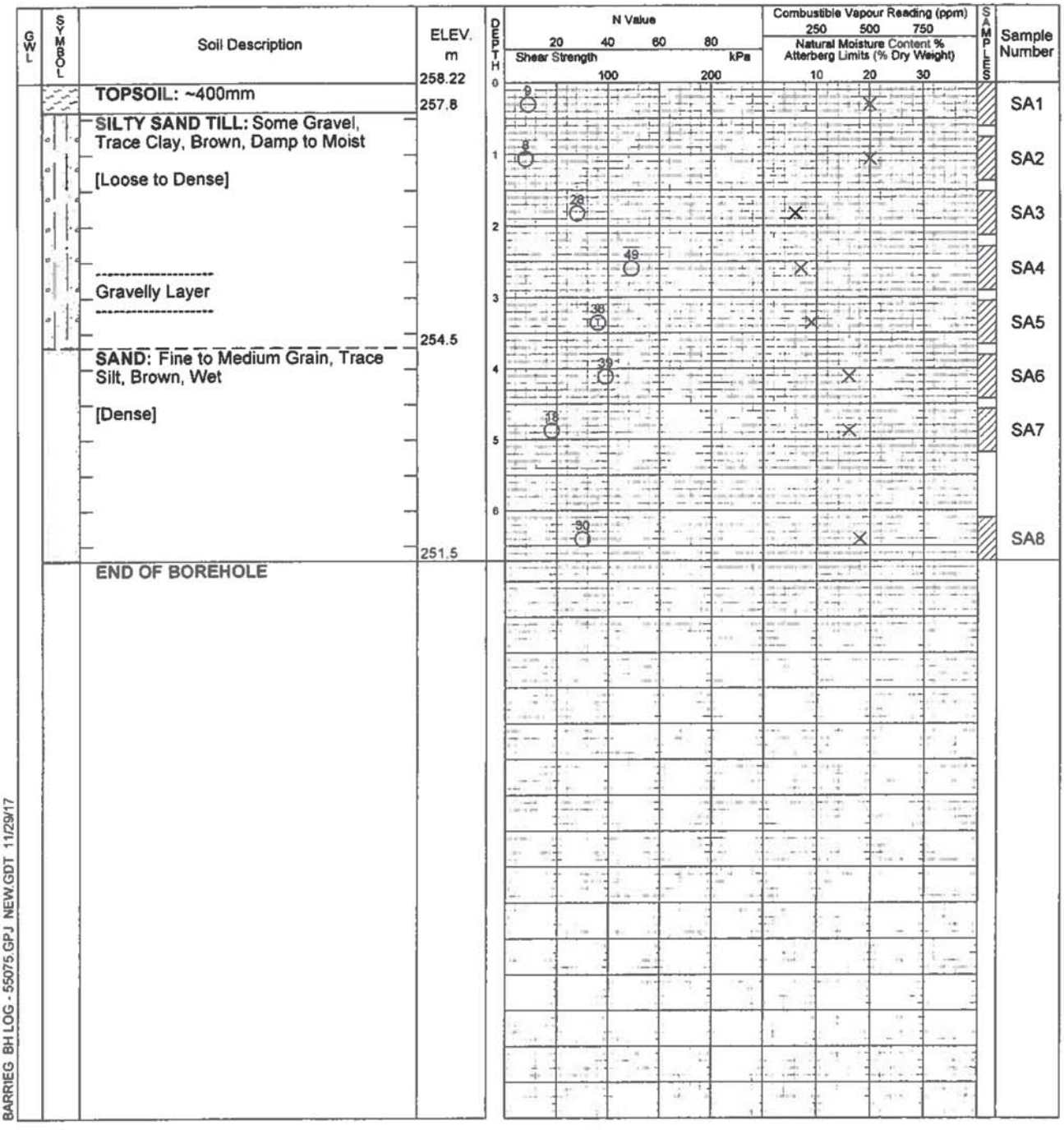
Date Drilled: October 16, 2017

Drill Type: Hollow Stem Augers

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer



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Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	3.1	3.1

Log of Borehole BH3

Project No. BAR-00055075-A0

Project: Geotechnical Investigation

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

Date Drilled: October 16, 2017

Drill Type: Hollow Stem Augers

Datum: Geodetic

Figure No. 4

Sheet No. 1 of 1

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value / Shear Strength (kPa)	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Sample Number
		TOPSOIL: ~300mm	258.70 258.4	0	4			SA1
		SILTY SAND TILL: Trace to Some Gravel, Trace to Some Clay, Brown, Moist to Wet [Compact to Dense]		1	31			SA2
				2	24			SA3
					45			SA4
			255.7	3	36			SA5
		SAND: Fine to Medium Grain, Trace Silt, Brown, Wet [Dense to Very Dense]		4	69			SA6
				5	48			SA7
				6	52			SA8
		END OF BOREHOLE	252.0					

BARRIEG BH LOG - 55075.GPJ NEW.GDT 11/29/17

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Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	3.1	3.1

Log of Borehole BH4

Project No. BAR-00055075-A0

Project: Geotechnical Investigation

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

Date Drilled: October 16, 2017

Drill Type: Hollow Stem Augers

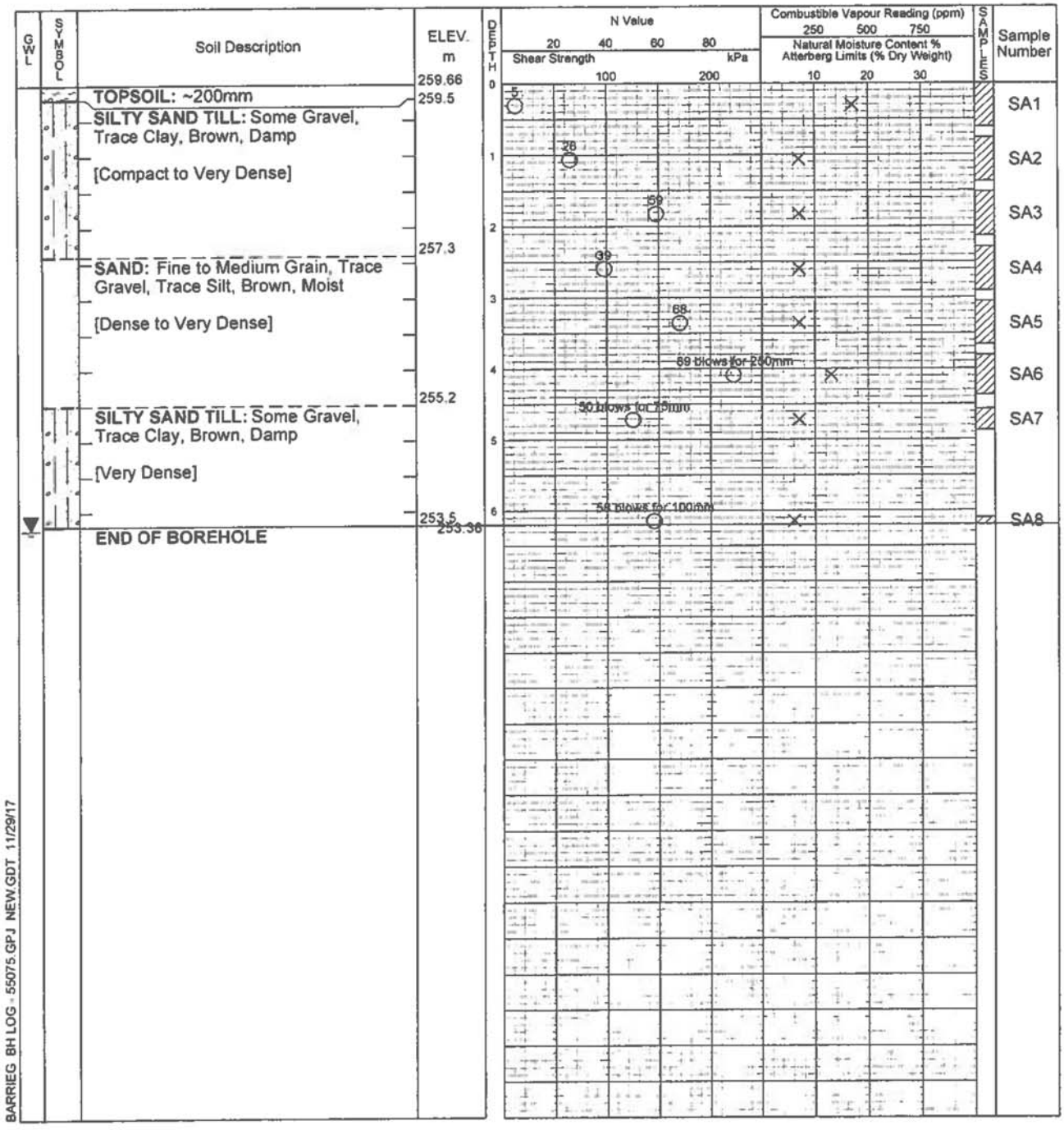
Datum: Geodetic

Figure No. 5

Sheet No. 1 of 1

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



BARRIEG BH LOG - 55075.GPJ NEW.GDT 11/29/17

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Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	6.3	Open

Log of Borehole BH5

Project No. BAR-00055075-A0 | Figure No. 6

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

Date Drilled: October 16, 2017

Drill Type: Hollow Stem Augers

Datum: Geodetic

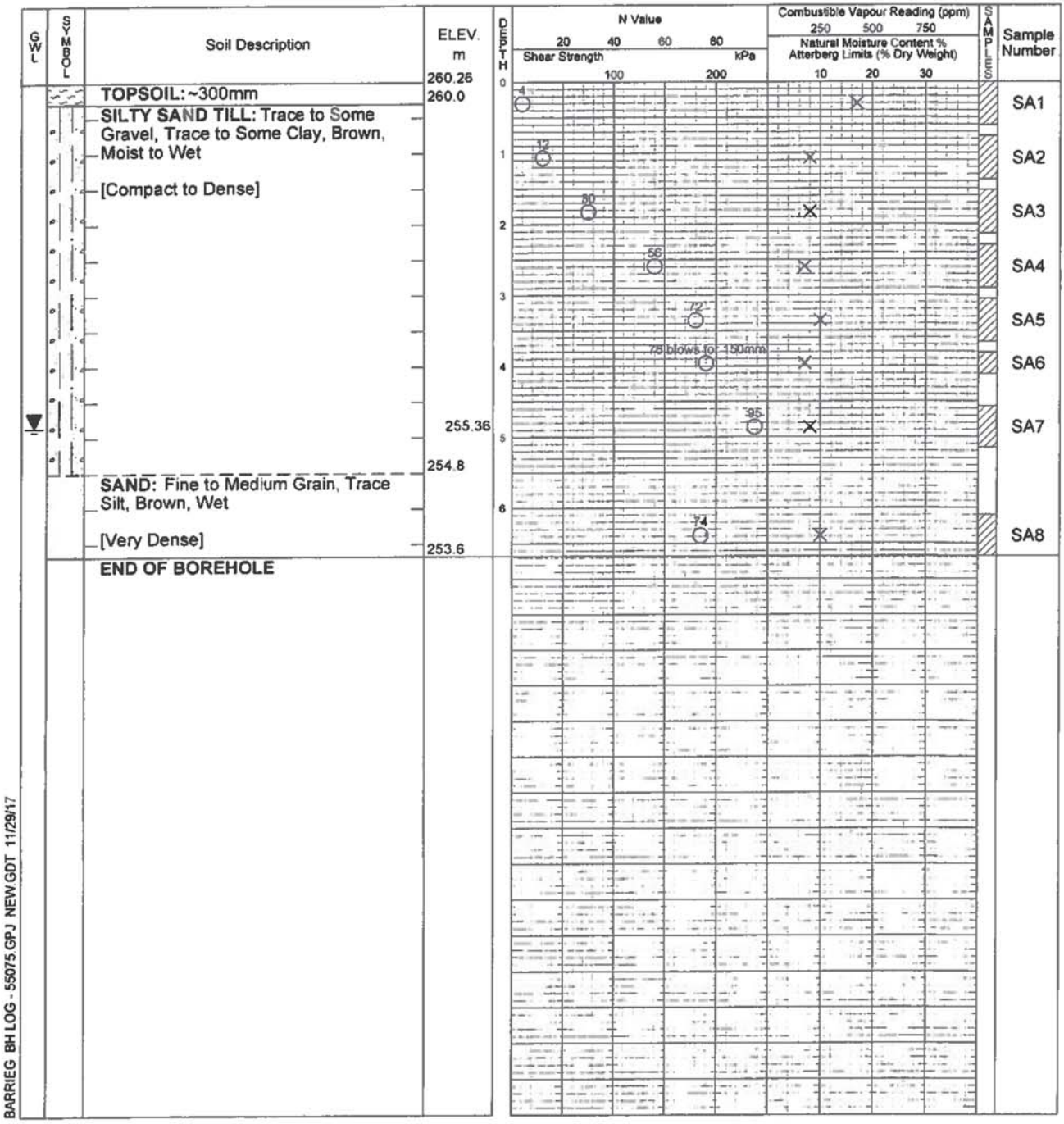
Auger Sample | Combustible Vapour Reading

SPT (N) Value | Natural Moisture

Dynamic Cone Test | Plastic and Liquid Limit

Shelby Tube | Undrained Triaxial at % Strain at Failure

Field Vane Test | Penetrometer



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Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	4.9	5.3

Log of Borehole BH6

Project No. BAR-00055075-A0

Project: Geotechnical Investigation

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

Date Drilled: October 16, 2017

Drill Type: Hollow Stem Augers

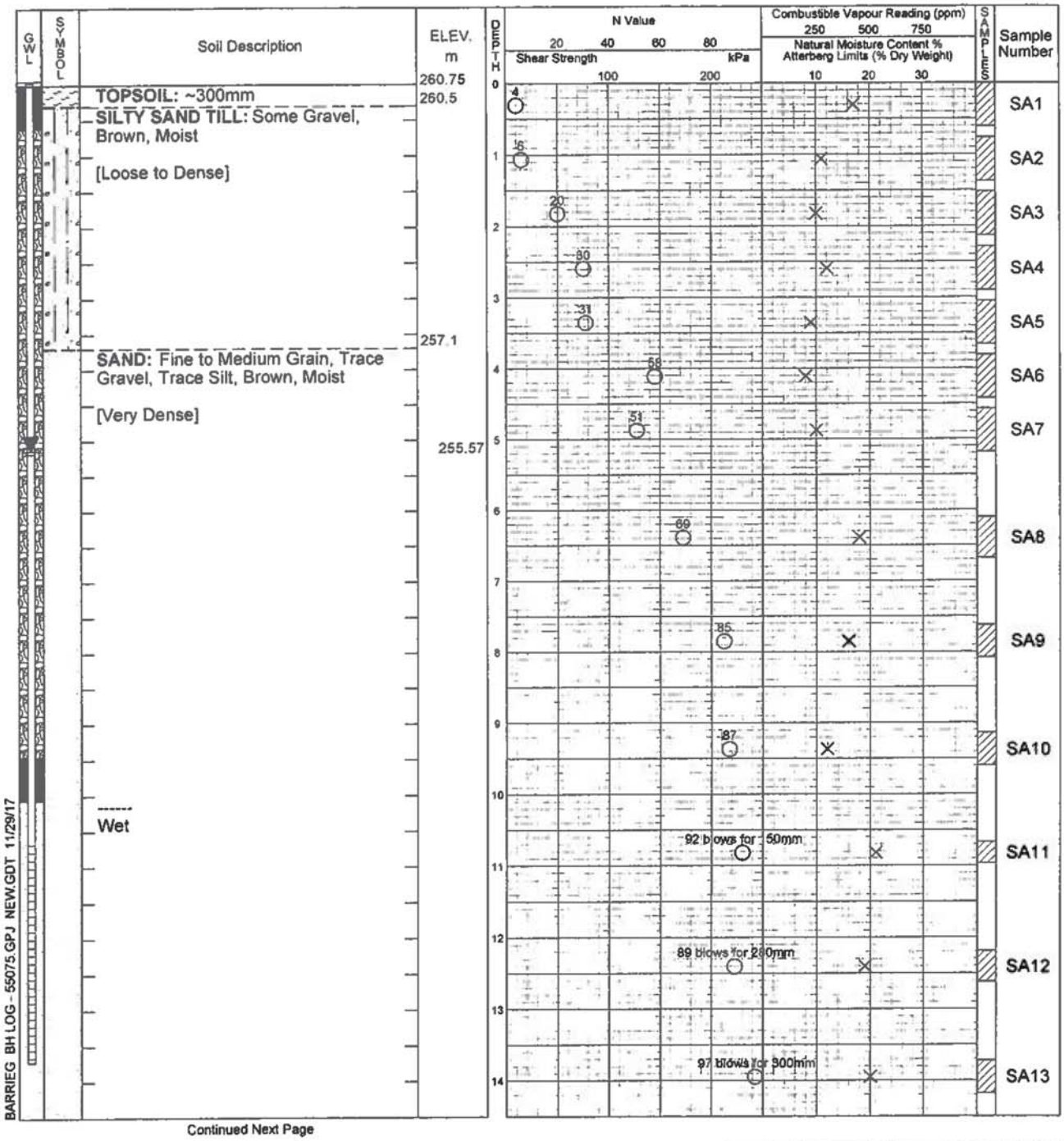
Datum: Geodetic

Figure No. 7

Sheet No. 1 of 2

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



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Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	5.1	7.6
Nov. 23, 2017	5.18	

Log of Borehole BH6

Project No. BAR-00055075-A0

Figure No. 7

Project: Geotechnical Investigation

Sheet No. 2 of 2

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Sample Number
			246.25		20 40 60 80 / 100 200	250 500 750 / 10 20 30		
		Some Silt, Fine Grain		15	30			SA14
			245.0					
		END OF BOREHOLE						

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Borehole data requires interpretation assistance from **Exp** before use by others.

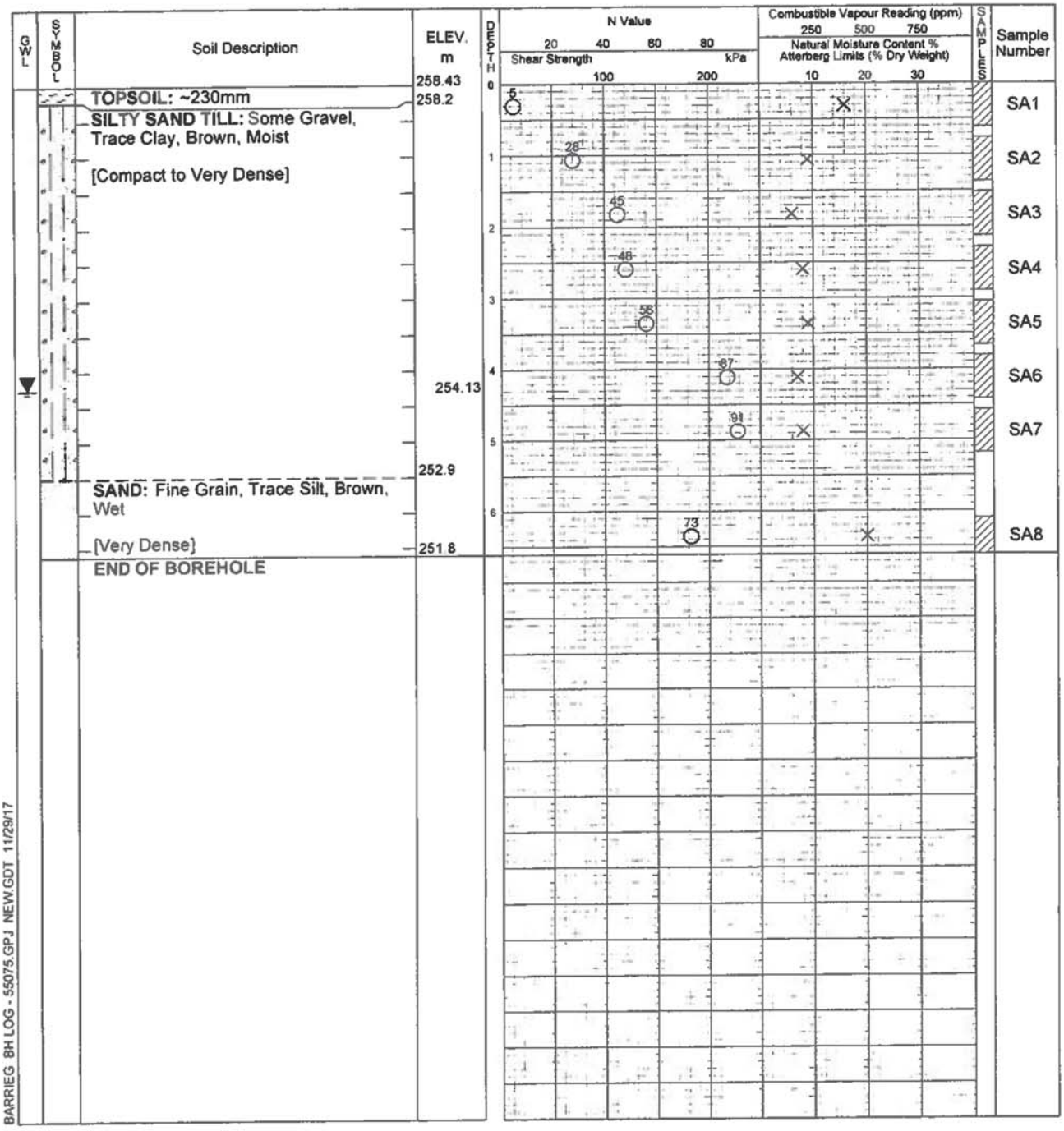
See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	5.1	7.6
Nov. 23, 2017	5.18	

Log of Borehole BH7

Project No. BAR-00055075-A0
Figure No. 8
Project: Geotechnical Investigation
Sheet No. 1 of 1
City/ Municipality: Barrie
Location: 883 Mapleview Drive East
Date Drilled: October 16, 2017
Drill Type: Hollow Stem Augers
Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test
Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



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Borehole data requires interpretation assistance from Exp before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	4.3	5.2

Log of Borehole BH8

Project No. BAR-00055075-A0 | Figure No. 9

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

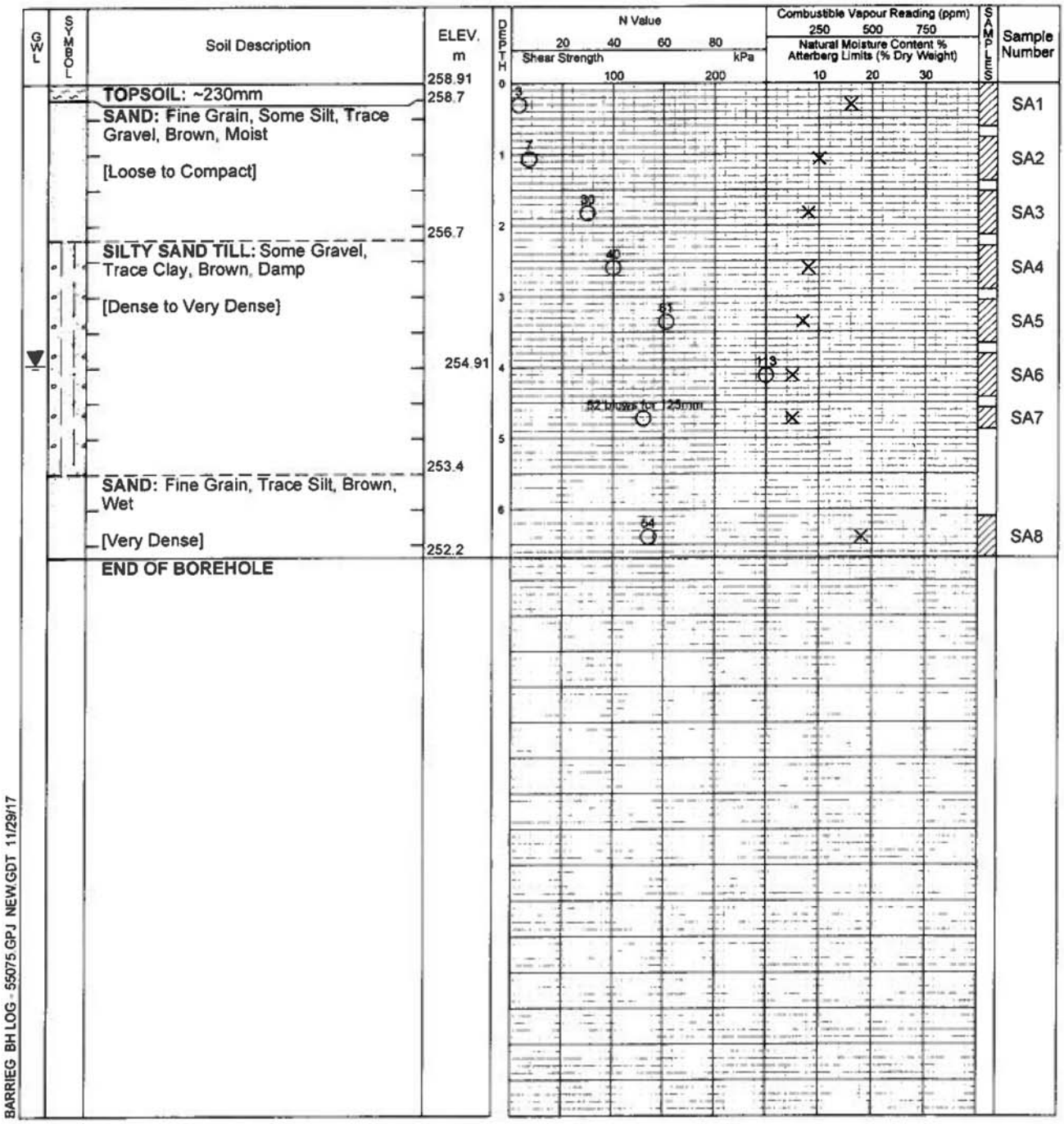
Date Drilled: October 16, 2017

Drill Type: Hollow Stem Augers

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer



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Borehole data requires interpretation assistance from Exp before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	4.0	4.9

Log of Borehole BH9

Project No. BAR-00055075-A0 | Figure No. 10

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

Date Drilled: October 16, 2017

Drill Type: Hollow Stem Augers

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	Sample Number
		TOPSOIL: ~230mm	261.11	0	
		SILTY SAND: Reddish Brown, Moist	260.9		SA1
		[Very Loose]		1	SA2
			259.7		
		SAND: Fine to Medium Grain, Trace Silt, Trace Gravel, Brown, Damp			SA3
		[Very Dense]		2	SA4
				3	SA5
				4	SA6
				5	SA7
		Grey, Wet	254.6	6	SA8
		END OF BOREHOLE			

N Value: 20 40 60 80 | Shear Strength kPa: 100 200 | Combustible Vapour Reading (ppm): 250 500 750 | Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30

Plotted values: 3, 2, 2, 32, 74, 55, 64, 82, 103 blows for 225mm

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Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	5.8

Log of Borehole BH10

Project No. BAR-00055075-A0 | Figure No. 11

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

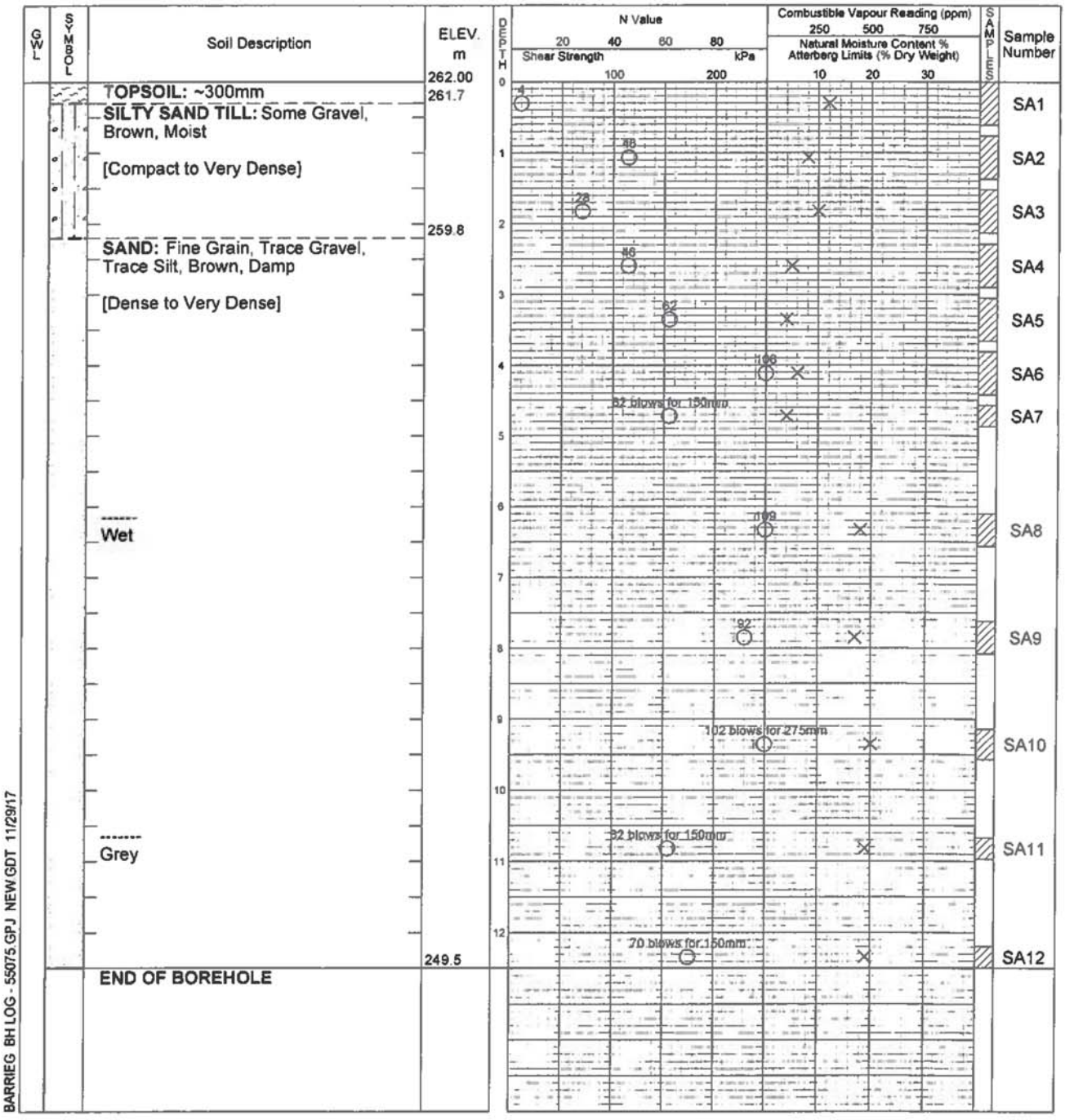
Date Drilled: October 13, 2017

Drill Type: Hollow Stem Augers

Datum: Geodetic

Auger Sample ☒ | SPT (N) Value ○ ▨ | Dynamic Cone Test ——— | Shelby Tube ■ | Field Vane Test ✚ S

Combustible Vapour Reading □ | Natural Moisture × | Plastic and Liquid Limit ⊢—○ | Undrained Triaxial at % Strain at Failure ⊕ | Penetrometer ▲



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Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	5.8

Log of Borehole BH11

Project No. BAR-00055075-A0

Figure No. 12

Project: Geotechnical Investigation

Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

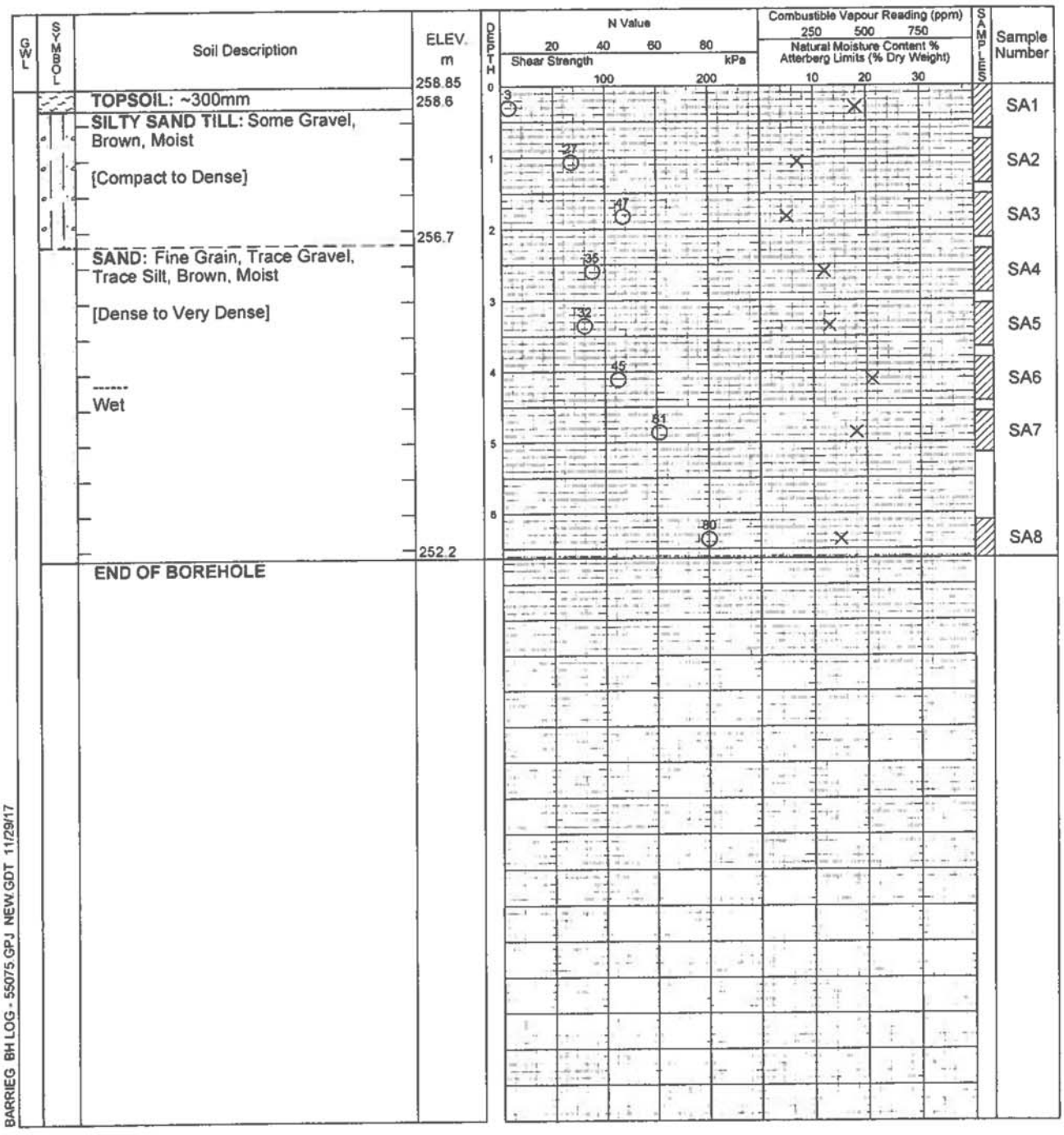
Date Drilled: October 17, 2017

Drill Type: Solid Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



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Borehole data requires interpretation assistance from Exp before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	6.6

Log of Borehole BH12

Project No. BAR-00055075-A0 | Figure No. 13

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

Date Drilled: October 25, 2017

Drill Type: Hollow Stem Augers

Datum: Geodetic

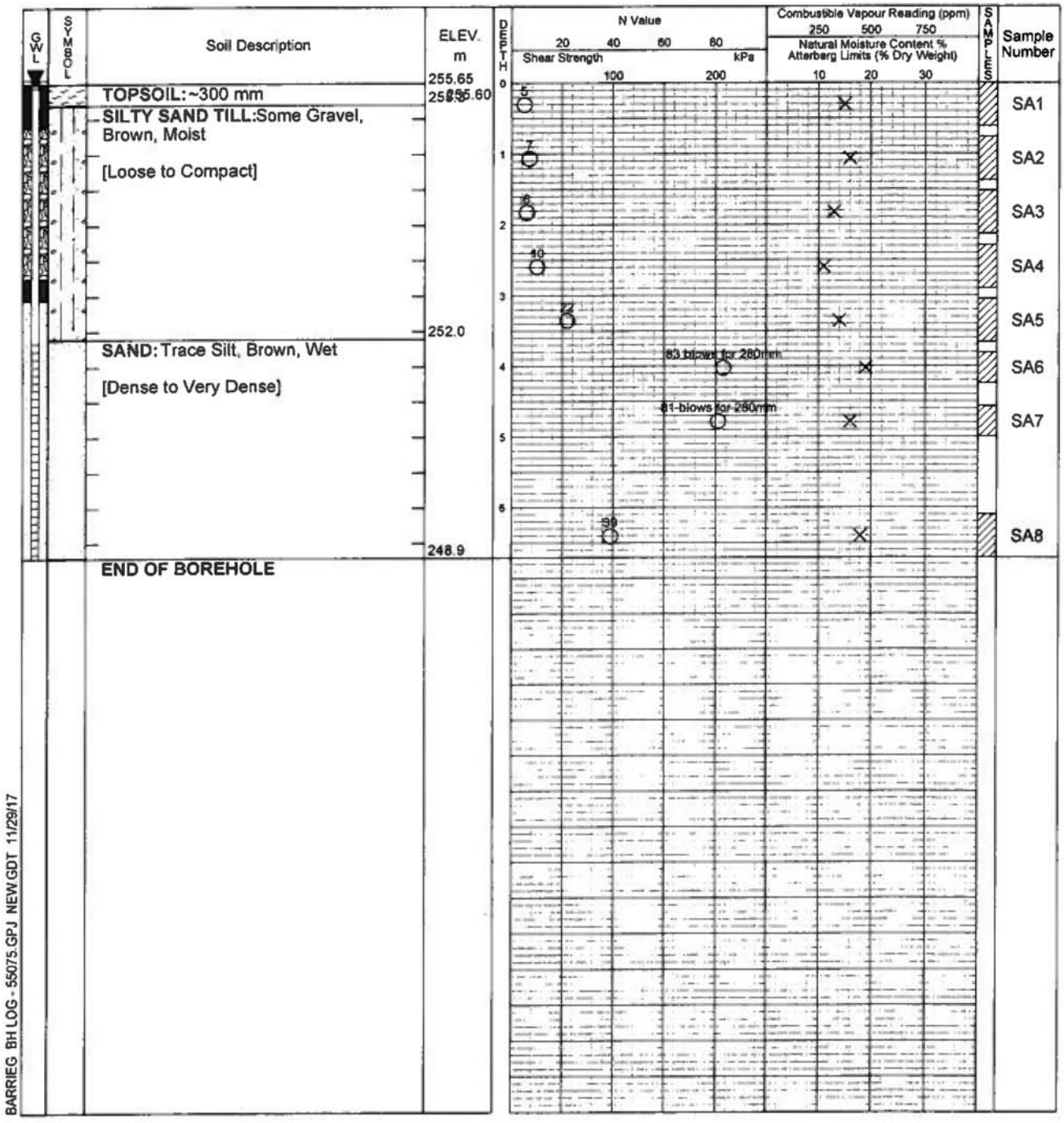
Auger Sample ☒ | Combustible Vapour Reading □

SPT (N) Value ○ ▨ | Natural Moisture ×

Dynamic Cone Test — | Plastic and Liquid Limit ⊢—○

Shelby Tube ■ | Undrained Triaxial at % Strain at Failure ⊕

Field Vane Test S | Penetrometer ▲



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Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	0.5	-
Nov. 23, 2017	0.05	

Log of Borehole BH13

Project No. BAR-00055075-A0 | Figure No. 14

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

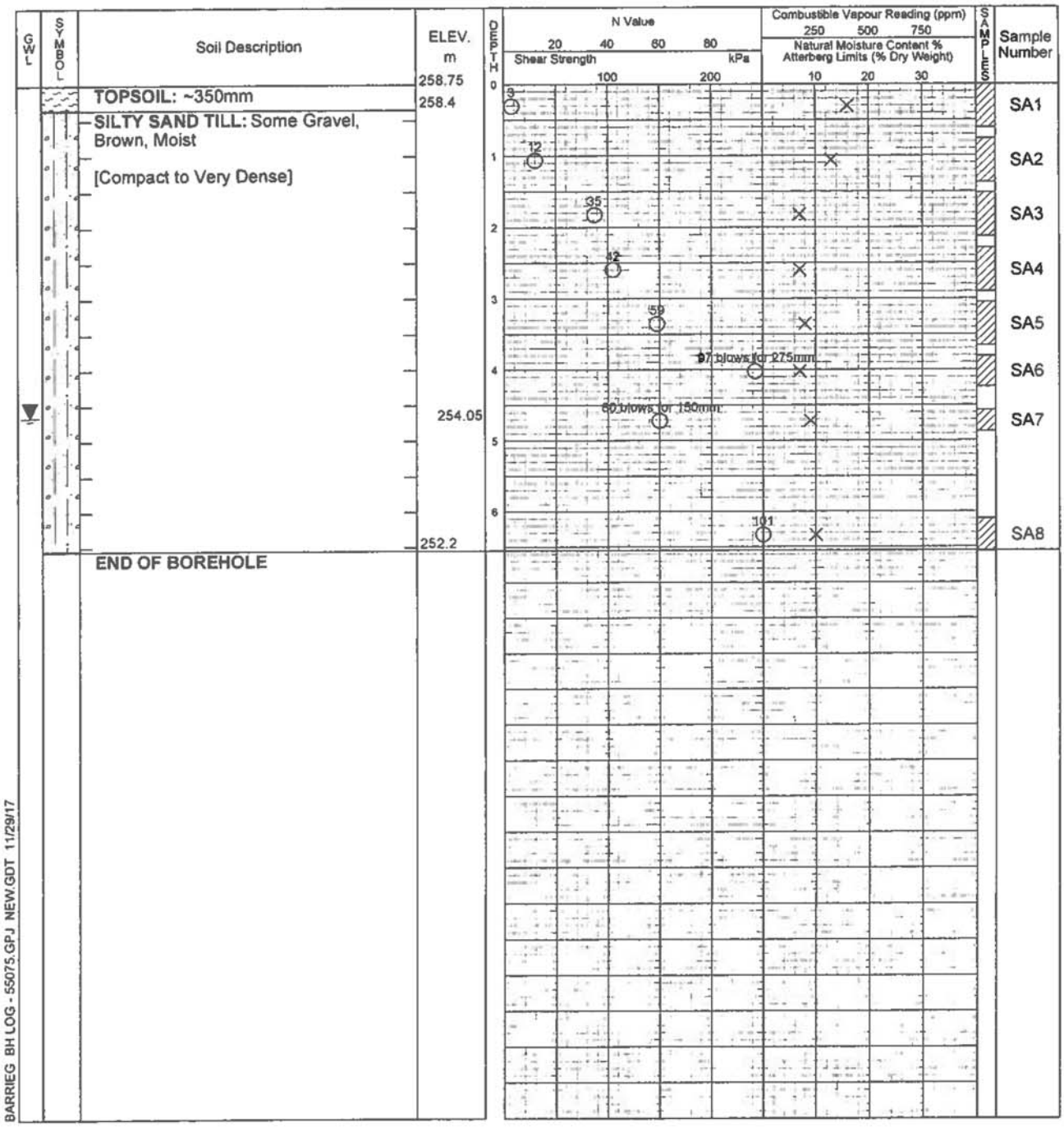
Date Drilled: October 17, 2017

Drill Type: Solid Stem Augers

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer



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Borehole data requires interpretation assistance from Exp before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	4.7	5.2

Log of Borehole BH14

Project No. BAR-00055075-A0 | Figure No. 15

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

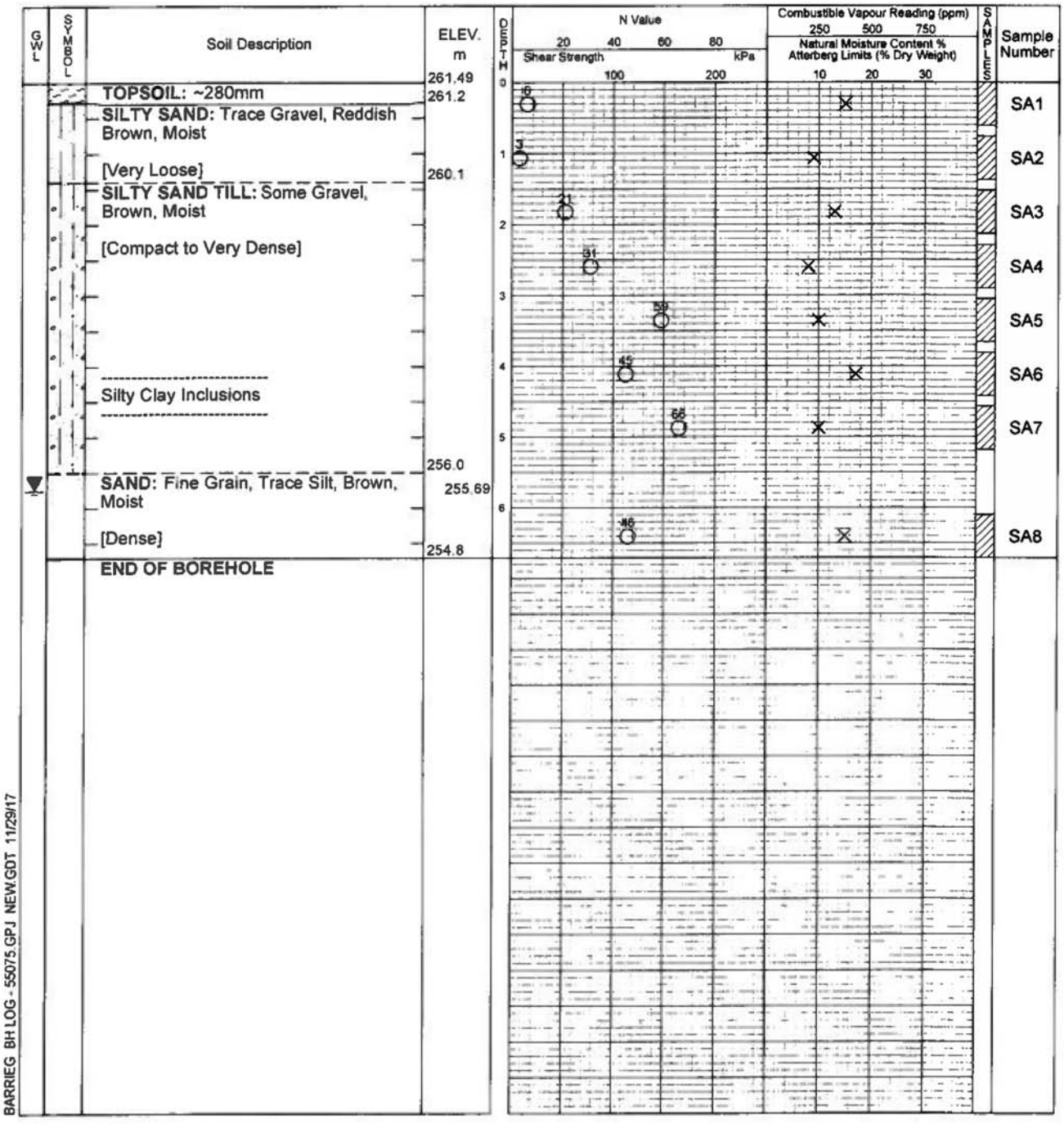
Date Drilled: October 17, 2017

Drill Type: Solid Stem Augers

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer



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Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	5.8	6.7

Log of Borehole BH15

Project No. BAR-00055075-A0 | Figure No. 16

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

Date Drilled: October 18, 2017

Drill Type: Solid Stem Augers

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	Sample Number
		TOPSOIL: ~250mm	256.06 / 255.8	0	SA1
		SILTY SAND TILL: Some Gravel, Brown, Moist [Compact]		1	SA2
				2	SA3
				2	SA4
				3	SA5
			252.3	4	SA6
		SAND: Fine Grain, Trace Gravel, Trace Silt, Brown, Moist [Compact to Dense]		5	SA7
				6	SA8
			249.4		
		END OF BOREHOLE			

N Value: 20 40 60 80 — Shear Strength kPa: 100 200

Combustible Vapour Reading (ppm): 250 500 750 — Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10 20 30

SAMPLES

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Borehole data requires interpretation assistance from Exp before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)

Log of Borehole BH16

Project No. BAR-00055075-A0 | Figure No. 17

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

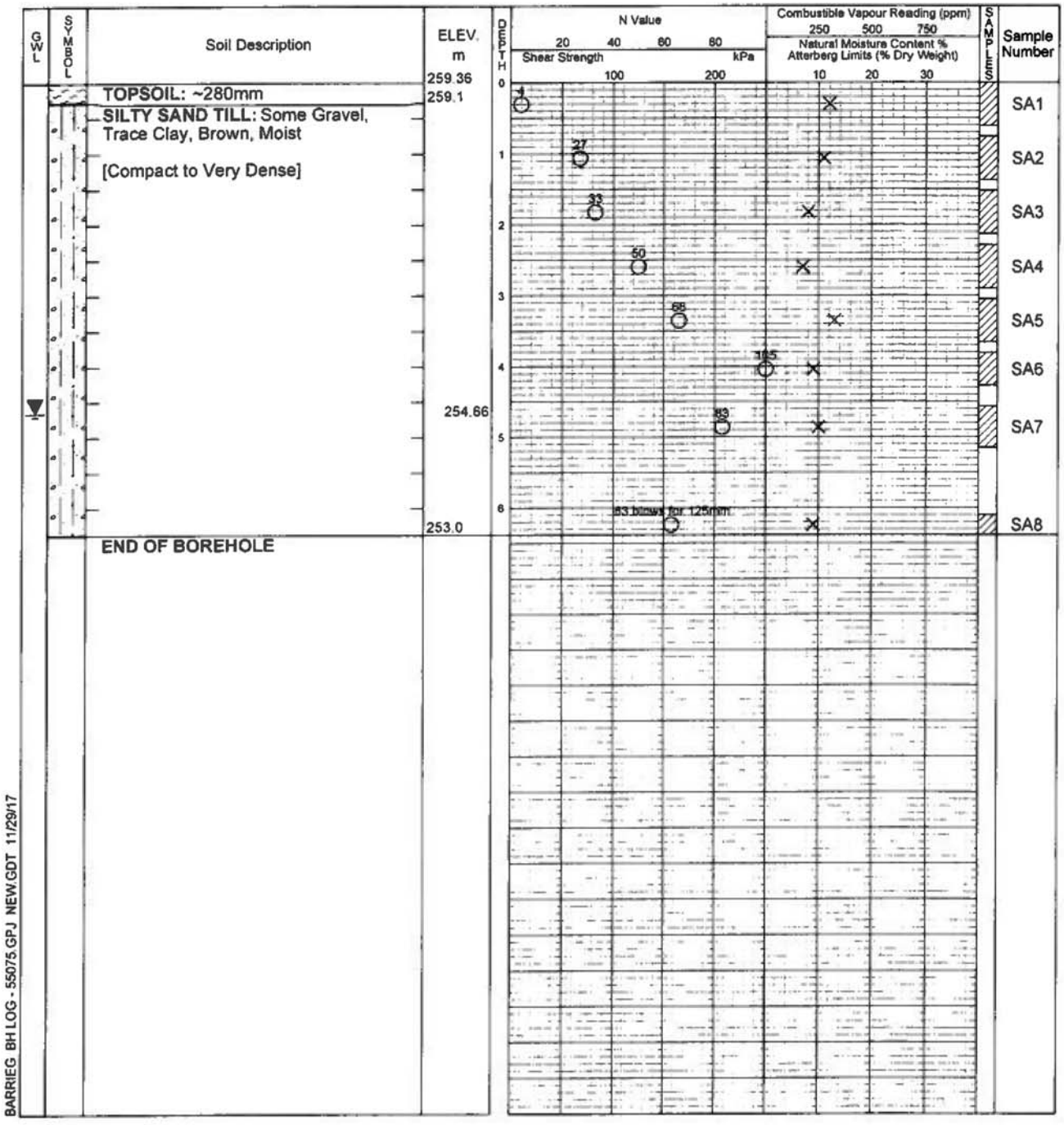
Date Drilled: October 17, 2017

Drill Type: Solid Stem Augers

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer



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Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	4.7	4.9

Log of Borehole BH17

Project No. BAR-00055075-A0 | Figure No. 18

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

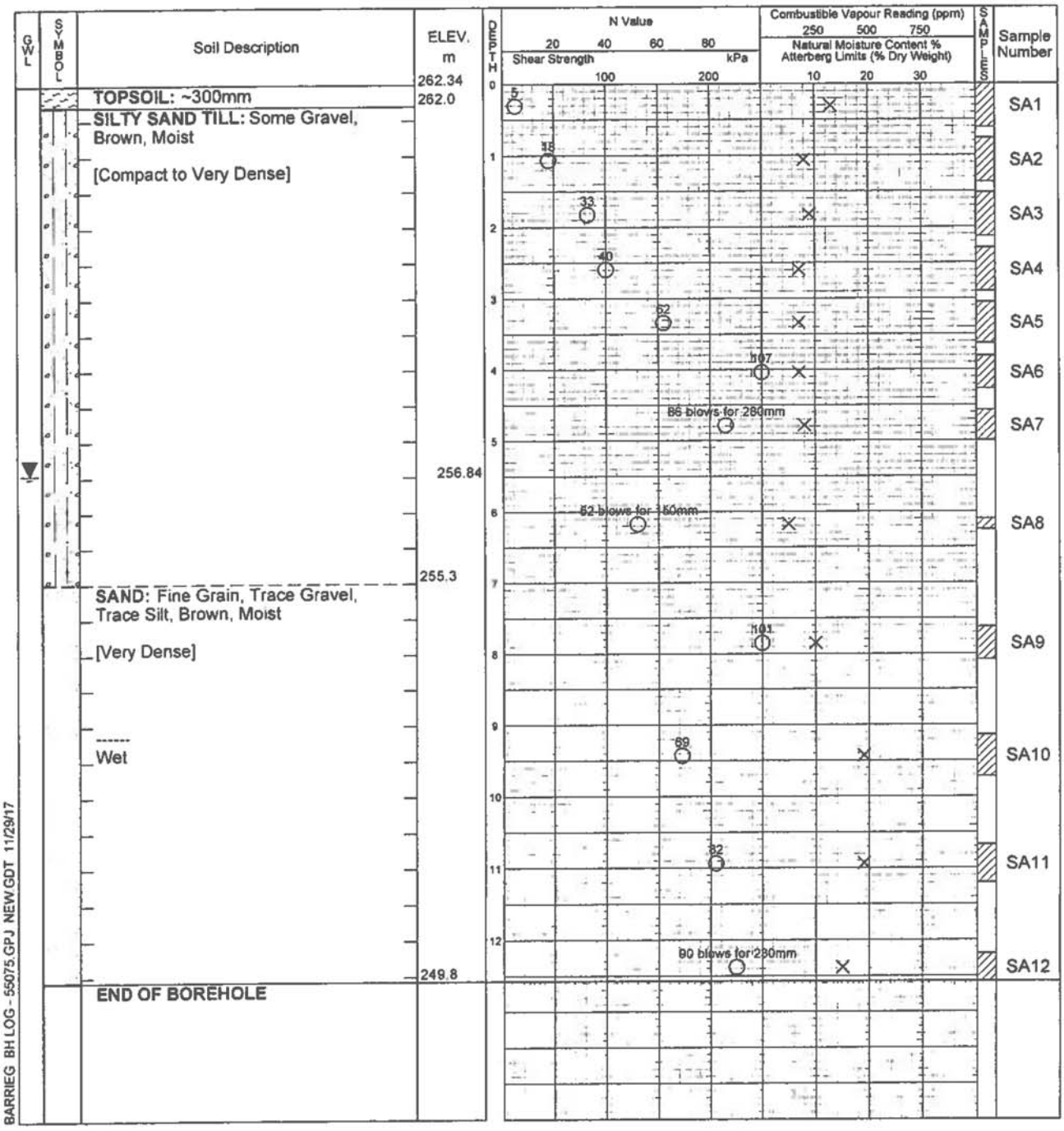
Date Drilled: October 19, 2017

Drill Type: Hollow Stem Augers

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer



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Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	5.5	7.0

Log of Borehole BH18

Project No. BAR-00055075-A0 | Figure No. 19

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

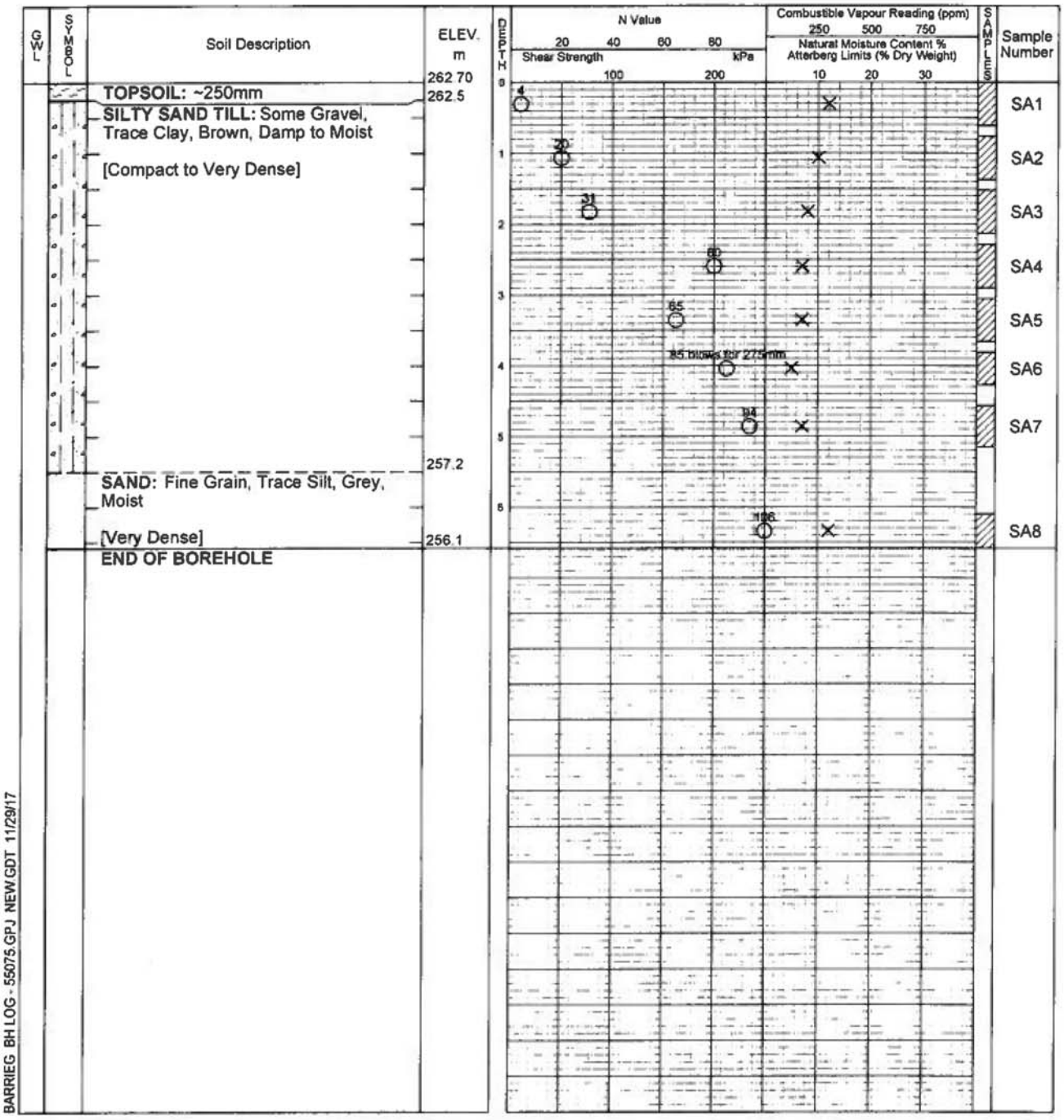
Date Drilled: October 17, 2017

Drill Type: Solid Stem Augers

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer



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Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	6.5

Log of Borehole BH19

Project No. BAR-00055075-A0

Project: Geotechnical Investigation

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

Date Drilled: October 24, 2017

Drill Type: Hollow Stem Augers

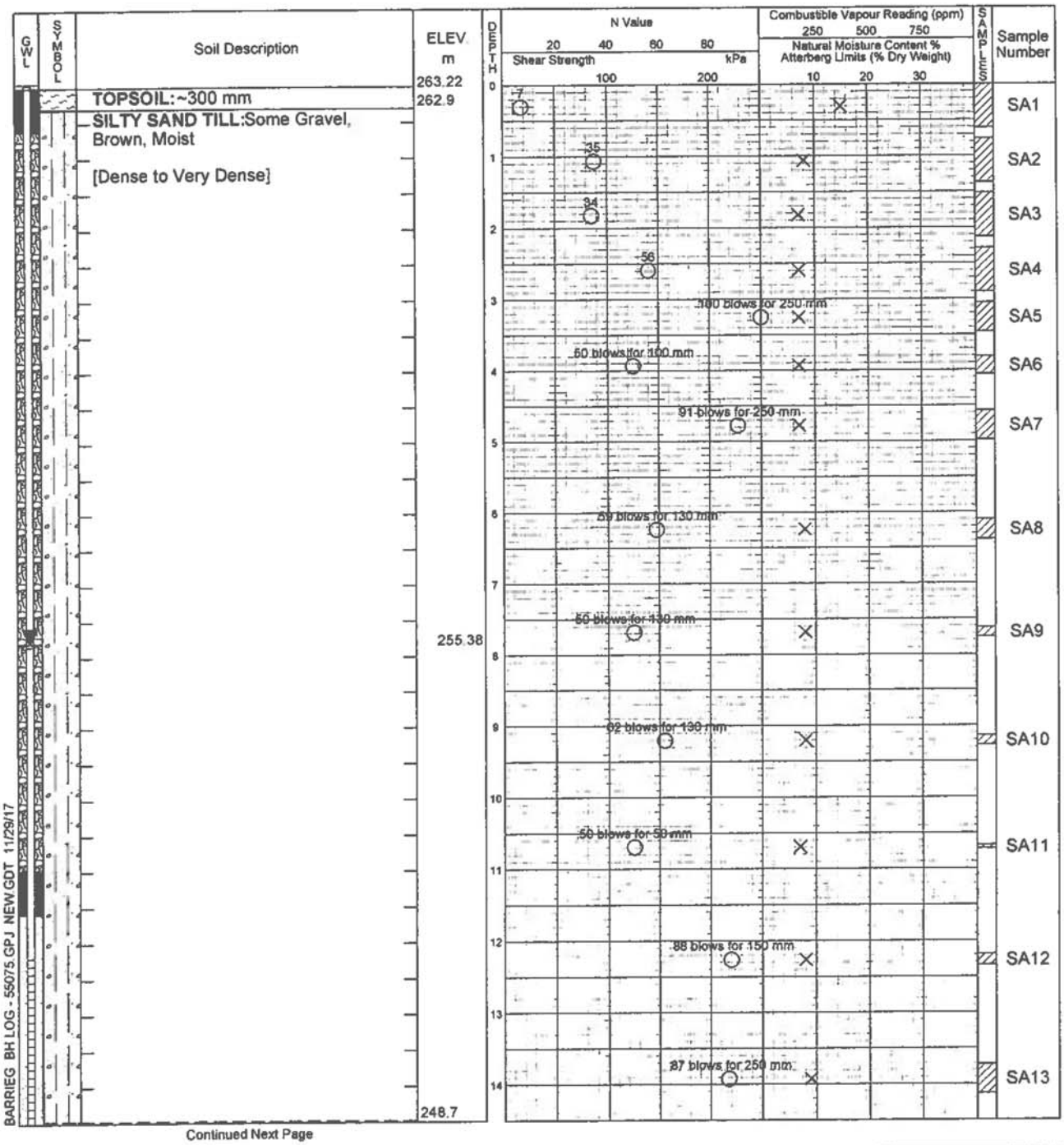
Datum: Geodetic

Figure No. 20

Sheet No. 1 of 2

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



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Borehole data requires interpretation assistance from Exp before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	13.72
Nov. 23, 2017	7.84	

Log of Borehole BH19

Project No. BAR-00055075-A0 Figure No. 20

Project: Geotechnical Investigation Sheet No. 2 of 2

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH
		SAND: Trace Gravel, Some Silt, Brown, Wet	248.72	
		[Very Dense]	247.7	15
		END OF BOREHOLE		

N Value: 20 40 60 80
Shear Strength: 100 200 kPa
Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30

80 blows for 150 mm

SAMPLES	Sample Number
	SA14

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Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	13.72
Nov. 23, 2017	7.84	

Log of Borehole BH20

Project No. BAR-00055075-A0

Figure No. 21

Project: Geotechnical Investigation

Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

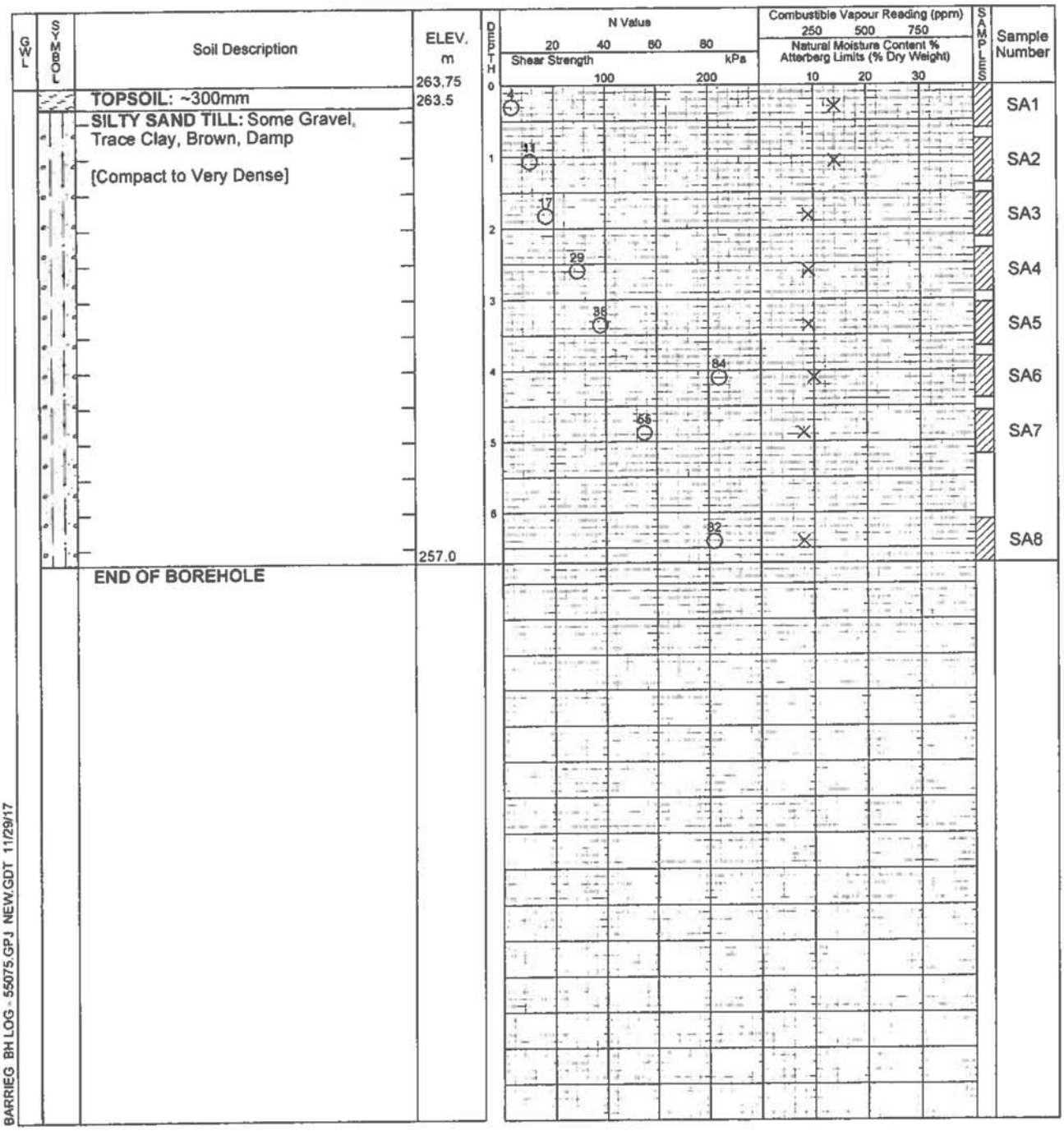
Date Drilled: October 18, 2017

Drill Type: Hollow Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



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Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	6.7

Log of Borehole BH21

Project No. BAR-00055075-A0 | Figure No. 22

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

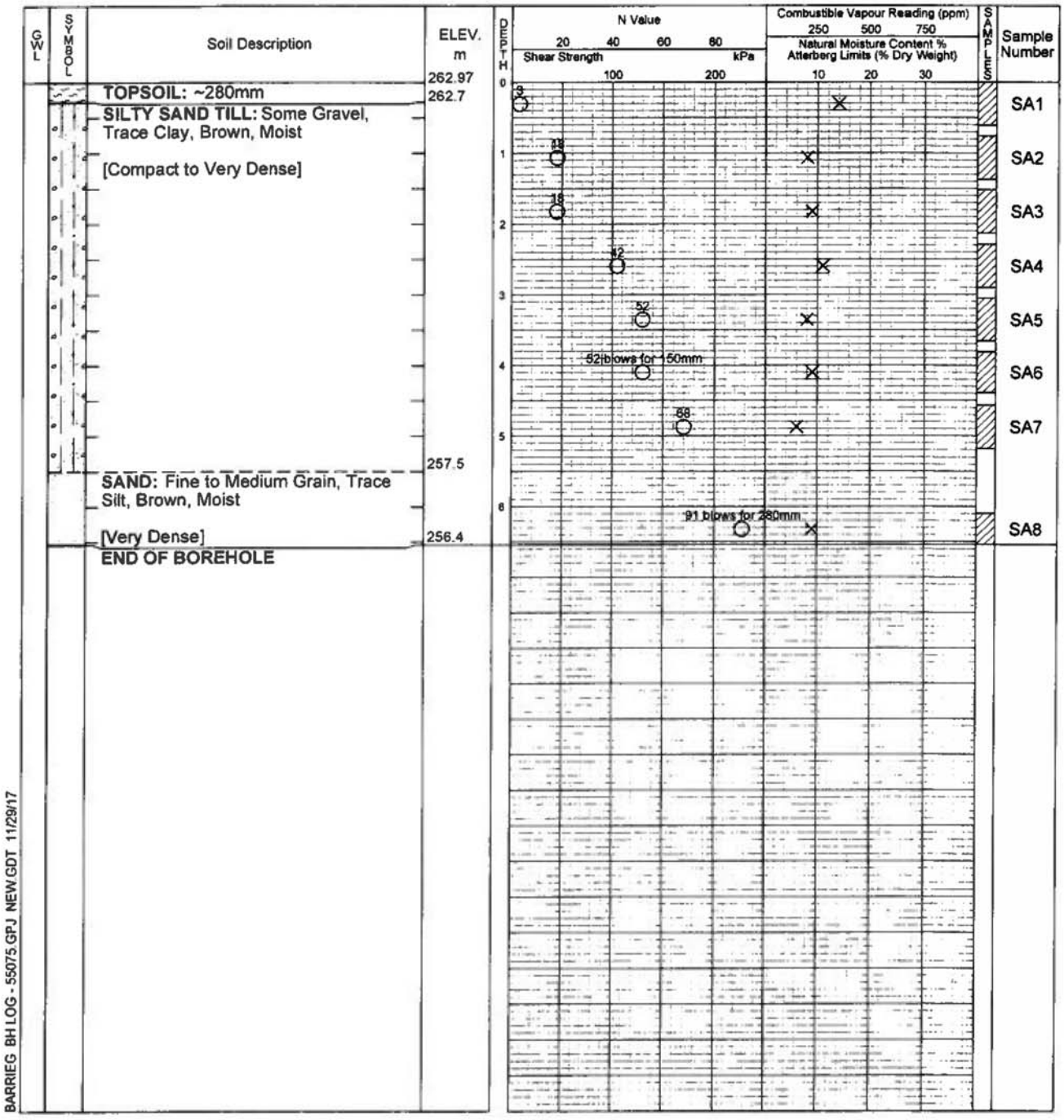
Date Drilled: October 17, 2017

Drill Type: Solid Stem Augers

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer



BARRIEG BH LOG - 55075.GPJ NEW.GDT 11/29/17

exp. Services Inc.
14 Cedar Pointe Drive
Barrie, ON L4N 5R7
t: +1.705.734.6222
f: +1.705.734.6224

Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	6.5

Log of Borehole BH22

Project No. BAR-00055075-A0

Project: Geotechnical Investigation

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

Date Drilled: October 19, 2017

Drill Type: Hollow Stem Augers

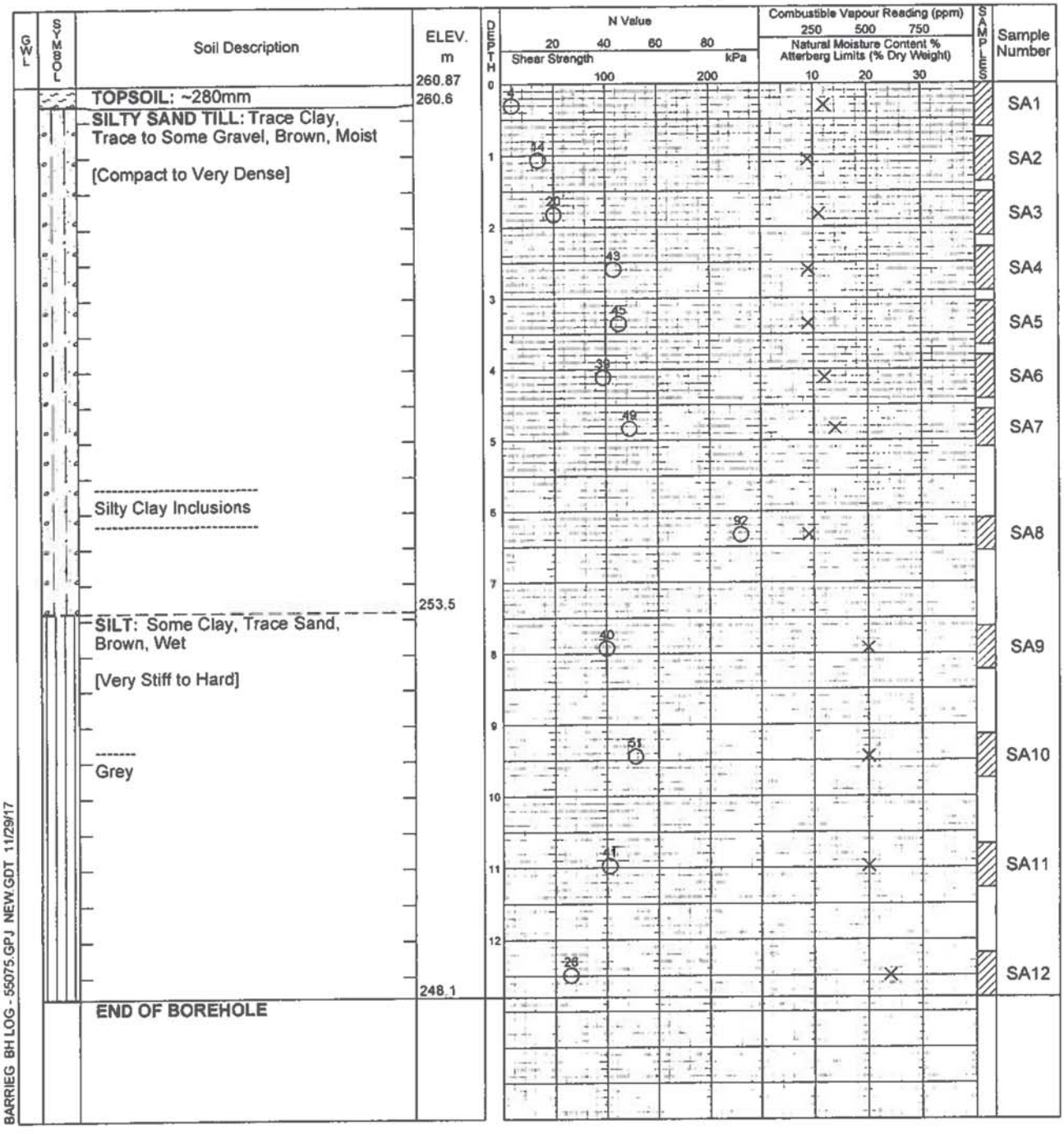
Datum: Geodetic

Figure No. 23

Sheet No. 1 of 1

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



BARRIEG BH LOG - 55075.GPJ NEW.GDT 11/29/17

exp. Services Inc.
14 Cedar Pointe Drive
Barrie, ON L4N 5R7
t: +1.705.734.6222
f: +1.705.734.6224

Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	6.9

Log of Borehole BH23

Project No. BAR-00055075-A0 | Figure No. 23

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

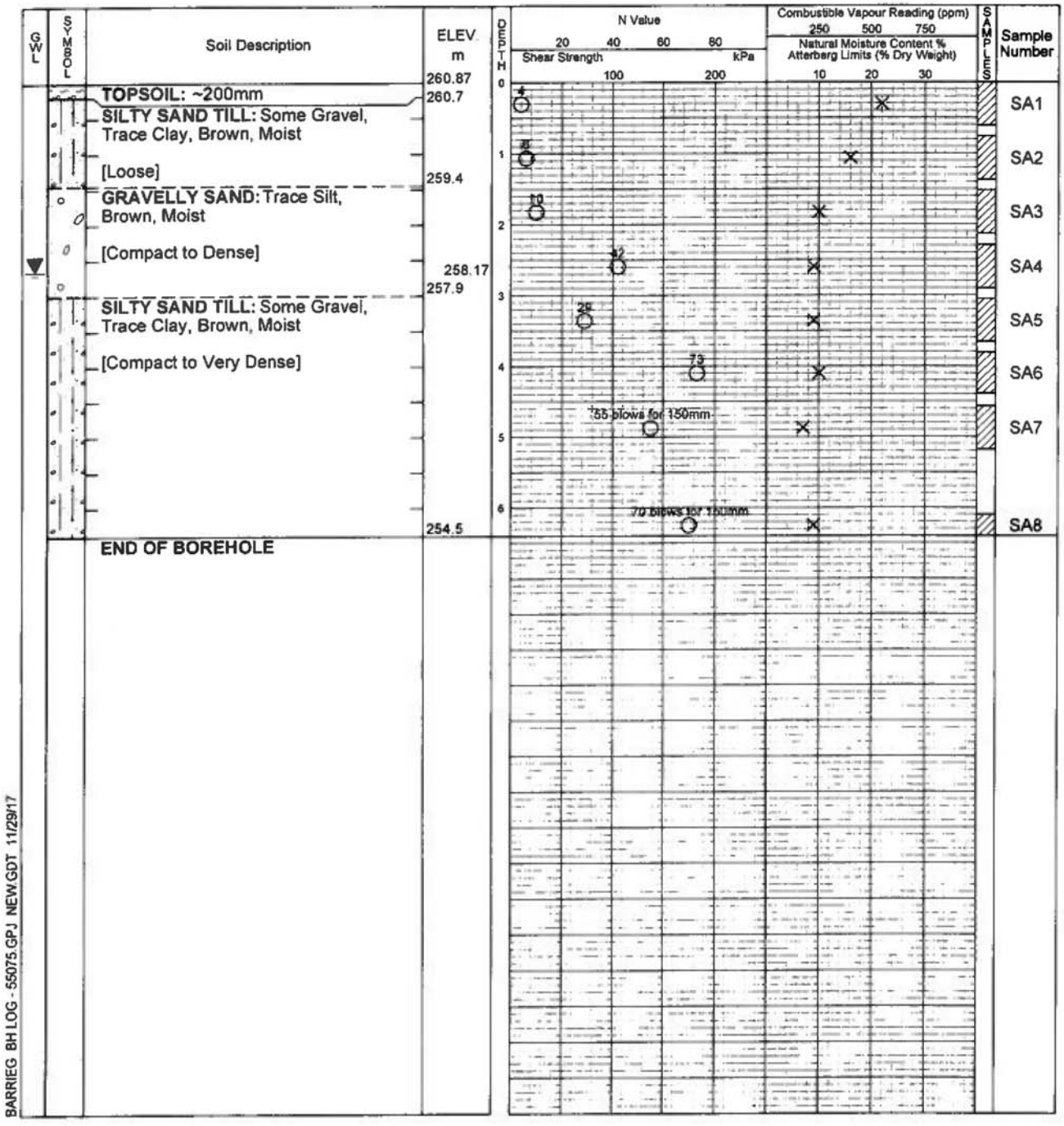
Date Drilled: October 17, 2017

Drill Type: Solid Stem Augers

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer



BARRIEG BH LOG - 55075.GPJ NEW.GDT 11/29/17

exp. Services Inc.
14 Cedar Pointe Drive
Barrie, ON L4N 5R7
t: +1.705.734.6222
f: +1.705.734.6224

Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	2.7	2.9

Log of Borehole BH24

Project No. BAR-00055075-A0 | Figure No. 25

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

Date Drilled: October 18, 2017

Drill Type: Hollow Stem Augers

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	Sample Number
			253.81		
		TOPSOIL: ~300mm	253.5	0	SA1
		SILTY SAND TILL: Trace Clay, Some Gravel, Brown, Moist [Compact]		1	SA2
▼				2	SA3
			251.81		SA4
				3	SA5
			250.1		
		SAND: Fine Grain, Trace Gravel, Trace Silt, Grey, Moist to Wet [Compact to Very Dense]		4	SA6
				5	SA7
				6	SA8
			247.1		
		END OF BOREHOLE			

N Value: 20 40 60 80 — Shear Strength kPa: 100 200

Combustible Vapour Reading (ppm): 250 500 750 — Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30

SPT (N) values: 4, 15, 12, 14, 23, 17, 21, 56

BARRIEG BH LOG - 55075.GPJ NEW.GDT 11/29/17

exp. Services Inc.
14 Cedar Pointe Drive
Barrie, ON L4N 5R7
t: +1.705.734.6222
f: +1.705.734.6224

Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	2.0	4.6

Log of Borehole BH25

Project No. BAR-00055075-A0 | Figure No. 26

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

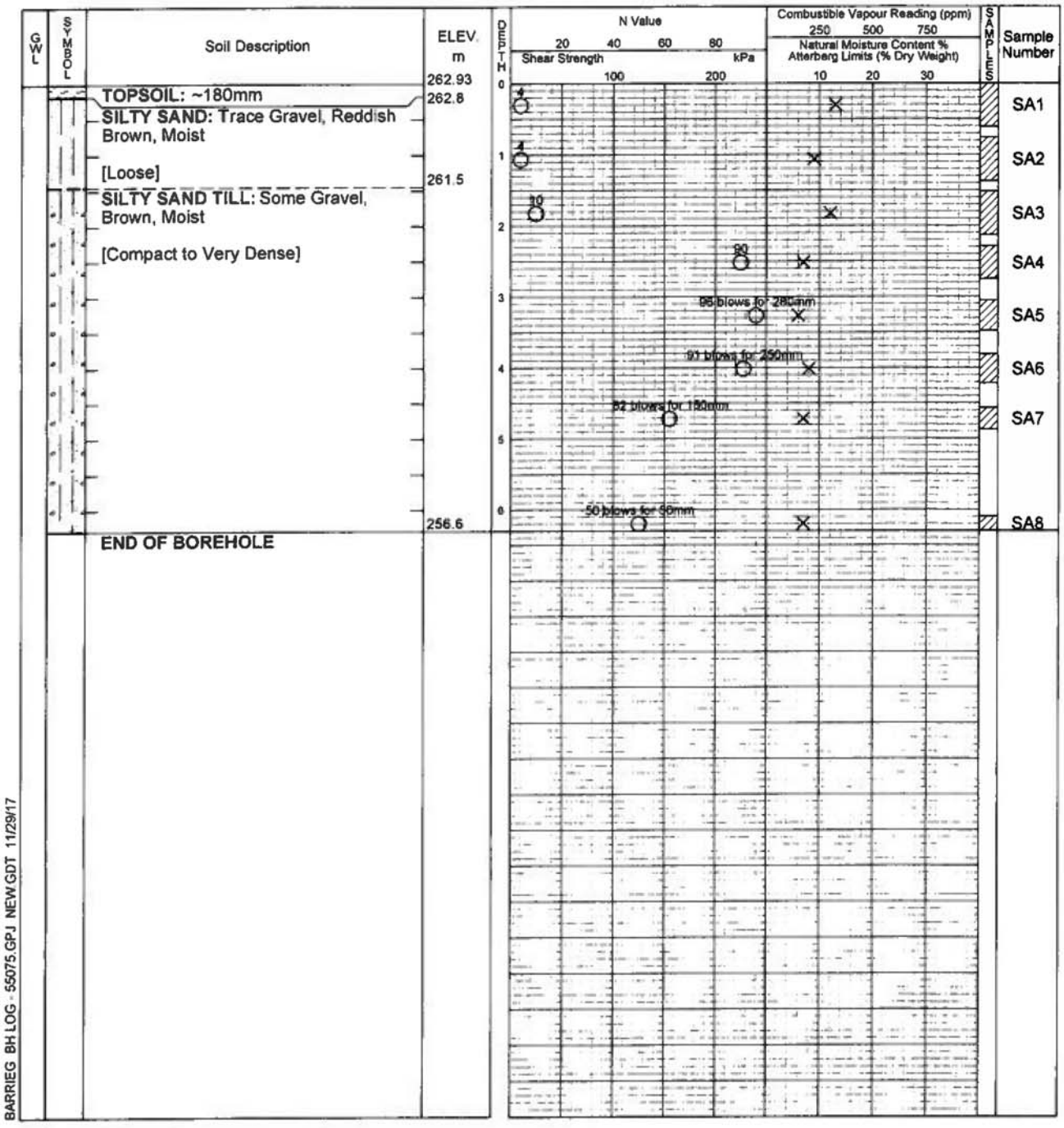
Date Drilled: October 18, 2017

Drill Type: Solid Stem Augers

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer



BARRIEG BH LOG - 55075.GPJ NEW.GDT 11/29/17

exp. Services Inc.
14 Cedar Pointe Drive
Barrie, ON L4N 5R7
t: +1.705.734.6222
f: +1.705.734.6224

Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	6.3

Log of Borehole BH26

Project No. BAR-00055075-A0 | Figure No. 27

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

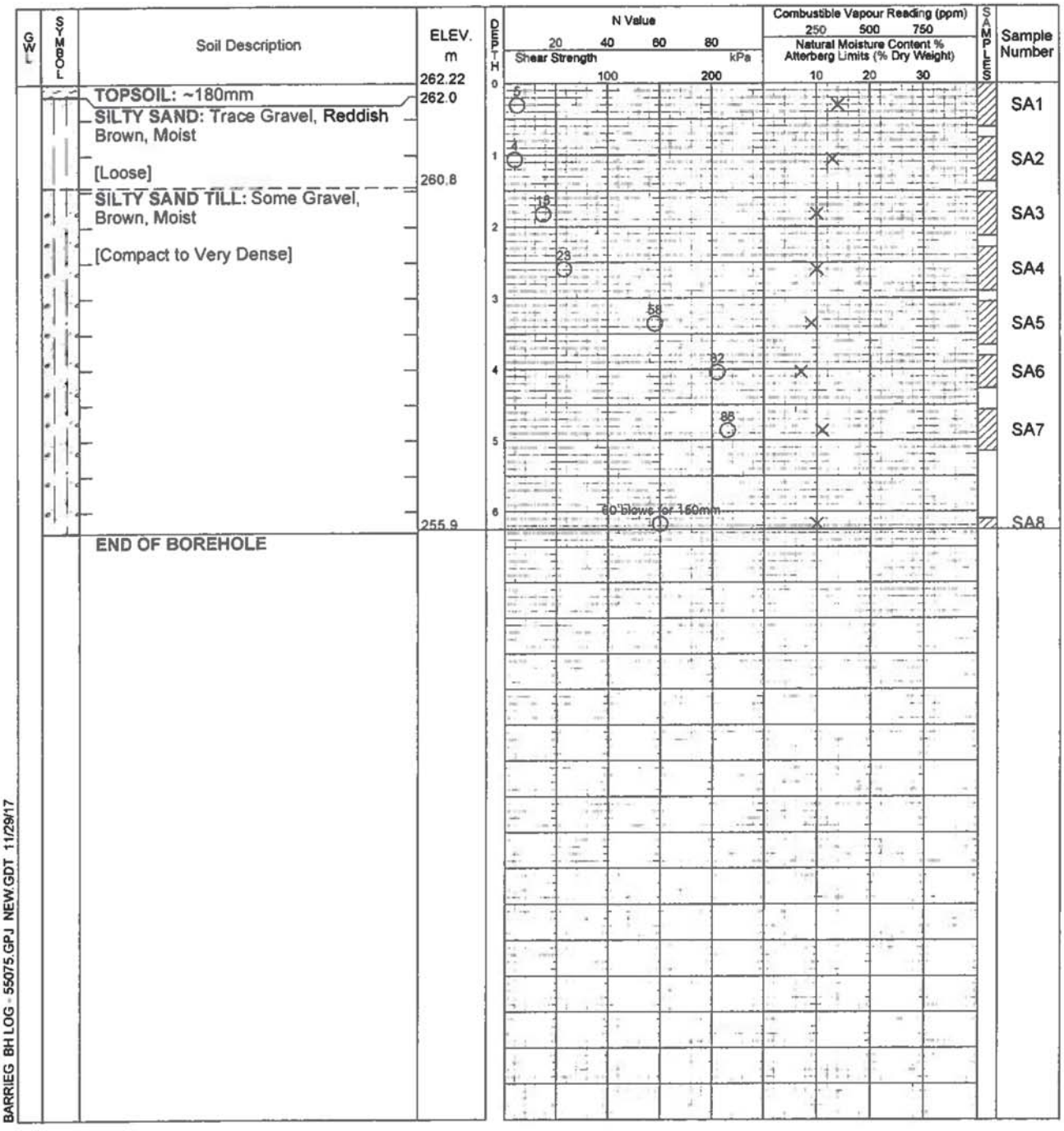
Date Drilled: October 18, 2017

Drill Type: Solid Stem Augers

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer



BARRIEG BH LOG - 55075.GPJ NEW.GDT 11/29/17

exp. Services Inc.
14 Cedar Pointe Drive
Barrie, ON L4N 5R7
t: +1.705.734.6222
f: +1.705.734.6224

Borehole data requires interpretation assistance from Exp before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	6.2

Log of Borehole BH27

Project No. BAR-00055075-A0 | Figure No. 28

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

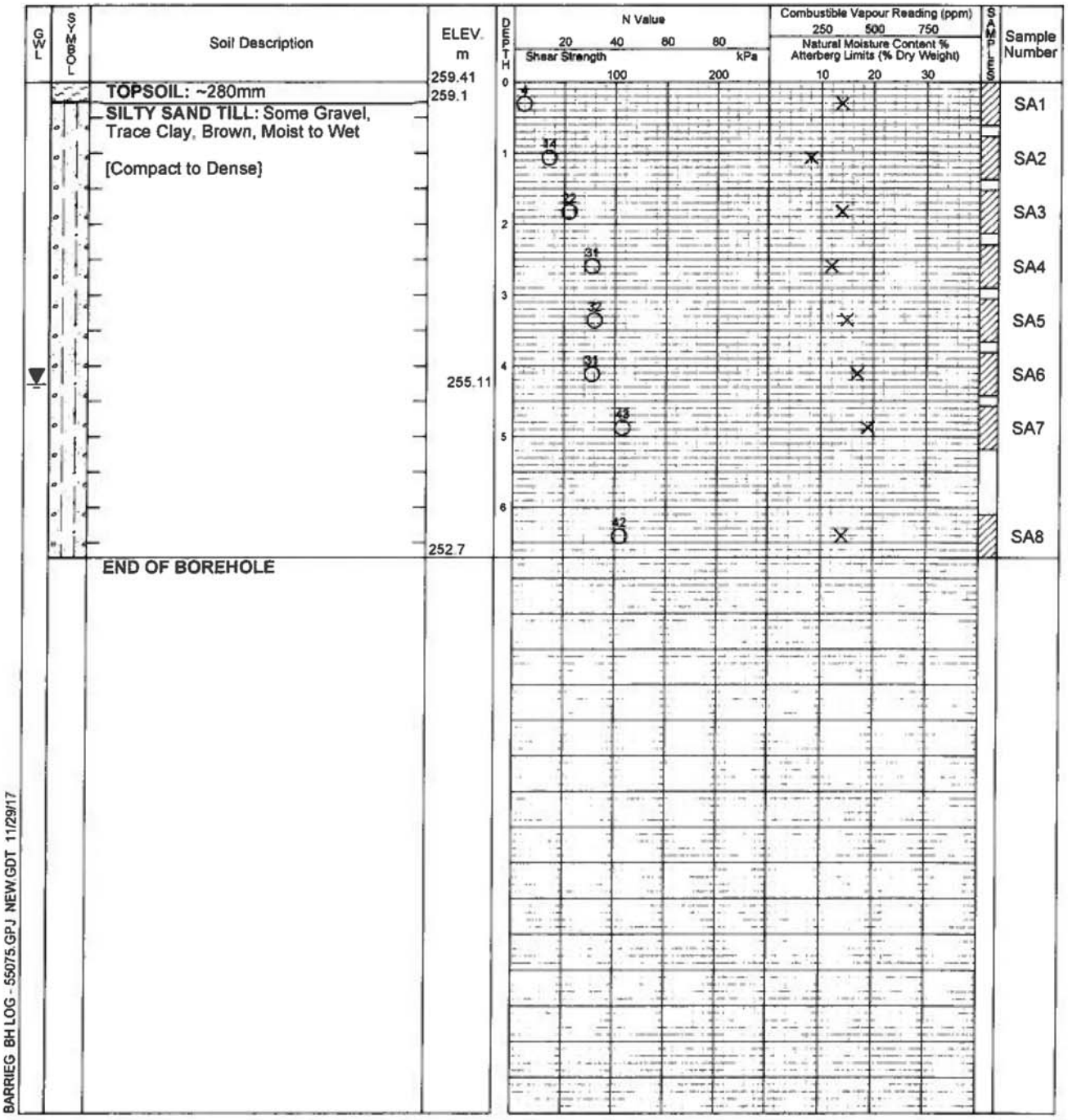
Location: 883 Mapleview Drive East

Date Drilled: October 18, 2017

Drill Type: Solid Stem Augers

Datum: Geodetic

Auger Sample | Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Undrained Triaxial at % Strain at Failure | Field Vane Test | Penetrometer



BARRIEG BH LOG - 55075.GPJ NEW.GDT 11/29/17

exp. Services Inc.
14 Cedar Pointe Drive
Barrie, ON L4N 5R7
t: +1.705.734.6222
f: +1.705.734.6224

Borehole data requires interpretation assistance from Exp before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	4.3	5.5

Log of Borehole BH28

Project No. BAR-00055075-A0

Project: Geotechnical Investigation

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

Date Drilled: October 24, 2017

Drill Type: Hollow Stem Augers

Datum: Geodetic

Figure No. 29

Sheet No. 1 of 1

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test
Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLERS	Sample Number
		TOPSOIL: ~250 mm	255.8	0	6			SA1
		SILTY SAND TILL: Trace to Some Gravel, Brown to Grey, Moist to Wet [Compact]		1	10			SA2
				2	10			SA3
				2	27			SA4
				3	13			SA5
				4	28			SA6
				5	22			SA7
		SAND: Trace to Some Silt, Trace Gravel, Grey, Moist to Wet [Dense]	250.4	6	31			SA8
				7				
				8	48			SA9
		END OF BOREHOLE	247.8					

BARRIEG BH LOG - 55075.GPJ NEW.GDT 11/29/17

exp. Services Inc.
14 Cedar Pointe Drive
Barrie, ON L4N 5R7
t: +1.705.734.6222
f: +1.705.734.6224

Borehole data requires interpretation assistance from Exp before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	2.3	-
Nov. 23, 2017	-0.02	

Log of Borehole BH29

Project No. BAR-00055075-A0 | Figure No. 30

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

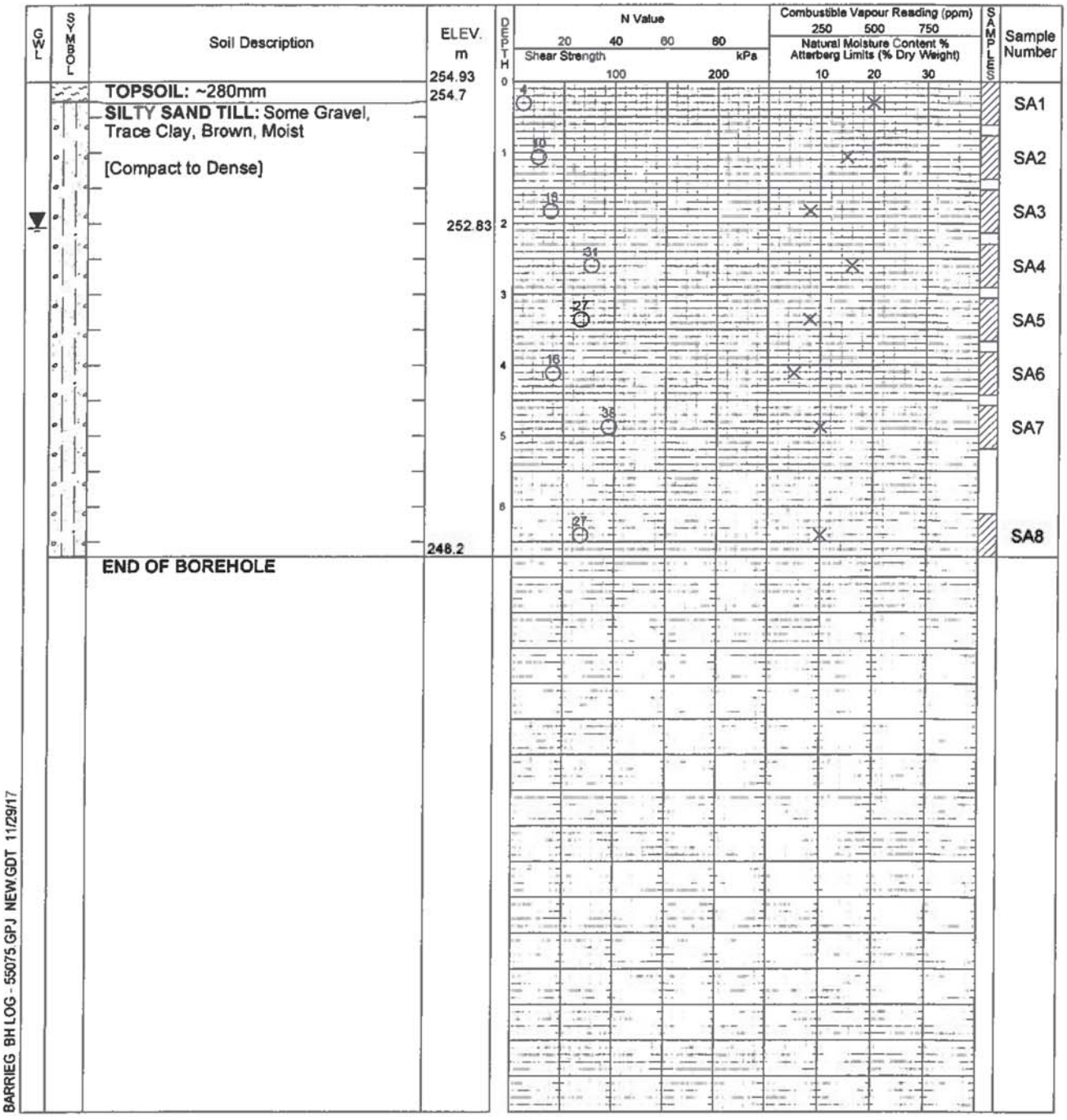
Date Drilled: October 19, 2017

Drill Type: Hollow Stem Augers

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer



BARRIEG BH LOG - 55075.GPJ NEW.GDT 11/29/17

exp. Services Inc.
14 Cedar Pointe Drive
Barrie, ON L4N 5R7
t: +1.705.734.6222
f: +1.705.734.6224

Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	2.1	5.5

Log of Borehole BH30

Project No. BAR-00055075-A0

Project: Geotechnical Investigation

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

Date Drilled: October 26, 2017

Drill Type: Hollow Stem Augers

Datum: Geodetic

Figure No. 31

Sheet No. 1 of 1

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLE	Sample Number
			254.52		20 40 60 80 / 100 200	250 500 750 / 10 20 30		
		TOPSOIL: ~250 mm	254.3	0	2			SA1
		CLAYEY SILT: Trace Sand, Brown, Moist [Firm]	253.1	1	7			SA2
		SAND: Some Gravel, Brown, Moist [Loose]	252.3	2	8			SA3
		SILTY SAND TILL: Trace Gravel, Brown, Moist [Compact]	250.8	3	14			SA4
		SAND: Trace to Some Gravel, Brown, Moist to Wet [Very Dense]		4	31			SA5
				5	51			SA6
				6	56			SA7
				7	60			SA8
			246.5	8	98 blows for 280 mm			SA9
		END OF BOREHOLE						

BARRIEG BH LOG - 55075.GPJ NEW.GDT 11/29/17

exp. Services Inc.
14 Cedar Pointe Drive
Barrie, ON L4N 5R7
t: +1.705.734.6222
f: +1.705.734.6224

Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	1.52	3.35

Log of Borehole BH31

Project No. BAR-00055075-A0 | Figure No. 32

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

Date Drilled: October 25, 2017

Drill Type: Hollow Stem Augers

Datum: Geodetic

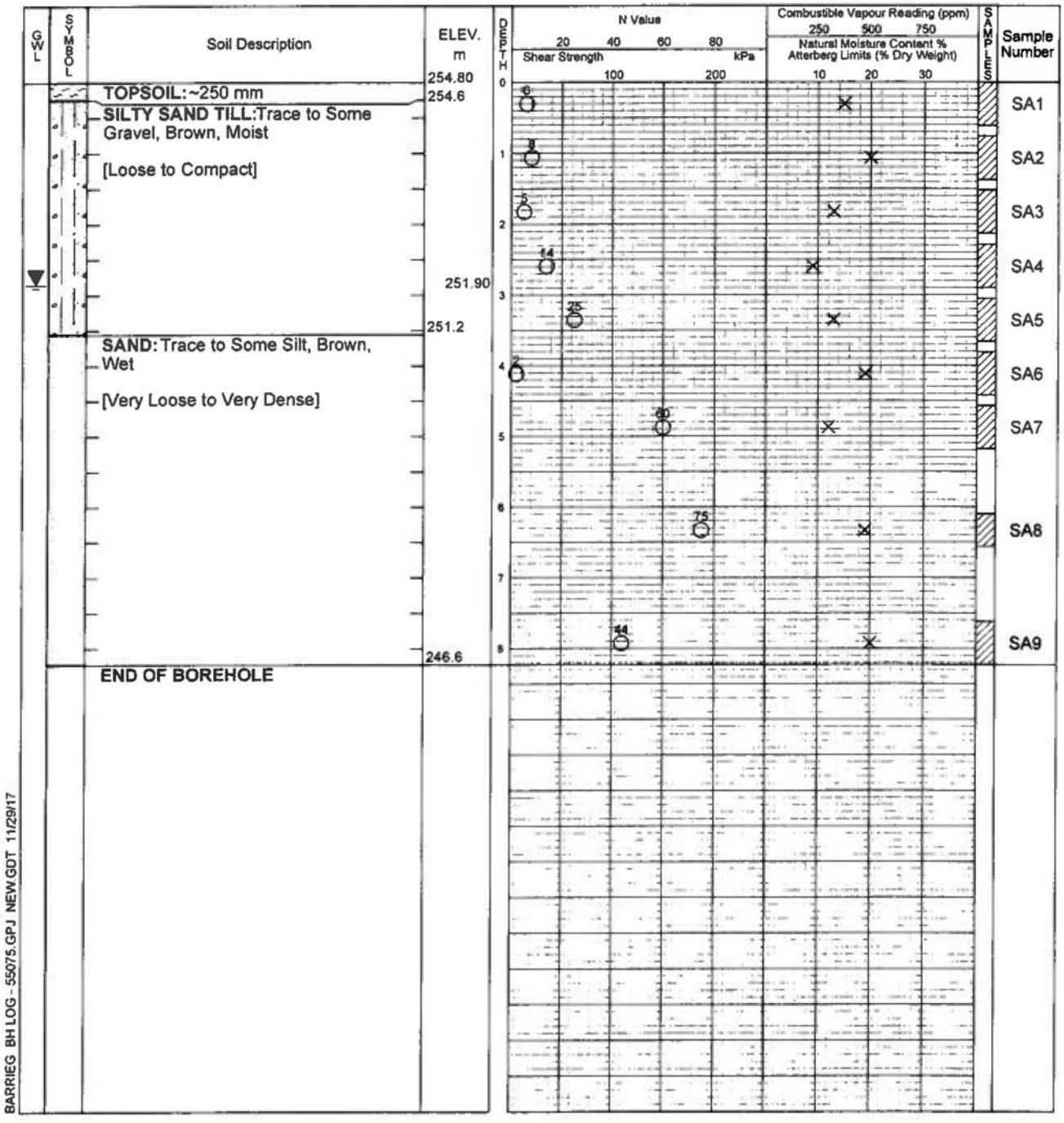
Auger Sample | Combustible Vapour Reading

SPT (N) Value | Natural Moisture

Dynamic Cone Test | Plastic and Liquid Limit

Shelby Tube | Undrained Triaxial at % Strain at Failure

Field Vane Test | Penetrometer



BARRIEG BH LOG - 55075.GPJ NEW.GDT 11/29/17

exp. Services Inc.
14 Cedar Pointe Drive
Barrie, ON L4N 5R7
t: +1.705.734.6222
f: +1.705.734.6224

Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Comption	2.9	3.7

Log of Borehole BH32

Project No. BAR-00055075-A0 | Figure No. 33

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

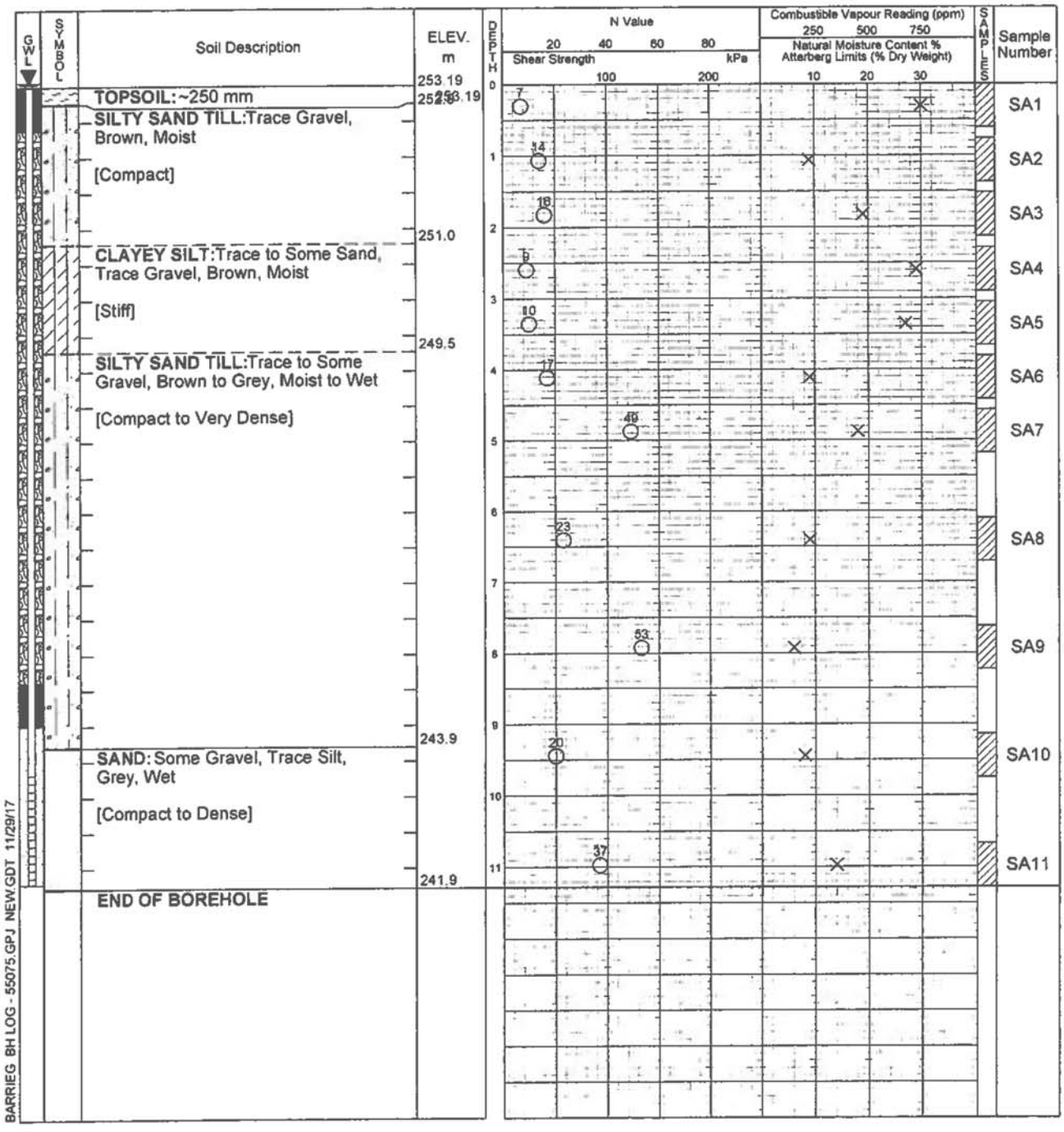
Date Drilled: October 26, 2017

Drill Type: Hollow Stem Augers

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer



BARRIEG BH LOG - 55075.GPJ NEW.GDT 11/29/17

exp. Services Inc.
14 Cedar Pointe Drive
Barrie, ON L4N 5R7
t: +1.705.734.6222
f: +1.705.734.6224

Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion Nov. 23, 2017	9.75 Artesian	10.67

Log of Borehole BH33

Project No. BAR-00055075-A0 | Figure No. 34

Project: Geotechnical Investigation | Sheet No. 1 of 1

City/ Municipality: Barrie

Location: 883 Mapleview Drive East

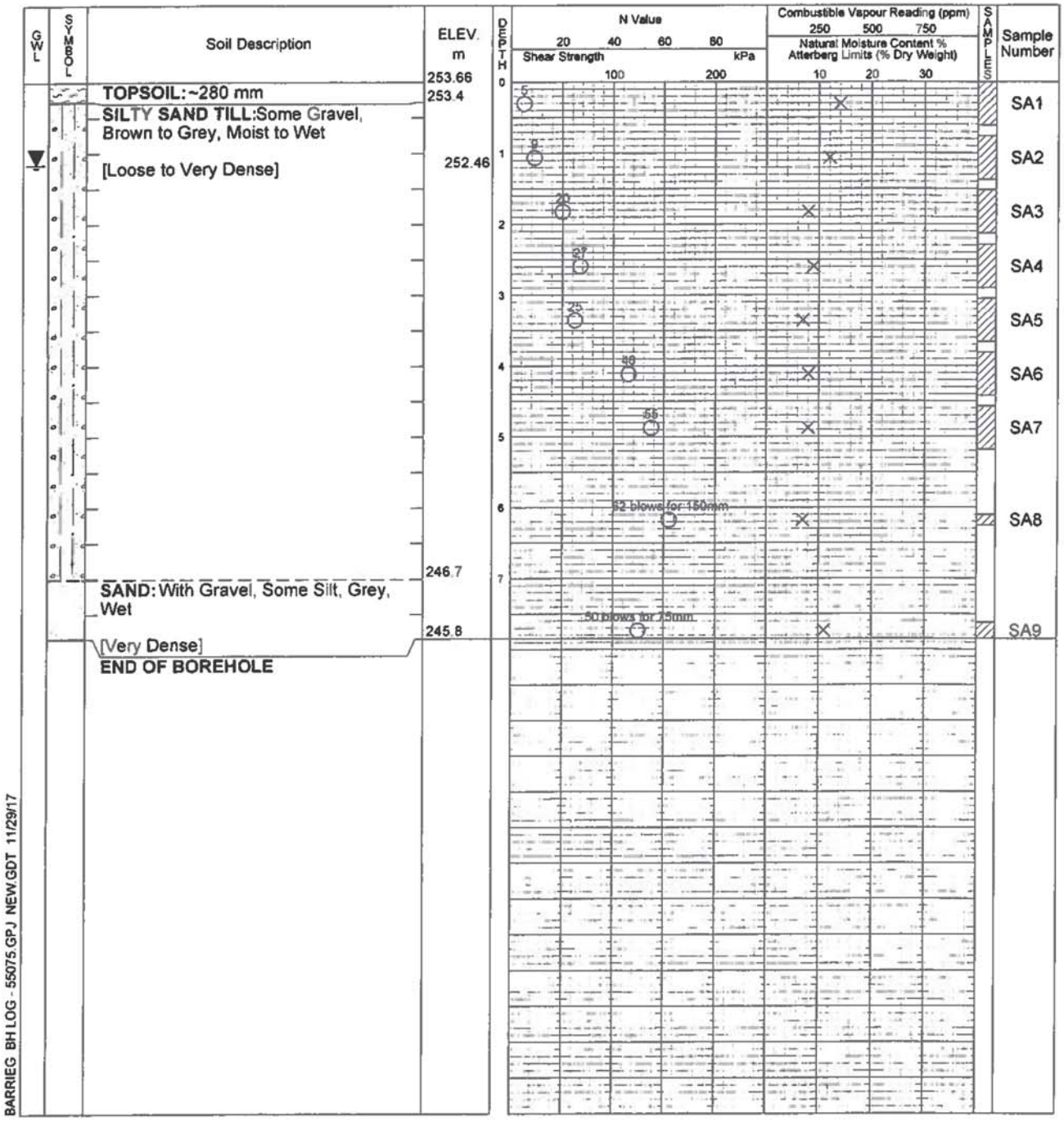
Date Drilled: October 25, 2017

Drill Type: Hollow Stem Augers

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer



BARRIEG BH LOG - 55075.GPJ NEW.GDT 11/29/17

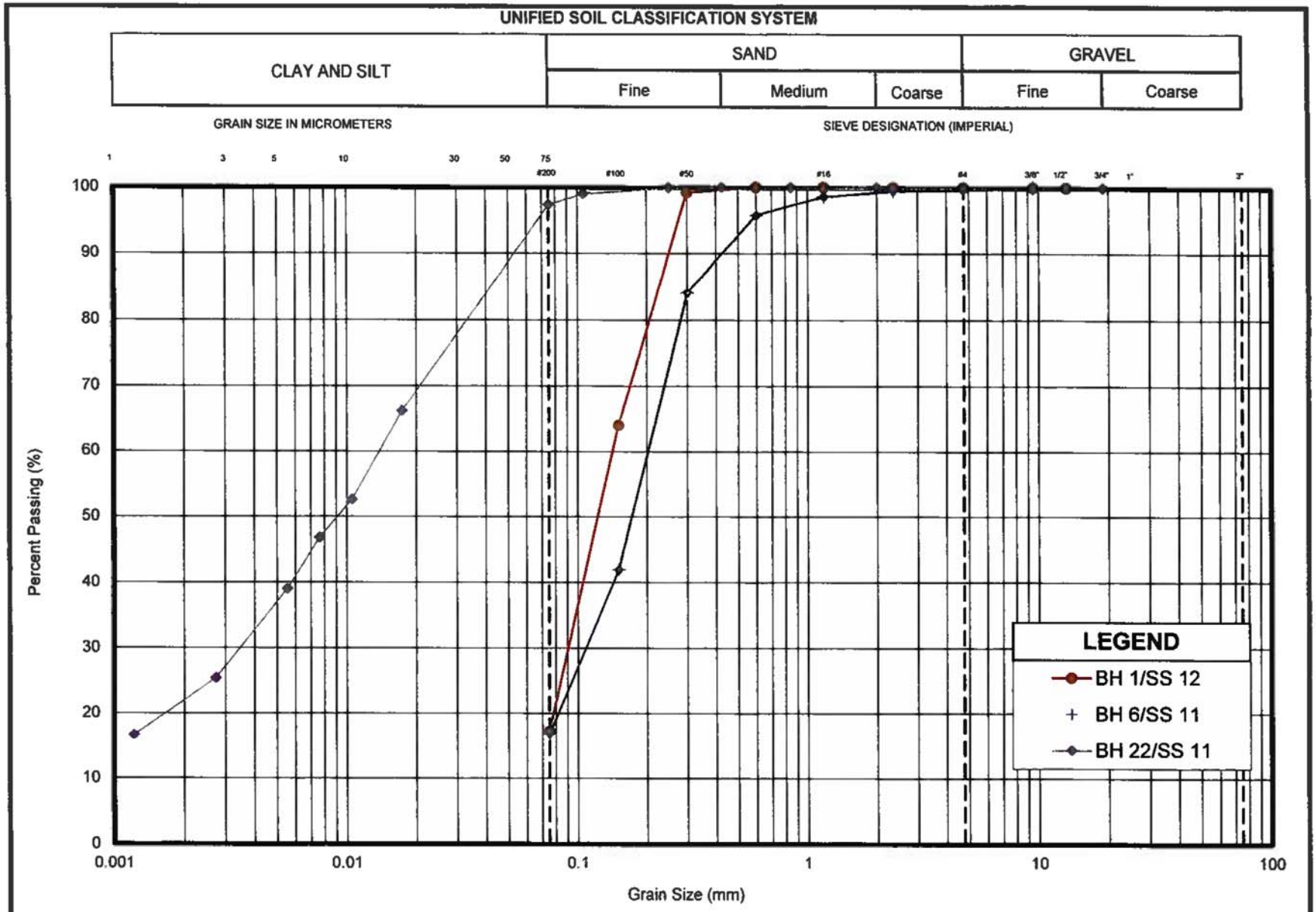
exp. Services Inc.
14 Cedar Pointe Drive
Barrie, ON L4N 5R7
t: +1.705.734.6222
f: +1.705.734.6224

Borehole data requires interpretation assistance from **Exp** before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	1.2	2.1

Appendix C:
Grain Size Analysis

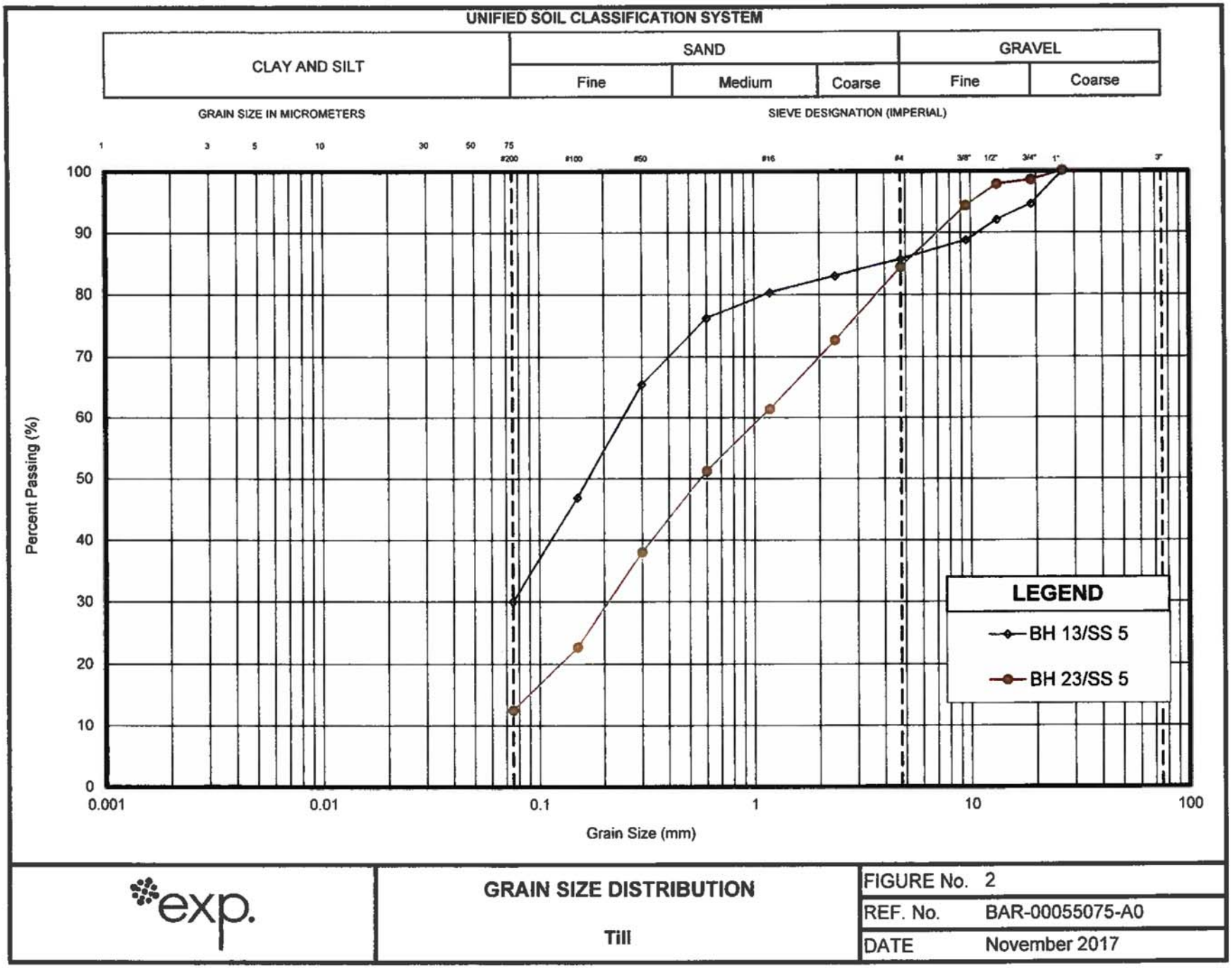


exp.

GRAIN SIZE DISTRIBUTION

Sands & Silts

FIGURE No.	1
REF. No.	BAR-00055075-A0
DATE	October 2017



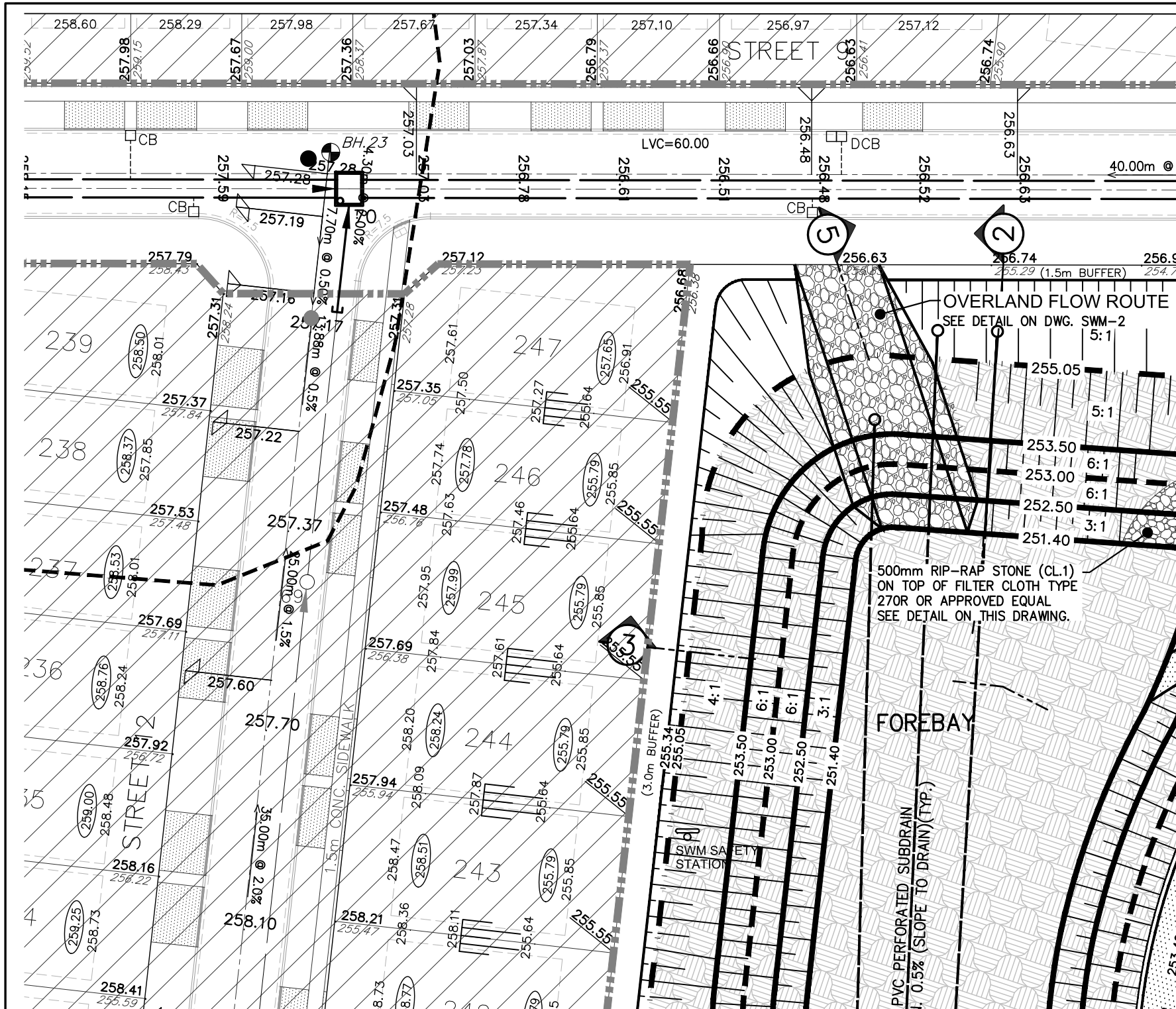
exp.

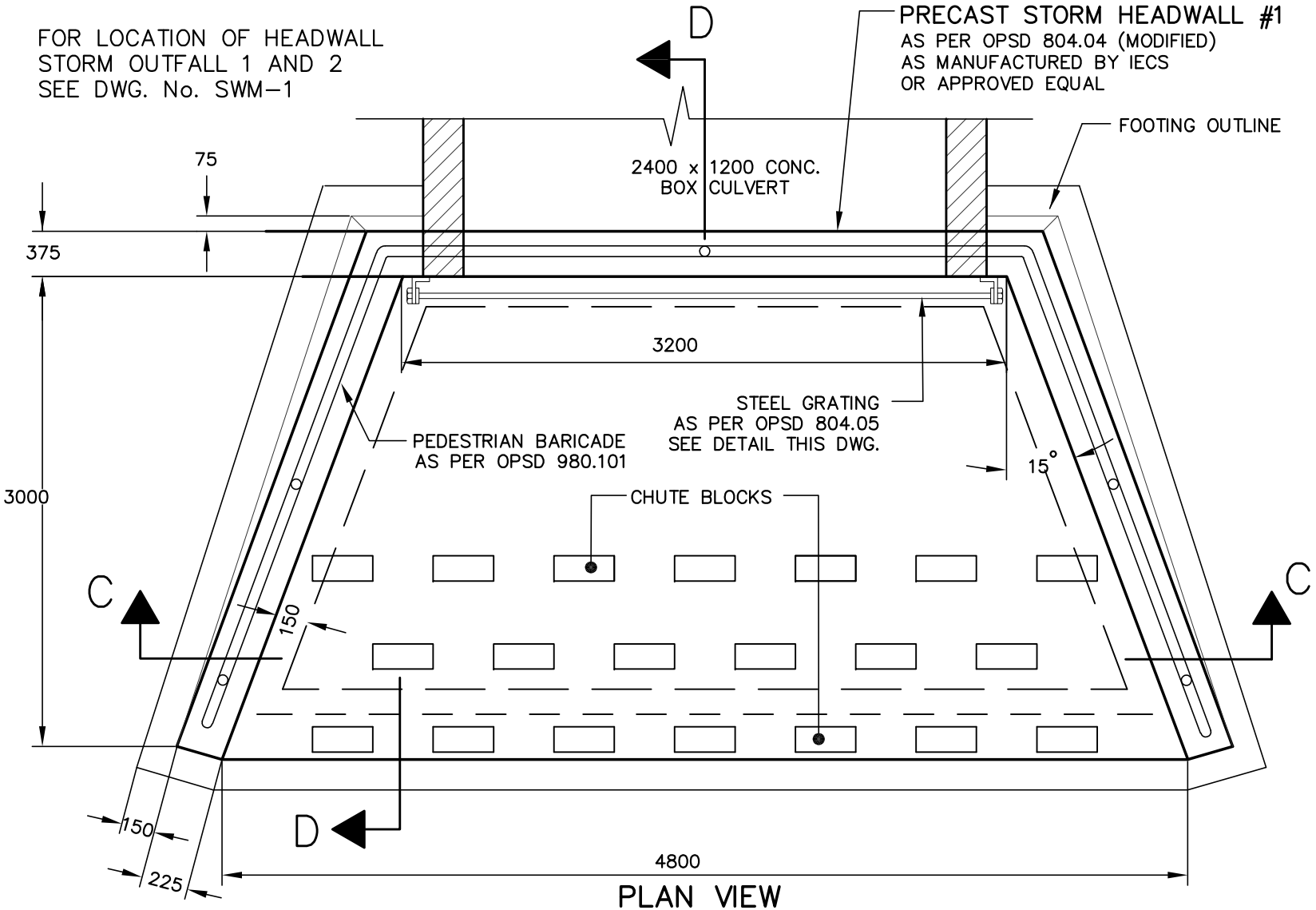
GRAIN SIZE DISTRIBUTION

Till

FIGURE No.	2
REF. No.	BAR-00055075-A0
DATE	November 2017

Appendix E:
Engineering Drawings


STREET 3
CB
BH 23
LVC=60.00
DCB
40.00m @
257.19
257.28
257.12
257.79
257.31
257.37
257.22
257.53
257.48
257.37
257.69
257.60
257.70
257.92
257.94
258.16
258.10
258.21
258.41
255.59
STREET 2
1.5m CONC. SIDEWALK
7.70m @ 0.50%
5.88m @ 0.50%
5.00m @ 1.5%
35.00m @ 2.0%
256.63
256.74
255.29 (1.5m BUFFER)
OVERLAND FLOW ROUTE
SEE DETAIL ON DWG. SWM-2
255.05
253.50
253.00
252.50
251.40
500mm RIP-RAP STONE (CL.1)
ON TOP OF FILTER CLOTH TYPE
270R OR APPROVED EQUAL
SEE DETAIL ON THIS DRAWING.
FOREBAY
(3.0m BUFFER)
255.34
SWM SAFETY
STATION
PVC PERFORATED SUBDRAIN
0.5% (SLOPE TO DRAIN)(TYP.)
5:1
6:1
4:1
3:1
255.55
255.64
255.79
255.85
255.91
256.91
257.61
257.50
257.74
257.78
257.63
257.46
257.95
257.99
257.84
257.61
258.20
258.24
258.09
257.87
258.47
258.51
258.36
258.11
258.73
258.77
239
238
237
236
247
246
245
244
243

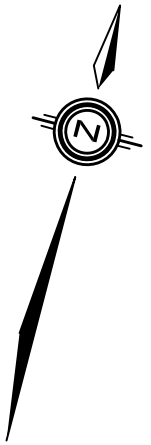


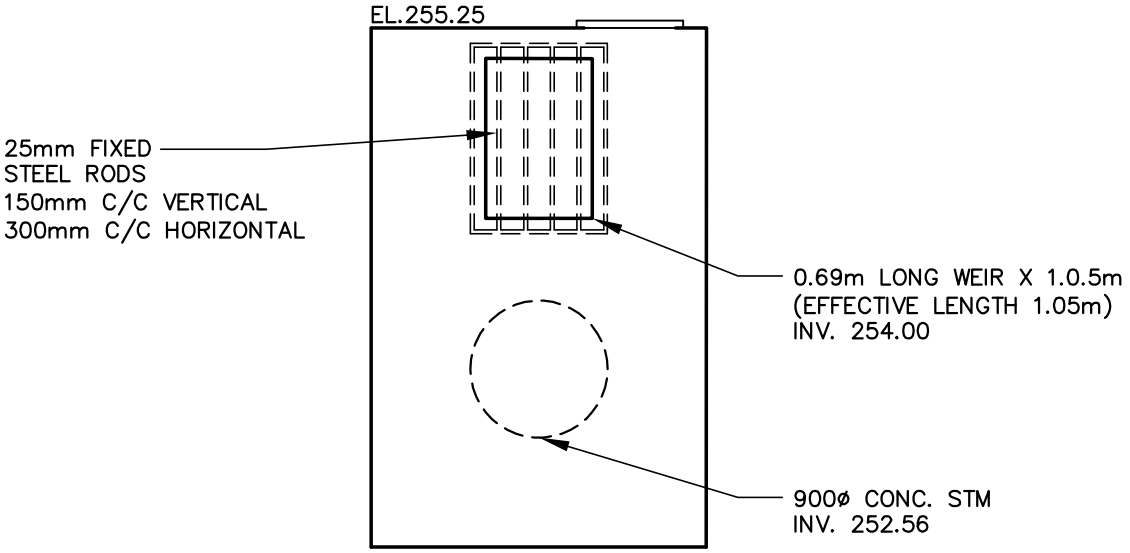
PLAN VIEW
(OUTFALL HEADWALL #1)
(MODIFIED)
NOT TO SCALE

PRECAST STORM HEADWALL #1
AS PER OPSD 804.04 (MODIFIED)
AS MANUFACTURED BY IECS
OR APPROVED EQUAL

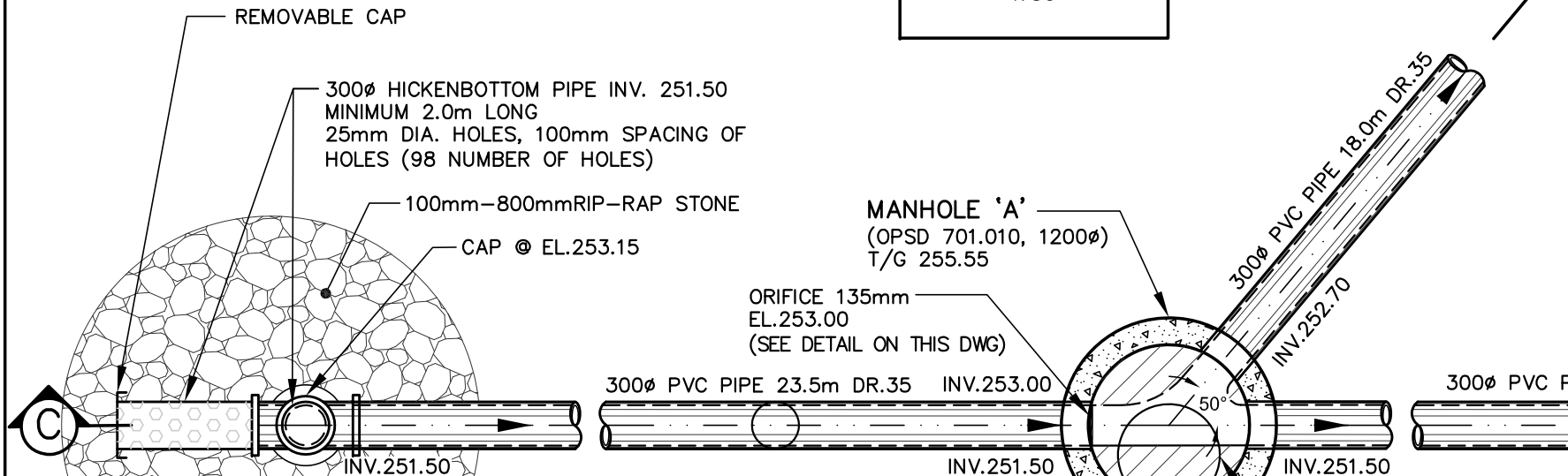
WARNING MESSAGE LAYOUT
DETAILS AS PER OPSD 3940.150

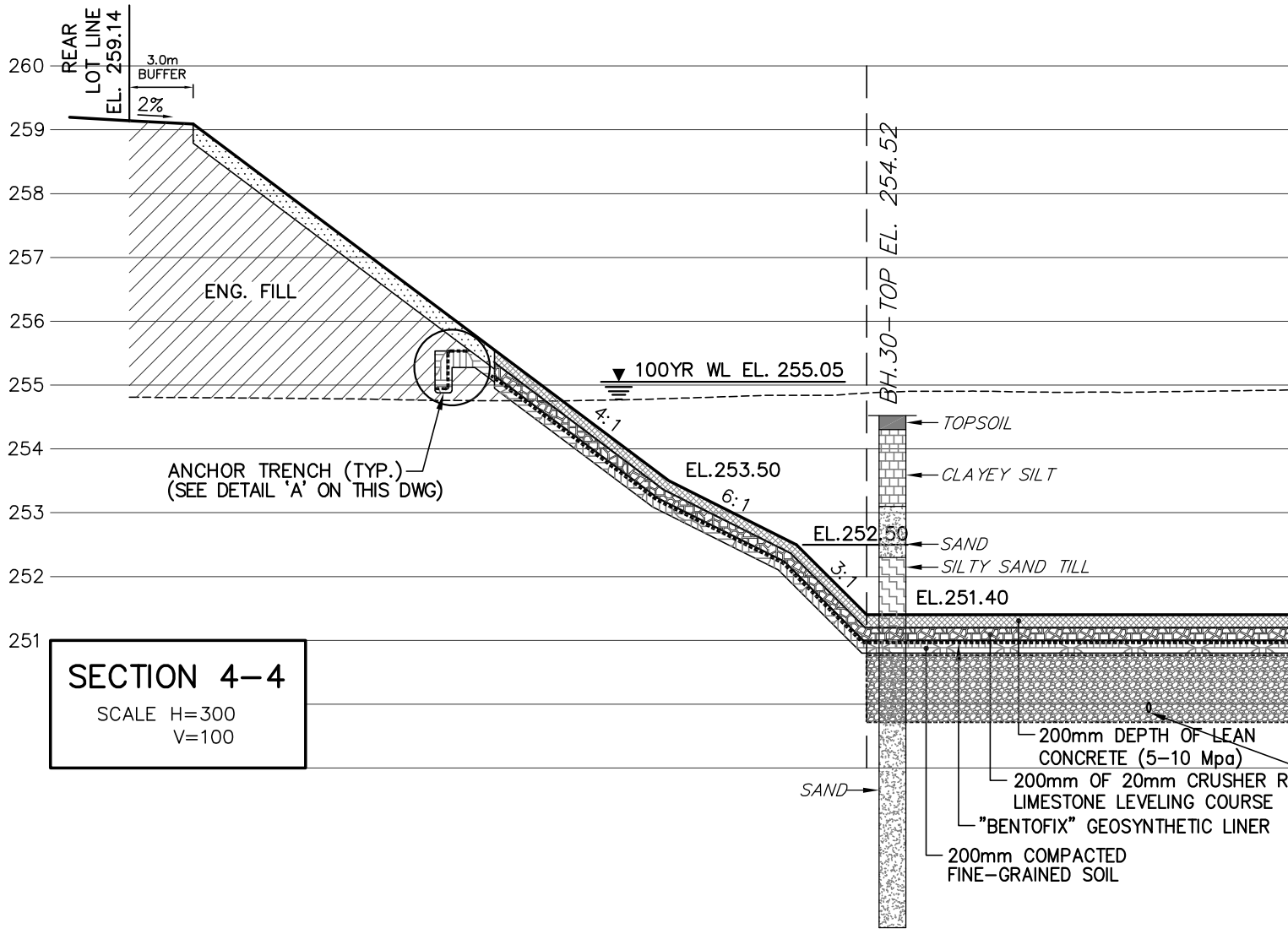
FLOW CONTROL STRUCTURE

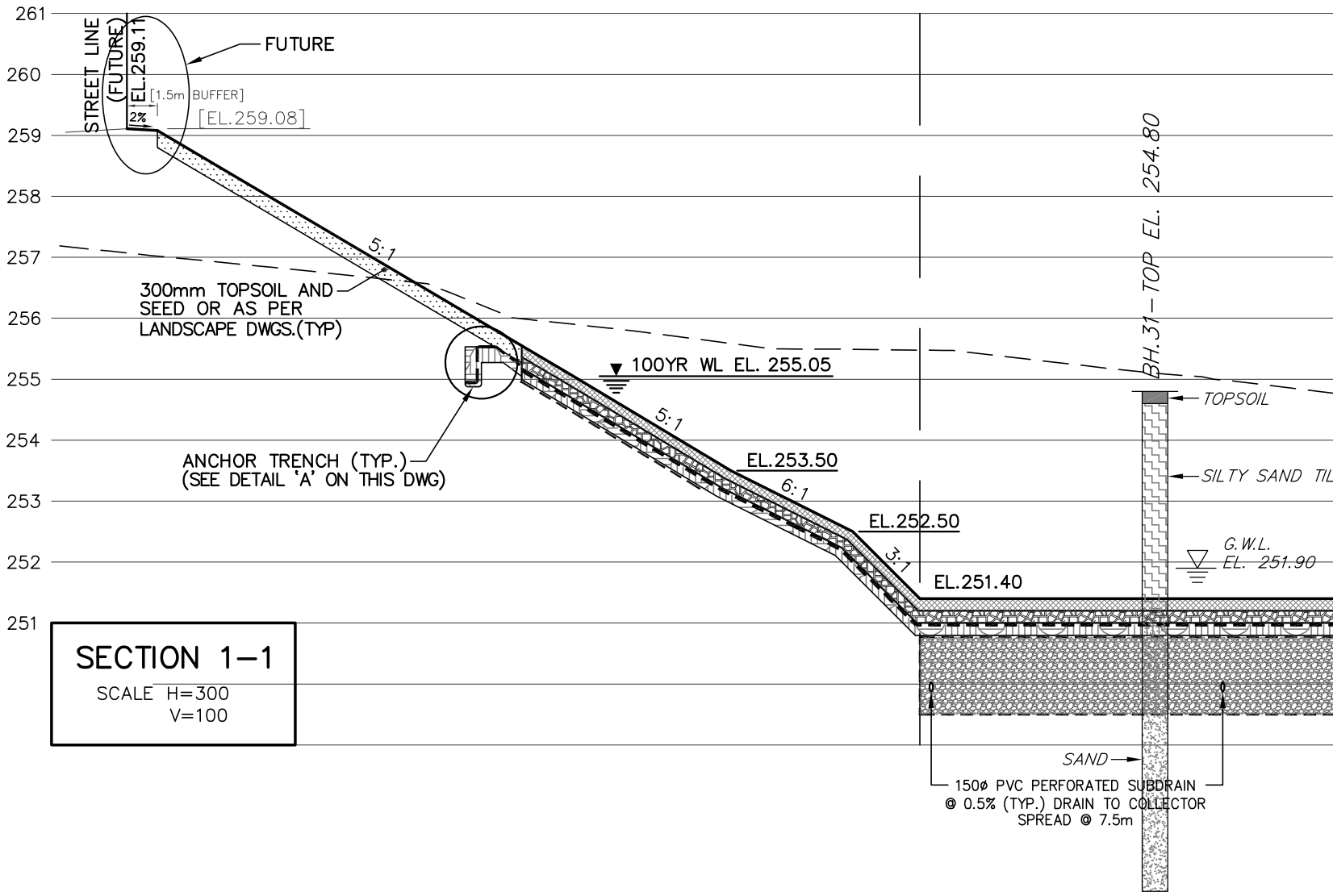




SECTION B
1:50

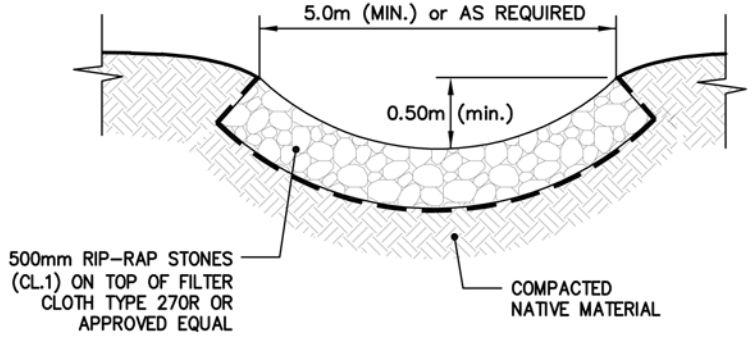



REAR LOT LINE EL. 259.14
3.0m BUFFER
2%
260
259
258
257
256
255
254
253
252
251
ENG. FILL
100YR WL EL. 255.05
BH.30–TOP EL. 254.52
TOPSOIL
CLAYEY SILT
SAND
SILTY SAND TILL
ANCHOR TRENCH (TYP.)
(SEE DETAIL 'A' ON THIS DWG)
4:1
6:1
3:1
EL.253.50
EL.252.50
EL.251.40
SECTION 4–4
SCALE H=300
V=100
200mm DEPTH OF LEAN CONCRETE (5–10 Mpa)
200mm OF 20mm CRUSHER R
LIMESTONE LEVELING COURSE
"BENTOFIX" GEOSYNTHETIC LINER
200mm COMPACTED FINE–GRAINED SOIL
SAND



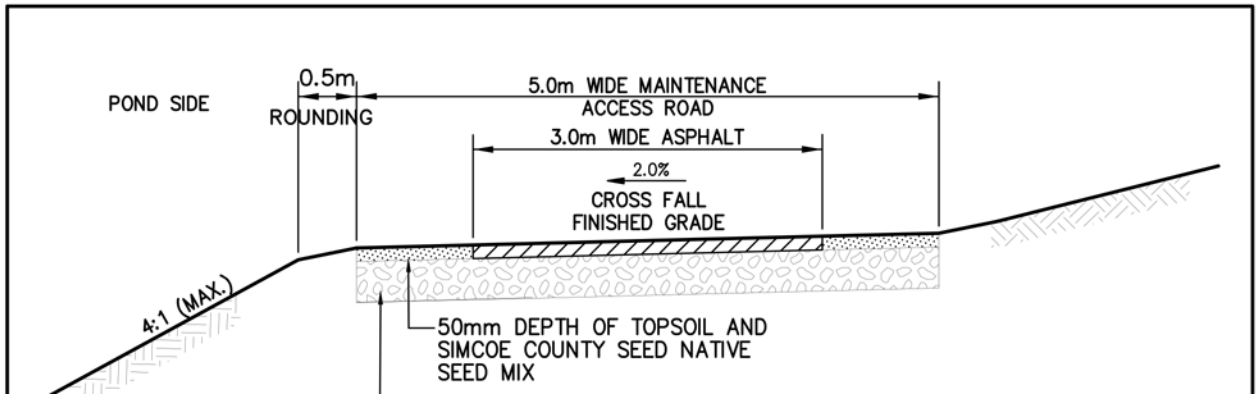
SECTION 1–1

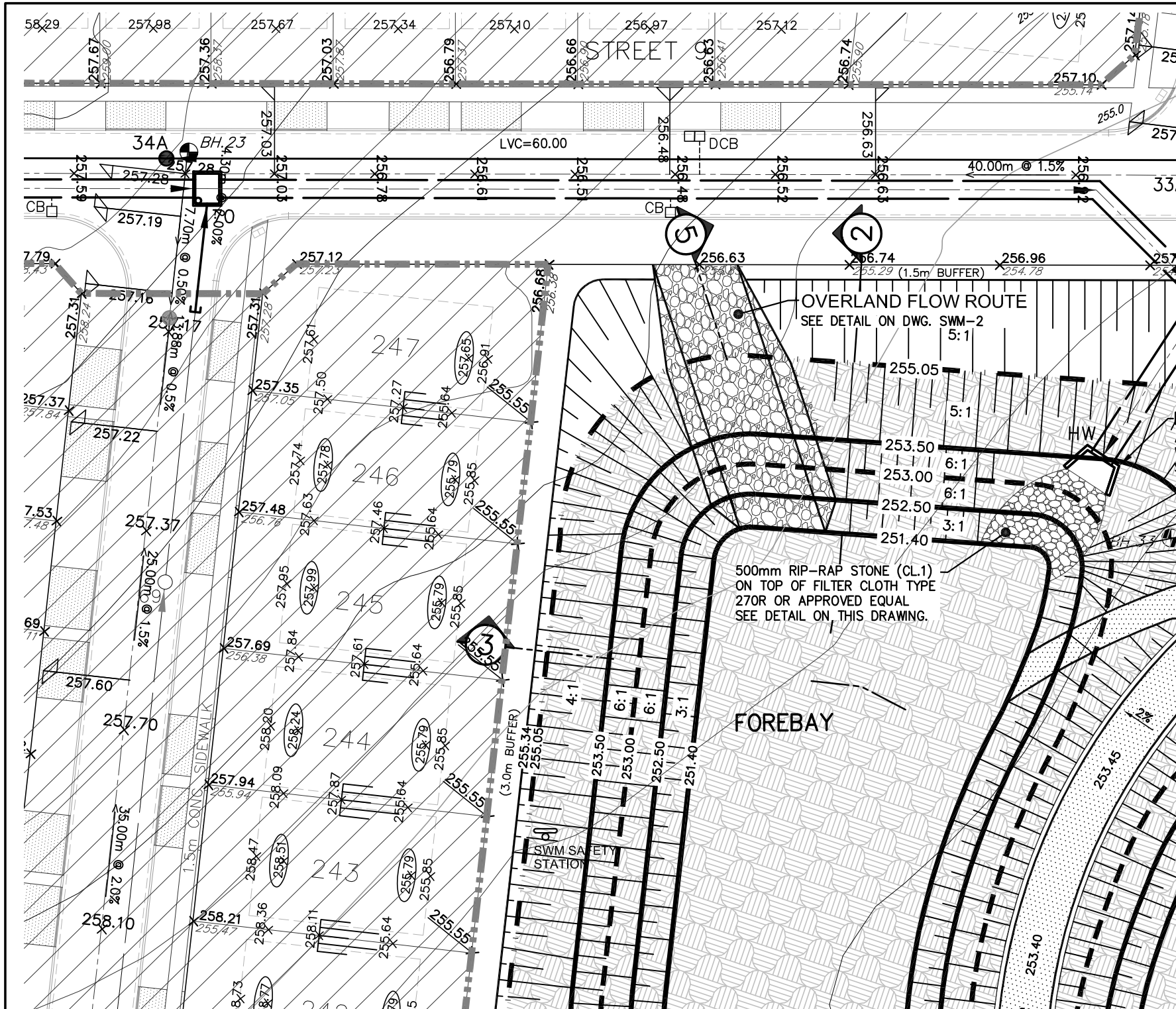
SCALE H=300
V=100

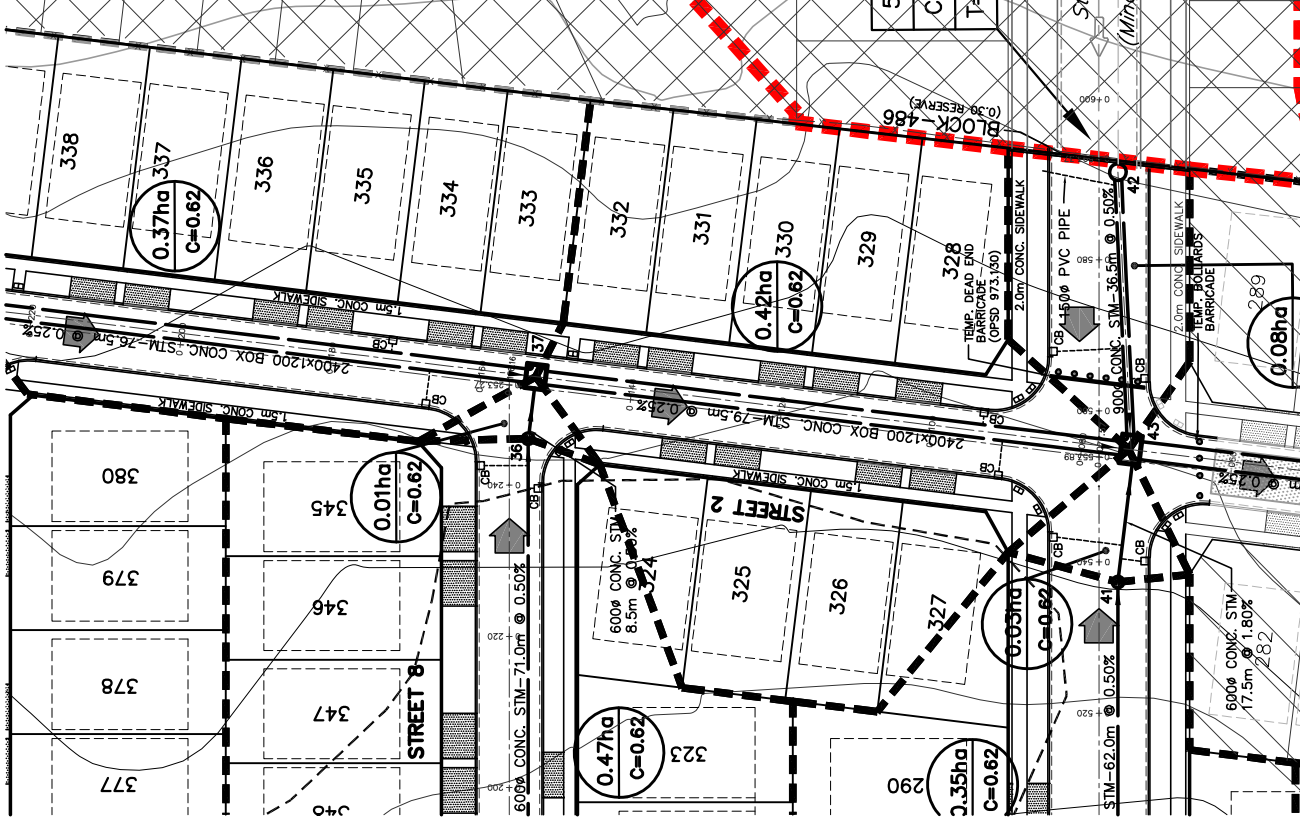


TYPICAL SECTION OF STM. OUTFALL

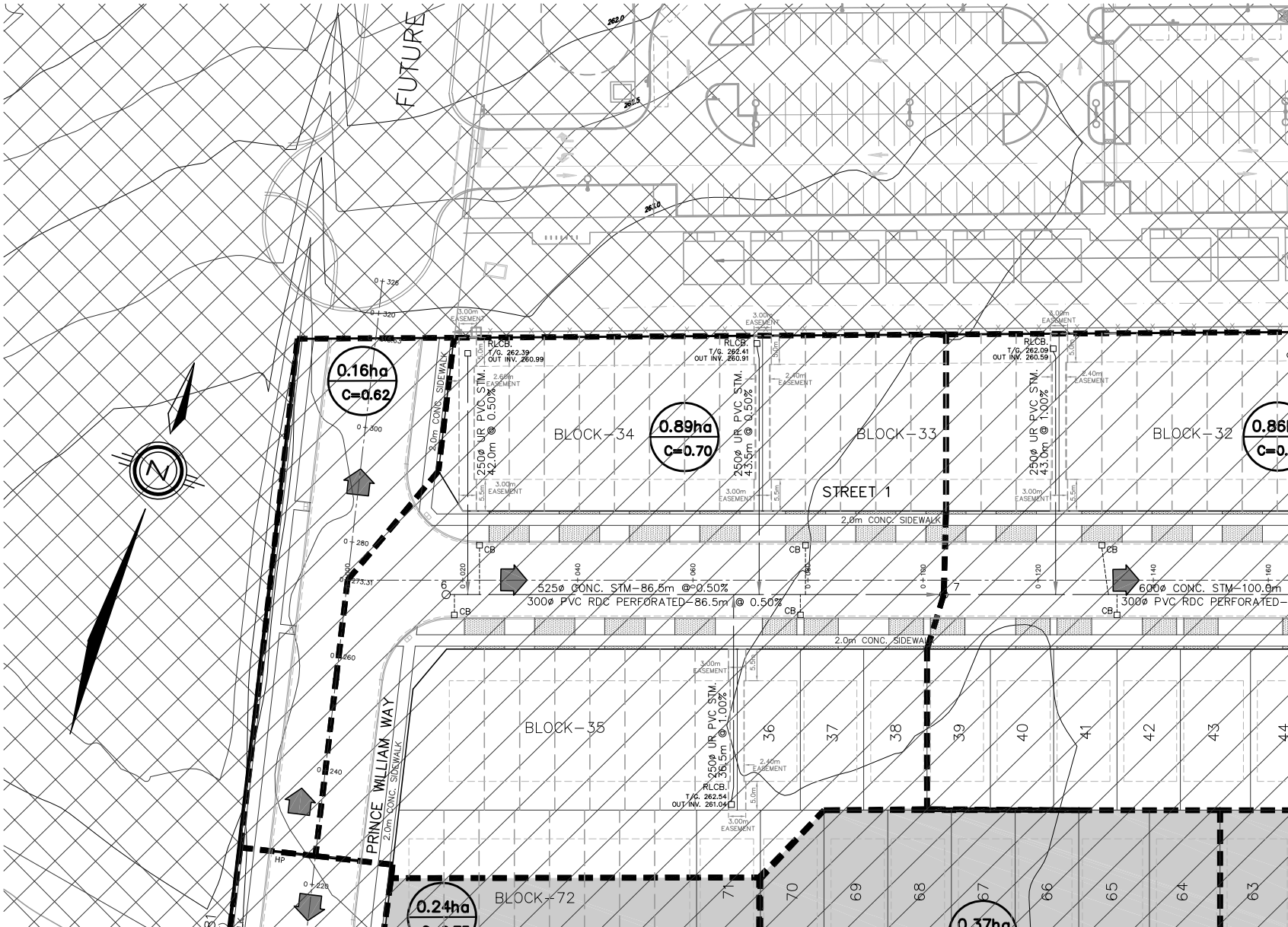
N.T.S.



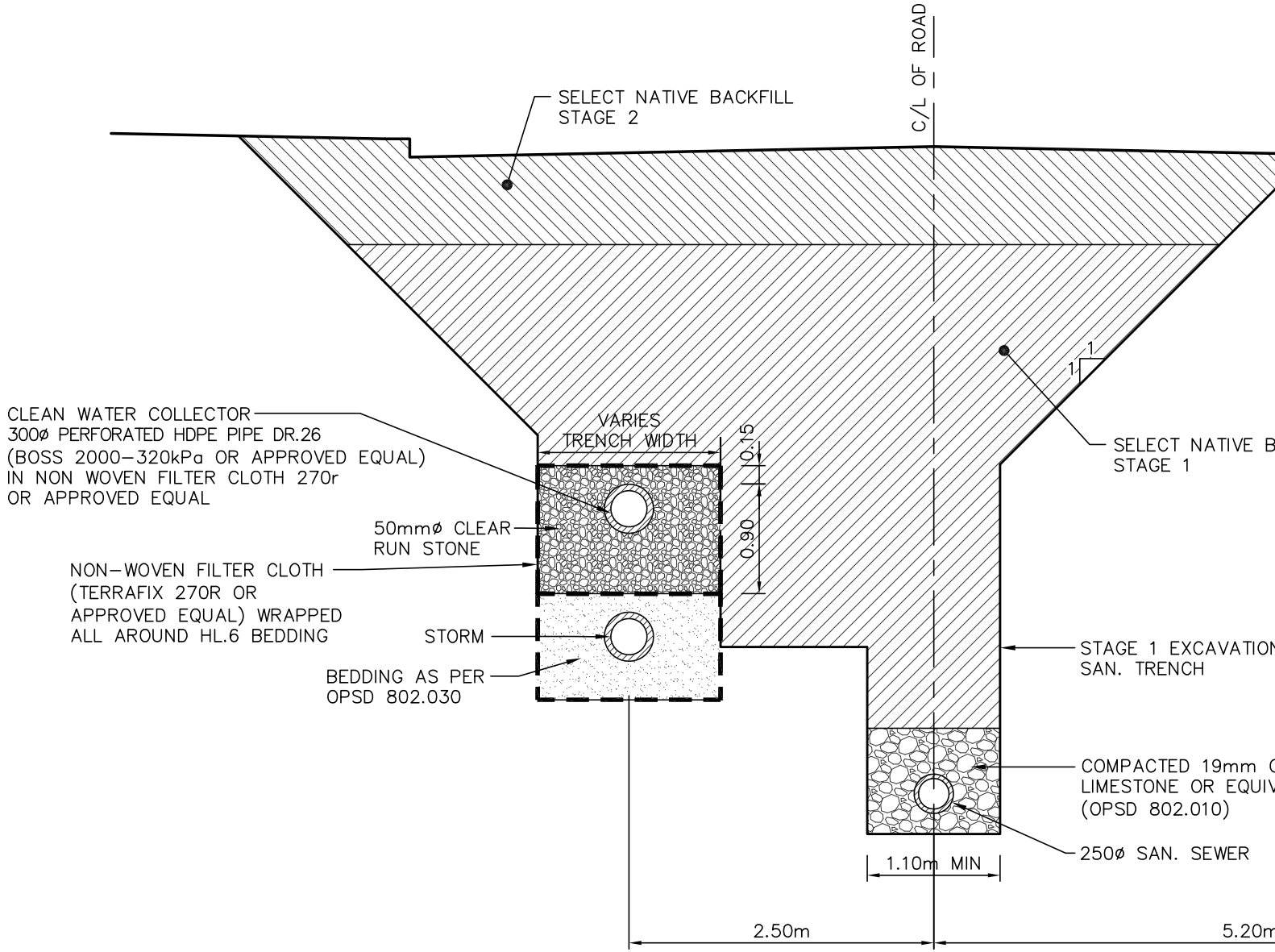

STREET
LVC=60.00
DCB
CB
CB
34A
BH.23
257.28
257.19
257.70m @ 0.50%
257.12
256.63
256.74
255.29 (1.5m BUFFER)
256.96
254.78
OVERLAND FLOW ROUTE
SEE DETAIL ON DWG. SWM-2
5:1
255.05
5:1
HW
253.50
6:1
253.00
6:1
252.50
3:1
251.40
500mm RIP-RAP STONE (CL.1)
ON TOP OF FILTER CLOTH TYPE
270R OR APPROVED EQUAL
SEE DETAIL ON THIS DRAWING.
FOREBAY
4:1
6:1
6:1
3:1
255.34
255.05
253.50
253.00
252.50
251.40
(3.0m BUFFER)
SWM SAFETY
STATION
247
246
245
244
243
257.37
257.22
257.48
257.37
257.69
257.60
257.70
257.94
258.10
258.21
25.000m @ 1.5%
35.00m @ 2.0%
1.5m CONC. SIDEWALK
253.45
253.40
40.00m @ 1.5%


BLOCK 486
(0.30 RESERVE)
STREET 2
STREET 8
1.5m CONC. SIDEWALK
2400x1200 BOX CONC. STM. 26.5m @ 0.25%
2400x1200 BOX CONC. STM. 79.5m @ 0.25%
600ø CONC. STM. 71.0m @ 0.50%
600ø CONC. STM. 8.5m @ 0.50%
1650ø PVC PIPE
900ø CONC. STM. 36.5m @ 0.50%
600ø CONC. STM. 17.5m @ 1.80%
STM. 62.0m @ 0.50%
2.0m CONC. SIDEWALK
TEMP. DEAD END BARRICADE (OPSD 973.130)
TEMP. BOLLARDS BARRICADE
0.37ha C=0.62
0.42ha C=0.62
0.01ha C=0.62
0.47ha C=0.62
0.03ha C=0.62
0.35ha C=0.62
0.08ha
337
338
336
335
334
333
332
331
330
329
328
345
346
347
323
324
325
326
327
290
289
282
379
378
377
380

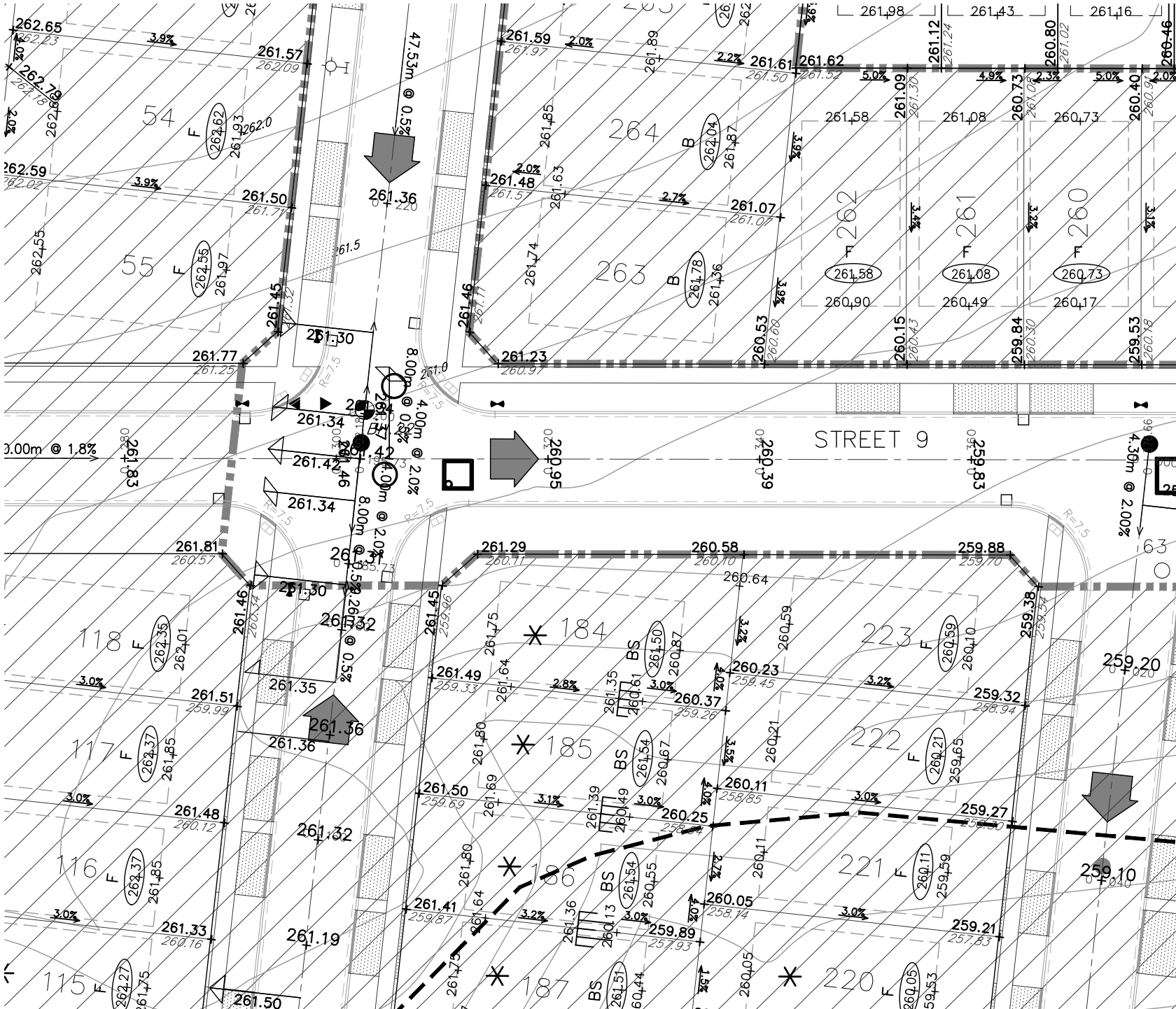
STREET 2
BLOCK-457
BLOCK-458
BLOCK-463
0.67ha
C=0.68
0.28ha
C=0.76
0.14ha
C=0.76
0.02ha
C=0.62
0.06ha
C=0.73
A4
1.41ha
456
455
454
453
452
459
460
462
461
448
447
3.0m WIDE ASPHALT TRAIL
2.0m WIDE CONC. SW
1.5m CONC SIDEWALK
250ø UR PVC STM.
35.0m @ 1.50%
250ø UR PVC STM.
38.0m @ 4.15%
1050ø CONC. STM
16.5m @ 0.30%
750ø CONC. STM-116.15m @ 0.65%
1200ø CONC. STM-60.5m @ 0.30%
1800X1200 BOX CONC. STM-46.5m @ 0.25%
MH1108
MH1301
DCB
CB

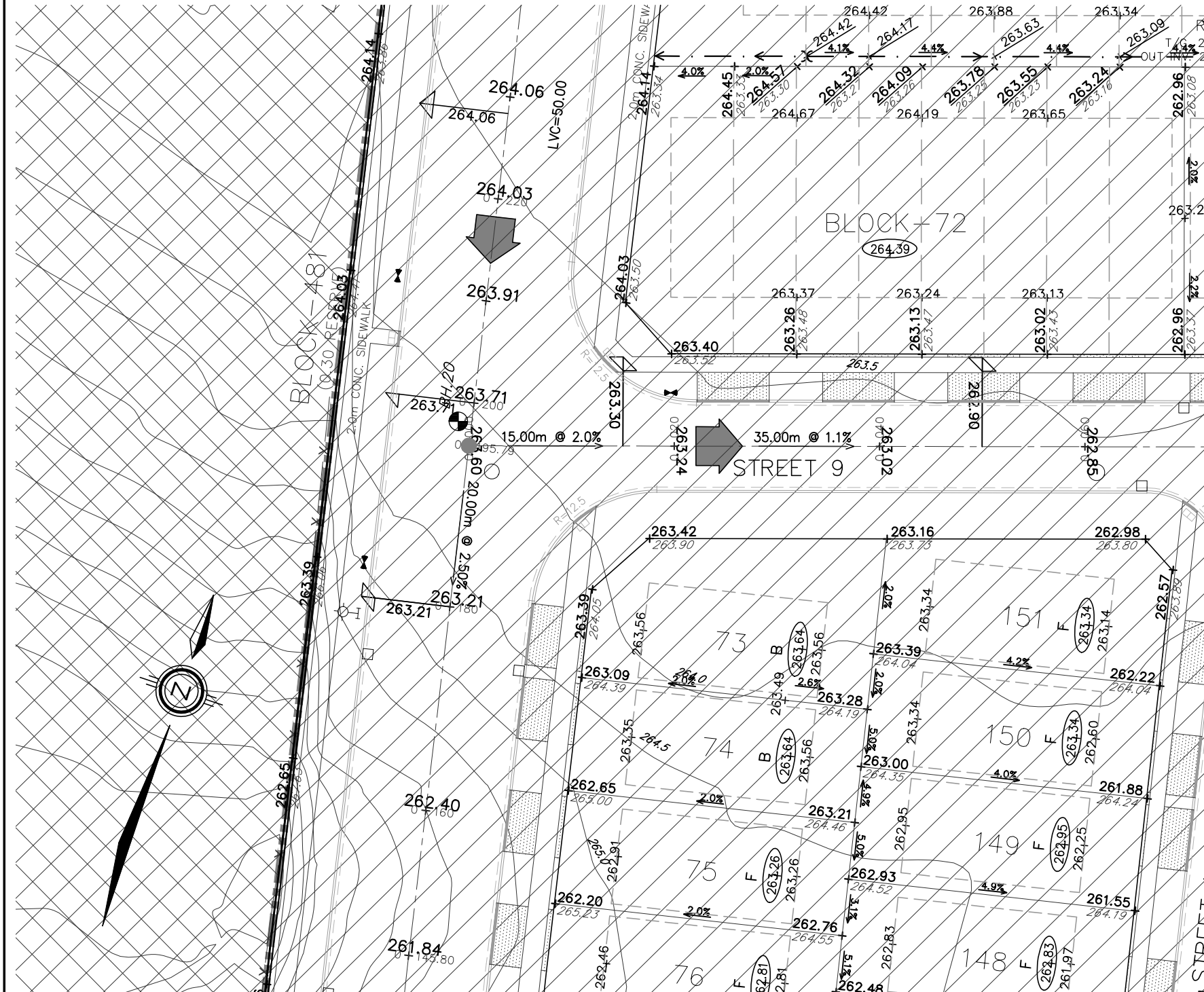

FUTURE
0.16ha
C=0.62
0.89ha
C=0.70
BLOCK–34
BLOCK–33
BLOCK–32
STREET 1
2.0m CONC. SIDEWALK
250ø UR PVC STM. @ 0.50%
42.0m
250ø UR PVC STM. @ 0.50%
43.5m
250ø UR PVC STM. @ 1.00%
43.0m
525ø CONC. STM–86.5m @0.50%
300ø PVC RDC PERFORATED–86.5m @ 0.50%
600ø CONC. STM–100.6m
300ø PVC RDC PERFORATED–
PRINCE WILLIAM WAY
2.0m CONC. SIDEWALK
BLOCK–35
250ø UR PVC STM. @ 1.00%
36.5m
BLOCK–72
0.24ha
0.37ha
RLCB.
T/G. 262.39
OUT INV. 260.99
RLCB.
T/G. 262.41
OUT INV. 260.91
RLCB.
T/G. 262.09
OUT INV. 260.59
RLCB.
T/G. 262.54
OUT INV. 261.04
3.00m EASEMENT
2.40m EASEMENT
2.60m EASEMENT
5.0m
5.5m
CB
HP
N

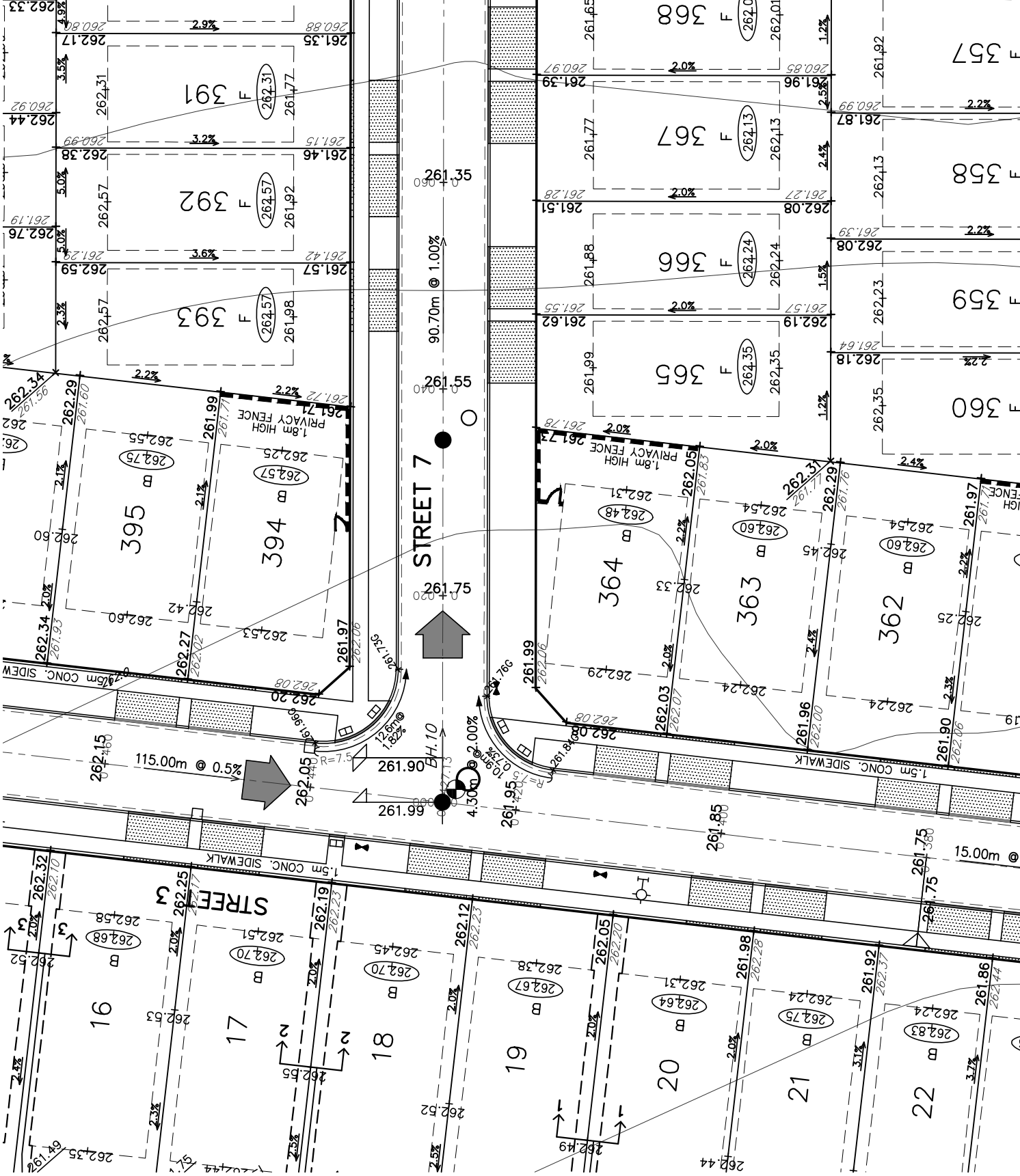
2.0m WIDE CONC. WALKWAY
BLOCK 480
(0.30 RESERVE)
3.00m EASEMENT
2.40m EASEMENT
3.0m
RLCB.
SECONDARY SCHOOL B.O.



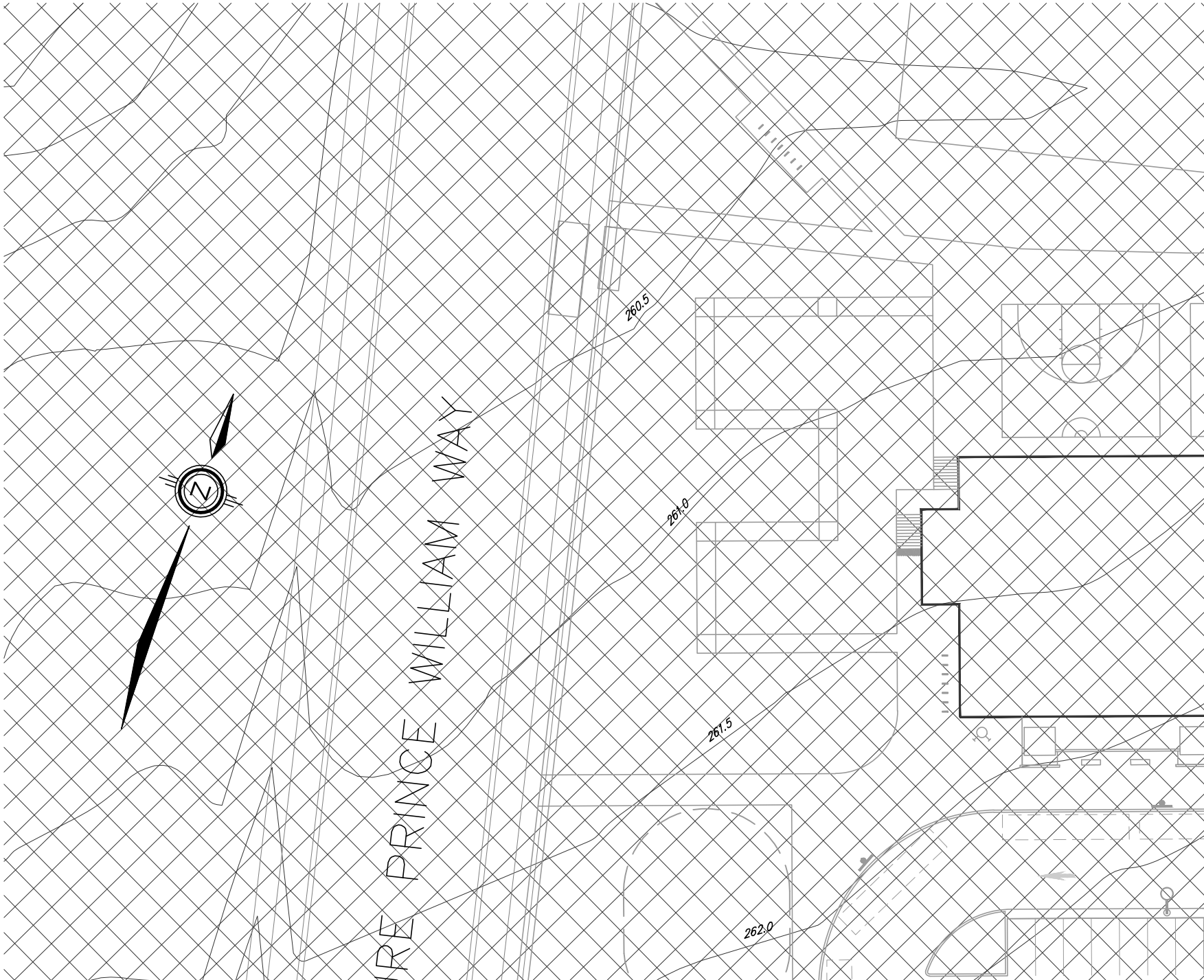
BEDDING DETAIL

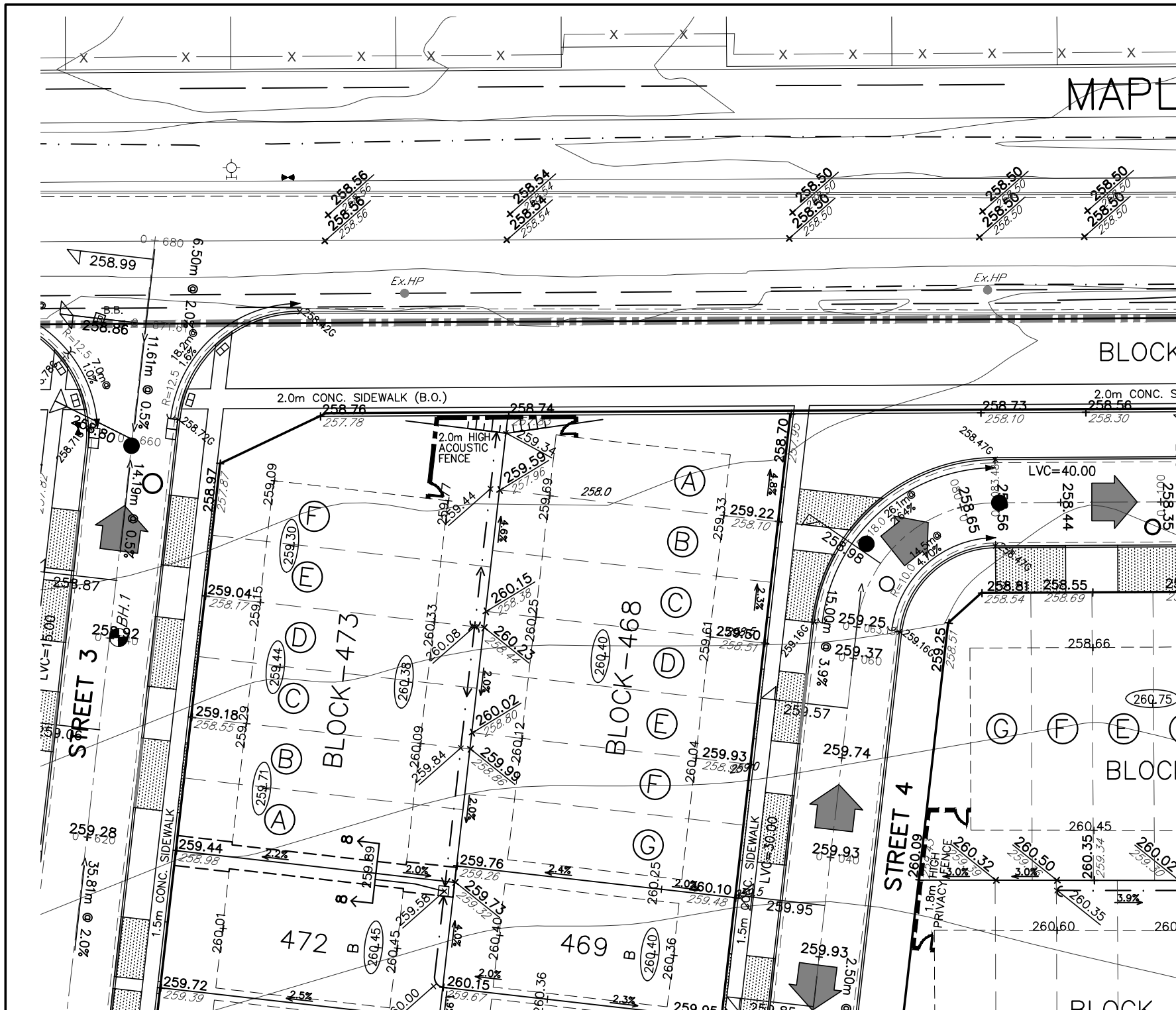

STREET 9
54
55
263
264
262
261
260
118
117
116
115
184
185
186
187
223
222
221
220
261.98
261.43
261.16
261.58
261.08
260.73
260.90
260.49
260.17
261.36
261.34
261.42
261.30
261.32
261.35
261.19
261.77
261.81
261.46
261.45
261.48
261.51
261.50
261.33
261.41
261.49
261.59
261.61
261.62
261.48
261.07
261.23
261.29
260.58
259.88
260.64
260.23
260.37
259.32
260.11
260.25
259.27
260.05
259.89
259.21
259.20
259.10
260.95
260.39
259.83
47.53m @ 0.5%
8.00m @ 0.5%
4.00m @ 2.0%
8.00m @ 2.0%
4.30m @ 2.00%
0.00m @ 1.8%
R=7.5
BH

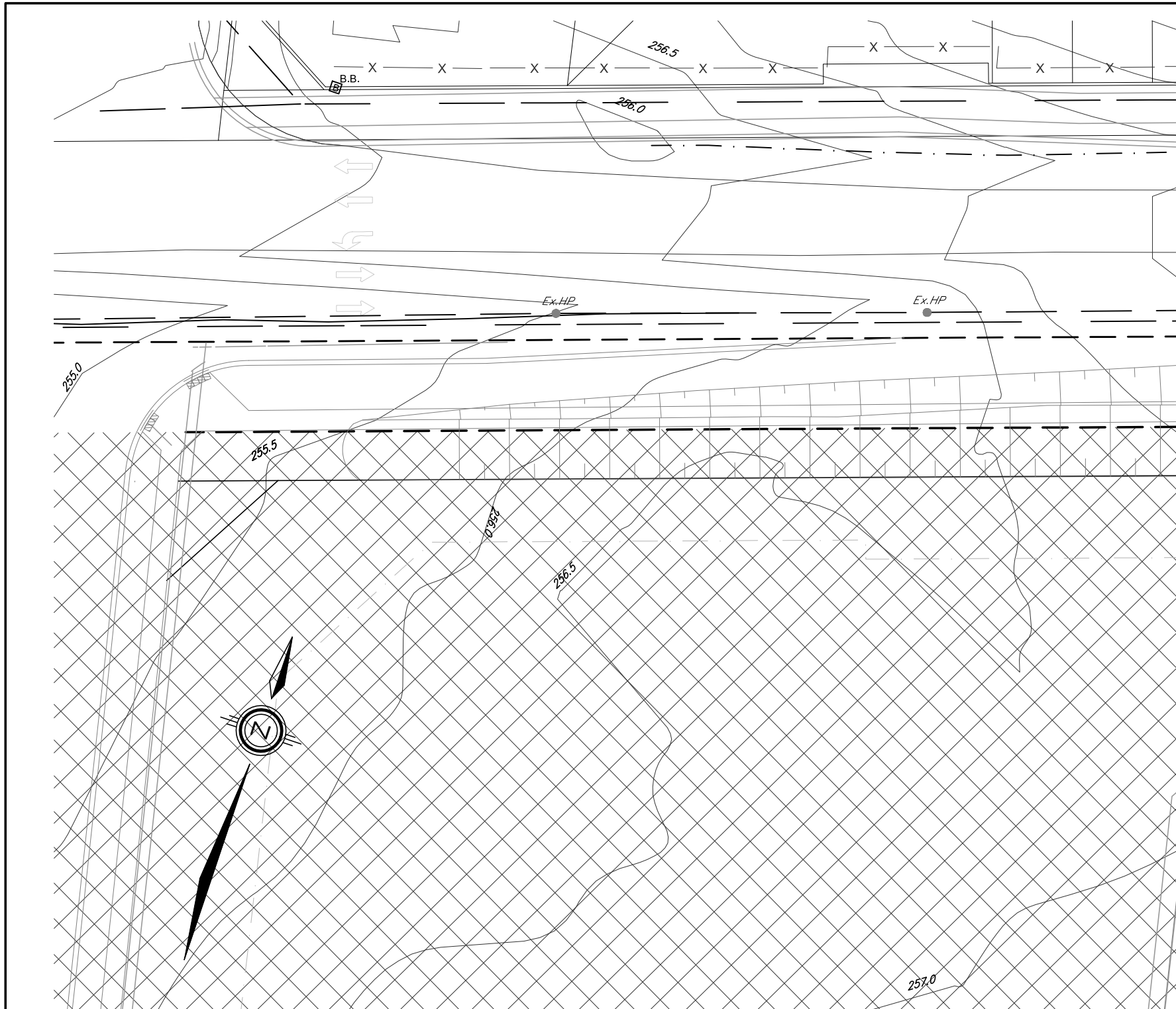

BLOCK 72
264.39
BLOCK 81
STREET 9
15.00m @ 2.0%
35.00m @ 1.1%
20.00m @ 2.50%
LVC=50.00
264.06
264.03
263.91
263.71
263.60
263.30
263.24
263.02
262.90
262.85
263.21
263.39
262.65
262.40
261.84
263.40
263.42
263.16
262.98
263.09
263.28
263.00
262.65
263.21
262.93
262.20
262.76
261.55
262.22
261.88
262.57
264.14
264.42
264.17
263.88
263.63
263.34
263.09
264.45
264.57
264.32
264.09
263.78
263.55
263.24
262.96
263.37
263.24
263.13
263.02
262.96
263.26
263.13
263.02
263.5
2.0m CONC. SIDEWALK
0.30 RESERVE
R=12.5
73
74
75
76
151
150
149
148
147
OUT


STREET 7
STREET 3
1.8m HIGH PRIVACY FENCE
1.5m CONC. SIDEWALK
115.00m @ 0.5%
90.70m @ 1.00%
BH.10
4.30m
391
392
393
394
395
366
367
368
357
358
359
360
362
363
364
365
16
17
18
19
20
21
22

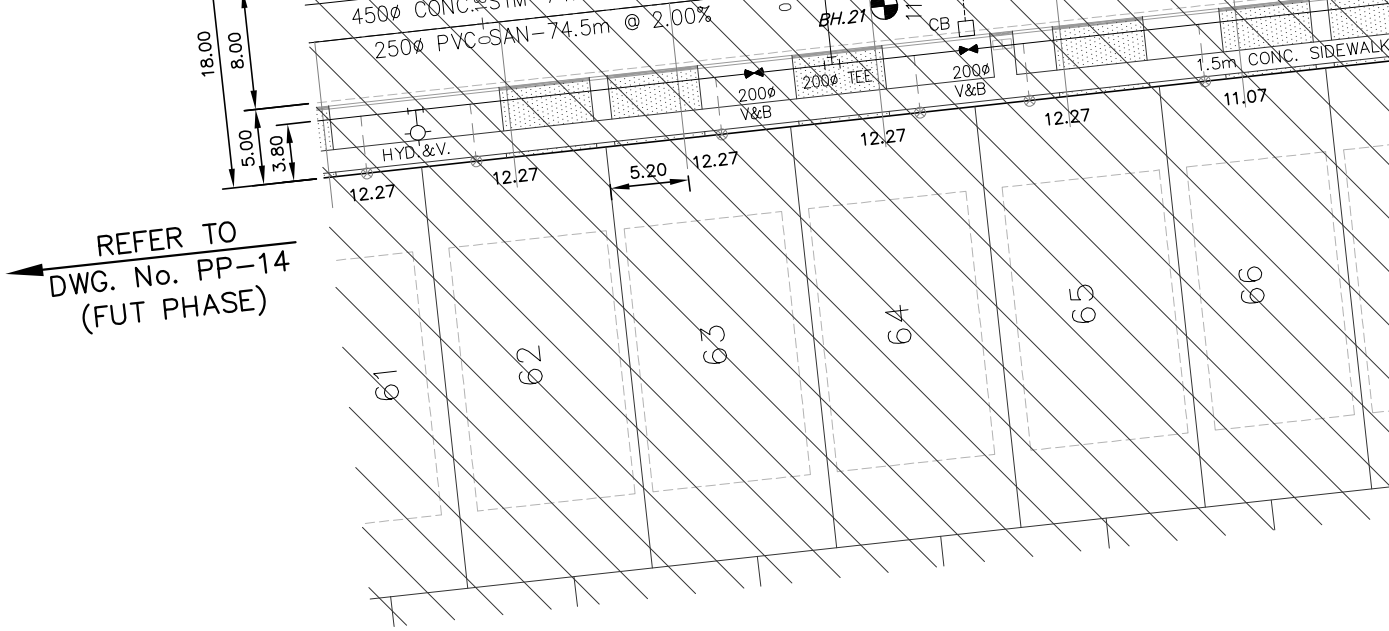
RE



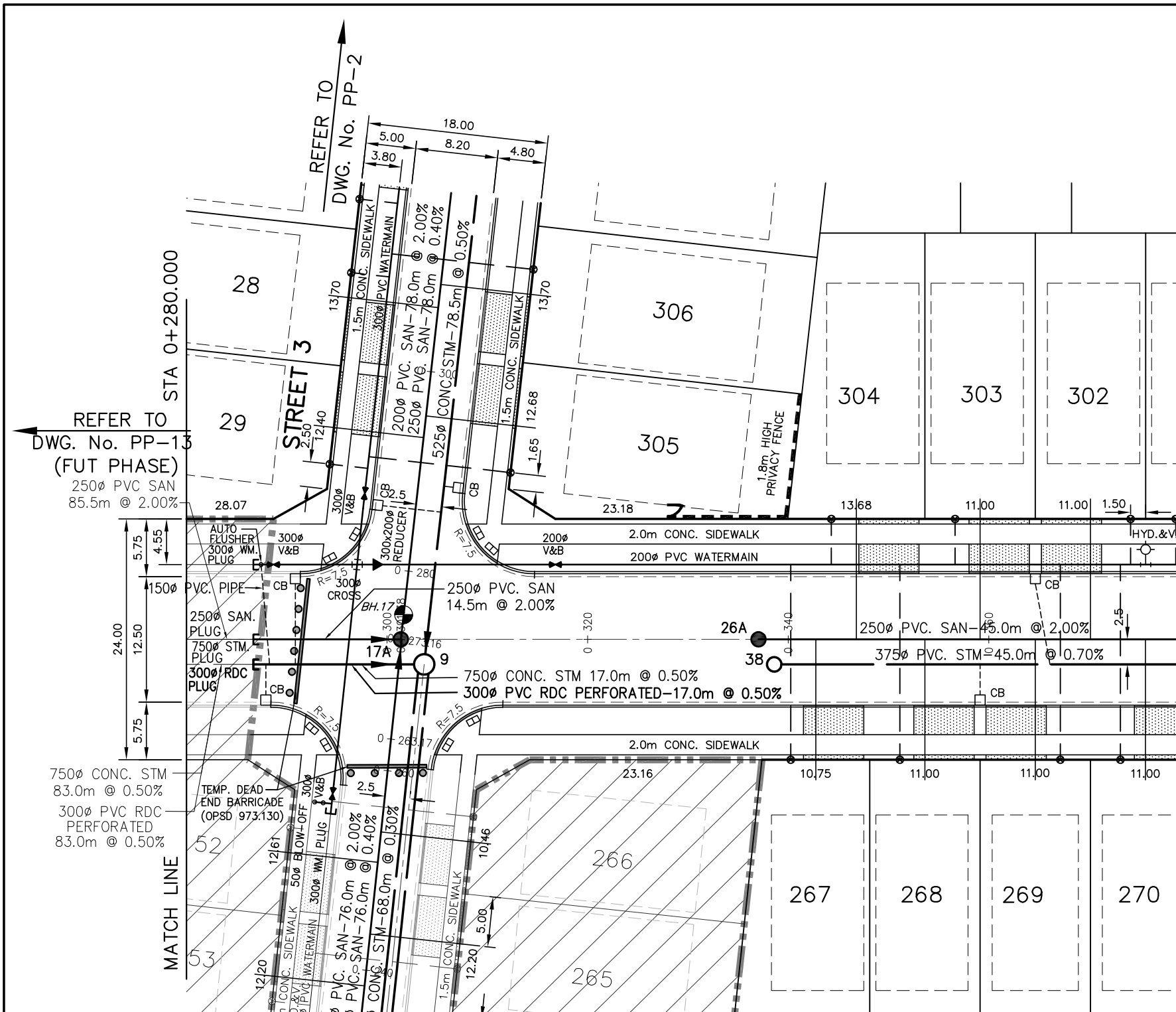

MAPL
BLOCK
2.0m CONC. SIDEWALK (B.O.)
2.0m HIGH ACOUSTIC FENCE
LVC=40.00
LVC=15.00
LVC=30.00
STREET 3
STREET 4
BLOCK-473
BLOCK-468
472
469
1.5m CONC. SIDEWALK
1.8m HIGH PRIVACY FENCE
Ex.HP
BH.1
258.99
258.86
258.87
259.28
259.72
259.39
259.44
258.98
259.76
259.26
259.73
259.32
259.10
259.48
259.95
259.93
260.10
260.15
259.67
260.01
260.45
260.40
260.36
259.04
258.17
259.15
259.09
259.30
259.44
259.71
259.18
258.55
259.29
260.15
258.38
260.33
260.08
260.25
260.22
260.38
260.09
259.84
260.12
259.99
258.80
260.02
260.40
259.61
260.04
259.90
259.57
259.74
259.93
259.25
258.51
259.16
259.37
258.66
260.75
260.45
260.32
260.50
260.35
260.60
258.73
258.10
258.56
258.30
258.44
258.65
258.81
258.54
258.55
258.69
258.47G
258.70
257.95
259.22
258.10
259.33
258.0
259.59
257.96
259.69
259.47
259.44
258.97
257.87
259.09
258.76
257.78
258.74
257.77
258.72G
258.71
258.80
258.78G
258.50
258.54
258.56
258.58
258.54
258.50
258.50
258.50
258.50
258.50
258.50
258.50
258.50
6.50m @ 2.0%
11.91m @ 0.5%
14.10m @ 0.5%
35.81m @ 2.0%
26.1m @ 4.64%
14.5m @ 4.70%
15.00m @ 3.9%
2.50m @ 3.9%
18.2m @ 1.6%
7.0m @ 1.0%
R=12.5
R=10.0
0+680
0+660
0+620
0+060
0+040
0+080
0+100
0+120
0+140
0+160
0+180
0+200
0+220
0+240
0+260
0+280
0+300
0+320
0+340
0+360
0+380
0+400
0+420
0+440
0+460
0+480
0+500
0+520
0+540
0+560
0+580
0+600
0+640
0+660
0+680
0+700
0+720
0+740
0+760
0+780
0+800
0+820
0+840
0+860
0+880
0+900
0+920
0+940
0+960
0+980
1+000
1+020
1+040
1+060
1+080
1+100
1+120
1+140
1+160
1+180
1+200
1+220
1+240
1+260
1+280
1+300
1+320
1+340
1+360
1+380
1+400
1+420
1+440
1+460
1+480
1+500
1+520
1+540
1+560
1+580
1+600
1+620
1+640
1+660
1+680
1+700
1+720
1+740
1+760
1+780

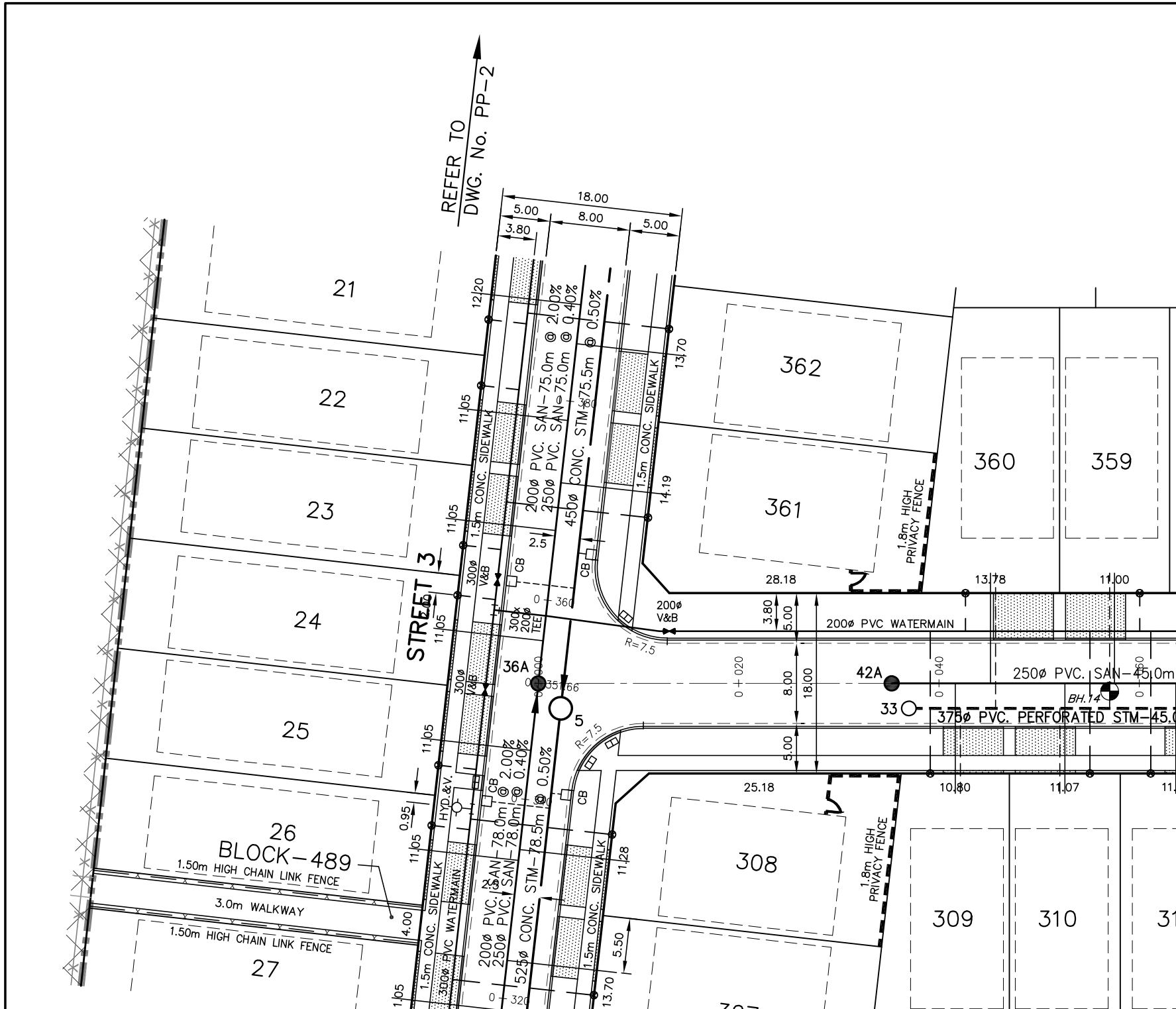

256.5
B.B.
256.0
Ex.HP
Ex.HP
255.0
255.5
256.0
256.5
257.0

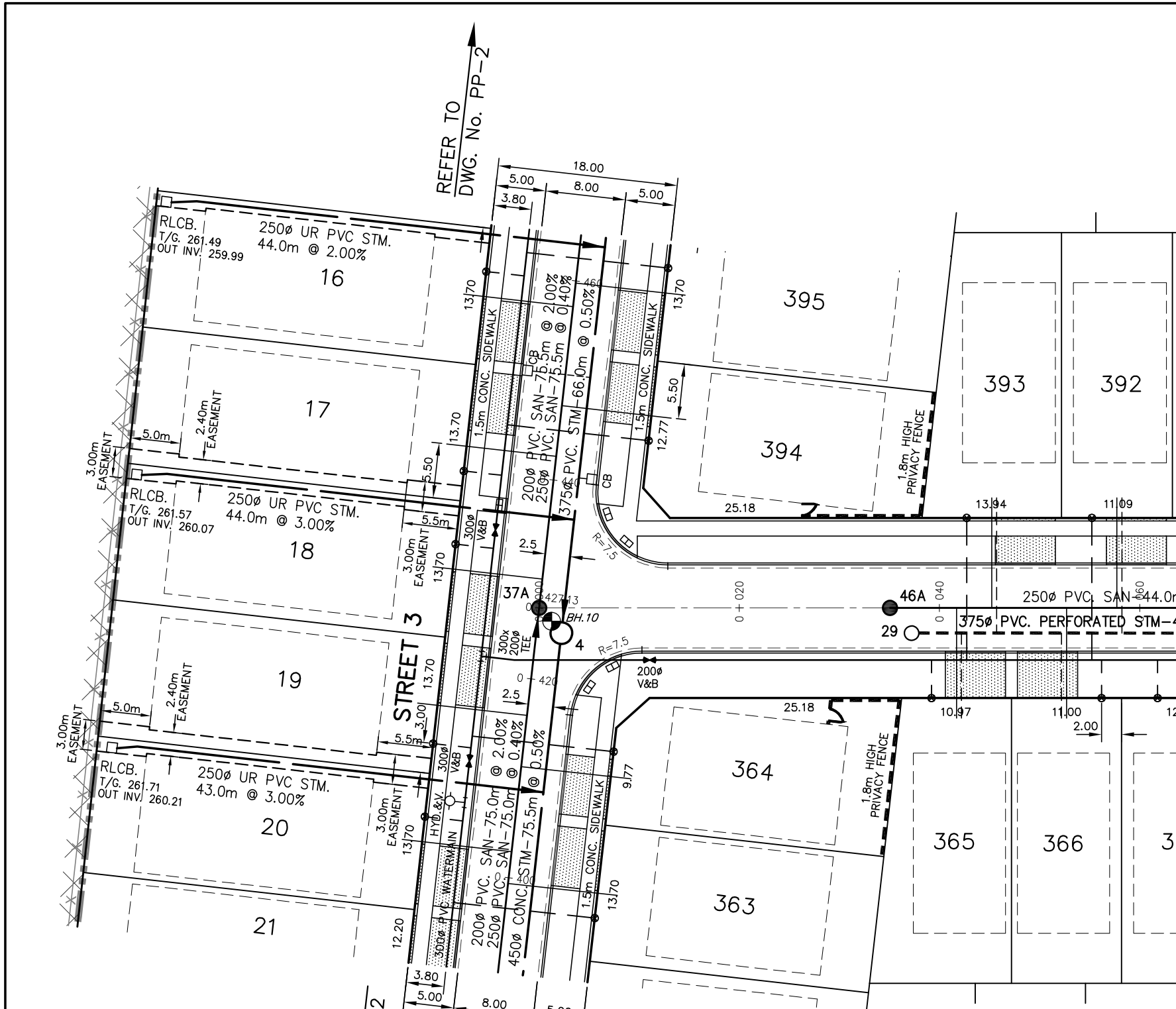
1800x1200 BOX CONC. STM-74.5m @ 0.30%
250ø PVC. SAN-72.5m @ 0.50%
18.00
8.00
5.00
3.80
1.5m CONC. SIDEWALK
HYD.&V.
200ø V&B
200ø TEE
CB
11.09
256
257
258
259
260
261
262

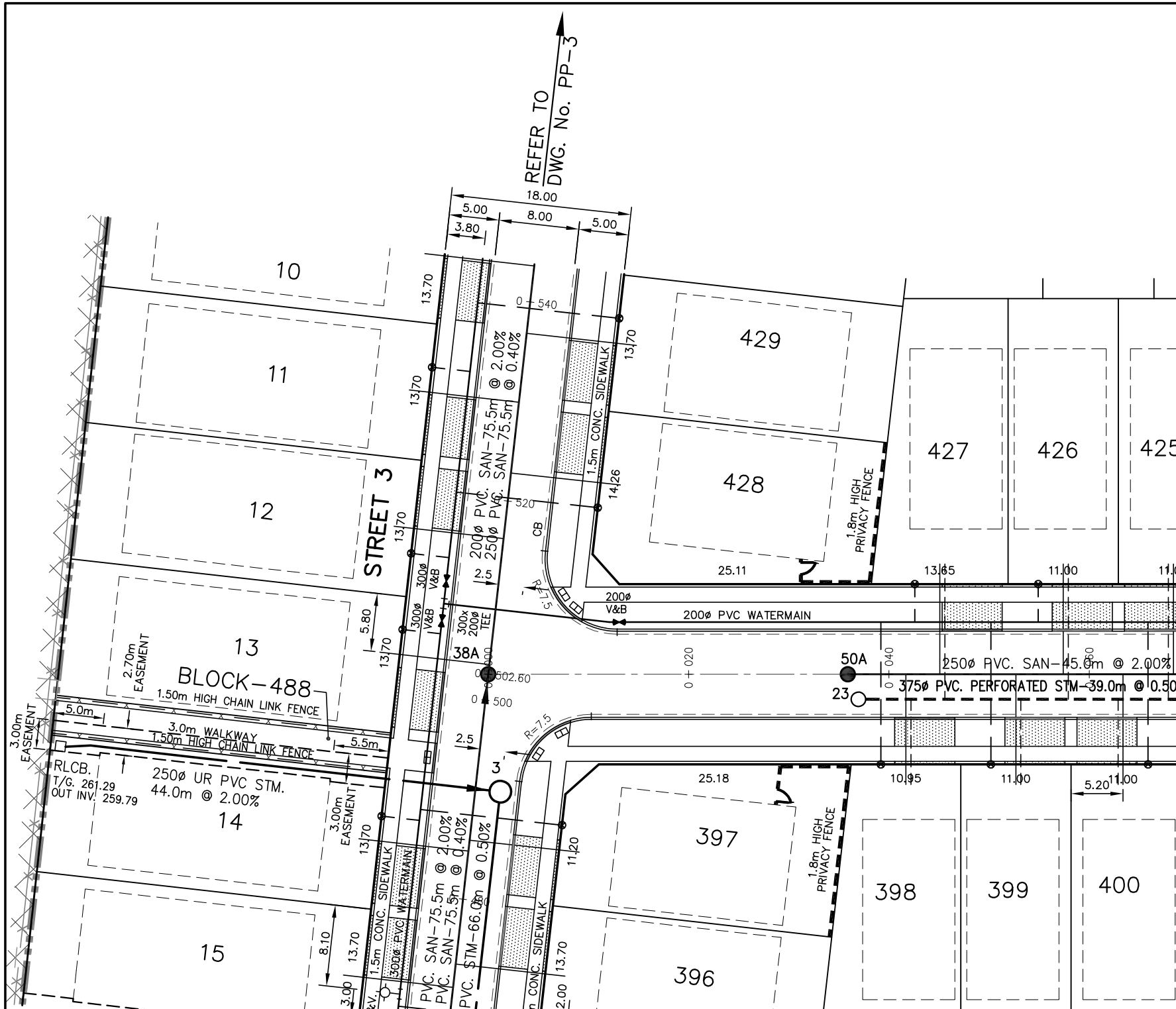

REFER TO
DWG. No. PP-14
(FUT PHASE)
18.00
8.00
5.00
3.80
450ø CONC. STM
250ø PVC-SAN-74.5m @ 2.00%
BH.21
CB
200ø TEE
200ø V&B
200ø V&B
HYD.&V.
1.5m CONC. SIDEWALK
12.27
12.27
5.20
12.27
12.27
12.27
11.07
61
62
63
64
65
66

REFER TO
DWG. No. PP-14
(FUT PHASE)
18.00
8.00
5.00
5.00
3.80
STREET 9
25.17
R7.5
CBMH56
CB
58
57
10A
250ø PVC. SAN-74.5m @ 2.00%
450ø CONC. STM-74.5m @ 0.70%
PVC. SAN-79.0m @ 2.00%
1.5m CONC. SIDEWALK
HYD.&V.
11.07
11.07
11.07
11.07
200ø
V&B
200ø
TEE
200ø
V&B
68
69
70
71
BLOCK-72
EASEMENT
3.00M


REFER TO DWG. No. PP-2
STA 0+280.000
STREET 3
REFER TO DWG. No. PP-13 (FUT PHASE)
250ø PVC SAN 85.5m @ 2.00%
MATCH LINE
28
29
306
305
304
303
302
267
268
269
270
266
265
52
53
18.00
5.00
8.20
4.80
3.80
1.5m CONC. SIDEWALK
300ø PVC WATERMAIN
200ø PVC. SAN-78.0m @ 2.00%
250ø PVC. SAN-78.0m @ 0.40%
525ø CONC. STM-78.5m @ 0.50%
1.8m HIGH PRIVACY FENCE
2.0m CONC. SIDEWALK
200ø PVC WATERMAIN
AUTO FLUSHER
300ø WM. PLUG
300ø V&B
300x200ø REDUCER
300ø CROSS
150ø PVC. PIPE
250ø SAN. PLUG
750ø STM. PLUG
300ø RDC PLUG
BH.17
250ø PVC. SAN 14.5m @ 2.00%
750ø CONC. STM 17.0m @ 0.50%
300ø PVC RDC PERFORATED-17.0m @ 0.50%
250ø PVC. SAN-45.0m @ 2.00%
375ø PVC. STM-45.0m @ 0.70%
26A
38
17A
9
750ø CONC. STM 83.0m @ 0.50%
300ø PVC RDC PERFORATED 83.0m @ 0.50%
TEMP. DEAD END BARRICADE (OPSD 973.130)
50ø BLOW-OFF
300ø WM. PLUG
250ø PVC. SAN-76.0m @ 2.00%
250ø PVC. SAN-76.0m @ 0.40%
300ø PVC. STM-68.0m @ 0.30%
1.5m CONC. SIDEWALK
300ø PVC WATERMAIN
24.00
12.50
5.75
4.55
28.07
23.18
23.16
13.68
11.00
10.75
1.50
2.5
1.65
12.68
13.70
12.40
12.61
10.46
12.20
5.00
R=7.5


REFER TO DWG. No. PP-2
STREET 3
21
22
23
24
25
26
BLOCK-489
27
362
360
359
361
308
309
310
1.50m HIGH CHAIN LINK FENCE
3.0m WALKWAY
1.50m HIGH CHAIN LINK FENCE
1.8m HIGH PRIVACY FENCE
1.5m CONC. SIDEWALK
300ø PVC WATERMAIN
200ø PVC WATERMAIN
200ø PVC. SAN=75.0m @ 2.00%
250ø PVC. SAN=75.0m @ 0.40%
450ø CONC. STM=75.5m @ 0.50%
200ø PVC. SAN=78.0m @ 2.00%
250ø PVC. SAN=78.0m @ 0.40%
525ø CONC. STM=78.5m @ 0.50%
375ø PVC. PERFORATED STM=45.0
250ø PVC. SAN=45.0m
36A
42A
33
5
BH.14
CB
HYD.&V.
200ø V&B
300ø V&B
300x200ø TEE
R=7.5
18.00
5.00
8.00
3.80
28.18
25.18
13.78
11.00
10.80
11.07


REFER TO DWG. No. PP-2
STREET 3
16
17
18
19
20
21
395
394
393
392
364
365
366
363
RLCB. T/G. 261.49 OUT INV. 259.99
250ø UR PVC STM. 44.0m @ 2.00%
RLCB. T/G. 261.57 OUT INV. 260.07
250ø UR PVC STM. 44.0m @ 3.00%
RLCB. T/G. 261.71 OUT INV. 260.21
250ø UR PVC STM. 43.0m @ 3.00%
200ø PVC. SAN-75.5m @ 2.00%
250ø PVC. SAN-75.5m @ 0.40%
375ø PVC. STM-66.0m @ 0.50%
200ø PVC. SAN-75.0m @ 2.00%
250ø PVC. SAN-75.0m @ 0.40%
450ø CONC. STM-75.5m @ 0.50%
300ø PVC. WATERMAIN
1.5m CONC. SIDEWALK
2.40m EASEMENT
3.00m EASEMENT
1.8m HIGH PRIVACY FENCE
CB
300ø V&B
200ø V&B
300x 200ø TEE
HYD. &V.
BH.10
37A
46A
29
4
250ø PVC. SAN-44.0m
375ø PVC. PERFORATED STM-
18.00
5.00
8.00
3.80
13.70
12.77
25.18
13.94
11.09
10.97
11.00
9.77
12.20
R=7.5
0+020
0+040
0+060
0+420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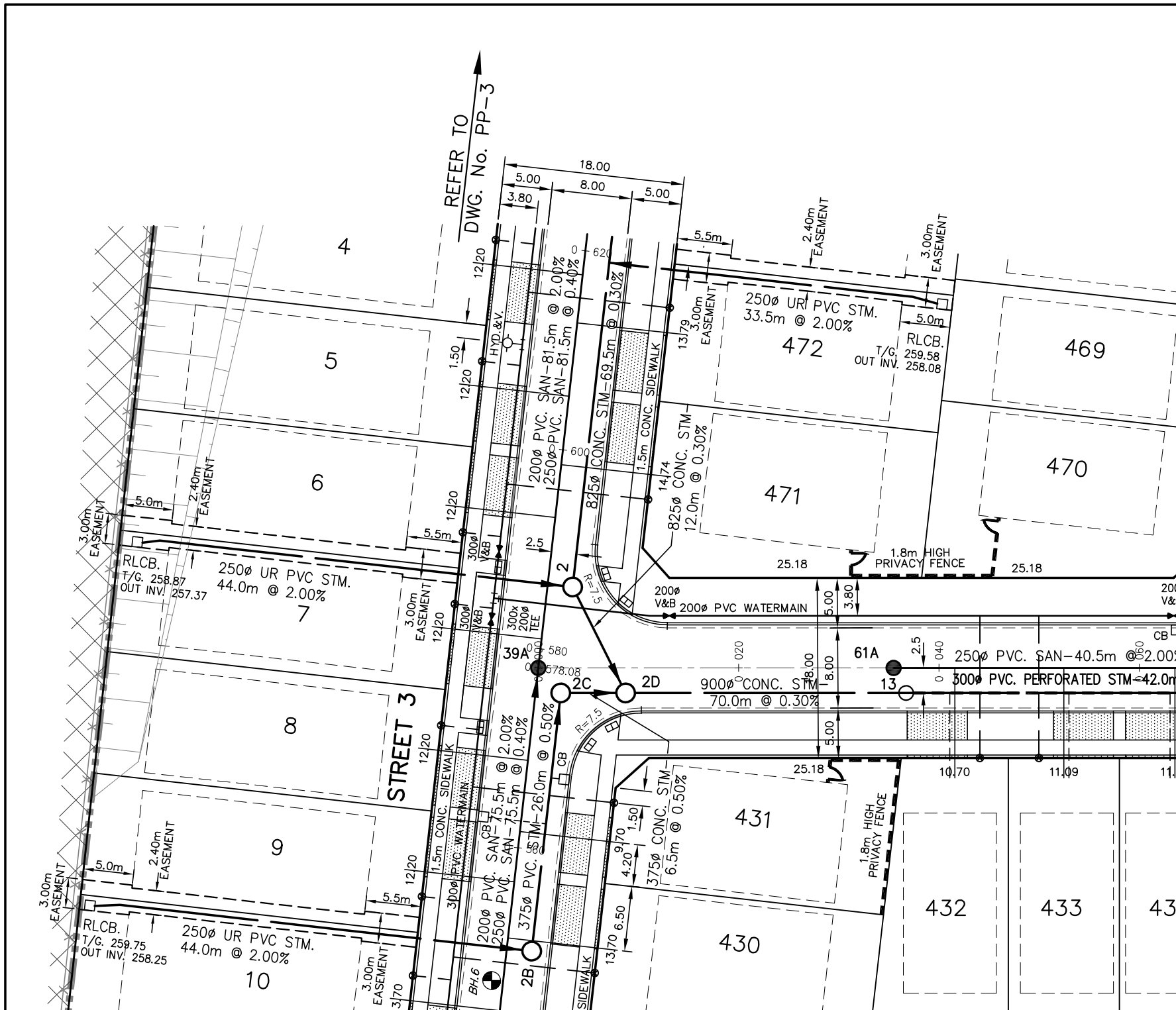
18.00
5.00
3.80
8.00
5.00
10
11
12
13
14
15
STREET 3
BLOCK-488
429
428
427
426
425
397
398
399
400
396
1.8m HIGH PRIVACY FENCE
1.5m CONC. SIDEWALK
200ø PVC. SAN-75.5m @ 2.00%
250ø PVC. SAN-75.5m @ 0.40%
300ø PVC. WATERMAIN
200ø PVC WATERMAIN
200ø V&B
300ø V&B
300x 200ø TEE
CB
R=7.5
38A
50A
23
3
250ø PVC. SAN-45.0m @ 2.00%
375ø PVC. PERFORATED STM-39.0m @ 0.50
PVC. SAN-75.5m @ 2.00%
PVC. SAN-75.5m @ 0.40%
PVC. STM-66.0m @ 0.50%
2.70m EASEMENT
3.00m EASEMENT
5.0m
3.0m WALKWAY
1.50m HIGH CHAIN LINK FENCE
5.5m
RLCB.
T/G. 261.29
OUT INV. 259.79
250ø UR PVC STM.
44.0m @ 2.00%
25.11
25.18
13.65
11.00
10.95
5.20
14.26
11.20
8.10
5.80
2.5
0+540
0+520
0+500
0+020
0+040
0+060
0+080
0+100
0+120
0+140
0+160
0+180
0+200
0+220
0+240
0+260
0+280
0+300
0+320
0+340
0+360
0+380
0+400
0+420
0+440
0+460
0+480
0+502.60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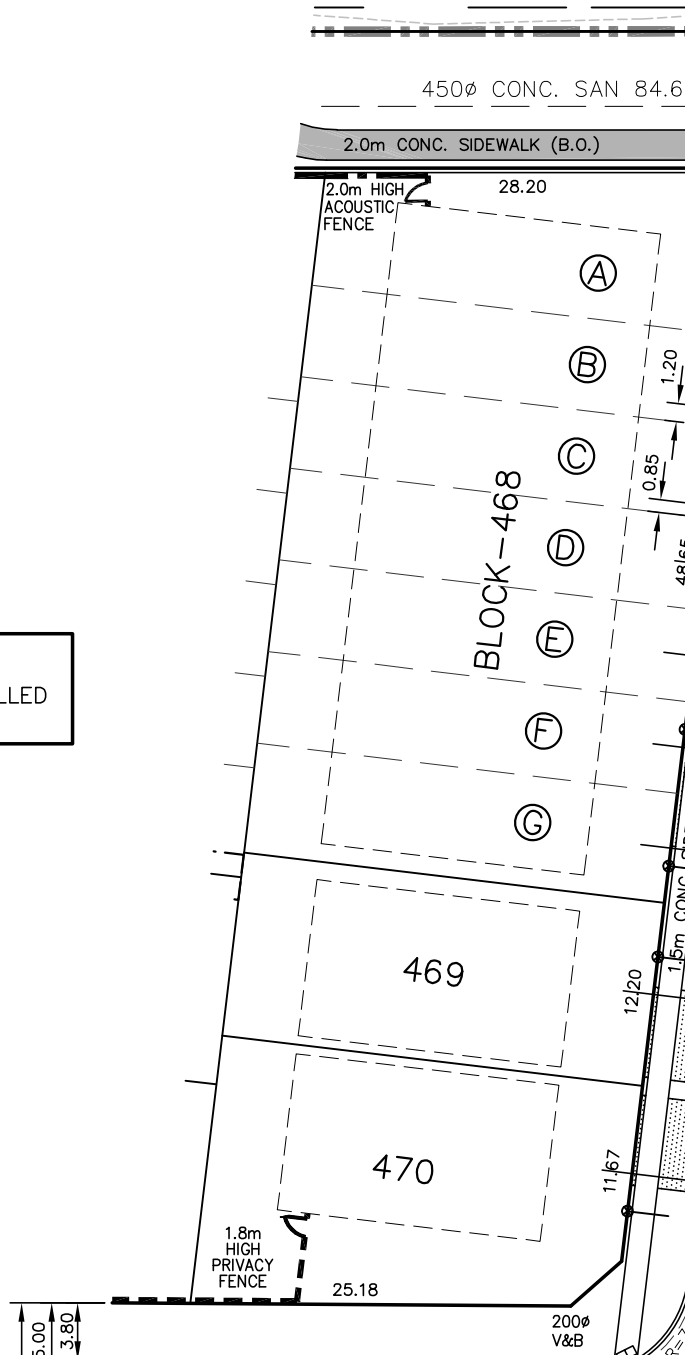
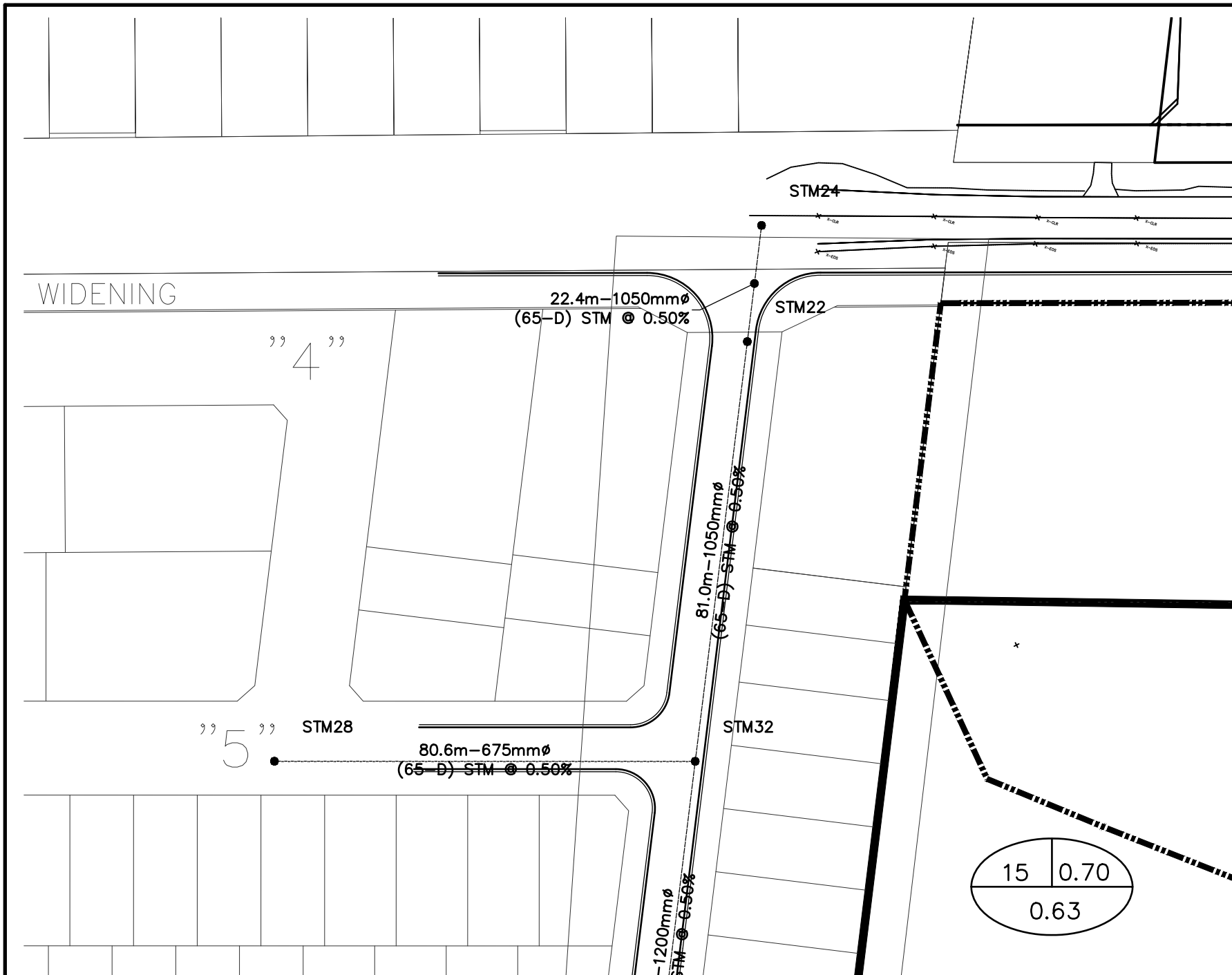
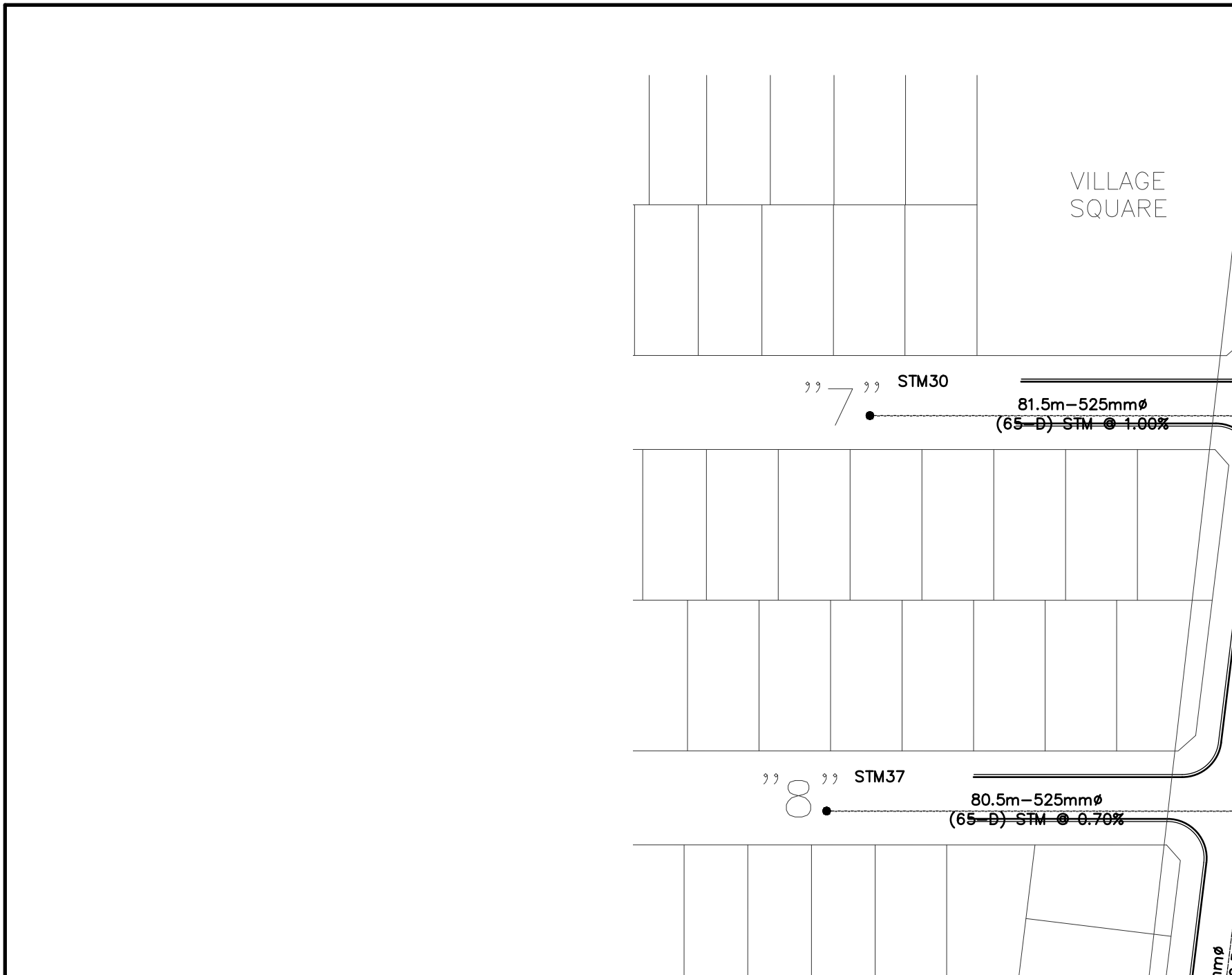
STREET 3
4
5
6
7
8
9
10
469
470
471
472
430
431
432
433
RLCB. T/G. 258.87 OUT INV. 257.37
RLCB. T/G. 259.75 OUT INV. 258.25
RLCB. T/G. 259.58 OUT INV. 258.08
250ø UR PVC STM. 44.0m @ 2.00%
250ø UR PVC STM. 33.5m @ 2.00%
200ø PVC. SAN-81.5m @ 2.00%
250ø PVC. SAN-81.5m @ 0.40%
825ø CONC. STM-69.5m @ 0.30%
825ø CONC. STM 12.0m @ 0.30%
200ø V&B
200ø PVC WATERMAIN
300ø V&B
300x200ø TEE
900ø CONC. STM 70.0m @ 0.30%
250ø PVC. SAN-40.5m @ 2.00%
300ø PVC. PERFORATED STM-42.0m
200ø PVC. SAN-75.5m @ 2.00%
250ø PVC. SAN-75.5m @ 0.40%
375ø PVC. STM-26.0m @ 0.50%
375ø CONC. STM 6.5m @ 0.50%
1.5m CONC. SIDEWALK
1.8m HIGH PRIVACY FENCE
2.40m EASEMENT
3.00m EASEMENT
5.0m
5.5m
25.18
18.00
5.00
8.00
3.80
2.5
R=7.5
CB
HYD.&V.
BH.6
2
2B
2C
2D
39A
61A
13
10.70
11.09

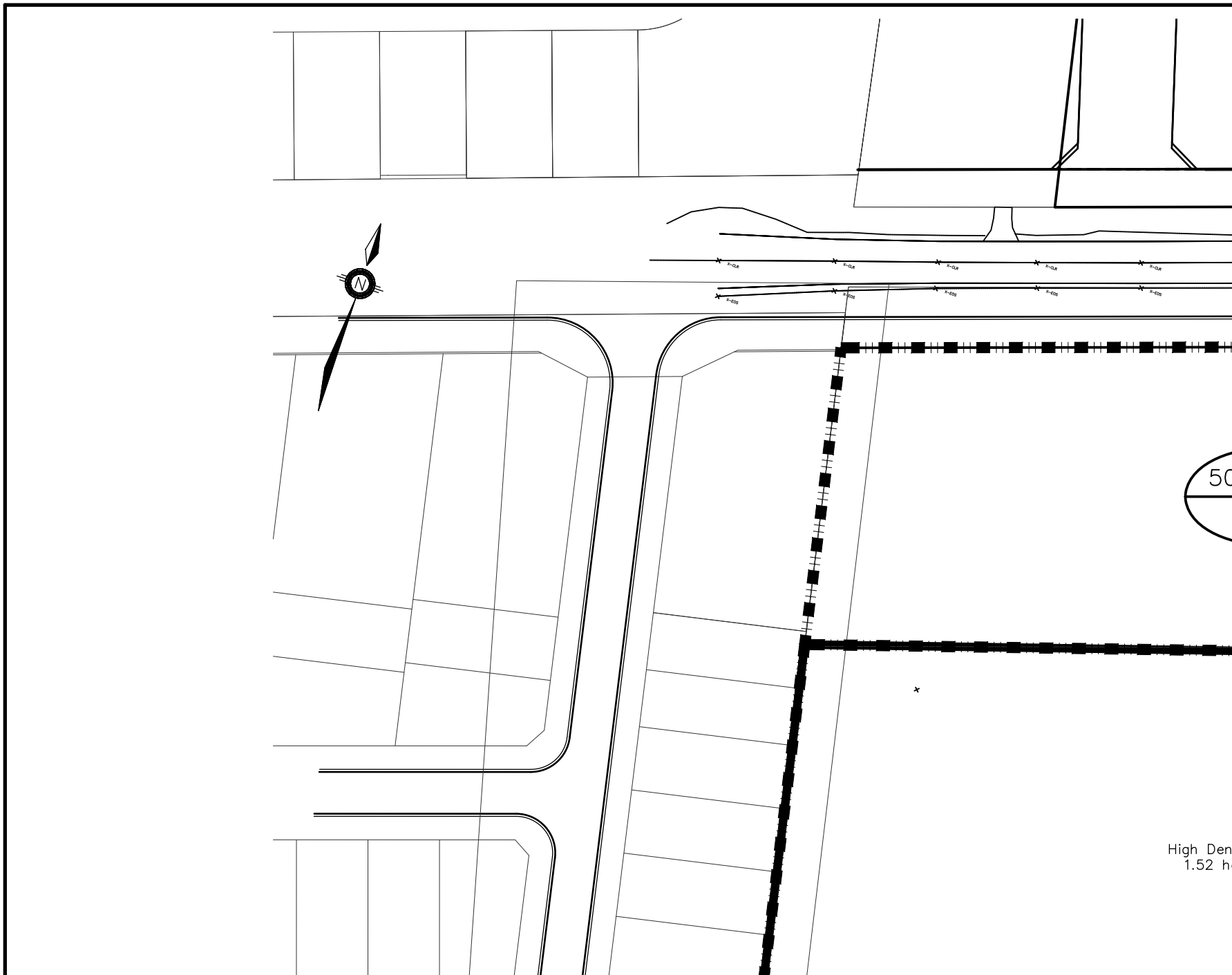
NOTE:

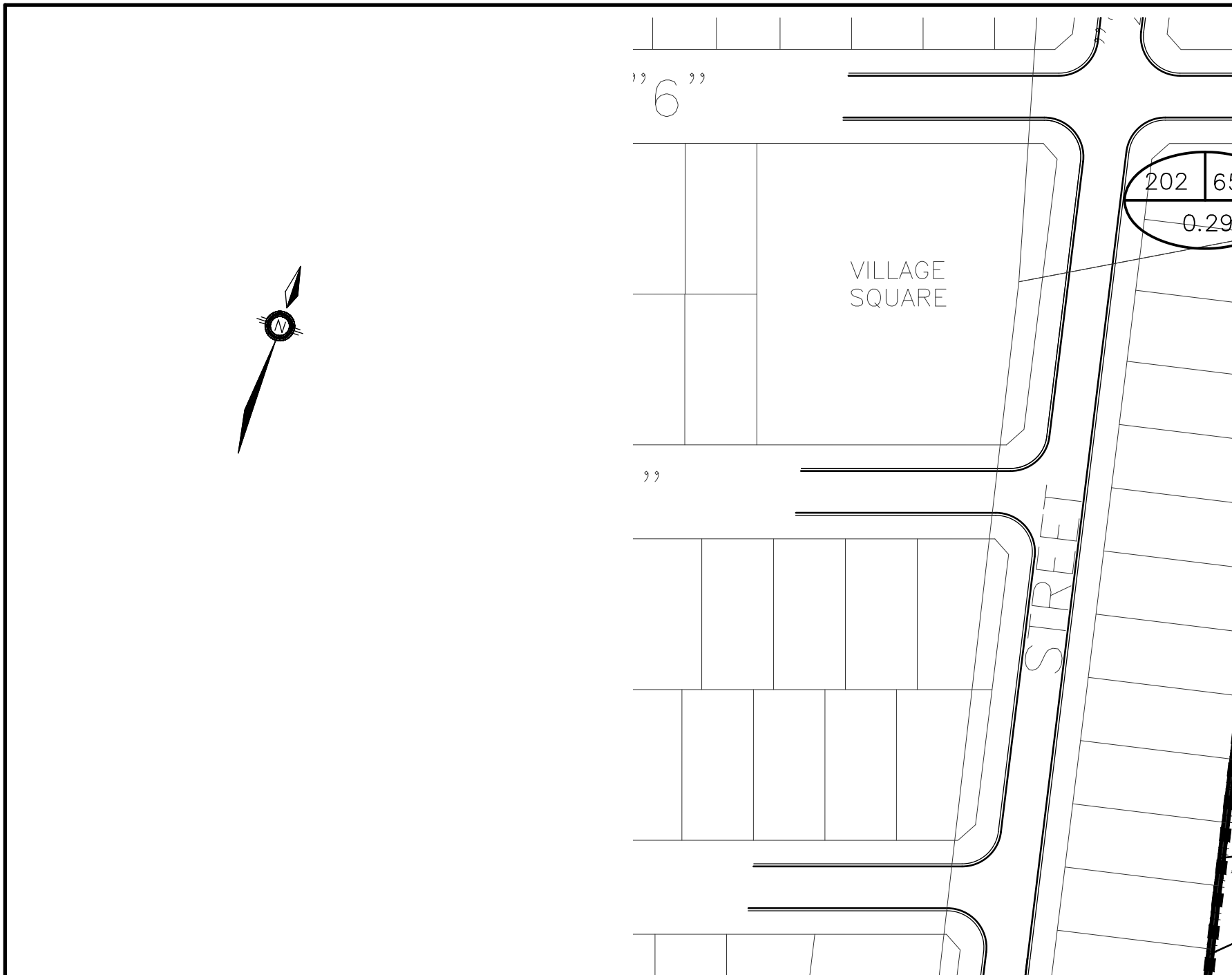
FOR BLOCK–468, LOT 469 & 470 WATER SERVICE TO BE INSTALLED BELLOW STORM SEWER (0.50m SEPARATION PER SBD–519)

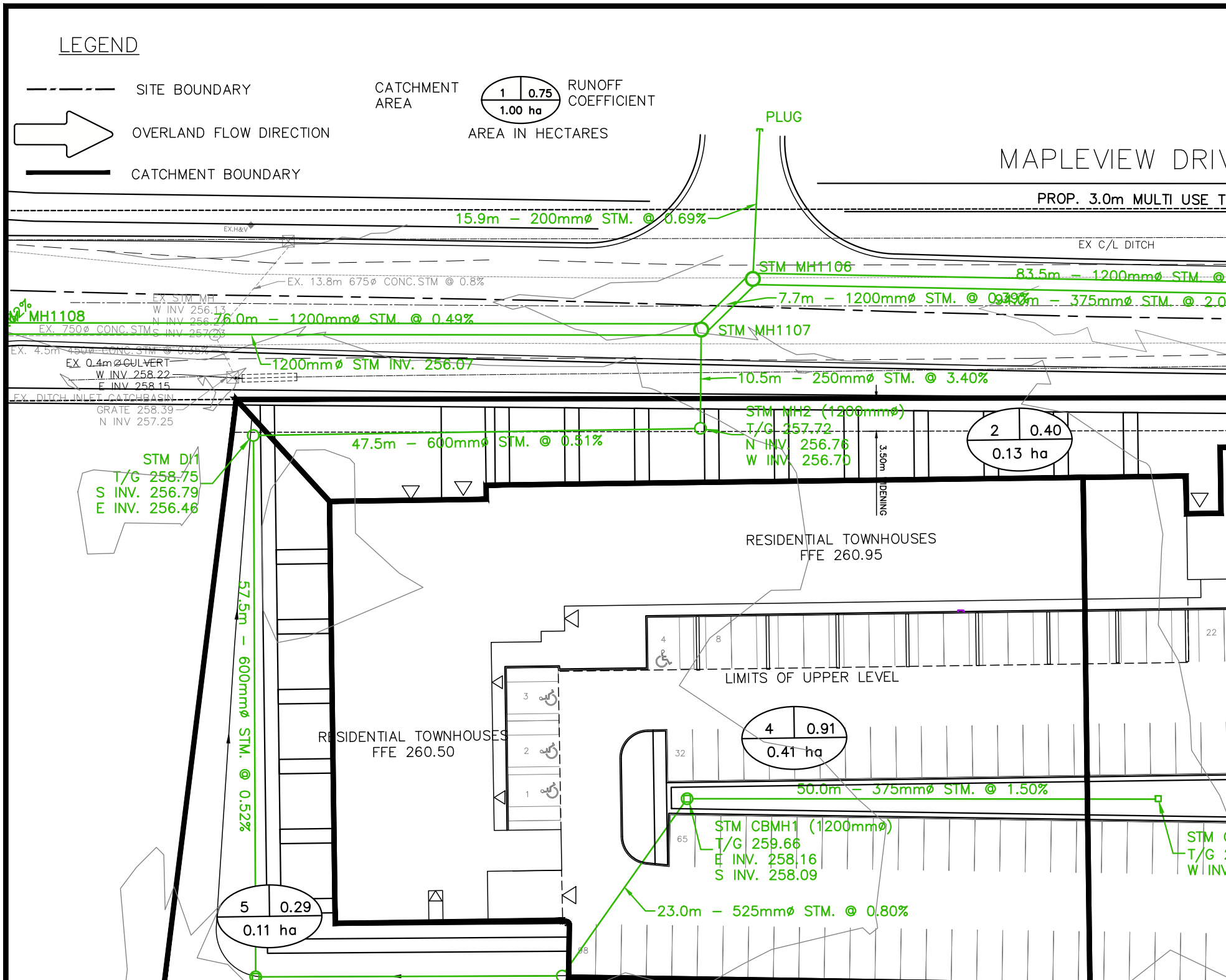



STM24
WIDENING
22.4m–1050mmø
(65–D) STM @ 0.50%
STM22
"4"
81.0m–1050mmø
(65–D) STM @ 0.50%
"5"
STM28
STM32
80.6m–675mmø
(65–D) STM @ 0.50%
15
0.70
0.63

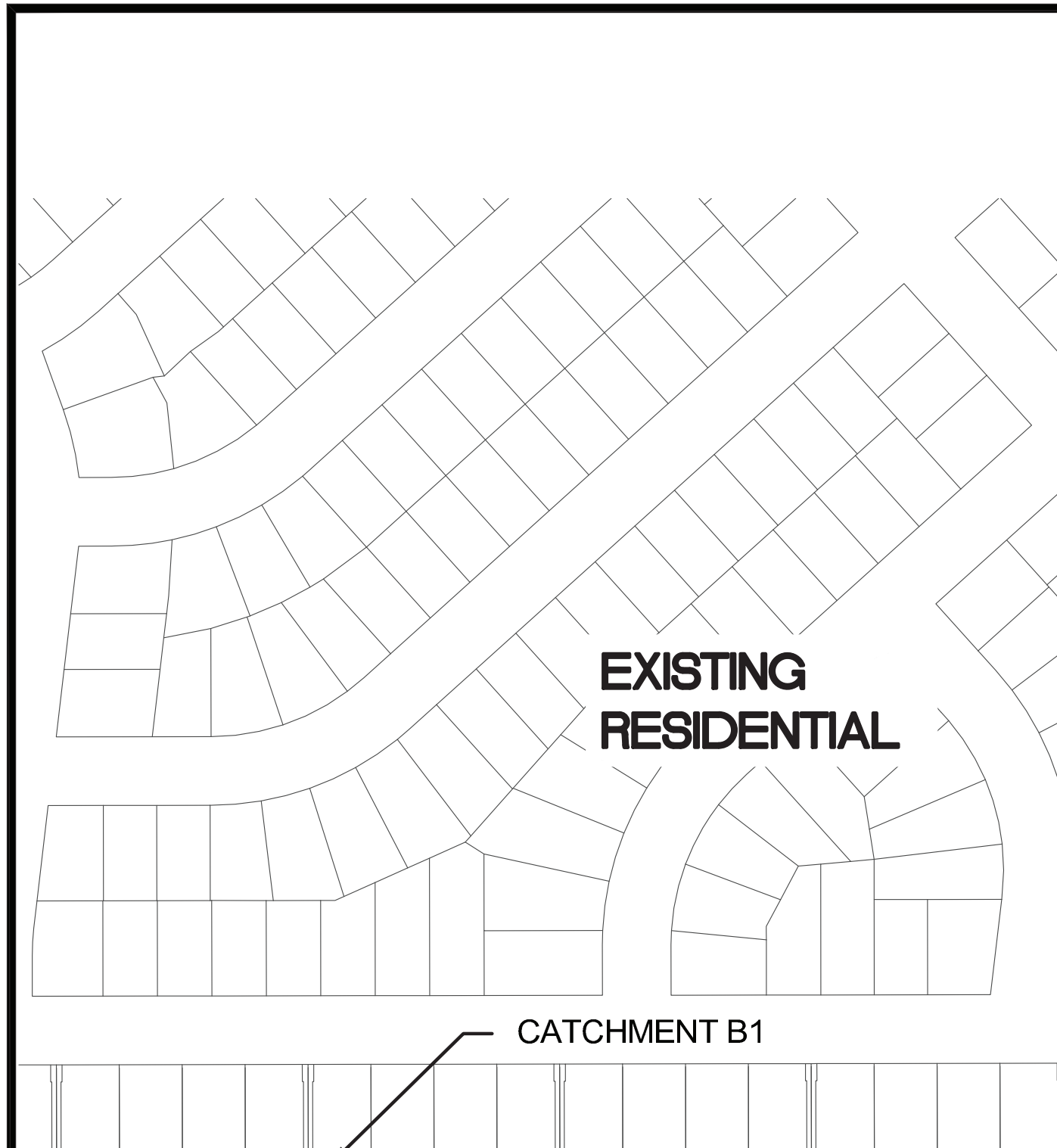

VILLAGE
SQUARE
7
STM30
81.5m–525mmø
(65–D) STM @ 1.00%
8
STM37
80.5m–525mmø
(65–D) STM @ 0.70%


N
50
High Den
1.52 h


6
VILLAGE
SQUARE
202
0.29



C:\Publish_16076\19057 – BASE.dwg Layout:FIG 5 – POST Plotted Jan 31, 2020 @ 4:20pm by mpinkney @ PEARSON ENGINEERING LTD.


EXISTING
RESIDENTIAL
CATCHMENT B1

BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix E

Water Balance Ledger

R.J. Burnside & Associates Limited 3 Ronell Crescent Collingwood ON L9Y 4J6 CANADA
telephone (705) 446-0515 **fax** (705) 446-2399 **web** www.rjburnside.com

BURNSIDE
[THE DIFFERENCE IS OUR PEOPLE]

970 Mapleview – Phase 1
Stormwater Management Facility 15 – Water Balance Ledger

Date: August 17, 2020 **Project No.:** 300039296.2019
Project Name: 970 Mapleview - SWMF15 Water Balance Ledger
Client Name: 970 Mapleview Inc.
Submitted To: Lake Simcoe Region Conservation Authority (LSRCA)
Submitted By: Aaron Pettifer

Summary

As described in the 970 Mapleview SWMF 15 Report, dated June 19, 2020, SWMF 15 includes an infiltration sump with 2,011 m^3 of storage. To evaluate the design infiltration performance of the facility, a continuous simulation was completed within PCSWMM, using observed rainfall data from Environment Canada Weather Station Barrie WPCC over a 30-year period (1978 to 2007). Over the 30-year period, 99% of inflow to the facility was infiltrated. Applying this ratio of infiltration to the unmitigated available annual runoff, as defined in the water balance, equates to 160,200 m^3/year of infiltration, which exceeds the recommended mitigation infiltration volume of 55,700 m^3/year for the entire 970 Mapleview Lands.

As discussed with the LSRCA this surplus volume may be distributed amongst various sites. The ledger below describes how the infiltration volume will be distributed. Additions to the ledger will be incorporated, updated and re-distributed when opportunities are confirmed.

Ledger

Description	Volume Used (m^3)	Remaining Volume (m^3)
Annual SWMF15 Infiltration Volume	0 m^3	160,200 m^3
970 Mapleview Inc. – Entire Site Mitigation	55,700 m^3	104,500 m^3
Blue Sky Development (1597229 Ontario Ltd.) Mitigation*	56,900 m^3	47,600 m^3
Transfer to Mapleview Developments Inc. (700 Mapleview Drive)	8,217 m^3	39,383 m^3
Transfer to BEMP Holdings 2 Inc.	10,615 m^3	28,768 m^3
Remaining Infiltration Surplus belonging to 970 Mapleview Inc.	0 m^3	28,768 m^3

*This is not to mitigate the entire Blue Sky development, this value is based on a percentage of total contributing impervious area to SWMF 15.

To track changes to this document, all updates will be noted in the Revision Block below.

Revision Number	Date	Description	Remaining Volume
0	June 19, 2020	Original – 970 Mapleview Inc., 1597229 Ontario Ltd., Mapleview Developments Inc.	**39,383 m^3**
1	August 17, 2020	Transfer of 10,615 cu.m to BEMP Holdings 2 Inc.	**28,768 m^3**

R.J. Burnside & Associates Limited

Aaron Pettifer, P.Eng.
Project Manager
AP:jm

200817_970 Mapleview_WB LEDGER
17/08/2020 5:23 PM