VALDOR ENGINEERING INC.
Municipal • Land Development • Water Resources
Site Development • Project Management • Contract Administration
Consulting Engineers – est. 1992

741 Rowntree Dairy Road, Ste.2
Woodbridge, Ontario L4L 5T9
TEL (905) 264-0054
FAX (905) 264-0069
info@valdor-engineering.com
www.valdor-engineering.com

FUNCTIONAL SERVICING REPORT

Millbrook Subdivision, Phase 2

West Side of County Road 10, North of Fallis Line
Community of Millbrook
Township of Cavan Monaghan
County of Peterborough
15T-18002

September 2018
Rev. March 2019
Rev. May 2020

Prepared For: **Towerhill Development Inc.**

CORTEL GROUP

File: **17125**

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1.0 INTRODUCTION

Valdor Engineering Inc. has been retained by Towerhill Development Inc. to provide consulting engineering services for the proposed Millbrook Phase 2 Subdivision located on 52.1 hectare parcel on the west side of County Road 10, north of Fallis Line, in the Community of Millbrook, Township of Cavan Monaghan, County of Peterborough as illustrated in **Figure 1**.

The subject site is located in the Millbrook urban expansion area which is planned to accommodate new residential, industrial, commercial and institutional lands. The subject lands are part of a larger land holding which includes the Phase 1 lands on the south side of Fallis Line which have recently being serviced and houses are currently under construction. The future Phase 3 lands and partially outside the limits of the expansion area as seen in **Figure 2**.

1.1 Existing Conditions

The subject site is bounded to the north and west by agricultural lands and to the south by Fallis Line and a rural residential lot. The site is bounded to the east by County Road 10, the Township municipal offices a cemetery and a community centre which is currently under construction. The northeast corner of the site is traversed by Tributary C of Baxter Creek which flows in an easterly direction under County Road 10. A second watercourse, Tributary B, traverses the site draining in a northeasterly direction joining Tributary C upstream of County Road 10. The geotechnical and topographical conditions of the site are summarized as follows:

1.1.1 Geotechnical

A Geotechnical Investigation Report prepared by Geo-Logic Inc. included eight boreholes ranging in depth from 6.1m to 9.8m. Based on the investigation it was determined that the site is covered by a topsoil layer having a depth of approximately 300mm underlain by till comprised of clayey silt. The boreholes are included in **Appendix "H"**.

1.1.2 Topography

The surface condition of the subject site can be generally described having a rolling topography. Based on a recent topographic survey of the site, the property slopes from Fallis Line down in a northeasterly direction towards Tributary C. Based on an existing elevation of approximately 252.0 m at Fallis Line and an existing elevation of 241.0 at the north limit of the development, the differential of 11.0 m equates to an overall average slope of approximately 1.5% which is considered to be relatively moderate.

1.2 Proposed Development

The proposed development consists of a mix of lots for detached dwellings and street townhomes as well as bocks for apartment buildings. The lot frontages for the detached dwellings will range from 10.6m to 15.8m while the townhomes will consist of 7.6m frontages. Access for the subdivision will consist of a road network with three road connections off Fallis Line and one road connection to County Road 10. A park will be centrally located. A block of land has been established for a stormwater management facility to control and treat stormwater runoff. The remainder of the site, associated with the tributaries of Baxter Creek, will be retained in environmental protection blocks. The Draft Plan of Subdivision is contained in **Figure 3**. The development statistics and the equivalent population data are summarized in **Table 1**.

Table 1. Development Statistics

Land Use	**Area** (Ha)	**Residential Units** (No.)	**Equivalent Population** (persons)
Detached Dwellings	16.121	328	1,260
Street Townhomes	5.549	245	732
Apartments	3.013	192	384
School	2.213		
Parks, Open Space & Walkways	3.037		
Environmental Protection Lands	10.396		
SWM Pond	1.971		
Agricultural	1.222		
Roads, Reserves & Widenings	8.586		
TOTAL	**52.108**	**765**	**2,376**

1.3 Purpose of Report

This report has been prepared in support of the application for draft plan approval for the subject property. The primary intent of the report is to demonstrate the viability of water and wastewater servicing, storm drainage and stormwater management, grading as well as vehicular and pedestrian access for the proposed development with respect to applicable guidelines, policies and design criteria.

This report has been prepared based on a review of the topographic survey and background studies, discussions with municipal staff and a visit to the site. This document provides guidance for detailed engineering design of the subdivision.

1.4 Approving Authorities

This report will be circulated for review, comment and approval to:

1. The Township of Cavan Monaghan;
2. The County of Peterborough; and
3. The Otonabee Region Conservation Authority (ORCA).

2.0 WATER SERVICING

The existing Millbrook water servicing system consists of a water treatment facility, with water taken from three local wells, a water storage tank and a network of watermains that service most of the existing urban area of the community.

The existing Millbrook Water Treatment Plant (WTP) consists of 3 wells, each with 25 L/s capacity, chlorine disinfection and a chlorine contact tank. The existing water storage tank was built in 1976 and is located on the east end of Millbrook on a local high point of land. The existing 10.4m diameter tank has a useable storage capacity of 1,410m^3 with a top water level at an elevation of 278.0m.

The Township of Cavan Monaghan completed a Class Environmental Assessment (Class EA) in June 2014 to investigate on the alternatives to address concerns associated with the water storage and water servicing needs. In this regard, the expansion of the existing urban boundary of Millbrook required additional water storage and expansion of the existing water servicing network to the new development area.

As a result, a new, larger water storage tank was constructed on the Township Office site, a new watermain was constructed to connect to the tank to the existing water supply main and the original water storage tank in Millbrook as decommissioned. A booster station was also constructed within the Township Office site to ensure proper minimum fire pressures are maintained during maximum day demand throughout the higher elevations within the development.

The location of the existing WTP and the existing water storage tank as well as the proposed storage tank, booster station are indicated in **Figure 4B**. The following is a summary of the water servicing requirements for the subject site.

2.1 Domestic Demand

The domestic water demand is to be calculated using the Township and Ministry of the Environment design standards which includes the following parameters:

Residential Average Day Demand: 450 L/person/day
Maximum Day Factor: 2.00
Peak Hour Factor 3.00

A detailed tabulation of the domestic water demand calculation is detailed in **Table A1** of **Appendix "A"**. The demands are summarized in **Table 2** below.

Table 2. Domestic Water & Fire Flow Demand

Land Use	Equivalent Population (Persons)	Domestic Demand (L/min)	Maximum Day Demand (L/min)	Peak Hour Demand (L/min)	Fire Flow (L/min)	Maximum Day Plus Fire Flow (L/min)
Detached Dwellings	1,260	394	788	1,181	5,000	
Street Townhomes	732	229	458	686	9,000	
Apartments	384	120	240	360		
School	538	168	336	504		
TOTAL	**2,914**	**911**	**1,821**	**2,732**	**9,000**	**10,821**

2.2 External Watermains

In accordance with the recommendations of the Class EA, a trunk watermain has been constructed northerly from the existing Millibrook community along County Road 10 and across the frontage of the subject site. This trunk watermain supplies the existing water storage tank which is located on the site of the municipal offices which is located on the high point of the urban expansion area. This tank feeds a local distribution network which provides water supply to the existing municipal office, the existing community centre, the existing Millbrook Subdivision Phase 1 and will also service the subject Phase 2 lands.

The future Phase 3 lands will be serviced by the northerly extension of the County Road 10 watermain. The other lands owned by Towerhill to the west will be serviced by the westerly extension of the Fallis Line watermain.

Due to the significant variation in topography of the urban expansion area, pressure reducing valves and a booster pumping station have been implemented. The configuration of the water distribution system is illustrated on **Figure 4B**.

2.3 Local Watermains & Service Connections

The local water distribution system within the subdivision will consist of watermains ranging in diameter from 150mm to 300mm. This water system will connect to the trunk watermain.

In accordance with Township standards the individual detached dwellings are each to have separate water connections. Based on Ontario Building Code (OBC 2012) regulations (7.6.3.4.(1) and (5) and Table 7.6.3.4), the dwellings will be serviced with 25mm diameter water connections given that it is anticipated that the dwellings will each have more than 16 fixture units.

Water sampling stations will be required in order to monitor the water quality. The location of the water sampling stations will be determined at the detailed subdivision engineering design stage.
Water meters are to be purchased from the Township and will be installed in the basement of each dwelling with a remote readout device located on the exterior ground floor wall of the house. Generally, residential water meters are selected to be one size smaller than the water service and therefore 20mm x 25mm water meters will be installed.

The configuration of the site watermain is illustrated in **Figure 4A**. A copy of the Township standard water service connection and water meter details is included in **Appendix "A"**.

2.4 Fire Protection

The fire flow required for the proposed dwelling units was calculated using the criteria indicated in the *Water Supply for Public Fire Protection Manual*, 1999, by the Fire Underwriters Survey (FUS). The calculation incorporates various parameters such as coefficient for fire-resistant construction, an area reduction accounting for a fire-resistant (one hour rating) protection, a reduction for low-hazard occupancies, and a factor for neighbouring building proximity.

The calculation was completed to reflect the governing conditions which are the largest detached dwelling and the largest interior townhouse unit. Based on the calculations, the minimum fire suppression flow required for the detached dwellings and the townhouse units is 5,000 L/min and 9,000 L/min respectively. The detailed fire flow calculation is shown in **Table A2-1** to **Table A2-2** of **Appendix "A"**. In accordance with the Township standards, this flow must be available at the nearest hydrant with a minimum pressure of 140 KPa.

Fire hydrants will be provided along the municipal roads such that a fire hydrant will be available within 90m of the principle entrance of each unit as set out in the Ontario Building Code (OBC 2012). A copy of the standard fire hydrant detail is included in **Appendix "A"**.

3.0 WASTEWATER SERVICING

The community of Millbrook is currently serviced by the existing Millbrook Wastewater Treatment Plant (WWTP) located at the east limit of Centennial Lane. This WWTP was built in 1975 and the plant was upgraded in 2004 to improve the treatment quality.

In May 2013 the Township of Cavan Monaghan completed a Class Environmental Assessment (Class EA) which investigated the alternatives to address concerns associated with the existing WWTP, in particular, the fact that it did not have sufficient capacity to sustain the projected growth. In addition, the existing plant is at the end of its useful life and requires substantial upgrade and rehabilitation. Based on the recommendations of the EA, the expansion and upgrade of the existing Millbrook WWTP was completed in 2015 to include a high-level tertiary treatment facility that is able to provide improved effluent quality to meet the current effluent discharge criteria, as well as the increased capacity to accommodate future flows.

The location of the existing sanitary sewers and the WWTP is indicated in **Figure 5B**. The following is a summary of the wastewater servicing analysis for the subject site.

Based on the current status of development, the Township has advised that allocation in the WWTP is only available for 305 of the 765 units in the subject development so the proposed subdivision will have to be phased.

3.1 Wastewater Loading

The wastewater loading is to be calculated using the Township engineering design standards which include the following parameters:

Residential Average Daily Flow: 450 L/person/day

Residential Peaking Factor: $K_H = 1 + \frac{14}{4 + \sqrt{P}}$

Where: K_H = Harmon Peaking Factor (Max. 4.0, Min. 2.75)
p = Population in thousands

Extraneous Flow, *I*: 0.28 L/s/Ha (Infiltration)

Design Flow, Q = $Q \times K_H + I$

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Based on the above criteria the sewage flow calculations are provided in **Table B1** contained in **Appendix "B"** and the total flow is summarized in **Table 3**.

Table 3. Wastewater Loading Summary

Land Use	Area (Ha)	Equivalent Population (Persons)	Average Daily Flow (L/s)	Peaking Factor	Peak Daily Flow (L/s)	Infiltration Rate (L/s)	Total Flow (L/s)
Detached Dwellings	16.121	1,148	5.98	3.73	22.48	4.51	26.65
Street Townhomes	5.549	858	4.47	3.88	17.16	1.55	15.64
Apartments	3.013	384	2.00	4.00	8.00	0.84	8.38
School	2.213	538	2.80	1.50	4.20	0.62	
Roads	8.586					2.40	1.39
TOTAL	**35.482**	**2,927**	**15.25**		**51.84**	**9.93**	**61.78**

3.2 External Sanitary Sewers

In accordance with the recommendations of the Class EA, a trunk sanitary sewer was constructed from the existing Millbrook community, along County Road 10, to service the urban expansion area including the existing municipal office, the existing Phase 1 lands, the subject Phase 2 lands. Given the existing rolling topography of the area, the route of this existing West Trunk Sewer was selected to minimize the depth of this 375mm diameter gravity sewer and to maximize the area that can be serviced by a gravity system. The alignment of the trunk sanitary sewer is indicated in **Figure 5B**.

Due to the location of the future Phase 3 lands on the north side of the watercourse, a pumping station will be required to service Phase 3. It is anticipated that this future pump station will discharge to the future East Trunk Sewer which will be located east of County Road 10. It is anticipated that the other lands owned by Towerhill to the west will be serviced by the West Trunk Sewer.

An analysis of the downstream sanitary sewer was conducted to confirm that there is sufficient capacity. In this regard, a sanitary sewer design sheet has been prepared which indicates that there is sufficient capacity in the downstream sanitary sewer from the subject site to the WWTP to accommodate the subject Phase 2 subdivision. The design sheet is included in **Table B2** which is included in **Appendix "B"** together with the sanitary sewer drainage plan as delineated in **Figure B-1**.

3.3 Local Sanitary Sewers & Service Connections

The subject site will be serviced by a local sanitary system consisting of 200mm diameter sewers which will discharge to the trunk sewer. The local sewer will be designed such that the upstream end of each length will have a minimum 1% slope to assist with self cleansing. In accordance with standard practice, manholes will be provided for maintenance access at a maximum spacing of 120m.

Each dwelling unit will be provided with a 100mm diameter single connection in accordance with Township standards.

4.0 STORM CONVEYANCE SYSTEM

The subject site is located in the Baxter Creek watershed which is one of the twelve watersheds under the jurisdiction of the Otonabee Region Conservation Authority (ORCA). Baxter Creek originates from the Oak Ridges Moraine and flows in an easterly direction and outlets into the Otonabee River. Baxter Creek meets the Otonabee River approximately 20 km upstream of Rice Lake. A map illustrating the Baxter Creek watershed is contained in **Appendix "C"**.

In accordance with Township standards, a major / minor system storm conveyance concept has been incorporated into the functional servicing design for the subject development. The following sections provide a brief summary of the storm drainage components:

4.1 Minor System Design

As per the Township engineering design criteria, the proposed development is to be serviced with a minor storm sewer system that is designed to convey runoff from the 5-year storm event. The rainfall intensity values, *I*, are calculated in accordance with the 2014 rainfall intensity duration frequency (IDF) data for the Peterborough Airport weather station, obtained from Environment Canada. Based on this data the rainfall intensity for the 5- and 100-year rainfall events is calculated as follows:

$$I_5 = \frac{844}{(t+7.5)^{0.78}} \qquad I_{100} = \frac{1697}{(t+10.5)^{0.81}}$$

The peak flows are calculated using the following formula:

$Q = R \times A \times I \times 2.778$ where: Q = peak flow (L/s)
A = area in hectares (ha)
I = rainfall intensity (mm/hr)
R = composite runoff coefficient
t = time of concentration (min)

The proposed storm sewer will discharge to the proposed stormwater management facility (SWM pond) located in the north-west corner of the site.

The IDF curve data is included in **Appendix "C"**. A schematic design of the minor system is illustrated in on **Figure 6**.

4.2 Major System Design

The major system will generally be comprised of an overland flow route along the municipal road network directing drainage to a safe outlet. This major system will convey flows which are in excess of the capacity of the minor storm sewer system. The major system flow route is illustrated in **Figure 10**. Major flows will be captured at the low point on Street 'A' and conveyed to the SWM pond via the maintenance access road overland flow route.

4.3 Foundation Drainage

It is anticipated that the dwellings will have basements and therefore a foundation weeping tile system will be required. In accordance with Township standards, storm service connections are to be provided to each dwelling unit. A hydraulic grade line analysis of the storm sewer system will be completed at the detailed design stage to ensure that basements are protected during the 100-year storm event.

4.4 Roof Drainage

It is anticipated that the proposed dwellings will have conventional peaked roof with eaves troughs and downspouts. As per standard practice the downspouts are to discharge to grade over splash pads, preferably towards sodded areas. Roof downspouts are not to be connected to the storm sewer.

4.5 Floodplain Analysis

The north part of the subject site is traversed by Tributary C of Baxter Creek which flows in an easterly direction before discharging under County Road 10. A second watercourse, Tributary B, traverses the site draining in a northeasterly direction joining Tributary C upstream of County Road 10. The following is a summary of the analysis completed related to these two watercourses.

4.5.1 Tributary C

The total upstream drainage area of Tributary C is 1,055.74 Ha (*Catchments 101-106*), as shown on **Figure 7**. In order to determine the extent of the Regulatory floodplain at this location, a HEC-RAS model was prepared and the Regulatory floodplain is delineated in **Figure 8**.

As indicated in **Figure 3**, the flood plain associated with Tributary C will be entirely contained within open space blocks and therefore the proposed lots are protected from flooding.

Supporting documentation, VO5 and HEC-RAS modelling output, and hydraulic calculations are provided in **Appendix "D"**.

4.5.2 Tributary B

An application was made to the Department of Fisheries & Oceans (DFO) to obtain approval for the re-alignment of Tributary B such that it would be directed around the subject development in the form of a channel. The proposed channelization has the benefit of resulting in an increase of 264 m of watercourse length with the entire section incorporating natural channel design features within a protected block whereas the existing watercourse passes through an agricultural field and has barriers to fish passage.

Based on the foregoing, the proposed channelization will result in a net gain of potential fish habitat. The DFO reviewed the proposal for the channelization and has confirmed that it will not result in serious harm to fish and therefore no formal approval is required from DFO. The DFO correspondence dated February 5, 2018 is included in **Appendix "D"**. The alignment of the proposed channel is indicated in **Figure 6**.

In order to determine the Regulatory flow through the subject site associated with Tributary B, the upstream drainage areas were delineated, and hydrologic modelling using Visual OTTHYMO 5.1 (VO5) was completed. The total upstream drainage area is 28.41 ha (*Catchment 107*, as shown on **Figure 7**)**.** Based on this analysis, it was determined that the Regional Storm (Timmins Storm) is the Regulatory Storm, with a peak flow of 2.228 cms at *Flow Node #6* (refer to **Table D.4** in **Appendix "D"**).

Two (2) 2.4 m wide by 1.2 m high open-bottom concrete box culverts are proposed at Street "K" where it crosses the proposed channel. These culverts have been sized to convey the regional flow (refer to *CulvertMaster* output in **Appendix "D"**). As per *Table 3* of the *Fish and Wildlife Crossing Guidelines* (Credit Valley Conservation, April 28th, 2017, provided in **Appendix "D"**), the minimum recommended openness ratio for mid-sized mammals is 0.1, with a minimum width and height of 1 m. The openness ratio for a box culvert is calculated using the following formula:

$$Openness\ Ratio = \frac{(Height \times Width)}{Length} = \frac{(2.4 \times 1.2)}{20} = 0.144$$

The proposed culverts therefore meet the minimum wildlife passage requirements.

The SWM pond will discharge to the proposed channel at the northwest corner of the site. The uncontrolled Regional flow from the SWM pond (discharged via the emergency spillway) is 4.187 cms. The proposed channel must therefore convey a total flow of 6.415 cms (2.228 cms from upstream, plus 4.187 cms from the proposed development). The proposed channel will be 1.10 m deep, with an 11.00 m wide bottom, 3:1 side slopes and a minimum slope of 0.5%. Based on *FlowMaster* modelling of the proposed channel (refer to output in **Appendix "D"**), the Regional flow can be conveyed at a flow depth of 0.57 m (at a minimum 0.5% slope), resulting in a minimum freeboard depth of 0.53 m to the top of the channel. It is to be noted that the proposed channel will be construct entirely in cut, and that the channel will typically be deeper than the minimum 1.10 m depth required. The bottom of the channel will consist of a low-flow channel designed in accordance with geomorphic and natural channel design principles.

The flood plain associated with the Tributary B will be entirely contained within the proposed channel which will be located within an open space block. Based on the foregoing, the proposed lots will be protected from flooding.

Supporting documentation, VO5 and HEC-RAS modelling output, and hydraulic calculations are provided in **Appendix "D"**.

5.0 STORMWATER MANAGEMENT

5.1 Storm Drainage Areas

Based on the topographic survey and the proposed draft plan of subdivision, the following is a summary of the pre and post-development drainage areas.

5.1.1 Pre-Development

There is a tributary of Baxter Creek (Tributary C) that passes through the proposed development before it flows beneath County Road 10 via a 6.1 m by 2.44 mm concrete box culvert. The overall topography north of Fallis Line generally drains to the watercourse running through the middle of the site, which flows in a north-easterly direction. Elevations vary from 257.92 m adjacent the existing Township Office property north of Fallis Line, to approximately 233.78 m at the north-east corner of the site where the watercourse enters the culvert under County Road 10. The existing slopes range from 0.4% to approximately 12%.

The existing land use for the area that is to be developed (*Catchments 103 & 104*) is agricultural. **Figure 9** illustrates the drainage patterns for existing conditions.

5.1.2 Post-Development

The subject site will be developed into a residential subdivision, including a mix of single detached dwellings, street townhouses, high-density residential buildings, open space blocks and a SWM block. Drainage will be conveyed to the SWM pond via the storm sewer system, or overland via the road network to the low point adjacent to the SWM pond maintenance access road.

Discharge from the SWM pond will be released to the proposed channel, which will in turn discharge to the existing channel immediately upstream of County Road 10. **Figure 10** illustrates the details of the proposed drainage plan for the subject site.

The lots fronting Fallis Line (*Catchment 206*) will drain to the Fallis Line storm sewer and be conveyed to the Millbrook Subdivision, Phase 1 SWM pond. This area has been accounted for as part of the Phase 1 SWM pond design (*Stormwater Management Report, Millbrook Subdivision, Phase 1*, Valdor Engineering Inc., October 2016).

The eastern portion of the community centre (*Catchment 208*) will be serviced by a storm sewer that will capture the minor system flows (up to and including the 5-year event) and convey flows to the existing culvert under County Road 10. The major system flows (the 100- minus 5-year flows) will discharge overland to the SWM pond. Further details on the SWM design for this site is provided in the *Stormwater Management Report, Proposed Community Centre, Community of Millbrook* (Valdor Engineering Inc., 28 November 2017).

5.1.3 Future Development

The Township has requested that all potential future development areas are to be accommodated as part of the stormwater management system, regardless of whether or not they are currently within the settlement area. The Township has expressed particular interest in the land north of the subject site (up to Larmer Line), as well as the land to the west of the subject site (along the north side of Fallis Line).

The land to the north of the subject development is located on the north side of Baxter Creek, and therefore cannot be serviced by the proposed SWM Pond. This land will need to be serviced by a separate SWM facility. A conceptual SWM pond location for this area is provided in **Figure 11**.

At the request of the Township, the SWM pond has been revised to accommodate an additional 5.6 ha of land to the west of the subject site development, along the north side of Fallis Line (*Catchment 105* on **Figure 9**, *Catchments 209-210* on **Figure 10**). Modelling has been completed for two development scenarios (one scenario which considers only the current development, and a second scenario which includes the additional lands to the west) in order to demonstrate that the proposed SWM pond has adequate capacity to provide the required levels of quality, quantity and erosion control for both development conditions.

5.2 Stormwater Management Design Criteria

The proposed SWM facility shall be designed to provide the following levels of control as per the requirements of the Ministry of the Environment (MOE), Otonabee Region Conservation Authority (ORCA) and Township of Cavan Monaghan:

- **Quality control**: The permanent pool shall be sized to provide Enhanced (Level 1) treatment of stormwater runoff for the proposed development.
- **Erosion control**: Stormwater runoff from the 25 mm storm event shall be stored and released over a minimum 24-hour period.
- **Flood control**: Flood storage and control shall be provided to maintain peak outflows from the pond at or below pre-development levels for the critical of the 6, 12 & 24-hour SCS, the 6, 12 & 24-hour AES, and the 4-hour Chicago storm distributions, for the 2-yr through 100-yr design storm events.

5.3 Stormwater Management Pond Design

A SWM facility is proposed to serve the subject site. The total service area for the SWM facility is approximately 41.49 ha (46.44 ha with future development area). The proposed SWM pond is located at the north-west corner of the proposed development, as illustrated in **Figure 10**. The configuration of the SWM Pond is illustrated in **Figure 12**.

Per the Township standards, MOE SWM pond criteria and recommendations in the geotechnical report, the SWM pond design includes 5H:1V side slopes, a 4.0 m wide maintenance access road to the headwalls and control structure, and access to the bottom of the forebay with a maximum 10% slope.

5.3.1 Quality Control

Various source controls, conveyance and end-of-pipe SWM facilities were considered to provide the appropriate level of stormwater quality control. Reduced lot grades, rear and side yard swales, and discharge of roof leaders to pervious surfaces will augment the control provided by the SWM facility and promote infiltration where possible. Based on a preliminary review of available controls, it appears that the primary and most effective option to provide water quality control for runoff from the contributing drainage areas is a SWM facility. The options reviewed are as follows:

- Roof Leader to Ponding Areas or Soakaway Pits (Lot Level): The Township design criteria do not address the use of ponding areas or soakaway pits in the rear yards. Roof leaders will discharge directly to pervious surfaces to encourage infiltration and filtration on the lots. Soakaway pits can be an effective means of improving infiltration of stormwater, but require a large area in comparison to typical residential rear yard dimensions. As a result, soakaway pits and ponding areas are not recommended.
- Grassed Swales (Conveyance): Rear and side yard swales will be incorporated into the grading plan. The swales will convey runoff to rear lot catch basins. The number of rear lot catch basins will be minimized in order to encourage infiltration via swales.
- Stormwater Management Facilities (End-of-Pipe): Based on discussions with the ORCA, SWM facilities are required to provide water quality, extended detention and flood control of stormwater runoff. Stormwater management facilities will be constructed within the subject property.
- Oil/Grit Separation Technologies (End-of-Pipe): These SWMF's can be effective for smaller, high impervious sites where spill protection is desired and when area for a stormwater pond is unavailable. The construction of the stormwater pond will eliminate the need for any oil/grit separation units.
- Infiltration Trenches/Basins (End-of-Pipe): These SWMF's are most effective in areas with highly pervious soils and large areas.

In accordance with the ORCA requirements for development within the Baxter Creek watershed, Enhanced (Level 1) water quality protection shall be provided by the proposed SWM facility.

Based on the inclusion of the potential future development area to the west, the total drainage area to the SWM pond for quality control purposes is 46.44 ha (not including *Catchment 208* for which the minor system drainage is not conveyed to the SWM pond). Based on a total average imperviousness of 66.0%, the required permanent pool volume is provided below.

SWM Pond Permanent Pool Volume Calculation

Volume required for catchment with 66.0% imperviousness:	215.7	m^3/ha
Less 40 m^3/ha of extended detention storage zone:	- 40.0	m^3/ha
Permanent Pool Volume Required:	175.7	m^3/ha

The permanent pool storage volume required for the Pond is 175.7 m^3/ha × 46.44 ha = 8,158 m^3.

In order to maintain a permanent pool of water in the pond and to prevent the mixing of surface water with ground water, the pond must be constructed in native, undisturbed till material or lined with either an imported clay material or synthetic material. A review of the Geotechnical Investigation Report for the site indicates that the native soils are till (clayey silty sand with gravel) based on Test Pits #31 & 36, which was drilled in the location of the proposed SWM pond. The preliminary geotechnical investigation indicates that this native material re-compacted would be too permeable to use as a SWM pond liner, but that native, undisturbed till may have a low enough permeability to be used as a pond liner. It is assumed that a pond liner will be required, but this will be confirmed at detailed design.

The normal water level of the permanent pool for the pond is set at an elevation of 241.50 m. The bottom of the pond is set at an elevation of 239.50 m, providing a permanent pool depth of 2.00 m in the forebay and main cell. The actual permanent pool storage volume provided is approximately 8,622 m^3 which is greater than the minimum required volume (8,158 m^3). The required and provided quality control volume together with the elevation of the normal water level are summarized in **Tables 5A & 5B**.

The forebay has been sized based on MOE design criteria and supporting calculations are provided below. These calculations have been completed based on the more conservative development scenario, which includes the potential future development to the west.

Forebay Sizing Calculations

The proposed forebay is approximately 55 m in length and 27 m in average width, on average. The resultant length-to-width ratio is therefore 2:1. Using the methodology provided in the *Stormwater Management Planning and Design Manual*, the recommended forebay length based on particulate settling is calculated using the following expression:

$$Dist = \sqrt{\frac{r \cdot Q_p}{V_s}} \qquad [1]$$

where: *Dist* is the forebay length (m)
r is the length-to-width ratio of the forebay (2:1 or r = 2)
Q_p is the pond's peak discharge (0.056 m^3/s, OTTHYMO modelling of 25 mm storm)
V_s is the settling velocity (0.0003 m/s for 150 μm particles)

Solving [1] gives:

$$Dist = \sqrt{\frac{2 \times 0.056}{0.0003}} = 19.3\ m$$

VALDOR

The recommended forebay length based on flow dispersion calculations is calculated using the following expression:

$$Dist = \frac{8 \cdot Q}{d \cdot V_f} \qquad [2]$$

where: *Dist* is the forebay length (m)
Q is the peak inlet flow (5.809 m^3/s, OTTHYMO modeling of 5-year storm)
d is the depth of the permanent pool in the forebay (2.00 m)
V_f is the desired velocity in the forebay (0.50 m/s)

Solving [2] gives:

$$Dist = \frac{8 \times 5.809}{2.00 \times 0.50} = 46.5\ m$$

The distance from the headwall to the forebay berm is 55 m. The proposed design therefore satisfies the minimum forebay length recommendations.

The minimum recommended forebay bottom width is calculated as follows, based on the maximum distance from the calculations above:

$$Width = \frac{Dist}{8} = \frac{46.5}{8} = 5.8\ m$$

The design proposes an average forebay bottom width of approximately 12 m, which satisfies this criterion.

5.3.2 Erosion Control

In accordance with the ORCA guidelines, erosion control shall be provided using an extended detention active storage zone sized to capture the runoff resulting from a 25 mm rainfall event and to release the runoff over a period of at least 24 hours. Based on the VO5 modelling of this storm condition (i.e. the 25 mm 4-hour Chicago storm distribution), the estimated runoff volume is 13.71 mm distributed over the 46.44 ha catchment area draining to the SWM pond (includes potential future development to the west but excludes *Catchment 208*) for a required erosion control volume of 6,367 m^3.

Based on the design for the SWM pond, the erosion control volume provided is 6,443 m^3 at an elevation of 242.35 m. This exceeds the required erosion control volume of 6,367 m^3. The proposed extended detention depth is 0.85 m, which is less than the maximum recommended extended detention depth of 1.00 m.

The extended detention function of the pond will be controlled with a 180 mm diameter orifice plate (*Orifice #1*) located in the box manhole control structure to achieve the minimum required drawdown time of 24 hours (48 hours is considered preferable).

The drawdown time can be calculated using the following expressions, from the *Stormwater Management Planning and Design Manual*:

$$t_d = \frac{0.66 \cdot C_2 \cdot h_1^{1.5} + 2 \cdot C_3 \cdot h_1^{0.5}}{2.75 \cdot A_o} \quad [3]$$

where: t_d is the drawdown time (s)
h is the maximum water elevation above the orifice (0.85 m)
A_o is the cross-sectional area of the orifice (0.0254 m^2)
C_2 is the slope coefficient from area-depth linear regression (2879.6)
C_3 is the intercept from area-depth linear regression (6370.0)

The variable *h* is the maximum water elevation above the centroid of the orifice and is calculated as follows (invert of orifice set at normal water level):

$$h_1 = HWL_{25mm} - \left[NWL + \frac{D}{2}\right] = 242.35 - \left[241.50 + \frac{0.180}{2}\right] = 0.760\ m$$

where: HWL_{25mm} is the high water level for the 25 mm rainfall (242.35 m)
NWL is the normal water level (241.50 m)
D is the diameter of the orifice (0.180 m)

Solving [3] yields:

$$t_d = \frac{0.66 \times (2879.6) \times (0.760)^{1.5} + 2 \times (6370.0) \times (0.760)^{0.5}}{2.75 \times (0.0254)} = 177{,}032s = 49.1\ hrs$$

The orifice size, erosion control release rate, draw down time, extended detention volume and water level are summarized in **Table 5A** and **Table 5B**.

5.3.3 Quantity Control

As per the ORCA and the Township's standards, the SWM facility shall be designed to control the post-development peak flow to pre-development levels for the 2-year through 100-year design storms and to safely convey the greater of the uncontrolled 100-year or Regional flow.

A critical storm analysis was completed to determined which storm distribution (based on the latest Peterborough Airport IDF data for 1971-2006 obtained from Environment Canada) requires the largest storage volume to achieve pre-development target flow rates. Based on the results provided in **Table E.9** (refer to **Appendix "E"**), the 6-hour SCS storm was identified as the critical storm requiring the largest storage volume to achieve the 100-year flow control.

The preliminary rating curve is provided in **Table E.5** (refer to **Appendix "E"**), and consists of a box manhole control structure with a 1.40 m wide by 0.60 m high rectangular orifice (*Orifice #2*) cut into the wall of the box manhole.

Table 4A and **Table 4B** show the VO5 modelling results for each development condition based on the 6-hour SCS storm distribution, and **Table 5A** and **Table 5B** shows the SWM facility performance characteristics for each return period event.

The SWM pond has been designed with a total active storage volume of 19,088 m^3 at an elevation of 243.50 m. The expected maximum storage required during 100-year storm conditions is approximately 16,790 m^3 for the current development condition, and 18,744 m^3 for the potential future development condition. The provided active storage is therefore sufficient.

As shown in **Tables 4A** and **Table 4B**, the peak discharge rates are equal to or less than the target release rates. Supporting documentation (**Tables E.1-4**) and output from the VO5 modelling is provided in **Appendix "E"**.

Table 4A. Summary of Storm Drainage Peak Flows - Flow Node #1 Current Development Condition

Return Period	**Existing Peak Flows** (m^3/s)	**Proposed Peak Flow** (m^3/s)
25mm Chicago	-	0.130
2-year	0.535	0.275
5-year	0.989	0.729
10-year	1.334	1.101
25-year	1.801	1.614
50-year	2.169	1.956
100-year	2.551	2.244
Regional	-	3.511

Table 4B. Summary of Storm Drainage Peak Flows - Flow Node #1 Potential Future Development Condition

Return Period	**Existing Peak Flows** (m^3/s)	**Proposed Peak Flow** (m^3/s)
25mm Chicago	-	0.166
2-year	0.591	0.387
5-year	1.090	0.923
10-year	1.470	1.353
25-year	1.984	1.890
50-year	2.389	2.198
100-year	2.810	2.486
Regional	-	4.538

5.3.4 Thermal Mitigation Measures

Mitigation measures shall be incorporated into the SWM pond design to minimize thermal impacts to the receiving watercourse. These measures include a bottom draw pipe and a planting strategy to promote shading along the pond perimeter.

Bottom Draw Pipe

Instead of the common perforated riser configuration, a bottom draw pipe will be implemented for the extended detention component to discharge water from the deepest section of the pond where the water temperature is lowest. This outlet consists of a submerged intake headwall and a bottom draw pipe which discharges via an orifice plate in the quality control structure. Given that this pipe is sized for frequent rainfall events (25mm storm), it will provide the greatest benefit to the thermal regime of the receiving watercourse.

Planting Strategy

In accordance with the Township and ORCA requirements the SWM facility will be planted to provide a natural appearance and to provide environmental benefits. The landscape plan will specify shade producing species to minimize solar heating of the permanent pool during summer months. The forebay design provides additional pond perimeter where shade producing vegetation can be planted.

5.3.5 SWM Pond Inspection & Maintenance

The stormwater management facility should be inspected periodically to determine the frequency of maintenance activities. As such, maintenance activities will be performed on an as-required basis. During the first two years of operation, it is recommended that the stormwater management facility be inspected following significant storm events to determine if and when maintenance activities are required. Subsequently, inspections should be carried out twice per year. The following items should be considered when inspecting the pond:

- Sediment accumulation to determine cleanout requirements;
- Erosion of side slopes and outfall channel;
- Safety hazards;
- Hydraulic operation of the pond;
- Drawdown time following a rainfall event (extended drawdown time greater than 49 hours may indicate a blocked orifice or intake);
- Condition of terrestrial and aquatic vegetation;
- Trash accumulation near hydraulic structures; and
- Surface sheen indicating possible oil contamination.

Table 5A: Stormwater Facility Performance Summary
Current Development Condition

Quality Control		
	Protection Level	Level 1 (Enhanced)
	Permanent Pool Required (m^3)	7,288
	Permanent Pool Provided (m^3)	8,622
	Normal Water Level, NWL (m)	**241.50**

Erosion Control		
25mm Chicago	Orifice Size (mm)	180
	Draw Down Time (hrs)	49.1
	Flow In (m^3/s)	1.702
	Flow Out (m^3/s)	0.053
	Storage Used (m^3)	5,103
	Pond W.S. Elevation (m)	**242.19**

Quantity Control (6-hour SCS)		
2-year	Flow in (m^3/s)	3.351
	Flow Out (m^3/s)	0.202
	Storage Used (m^3)	7,809
	Pond W.S. Elevation (m)	**242.50**
5-year	Flow in (m^3/s)	5.113
	Flow Out (m^3/s)	0.586
	Storage Used (m^3)	9,882
	Pond W.S. Elevation (m)	**242.71**
10-year	Flow in (m^3/s)	6.263
	Flow Out (m^3/s)	0.922
	Storage Used (m^3)	11,381
	Pond W.S. Elevation (m)	**242.85**
25-year	Flow in (m^3/s)	8.041
	Flow Out (m^3/s)	1.377
	Storage Used (m^3)	13,396
	Pond W.S. Elevation (m)	**243.03**
50-year	Flow in (m^3/s)	9.251
	Flow Out (m^3/s)	1.668
	Storage Used (m^3)	14,992
	Pond W.S. Elevation (m)	**243.17**
100-year	Flow in (m^3/s)	10.623
	Flow Out (m^3/s)	1.902
	Storage Used (m^3)	16,790
	Pond W.S. Elevation (m)	**243.32**
Regional Storm (Timmins)	Flow in (m^3/s)	4.187
	Flow Out (m^3/s)	2.911
	Storage Used (m^3)	19,594
	Pond W.S. Elevation (m)	**243.54**

Table 5B: Stormwater Facility Performance Summary
Potential Future Development Condition

Quality Control		
	Protection Level	Level 1 (Enhanced)
	Permanent Pool Required (m^3)	8,158
	Permanent Pool Provided (m^3)	8,622
	Normal Water Level, NWL (m)	**241.50**

Erosion Control		
25mm Chicago	Orifice Size (mm)	180
	Draw Down Time (hrs)	49.1
	Flow In (m^3/s)	1.986
	Flow Out (m^3/s)	0.056
	Storage Used (m^3)	5,766
	Pond W.S. Elevation (m)	**242.27**

Quantity Control (6-hour SCS)		
2-year	Flow in (m^3/s)	3.829
	Flow Out (m^3/s)	0.304
	Storage Used (m^3)	8,366
	Pond W.S. Elevation (m)	**242.56**
5-year	Flow in (m^3/s)	5.809
	Flow Out (m^3/s)	0.778
	Storage Used (m^3)	10,743
	Pond W.S. Elevation (m)	**242.79**
10-year	Flow in (m^3/s)	7.103
	Flow Out (m^3/s)	1.167
	Storage Used (m^3)	12,434
	Pond W.S. Elevation (m)	**242.95**
25-year	Flow in (m^3/s)	9.069
	Flow Out (m^3/s)	1.625
	Storage Used (m^3)	14,754
	Pond W.S. Elevation (m)	**243.15**
50-year	Flow in (m^3/s)	10.423
	Flow Out (m^3/s)	1.882
	Storage Used (m^3)	16,622
	Pond W.S. Elevation (m)	**243.30**
100-year	Flow in (m^3/s)	12.026
	Flow Out (m^3/s)	2.114
	Storage Used (m^3)	18,744
	Pond W.S. Elevation (m)	**243.47**
Regional Storm (Timmins)	Flow in (m^3/s)	4.702
	Flow Out (m^3/s)	3.905
	Storage Used (m^3)	20,278
	Pond W.S. Elevation (m)	**243.59**

5.4 Site Water Balance

In accordance with the requirements of the ORCA, a site water balance assessment was completed for the entire subject property to determine the overall infiltration deficit under proposed conditions and to design infiltration facilities as part of an overall mitigation strategy to maintain pre-development infiltration volumes. Data for the assessment was obtained from soil mapping obtained from the Ontario Soil Survey mapping for Durham County, satellite imagery, the Stormwater Management Planning and Design Manual (Ministry of the Environment, March 2003) and the Geotechnical Investigation Report for the site. These documents provide information with respect to the groundwater table level, soil types and soil infiltration rates. The following sections detail the methodology, volume calculations and proposed infiltration mitigation measures necessary to achieve a post-development site infiltration balance.

5.4.1 Methodology

The approach for estimating water balance volumes is based on the method described in the Stormwater Management Planning and Design Manual (MOE, 2003). The assessment was completed for the site using soils and land use information to calculate weighted evapotranspiration values. Weighted water surplus volumes were then calculated and a weighted infiltration factor was calculated. Surplus volumes were then split into runoff and infiltration components for existing and proposed conditions.

With regards to land use, the analysis reflects existing conditions which is described as predominantly agricultural, with pockets of pasture and shrub areas. The proposed land use is primarily residential with the pervious component being limited to the lawn areas. The proposed bypass channel and open space blocks will also consist of lawn areas, and a portion of the existing pasture and shrub areas will remain undeveloped.

The assumed hydrologic soil group (HSG) for the site was based on a review of soils mapping, which showed the predominant soil type within the subject development to be HSG “B”. Under proposed conditions, it is assumed that existing soils will be used in the grading of the proposed development and therefore HSG “B” soils were also assumed for the site under proposed conditions. The existing site soils were assumed to have a 30 mm/hr percolation rate for the sizing of the infiltration trench maximum depth. It is recommended that a percolation rate be provided by the geotechnical consultant at detailed design to confirm the maximum allowable infiltration trench depth.

The water balance calculations including the infiltration factor selection, rainfall analysis and evapotranspiration analysis are provided in **Table F.1** to **Table F.4** which are contained in **Appendix “F”**.

5.4.2 Existing Conditions Water Balance Volumes

The pre-development baseline site infiltration condition was calculated using the Peterborough Airport Climate Normal data (1981–2010) from Environment Canada and the current land cover and land use pattern. Based on the MOE Infiltration Factor

Method, the calculated infiltration factor for the site under existing conditions was 0.510. The calculations indicate that the existing annual surplus is 155,524 m^3 and the annual infiltration capacity is 79,317 m^3. The results of the annual water balance analysis for the existing condition are presented in the first row of **Table F.1**. The pre-development water balance conditions are illustrated in **Figure 13**.

5.4.3 Post-Development Unmitigated Water Balance Volumes

Under post-development conditions and without implementing any infiltration mitigation measures, it is estimated that approximately 45,779 m^3 of water will infiltrate the ground. This represents 57.7% of the existing infiltration volume. This notable reduction in infiltration volume is the result of an increase in the impervious area associated with the proposed development. The results of the annual water balance analysis for the proposed condition, with no infiltration best management practices, are presented in the second row of **Table F.1**. Therefore, mitigation measures are necessary to achieve the site infiltration water balance.

5.4.4 Site Infiltration Mitigation Measures

In order to minimize the impact of development on the future water balance for the site, infiltration mitigation measures will be promoted and incorporated within the proposed development. These measures include basic and enhanced best management practices (BMPs) as follows:

Basic Best Management Practices

The following basic BMPs are to be implemented on the subject site:

- Roof down spouts of the dwellings will be directed to pervious lawn areas and grassed swales where feasible to promote infiltration;
- Where applicable, grassed swales will be constructed along side and rear lot lines;
- Where possible, the fine grading of lots will be completed with an extra depth of topsoil to encourage infiltration and absorption.

Under proposed conditions with the implementation of the above basic infiltration BMPs, approximately 55,779 m^3 of water will infiltrate the ground which equates to approximately 70.3% of the pre-development infiltration volume. The third row of **Table F.1** provides the summary of the calculations for the post-development condition with basic infiltration BMPs.

Enhanced Best Management Practices

In an effort to better match the existing infiltration volumes, enhanced infiltration BMPs in the form of infiltration trenches are required. These measures will serve to further promote the infiltration of runoff from the proposed development.

Through the implementation of the proposed infiltration trenches, the annual infiltration capacity can increase by 23,871 m^3. As a result, the post-development infiltration volumes for the site will be 79,650 m^3, which is 100.4% of the pre-development volume. Based on the water balance calculations completed, a minimum drainage area of 8.60 ha, including rear yard and roof areas, will need to be directed to the proposed infiltration trenches to achieve the required annual infiltration volume. The exact drainage area to each infiltration facility will be confirmed at detailed design.

The proposed infiltration trenches will be lined with filter fabric, filled with 50mm diameter clear stone and will be designed to overflow into the storm sewer, or sheet flow to the open space blocks, once the storage capacity of the trench is exceeded.

At the detailed design stage it will need to be confirmed that the seasonal high groundwater level is a minimum of 1.0 m below the bottom of the proposed infiltration trenches. If there are challenges meeting the required infiltration trench length at detailed design, then the design of the SWM pond could be modified to incorporate a proposed infiltration trench at the pond outlet, subject to input from the geotechnical engineering consultant. Specific sizing details for the proposed infiltration trenches will also be provided at detailed design. A summary of the infiltration trench sizing is included in **Table F.6**. A copy of a typical infiltration trench detail is included in **Appendix "F"**. The location of the infiltration trenches are illustrated in **Figure 14**.

6.0 VEHICULAR & PEDESTRIAN ACCESS

The layout of the proposed subdivision has been developed with consideration for efficient and safe access and circulation of both vehicular and pedestrian traffic.

6.1 Municipal Roads

The subject site has a frontage on both Fallis Line and on County Road 10. Fallis Line is was a 20.0m wide road allowance which is operated and maintained by the Township. This road allowance was expanded to a 23m width with the development of the Millbrook Phase 1 subdivision and will be further expanded to a 26m wide road allowance with the development of the subject site. This municipal road allowance was urbanized in conjunction with Phase 1. County Road 10 is an arterial road which is under the jurisdiction of the County of Peterborough. This road consists of a rural cross section having two lanes with partially paved shoulders and road side ditches.

The vehicular access to the subdivision will be facilitated by three connections being the intersections of Street "B" and Street "I" with Fallis Line. These intersections align with Highlands Boulevard and Bromont Drive, respectively, which were constructed in conjunction with the servicing of the Phase 1 lands. The third connection to Fallis Line will be made further west at Street "L".

Road access will also be provided to County Road 10 with a new intersection with Street "'B", to be constructed north of the municipal office. The configuration of the proposed Street "B" / County Road 10 intersection is illustrated in **Figure 15**.

Street "B" will loop through the subdivision from Fallis Line to County Road 10 and will be in the form of a 20m wide road allowance. The balance of the streets in the subdivision will be in the form of 18.0m road allowance with 8.5m pavement width. The proposed roads will have urban sections having pavement crowned with a 2.0% cross fall and edged with concrete curb and gutter. The longitudinal slope of the road will generally be 0.50% with some length of road ranging up to 5% slope.

Based on the recommendations contained in the Geotechnical Investigation Report for the site, the recommended minimum pavement structure for the proposed roads is as follows:

Municipal Roads

Material	**Compacted Depth**
HL3 Surface Course Asphalt	40mm
HL8 Base Course Asphalt	50mm
Granular "A"	150mm
Granular "B"	300mm

6.2 Driveways

Each dwelling will have an attached garage and driveway. The recommended pavement structure for the residential driveways is as follows:

Driveways

Material	**Compacted Depth**
HL3 Surface Course Asphalt	40mm
Granular "A"	150mm

The residential driveways will be either single or double car width. The slope of driveways is to be within the range of 1.0% to 7.0% in accordance with Township criteria.

6.3 Sidewalks, Walkways & Trails

Internal pedestrian access will be provided by standard 1.5m wide concrete sidewalks to safely guide residents through the subdivision for access to the park, the existing community centre and the adjacent planned sidewalks in the existing road allowances. Sidewalks will be generally constructed on one side of each road. The sidewalks will have tactile warning plates at all curb ramps in accordance with Provincial accessibility standards.

In addition to the sidewalks, a trail will be constructed along the proposed channel which will have connections to the sidewalks along the local streets.

Details of the standard sidewalk, curb ramp and tactile warning plate are included in **Appendix "G"**.

7.0 GRADING

As is typical will all subdivision, earthmoving is required, to varying degrees, in order to achieve the municipal design criteria and accommodate the development form.

7.1 Grading Criteria

The subject site is to be graded in accordance with the Township grading criterion which dictates that road grades are to range from 0.5% to 5.0% and that sodded yard areas are to range from 2.0% to 5.0%. For large grade differentials, a maximum slope 3H : 1V can be used for sodded embankments. In areas where space is limited, retaining walls can be utilized to accommodate grade differentials, however, their use should be minimized.

7.2 Preliminary Design

Based on the topographic survey, the proposed subdivision configuration and the Township's criteria, a preliminary grading design has been prepared. The preliminary grading design, considered the following factors:

- Achieve the Township's lot grading criteria.
- Meet the Township's vertical road design parameters.
- Minimize the requirement for retaining walls.
- Match existing grades along the adjacent properties and road allowances.
- Grading along existing road allowances is to have consideration for their future urbanization and grades are to be established to accommodate future boulevard slopes in the range of 2 to 4%.
- Provide an overland flow route to direct drainage to a safe outlet.
- Provide sufficient cover over the sanitary sewer.

An analysis of the earthworks will be conducted using digital terrain modelling software at the detailed design stage to optimize the cut and fill volumes in an effort to achieve a balance. Based on the **Preliminary Grading Plan** (Dwg PGR-1), no significant difficulties are anticipated in achieving the municipal grading design standards. It is anticipated that the lots will generally be split draining and the lots along the north, east and west limits of the site will be basement walk-out type lots.

7.3 Permitting

A review of the Regulation Mapping indicates that the subject site is located within an area that is regulated by the ORCA. A grading permit is therefore required from their office under Ontario Regulation 166/06 prior to commencing topsoil stripping and earthworks. The permit application should be submitted in conjunction with the detailed design at the subdivision engineering stage.

8.0 EROSION & SEDIMENT CONTROL DURING CONSTRUCTION

Construction activity, especially operations involving the handling of earthen material, dramatically increases the availability of particulate matter for erosion and transport by surface drainage. In order to mitigate the adverse environmental impacts caused by the release of silt-laden stormwater runoff into receiving watercourses, measures for erosion and sediment control are required for construction sites. This is an extremely important component of land development that plays a large role in the protection of downstream watercourses and aquatic habitat. It is of particular concern for this site given the presence of a wetland and the proposed South SWM Pond in its vicinity.

The impact of construction on the environment is recognized by the Greater Golden Horseshoe Area Conservation Authorities. In December 2006 they released their document titled Erosion & Sediment Control Guidelines for Urban Construction (ESC Guideline). This document provides guidance for the preparation of effective erosion and sediment control plans.

Control measures must be selected that are appropriate for the erosion potential of the site and it is important that they be implemented and modified on a staged basis to reflect the site activities. Furthermore, their effectiveness decreases with sediment loading and therefore inspection and maintenance is required. The selection, implementation, inspection and maintenance of the control features are summarized as follows:

8.1 Control Measures

On relatively large sites, measures for erosion and sediment control typically include the use of sediment control basins, silt fencing, a mud mat and sediment traps. The following is a description of the sediment controls to be implemented on the subject site:

- **Temporary Sediment Control Basins** are commonly used to clarify silt-laden stormwater runoff by promoting sedimentation of the suspended particles in the runoff through long detention times. The proposed SWM pond will be utilized as temporary sediment control basins during construction. The basin is to be sized in accordance with the ESC Guideline based on a required storage volume of 250 m^3 per hectare of disturbed area (125 m^3/ha of permanent pool and 125 m^3/ha of active storage). The basin's outlet is to have a Hickenbottom riser and a minimum 75mm diameter orifice plate sized to provide a drawdown time in the order of 48 hours.
- **Silt Fences** are to be installed adjacent to all property limits subject to drainage from the development area prior to topsoil stripping and in other locations, such as at the bases of topsoil stockpiles. It is recommended that earthworks not extend immediately adjacent to the silt fence and instead 1m to 2m vegetated buffer be maintained for additional protection. The silt fences are to be constructed with 150 x 150mm wire farm fence fabric to properly support the geotextile. Heavy duty silt fence is recommended to be installed adjacent the South Wetland consisting of two rows of fence with a row of staked straw bales between.
- **Mud Mat** is to be installed at the construction entrance prior to commencing earthworks to minimize the tracking of mud onto municipal roads.
- **Sediment Traps** are to be installed at all catchbasin locations once the storm sewer system has been constructed to prevent silt laden runoff from entering.
- **Rock Check Dams** are to be constructed in swales and ditches to reduce velocities and trap sediment.

A set of Erosion and Sediment Control Plans are to be prepared at the detailed engineering design stage to reflect the various construction stages. Details of typical erosion and sediment control measures are included in **Appendix "I"**.

8.2 Construction Sequencing

The following is a summary of the scheduling of construction activities and the related implementation of sediment controls:

Stage 1 – Subdivision Earthworks

1. Construct mud mat for temporary construction access.
2. Install primary silt fencing around the limits of grading and secondary silt fencing along the south limit of the work area adjacent the existing wetland.
3. Install temporary swales and rock check dams.
4. Excavate and construct the temporary sediment basins including installation of hickenbottom drain and spillway and connect to temporary swales.
5. Strip any remaining topsoil, stockpile where indicated and install silt fence around the perimeter.
6. Constructed the channel including natural channel features and stabilize the channel. Upon completion, divert flow to the new channel.
7. Rough grade the site by placing cut material in fill areas and spreading and compacting of imported fill. Maintain the mud mat to minimize the tracking of silt onto the municipal road and provide street sweeping as necessary.

Stage 2 – Subdivision Servicing & Road Construction

1. Install underground servicing, covering the end of the pipe at the end of each work day to ensure that silt does not enter the storm sewer.
2. Construct roads, install sediment controls on catchbasins and install temporary hickenbottom drains at low point of lot blocks.

Stage 3 – House Construction

1. Construct houses and maintain all sediment controls including regular street sweeping and catchbasin cleaning.
2. Stabilize all lot surfaces as soon as possible after completion of the houses.
3. Remove silt fencing on a phased basis as areas are stabilized.

8.3 ESC Inspection & Maintenance

In order to ensure that the erosion and sediment control measures operate effectively, they are to be regularly monitored and they will require periodic cleaning (e.g., removal of accumulated silt), maintenance and/or re-construction.

Inspections of all of the erosion and sediment controls on the construction site should be undertaken with the following frequency:

- On a weekly basis
- After every rainfall event
- After significant snow melt events
- Prior to forecasted rainfall events

If damaged control measures are found they should be repaired and/or replaced within 48 hours. Site inspection staff and construction managers should refer to the Erosion and Sediment Control Inspection Guide (2008) prepared by the Greater Golden Horseshoe Area Conservation Authorities. This Inspection Guide provides information related to the inspection reporting, problem response and proper installation techniques.

9.0 UTILITIES

While some external upgrades may be necessary by the utility providers, it is anticipated that utilities such as electrical (Hydro One Networks Inc.), natural gas (Enbridge Gas Distribution Inc.) and telecommunications (Nexicom Inc.) will be available to service the subject development similar to the utility servicing in Phase 1. As per standard practice in subdivisions, utilities will be installed underground. Co-ordination with the Hydro One and the various utility companies will be undertaken at the detailed engineering design stage to determine appropriate locations for pedestals, transformers and street lights.

It is recommended that the utility installation be in the form of a joint trench. The process of joint trenching allows all of the utility companies to co-ordinate the placement of their lines in a common trench excavated by a single utility contractor. Joint trenching maximizes the efficiency of the available area in the utility corridor and provides for a safe installation.

In accordance with the Township requirements, street lights will be LED. The street lights will have black octagonal poles with black post top luminaires similar to those installed in the Phase 1 subdivision.

A copy of a typical joint trench detail is included in **Appendix "J"** together with a detail of the street light.

10.0 SUMMARY

Based on the analysis contained herein, the proposed residential subdivision can be adequately serviced with full municipal services (watermain, wastewater and storm) in accordance with the standards of the Township of Cavan Monaghan, the County of Peterborough and the Otonabee Region Conservation Authority design criteria and consists of the following:

Water

- The community of Millbrook is currently serviced by a well based water system with a treatment plant and water storage tank. A 300mm diameter trunk watermain was constructed northerly along County Road 10 with a water tower and booster station located on the site of the municipal offices. A 250mm diameter watermain was constructed on Fallis Line which will service the subject development.
- A local water distribution system will be constructed along the roads to provide domestic supply and fire protection for the proposed dwellings. This local system will connect to the existing 300mm diameter watermains on Fallis Line and County Road 10. Based on the Ontario Building Code (OBC 2012) requirements, the water service connections for the individual townhouse units are to be 25mm diameter.

Waste Water

- The community of Millbrook is currently serviced by the existing Millbrook Wastewater Treatment Plant (WWTP) located at the east limit of Centennial Lane. Based on the current status of development, the Township has advised that allocation in the WWTP is only available for 305 of the 765 units in the subject development so the proposed subdivision will have to be phased.
- A 375mm diameter trunk sanitary sewer was constructed in conjunction with the servicing of the Phase 1 subdivision and includes a sewer along Fallis Line extending up to the municipal office. This trunk sewer will service the subject development. An analysis of the downstream sanitary sewer was conducted which confirmed that there is sufficient capacity in the sewer from the subject site to the WWTP to accommodate the subject Phase 2 subdivision.
- A local sanitary sewer system will be constructed along the proposed roads to provide service to the dwellings. In accordance with Township standards, the dwellings will be serviced with individual sanitary connections.

Storm Drainage

- The subject site is located in the Baxter Creek subwatershed. The Baxter Creek drains to the Otonabee River which discharges to Rice Lake.
- In accordance with Township criteria, the subject site will be serviced by minor system comprised of a municipal storm sewer sized for the 5-year storm event. This storm sewer will outlet to the proposed SWM facility.
- The major system will be comprised of an overland flow route which will convey runoff from rainfall events in excess of the capacity of the municipal storm sewer to the SWM facility.

- The Regulatory floodplain of Tributary C of Baxter Creek is contained entirely within the valley lands and therefore the proposed residential lots and the stormwater management pond are outside the Regulatory floodplain.
- Tributary B will be re-aligned around the perimeter of the subject site in the form of a channel incorporating natural channel design features. This channel has been sized to accommodate the Regional flow and will be contained within an opens space block. Based on the foregoing, the residential lots will be outside the Regional floodplain

<u>Stormwater Management</u>

- A stormwater management facility will be constructed to service the subject property, as well as the potential future development to the west. This facility has been designed as a wet pond to provide Enhanced (Level 1) water quality treatment, extended detention for erosion control and flood control using the calculated pre-development flow targets up to and including the 100-year storm event. The wet pond consists of a sediment forebay and a main cell separated by a forebay berm.
- Thermal mitigation measures are to be incorporated in the design of the pond including bottom draw pipe and a planting strategy to provide shading around the pond perimeter.
- A site water balance assessment has been undertaken to ensure that pre-development infiltration volumes are maintained. Based on the analysis it was determined that mitigation measures are required in the form of infiltration trenches.

<u>Vehicular & Pedestrian Access</u>

- Vehicular access to the subject site will be provided by two road connections to Fallis Lane and one road connection is County Road 10.
- The proposed local roads will be constructed to urban standards having an 8.5m pavement width. The main road (Street "B") which loops from Fallis Line to County Road 10 will have a 20m road whereas the balance of the proposed roads in the subdivision will have 18m road allowances.
- Pedestrian access will be provided by 1.5m wide concrete sidewalks which are to be generally located on one side of each road.

<u>Grading</u>

- As is typical with large subdivision projects, earthmoving will be required to achieve the proposed subdivision grading necessary to meet the criteria of the Township. A detailed analysis of the earthworks will be conducted at the detailed design stage to optimize the cut and fill volumes. Based on the preliminary design, no significant difficulties are anticipated in achieving the municipal grading design standards.
- Since the subject site is located in an area which regulated by the ORCA, a permit will be required from their office prior to commencing earthworks.

<u>Erosion & Sediment Control During Construction</u>

- Erosion and sediment control (ESC) measures are to be implemented during construction to prevent silt laden runoff downstream in accordance with the Erosion & Sediment Control Guidelines for Urban Construction (December 2006). The ESC plans are to be prepared at the detailed engineering design stage and are to reflect the various construction stages.

Utilities

- Similar to the Phase 1 subdivision, utility servicing will include an underground joint utility trench for electrical, natural gas and telecommunications. Street lighting will be LED and will be comprised of black octagonal poles with black post top luminaires.

Subdivision Engineering Design

- Detailed design for the proposed development is to be prepared at the subdivision engineering stage. This detailed design is to include servicing and grading plans as well as a stormwater management report based on the criteria established in this Functional Servicing Report.

11.0 REFERENCES & BIBLIOGRAPHY

- Township of Cavan Monaghan, **Municipal Servicing Standards**, November, 2013.
- Ontario Ministry of Environment, **Stormwater Management Planning & Design Manual,** Mar 2003.
- Ontario Ministry of Transportation, **Drainage Management Manual**, 1997.
- Greater Golden Horseshoe Area Conservation Authorities, **Erosion & Sediment Control Guidelines for Urban Construction**, December 2006.
- Credit Valley Conservation, **Fish and Wildlife Crossing Guidelines**, April 28, 2017.
- Fire Underwriters Survey, Water Supply for Public Fire Protection, 1999.
- Ministry of Municipal Affairs & Housing, **Ontario Building Code**, 2012.
- Geo-Logic Inc., **Geotechnical Investigation Report, Proposed Residential Development, Fallis Line, Cavan-Monaghan, Ontario**, April 2014.
- Water's Edge Environmental Solutions Team Ltd., **Natural Channel Design: Channel Re-Alignment Design Brief**, July 26, 2017.
- Dillon Consulting Limited, **Environmental Impact Study**, October 2018.
- Innovative Planning Solutions, **Draft Plan of Subdivision**, Marc 13, 2020.
- Valdor Engineering Inc., **Stormwater Management Report, Millbrook Subdivision, Phase 1**, October 2016.
- Valdor Engineering Inc., **Stormwater Management Report, Proposed Community Centre, Community of Millbrook**, November 28, 2017.

Respectfully Submitted,

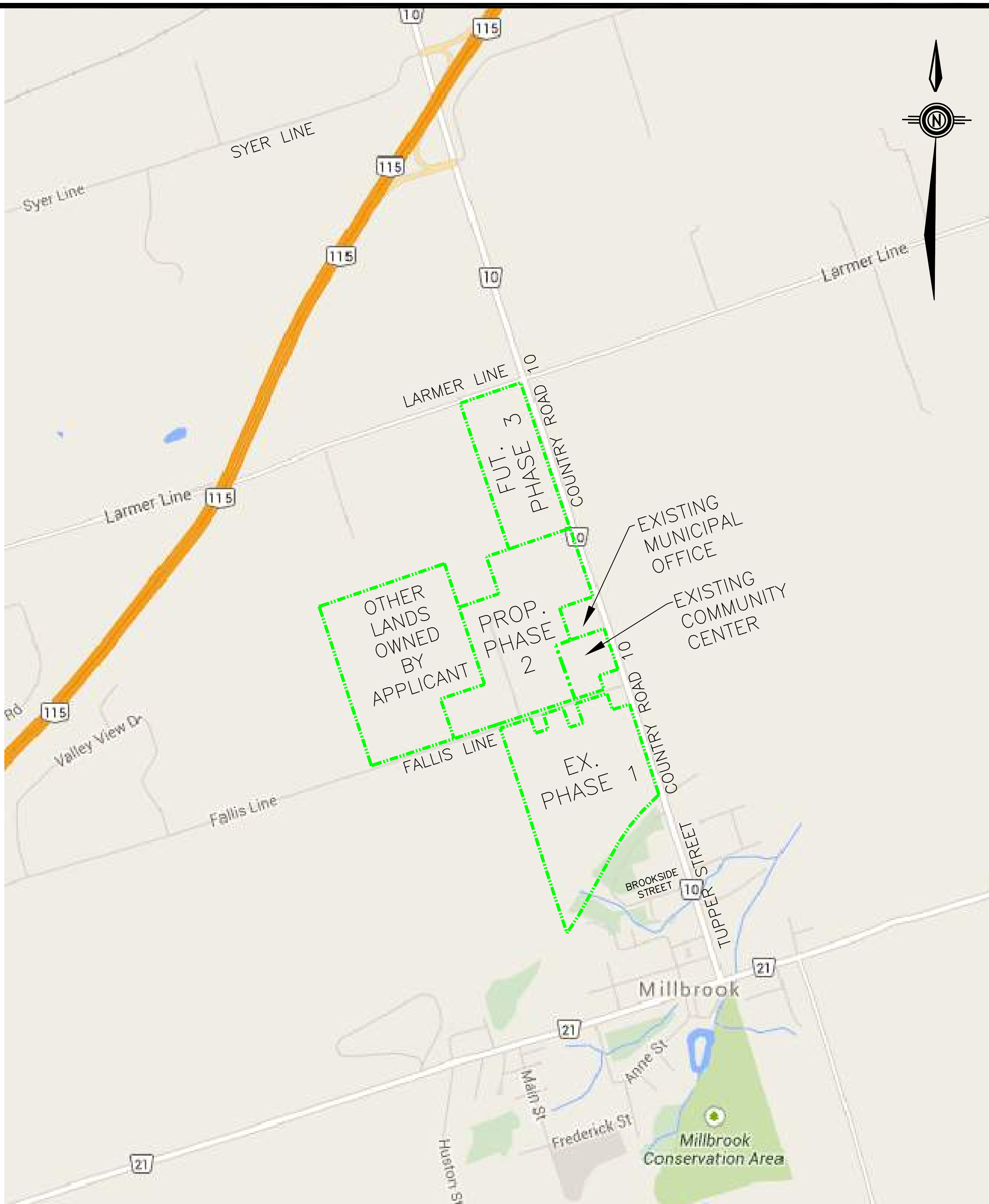
VALDOR ENGINEERING INC.

David Giugovaz, P.Eng., LEED AP
Senior Project Manager

905-264-0054 ext. 224
dgiugovaz@valdor-engineering.com

Oliver Beaudin, P.Eng.
Project Manager, Water Resources

647-632-1391
obeaudin@valdor-engineering.com



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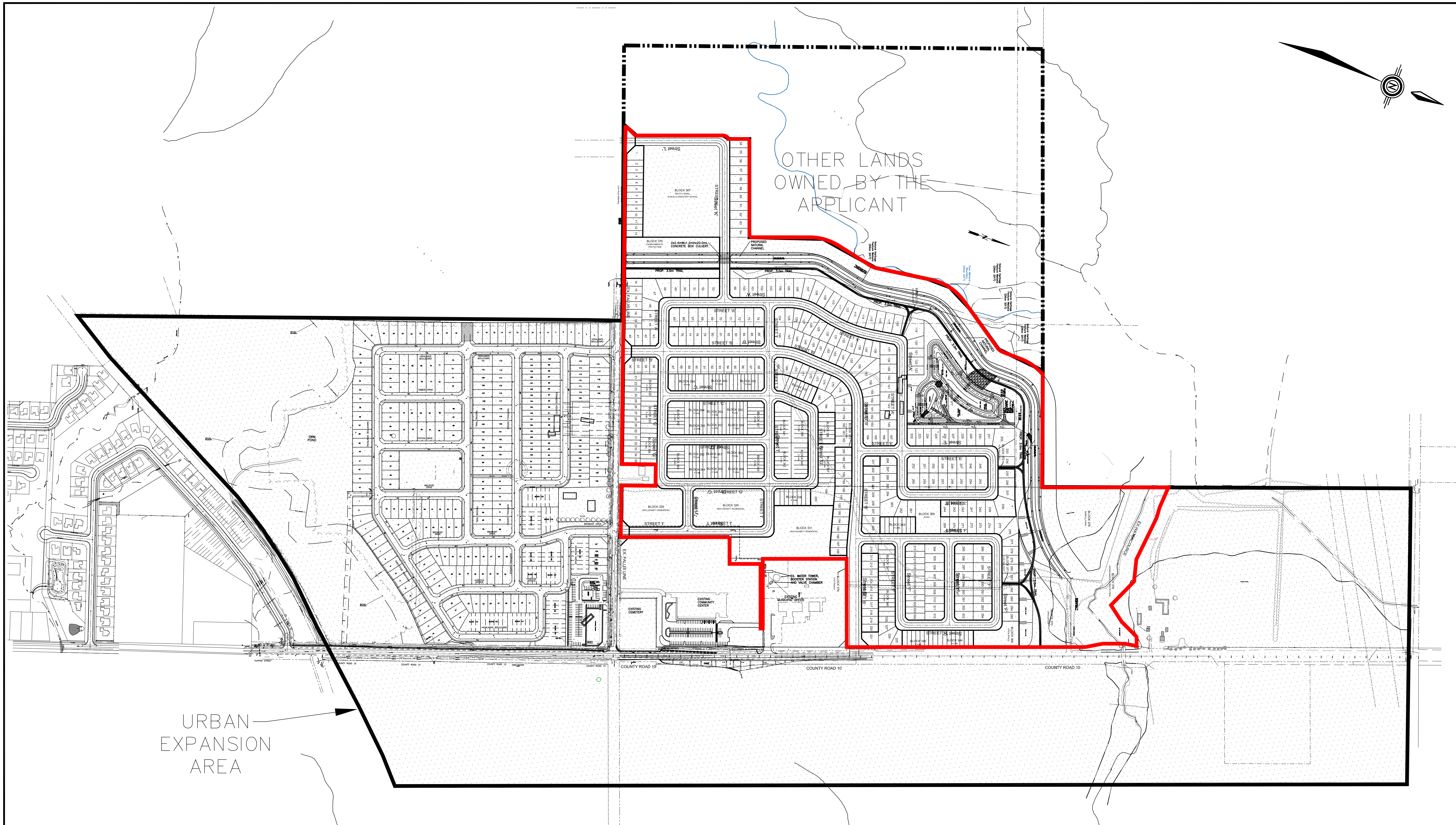
MILLBROOK SUBDIVISION PHASE 2

LOCATION MAP

VALDOR ENGINEERING INC.
Consulting Engineers - Project Managers
741 ROWNTREE DAIRY ROAD, SUITE 2, WOODBRIDGE, ONTARIO, L4L 5T9
TEL (905)264-0054, FAX (905)264-0069
E-MAIL: info@valdor-engineering.com
www.valdor-engineering.com

SCALE	N.TS.	PROJECT	17125	FIGURE 1
DATE	APRIL, 2020	DRAWN BY	V.L.	



MILLBROOK SUBDIVISION, PHASE 2

URBAN EXPANSION AREA

DRAWN BY	V.L.
CKD. BY	D.G.
DATE	APRIL, 2020
SCALE	N.T.S.
PROJECT	17125
	FIGURE 2

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Consulting Engineers - Project Managers
741 ROWNTREE DAIRY ROAD, SUITE 2, WOODBRIDGE, ONTARIO, L4L 5T9
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E-MAIL: info@valdor-engineering.com
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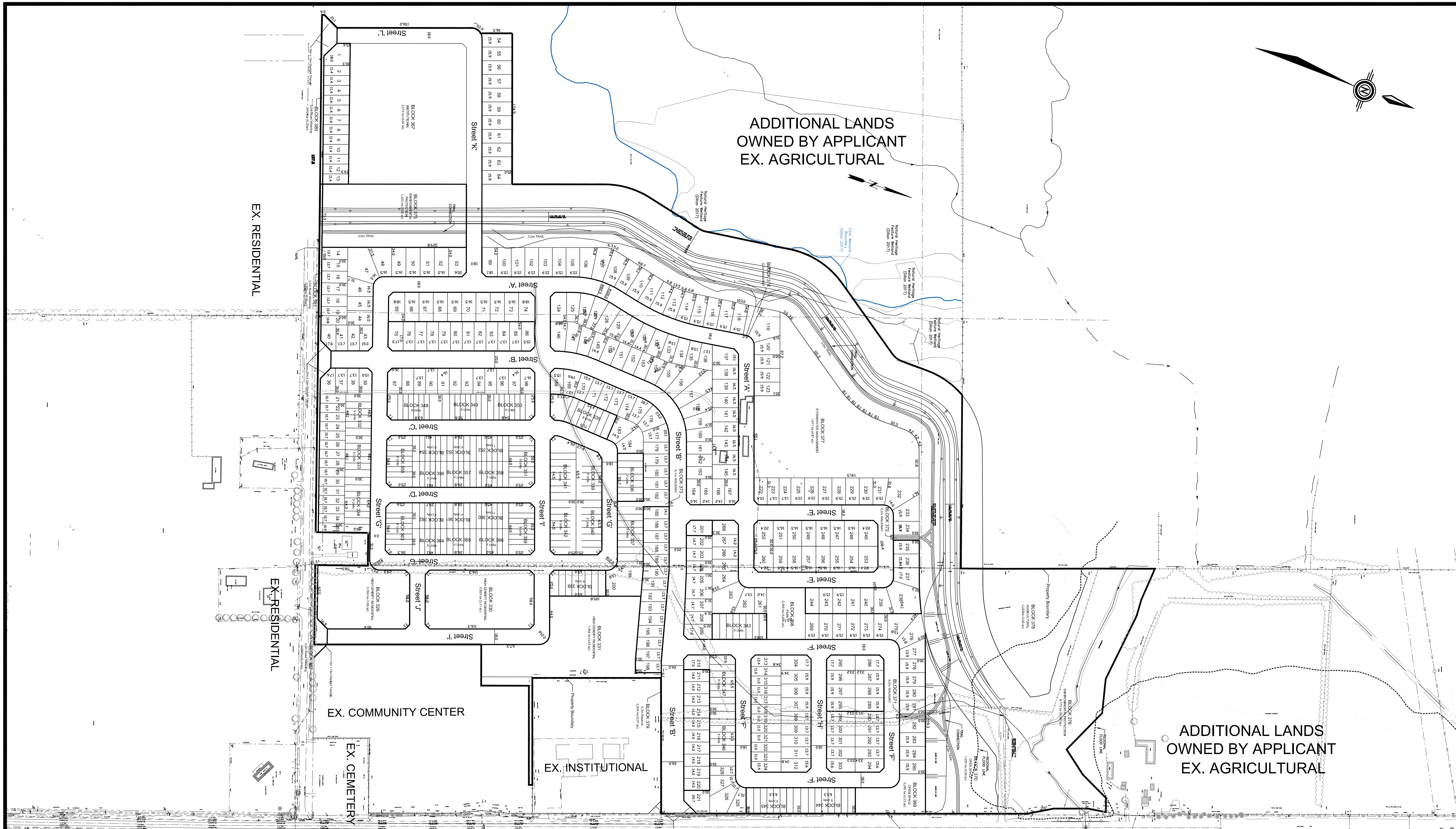

MILLBROOK SUBDIVISION, PHASE 2

DRAFT PLAN

DRAWN BY	V.L.
CKD. BY	D.G.
DATE	APRIL, 2020

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741 ROWNTREE DAIRY ROAD, SUITE 2, WOODBRIDGE, ONTARIO, L4L 5T9
TEL (905)264-0054, FAX (905)264-0069
E-MAIL: info@valdor-engineering.com
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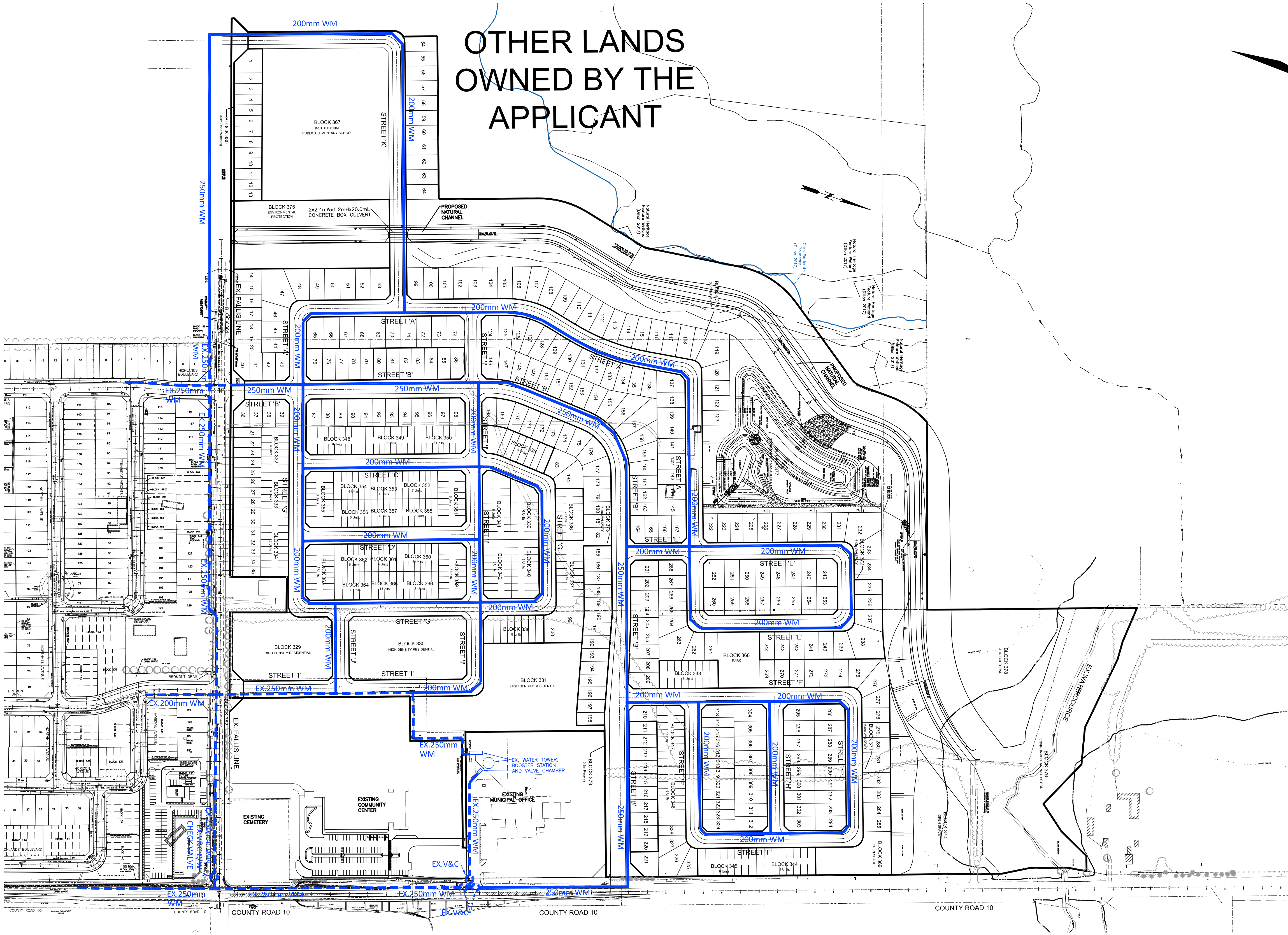
SCALE	PROJECT	
N.T.S.	17125	FIGURE 3



MILLBROOK SUBDIVISION, PHASE 2

WATER SERVICING

DRAWN BY	V.L.
CKD. BY	D.G.
DATE	APRIL, 2020

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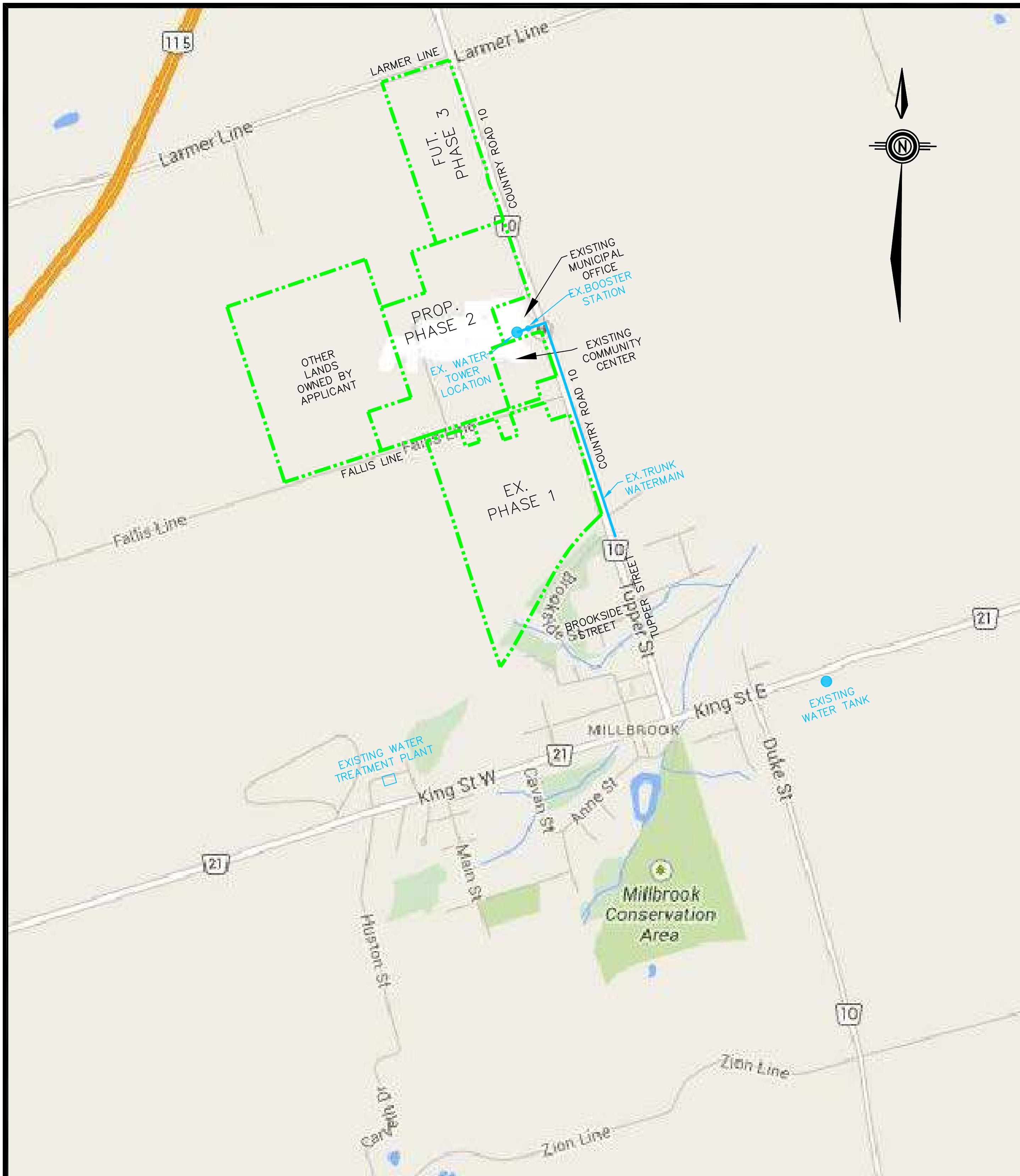
Consulting Engineers - Project Managers
741 ROWNTREE DAIRY ROAD, SUITE 2, WOODBRIDGE, ONTARIO, L4L 5T9
TEL (905)264-0054, FAX (905)264-0069
E-MAIL: info@valdor-engineering.com
www.valdor-engineering.com

SCALE	PROJECT	
N.T.S.	17125	FIGURE 4A



MILLBROOK SUBDIVISION

WATER SERVICING EXTERNAL

VALDOR ENGINEERING INC.
Consulting Engineers - Project Managers
741 ROWNTREE DAIRY ROAD, SUITE 2, WOODBRIDGE, ONTARIO, L4L 5T9
TEL (905)264-0054, FAX (905)264-0069
E-MAIL: info@valdor-engineering.com
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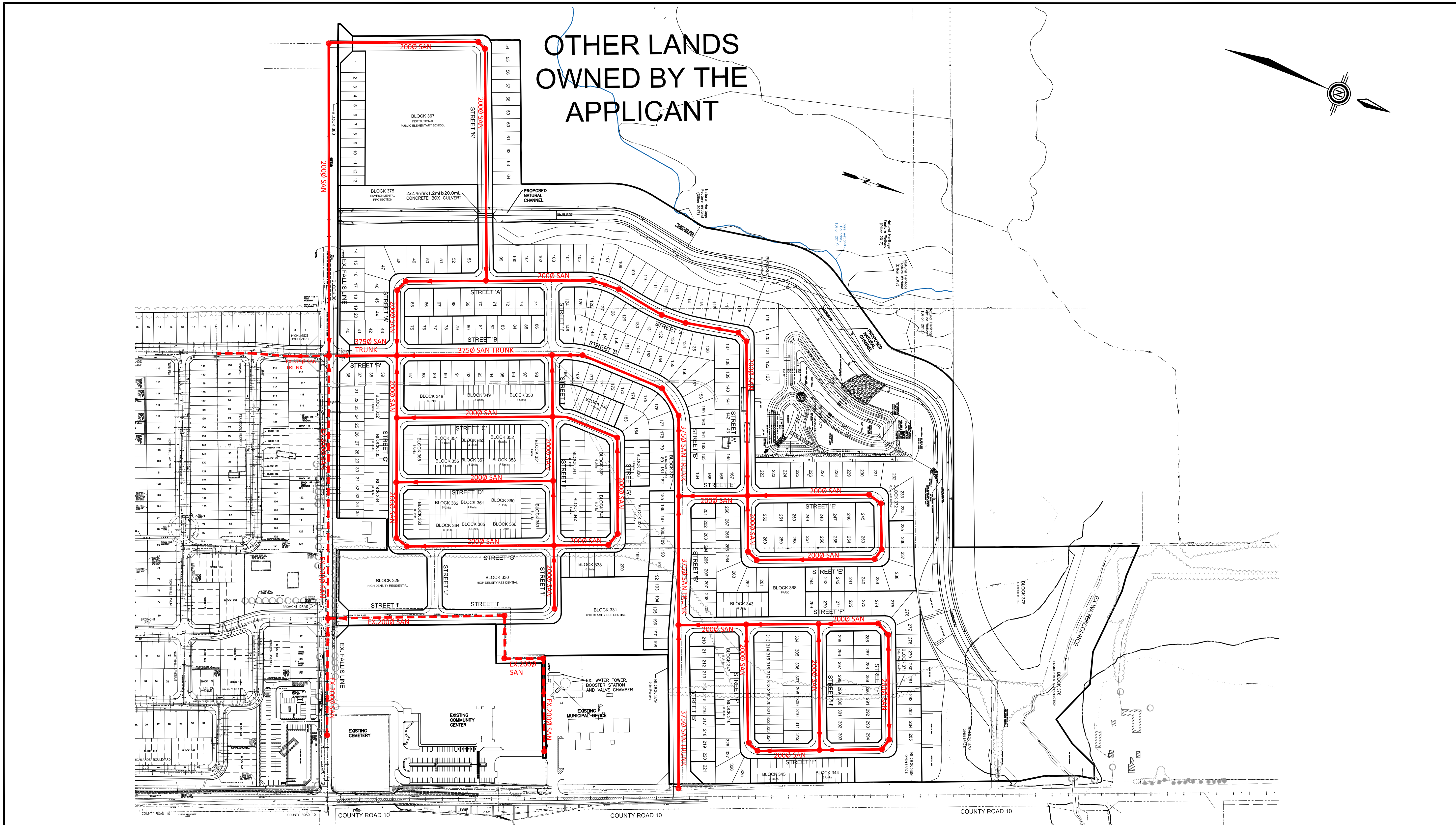
SCALE	N.TS.	PROJECT	17125	FIGURE 4B
DATE	APRIL, 2020	DRAWN BY	V.L.	



MILLBROOK SUBDIVISION, PHASE 2

WASTEWATER SERVICING

DRAWN BY	V.L.
CKD. BY	D.G.
DATE	APRIL, 2020
SCALE	N.T.S.
PROJECT	17125

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Consulting Engineers - Project Managers
741 ROWNTREE DAIRY ROAD, SUITE 2, WOODBRIDGE, ONTARIO, L4L 5T9
TEL (905)264-0054, FAX (905)264-0069
E-MAIL: info@valdor-engineering.com
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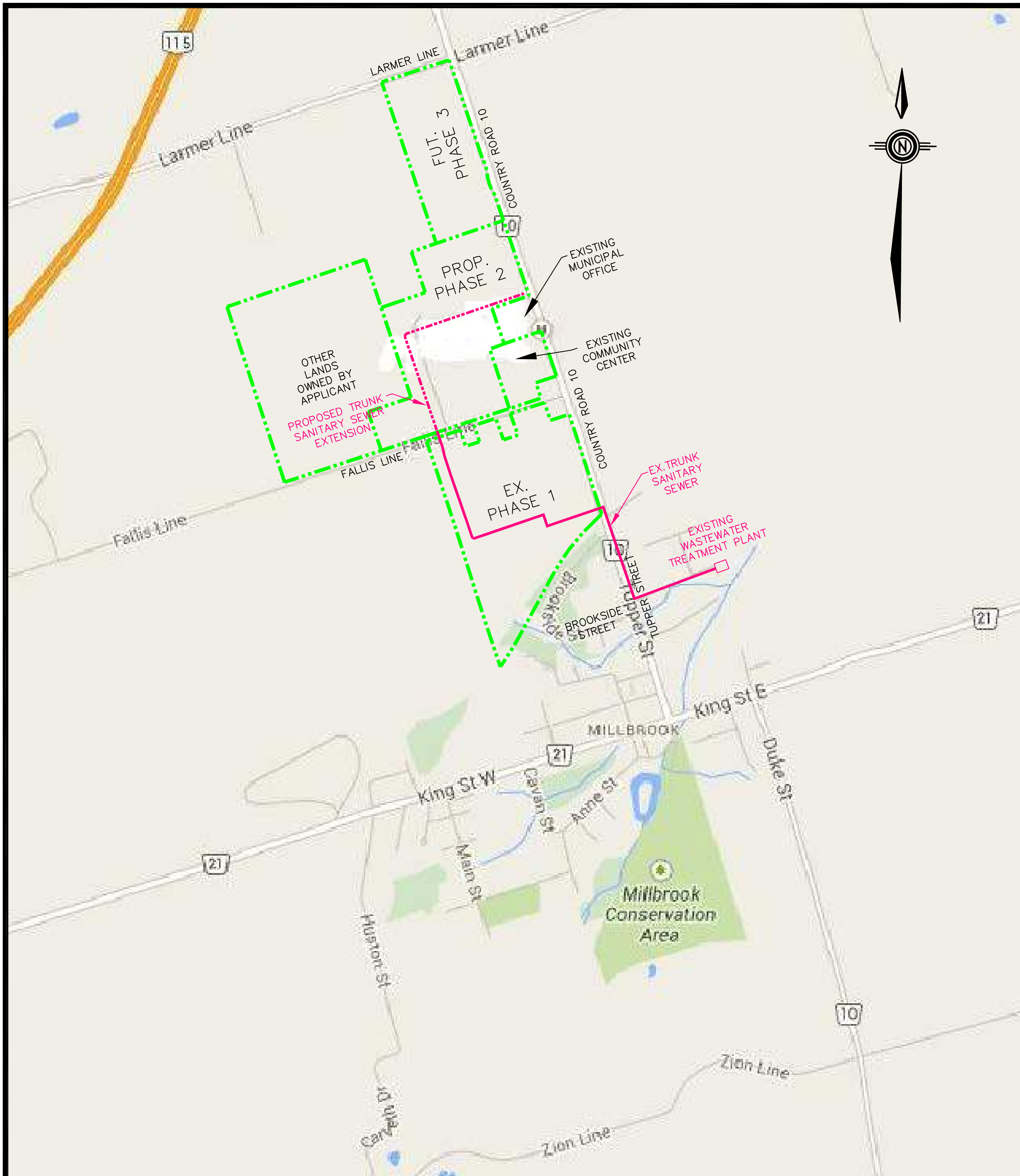
FIGURE 5A



MILLBROOK SUBDIVISION PHASE 2

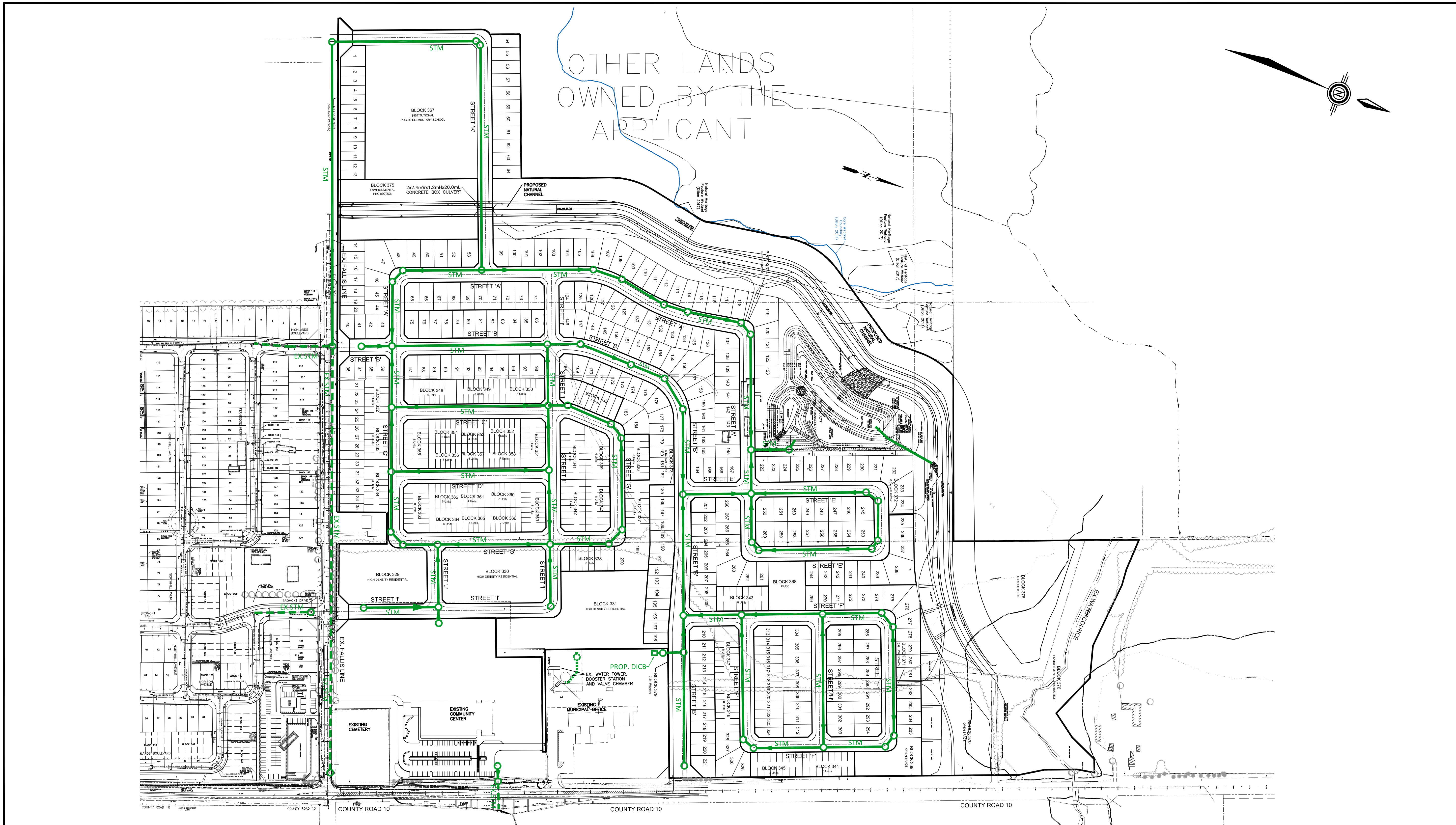
WASTEWATER SERVICING

VALDOR ENGINEERING INC.
Consulting Engineers - Project Managers
741 ROWNTREE DAIRY ROAD, SUITE 2, WOODBRIDGE, ONTARIO, L4L 5T9
TEL (905)264-0054, FAX (905)264-0069
E-MAIL: info@valdor-engineering.com
www.valdor-engineering.com

SCALE	N.TS.	PROJECT	17125
DATE	APRIL, 2020	DRAWN BY	V.L.

FIGURE 5B

\\192.168.0.30\VDE-DataBank\Projects\2017\17125\Report\FSR\Revision 2_April 2020\17125-FSR-DWG\17125-FSR-Ph2-FIG-1.dwg, 4/23/2020 3:01:20 PM



MILLBROOK SUBDIVISION, PHASE 2

STORM SERVICING

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CKD. BY	D.G.
DATE	APRIL, 2020
SCALE	N.T.S.
PROJECT	17125

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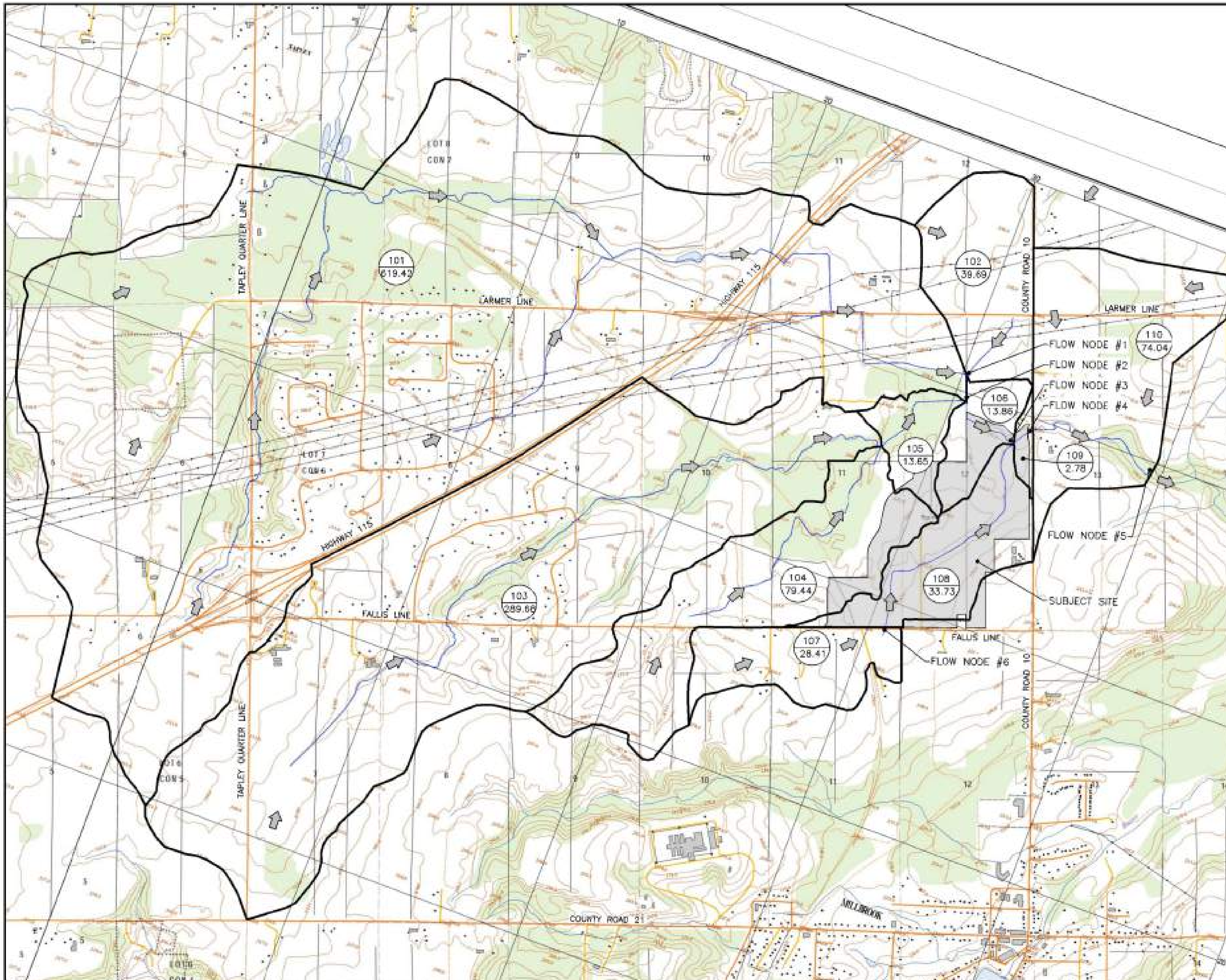
Consulting Engineers - Project Managers
741 ROWNTREE DAIRY ROAD, SUITE 2, WOODBRIDGE, ONTARIO, L4L 5T9
TEL (905)264-0054, FAX (905)264-0069
E-MAIL: info@valdor-engineering.com
www.valdor-engineering.com

FIGURE 6

S:\Projects\2017\17125\Report\FSR\Revision 2_April 2020\17125-FSR-DWG\17125-FSR-Ph2-FIG-2.dwg, 4/29/2020 4:56:28 PM



LEGEND

- 101 / 619.42 — CATCHMENT ID / AREA (HA)
- DRAINAGE BOUNDARY
- WATERCOURSE
- OVERLAND FLOW

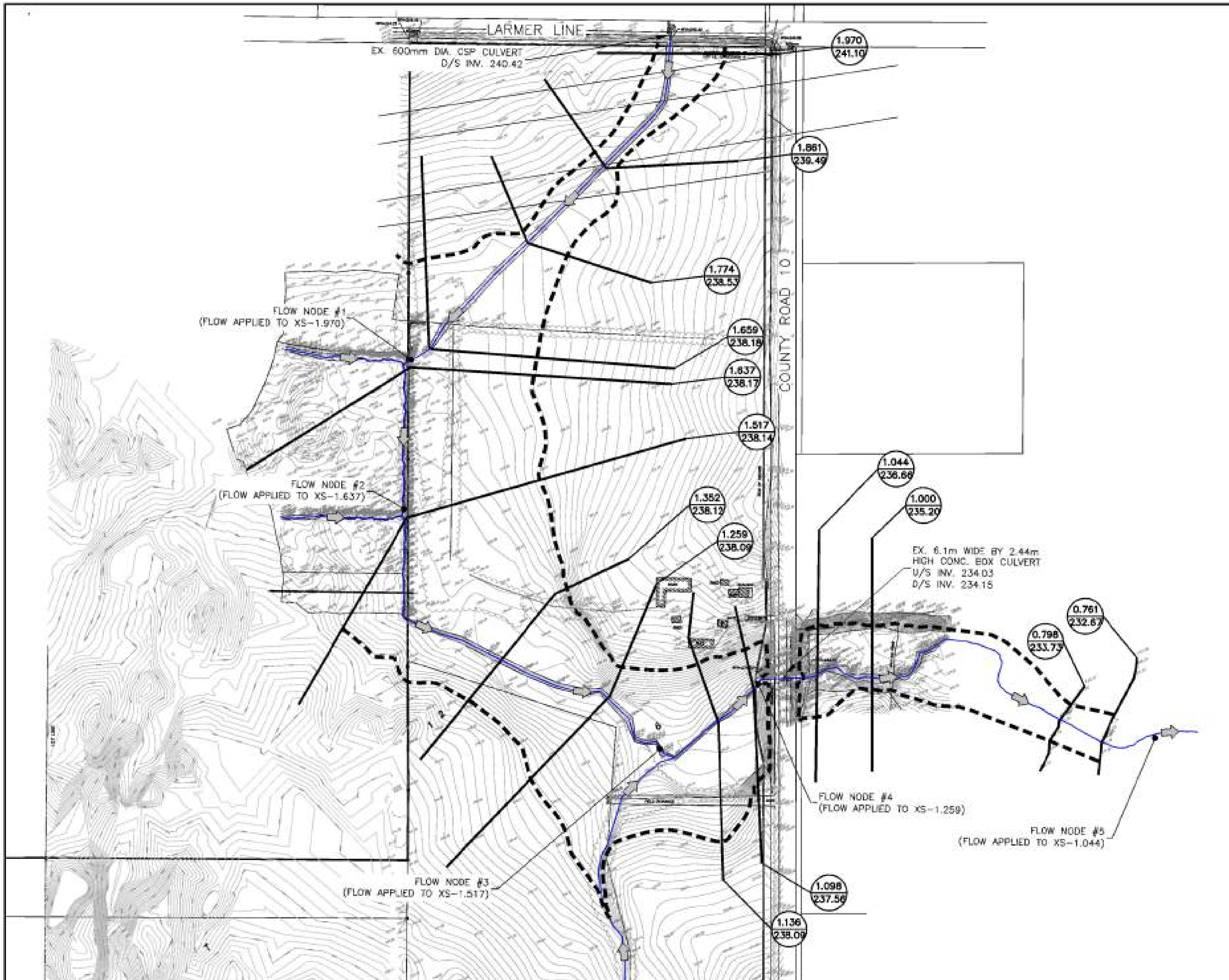
FLOW NODE #	REGIONAL FLOW (cms)
1	4.131
2	29.637
3	49.855
4	53.519
5	57.571
6	2.228

PROJECT
MILLBROOK SUBDIVISION, PHASE 2
TOWNSHIP OF CAVAN MONAGHAN

TITLE
FLOODPLAIN MAPPING DRAINAGE PLAN

VALDOR ENGINEERING INC.
Consulting Engineers - Project Managers

PREPARED BY	O.B.	CKD. BY	O.B.
SCALE	NTS	DATE	APR. 2020
PROJECT	17125		FIGURE 7



LEGEND

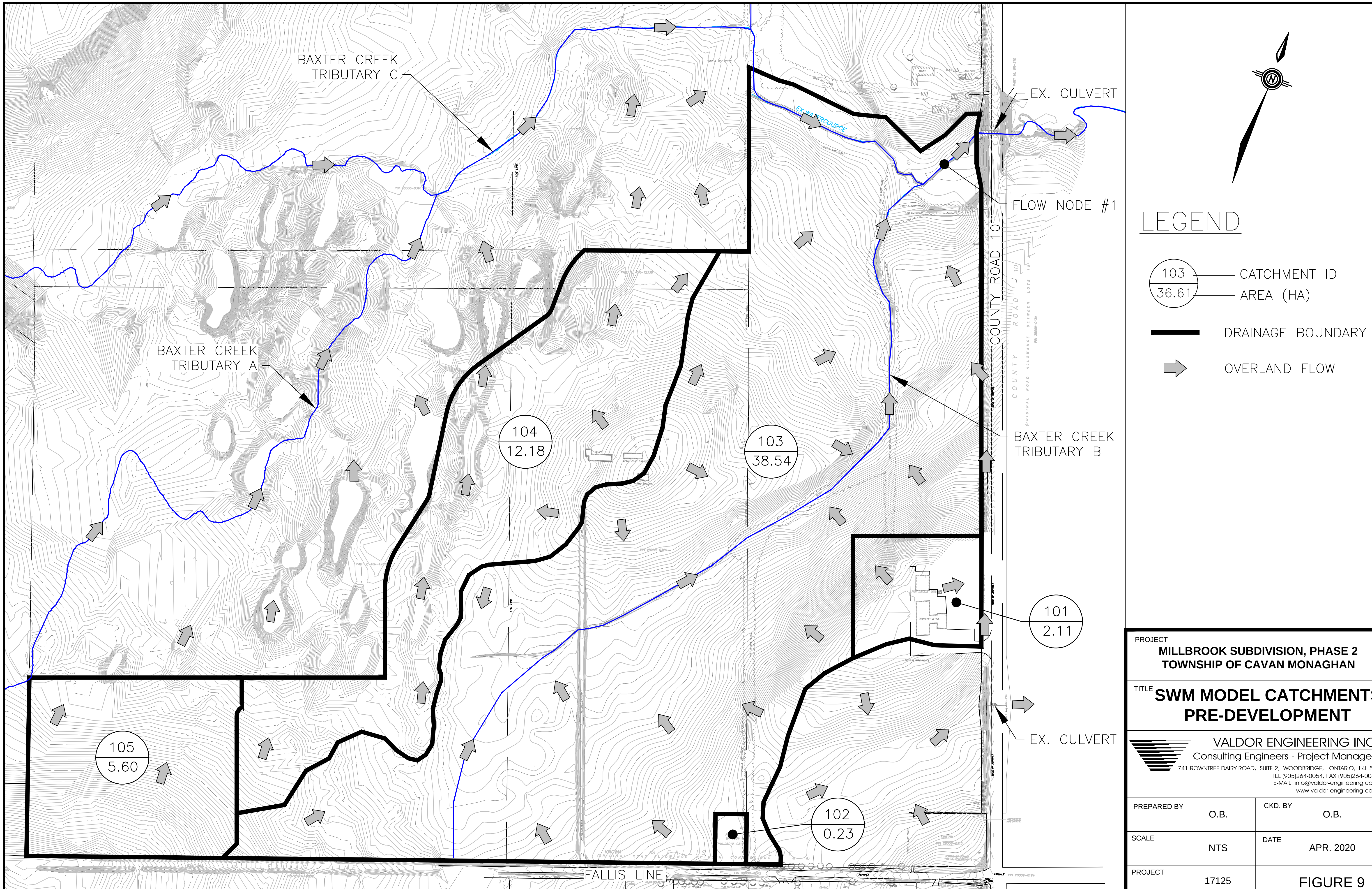
(1.970 / 241.10)	HEC-RAS SECTION ID / REGIONAL WSE (m)
- - - -	REGIONAL FLOODPLAIN
——	WATERCOURSE CENTERLINE
⇨	FLOW DIRECTION

PROJECT
MILLBROOK SUBDIVISION, PHASE 2
TOWNSHIP OF CAVAN MONAGHAN

TITLE
FLOODPLAIN MAPPING REGULATORY FLOODPLAIN

VALDOR ENGINEERING INC.
Consulting Engineers - Project Managers

PREPARED BY	O.B.	CKD. BY	O.B.
SCALE	1:3000	DATE	APR. 2020
PROJECT	17125		FIGURE 8



PROJECT

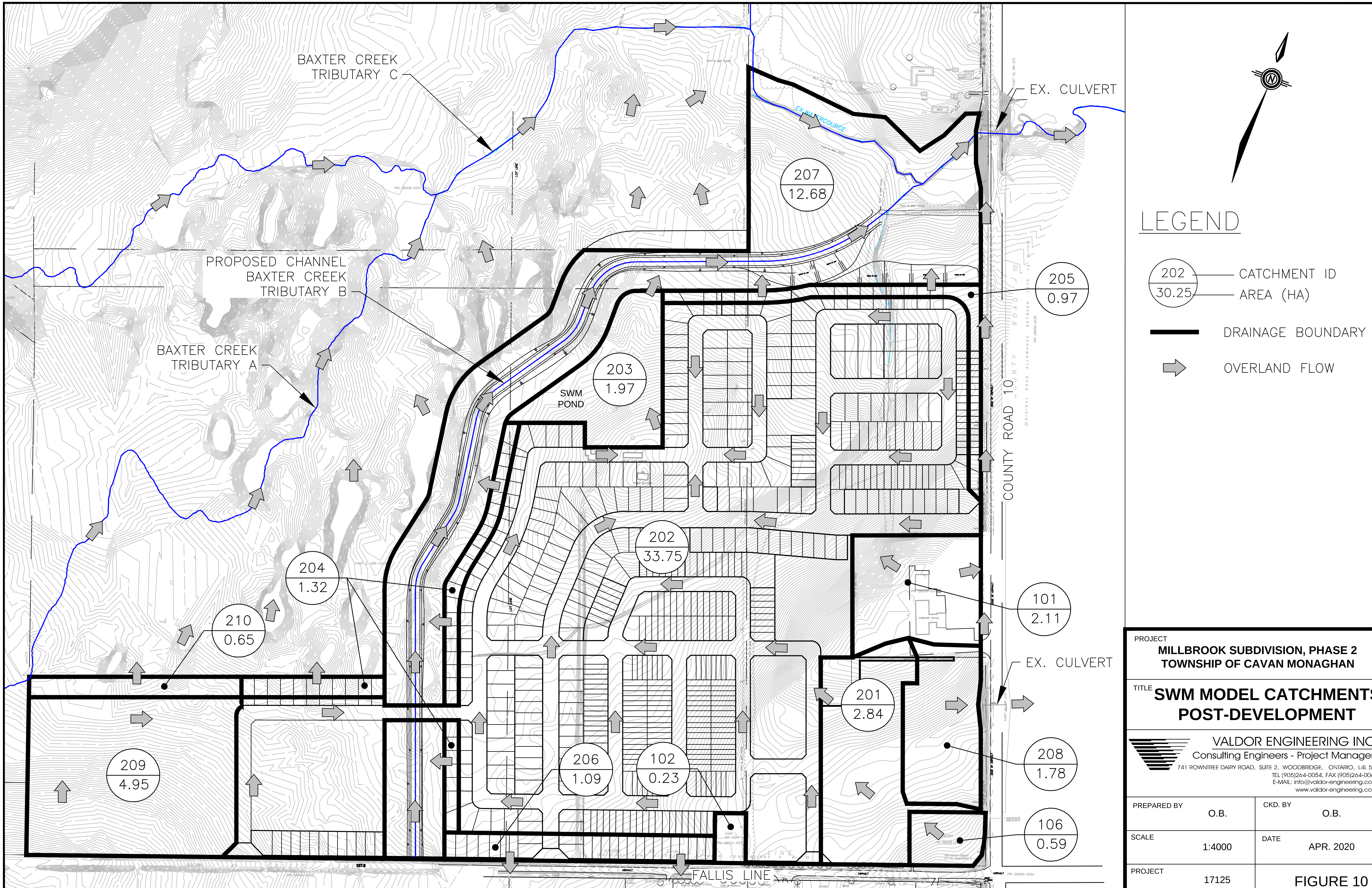
MILLBROOK SUBDIVISION, PHASE 2
TOWNSHIP OF CAVAN MONAGHAN

TITLE

SWM MODEL CATCHMENTS PRE-DEVELOPMENT

VALDOR ENGINEERING INC.
Consulting Engineers - Project Managers
741 ROWNTREE DAIRY ROAD, SUITE 2, WOODBRIDGE, ONTARIO, L4L 5T9
TEL (905)264-0054, FAX (905)264-0069
E-MAIL: info@valdor-engineering.com
www.valdor-engineering.com

PREPARED BY	O.B.	CKD. BY	O.B.
SCALE	NTS	DATE	APR. 2020
PROJECT	17125		FIGURE 9

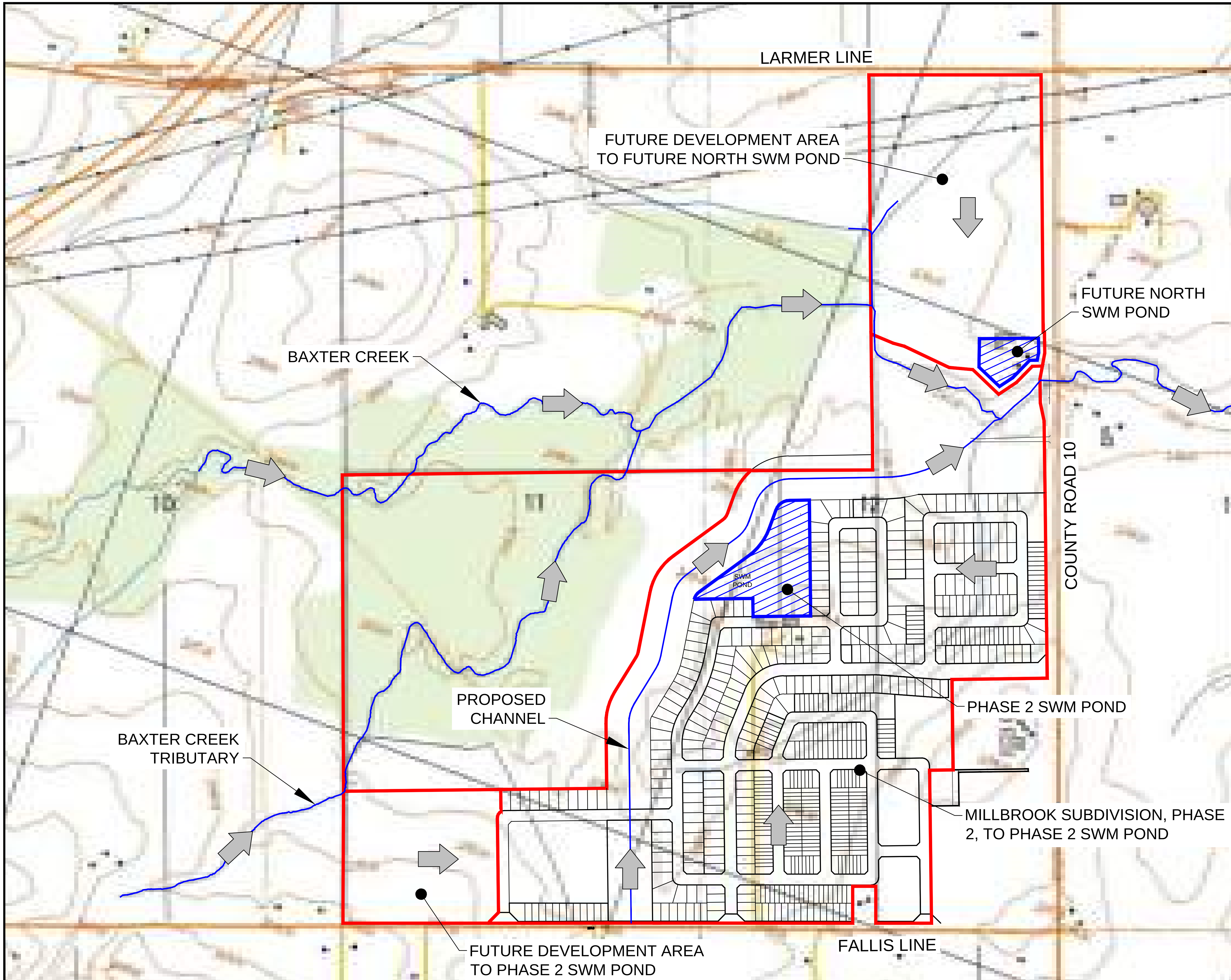


PROJECT
MILLBROOK SUBDIVISION, PHASE 2
TOWNSHIP OF CAVAN MONAGHAN

TITLE
SWM MODEL CATCHMENTS POST-DEVELOPMENT

VALDOR ENGINEERING INC.
Consulting Engineers - Project Managers
741 ROWNTREE DAIRY ROAD, SUITE 2, WOODBRIDGE, ONTARIO, L4L 5T9
TEL (905)264-0054, FAX (905)264-0069
E-MAIL: info@valdor-engineering.com
www.valdor-engineering.com

PREPARED BY	O.B.	CKD. BY	O.B.
SCALE	1:4000	DATE	APR. 2020
PROJECT	17125		FIGURE 10



PROJECT
MILLBROOK SUBDIVISION, PHASE 2
TOWNSHIP OF CAVAN MONAGHAN

TITLE
OVERALL SWM POND LOCATION PLAN

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Consulting Engineers - Project Managers
741 ROWNTREE DAIRY ROAD, SUITE 2, WOODBRIDGE, ONTARIO, L4L 5T9
TEL (905)264-0054, FAX (905)264-0069
E-MAIL: info@valdor-engineering.com
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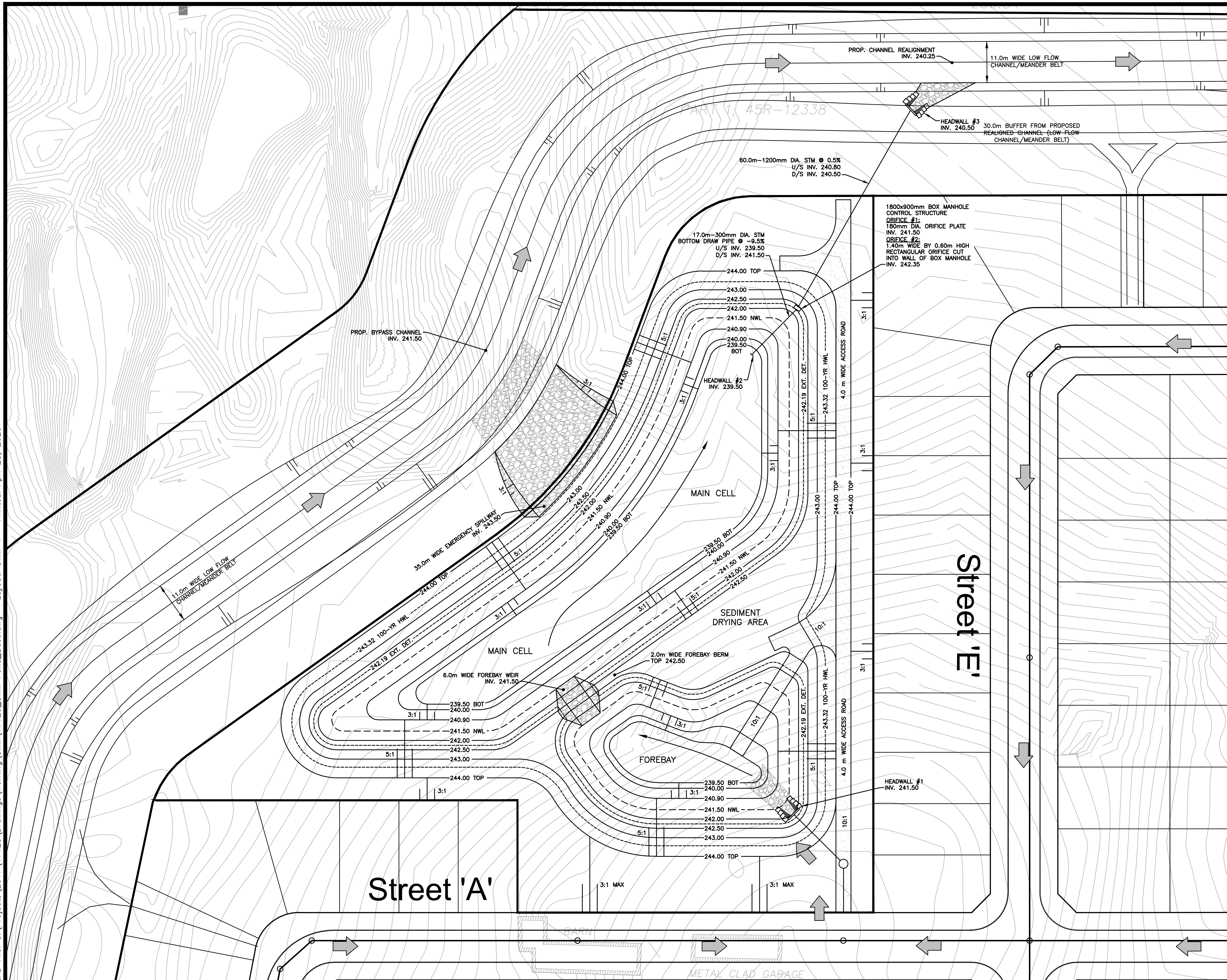
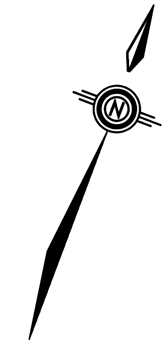
PREPARED BY O.B.	CKD. BY O.B.
SCALE NTS	DATE APR. 2020
PROJECT 17125	FIGURE 11





LEGEND

- OVERLAND FLOW
- PERMANENT POOL
- RIP-RAP EROSION PROTECTION
- MAINTENANCE ACCESS ROAD

RETURN PERIOD	POND WSEL (m)
25 mm	242.19
2-YEAR	242.50
5-YEAR	242.71
10-YEAR	242.85
25-YEAR	243.03
50-YEAR	243.17
100-YEAR	243.32
REGIONAL	243.54

PROJECT
MILLBROOK SUBDIVISION, PHASE 2
TOWNSHIP OF CAVAN MONAGHAN

TITLE
STORMWATER MANAGEMENT POND

VALDOR ENGINEERING INC.
Consulting Engineers - Project Managers
741 ROWNTREE DAIRY ROAD, SUITE 2, WOODBRIDGE, ONTARIO, L4L 5T9
TEL (905)264-0054, FAX (905)264-0069
E-MAIL: info@valdor-engineering.com
www.valdor-engineering.com

PREPARED BY	O.B.	CKD. BY	O.B.
SCALE	1:1000	DATE	APR. 2020
PROJECT	17125	FIGURE 12	

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LEGEND

WATER BALANCE LAND USE BOUNDARY

PROJECT
MILLBROOK SUBDIVISION, PHASE 2
TOWNSHIP OF CAVAN MONAGHAN

TITLE
WATER BALANCE PLAN PRE-DEVELOPMENT

VALDOR ENGINEERING INC.
Consulting Engineers - Project Managers
741 ROWNTREE DAIRY ROAD, SUITE 2, WOODBRIDGE, ONTARIO, L4L 5T9
TEL (905)264-0054, FAX (905)264-0069
E-MAIL: info@valdor-engineering.com
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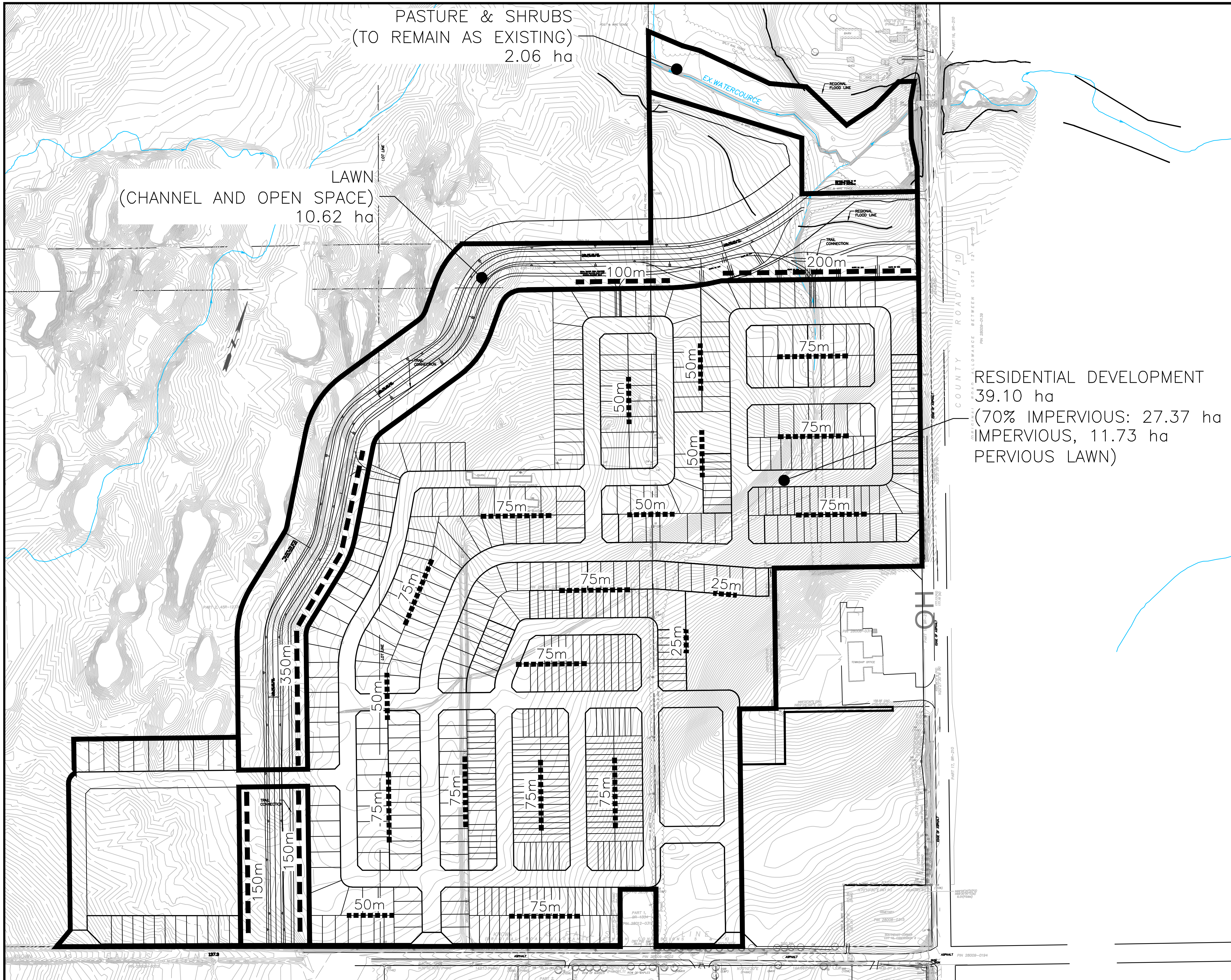
PREPARED BY O.B.	CKD. BY O.B.
SCALE 1:4000	DATE APR. 2020
PROJECT 17125	FIGURE 13

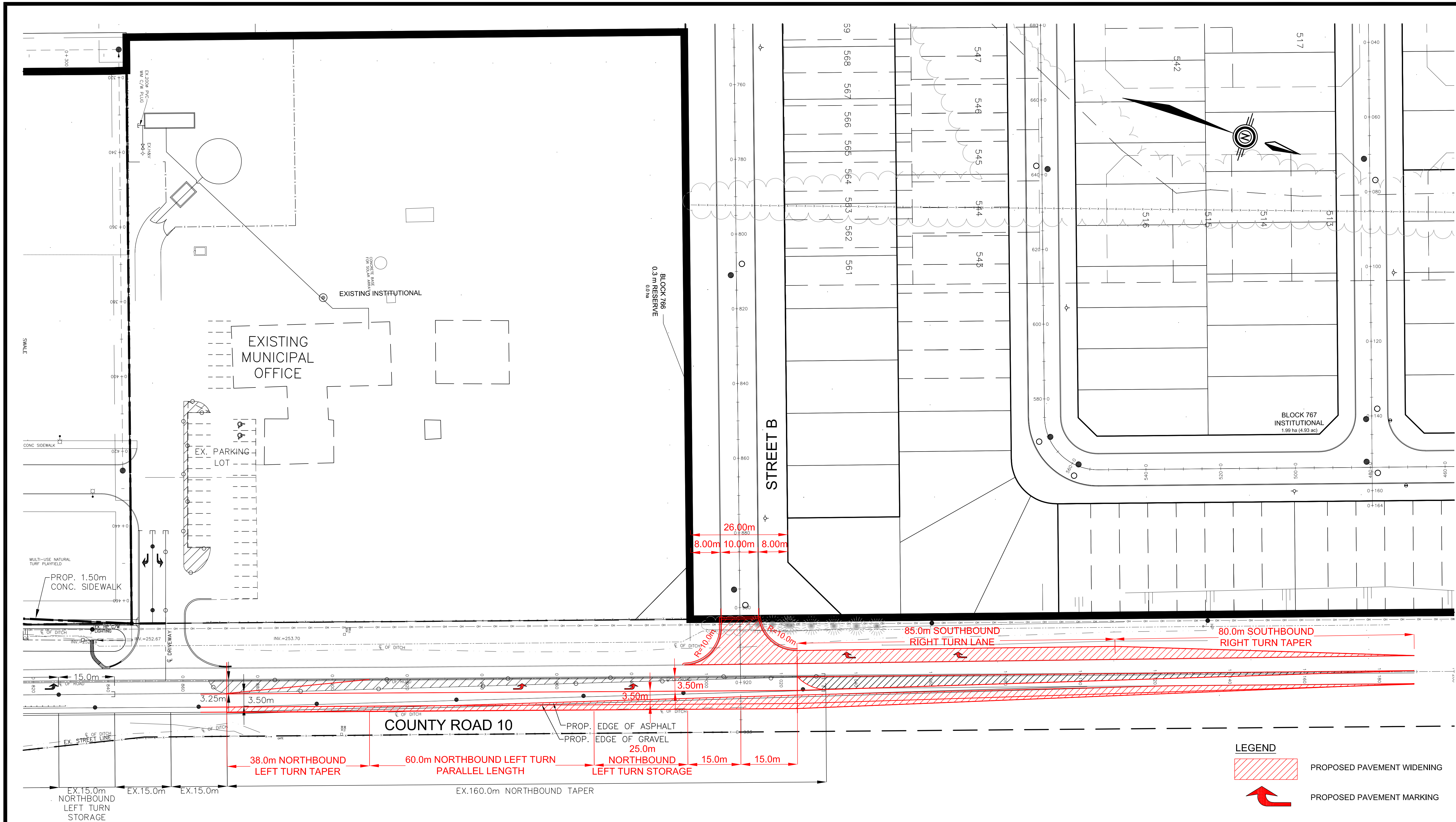


PROJECT
MILLBROOK SUBDIVISION, PHASE 2
TOWNSHIP OF CAVAN MONAGHAN

TITLE
WATER BALANCE PLAN POST-DEVELOPMENT

VALDOR ENGINEERING INC.
Consulting Engineers - Project Managers
741 ROWNTREE DAIRY ROAD, SUITE 2, WOODBRIDGE, ONTARIO, L4L 5T9
TEL (905)264-0054, FAX (905)264-0069
E-MAIL: info@valdor-engineering.com
www.valdor-engineering.com

PREPARED BY	O.B.	CKD. BY	O.B.
SCALE	1:4000	DATE	APR. 2020
PROJECT	17125		FIGURE 14



MILLBROOK SUBDIVISION, PHASE 2

STREET B / COUNTY ROAD 10 INTERSECTION GEOMETRICS

DRAWN BY: D.M.	CKD. BY: D.G.	DATE: APRIL, 2020	
SCALE: 1:1000	PROJECT: 17125	FIGURE 15	

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Consulting Engineers - Project Managers
741 ROWNTREE DAIRY ROAD, SUITE 2, WOODBRIDGE, ONTARIO, L4L 5T9
TEL (905)264-0054, FAX (905)264-0069
E-MAIL: info@valdor-engineering.com
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S:\Projects\2017\17125\Report\FSR\Revision 2_May 2020\17125-FSR-DWG\17125-FSR-Ph2-FIG-15.dwg, 5/1/2020 10:38:29 AM

APPENDIX "A"

Water Demand Calculations & Details

VALDOR ENGINEERING INC.
741 Rowntree Dairy Road, Suite 2, Woodbridge, ON L4L 5T9
Tel: 905-264-0054 Fax: 905-264-0069 info@valdor-engineering.com
www.valdor-engineering.com

TABLE: A1

DOMESTIC WATER DEMAND CALCULATION

Project Name: **Millbrook Subdivision Phase 2, Township of Cavan Monaghan**
File: 17125
Date: May 2020

Conditions:

Residential Average Day Demand	450	L/person/day
Maximum Day Factor	2.0	
Peak Hour Factor	3.0	

Population:

Land Use	No. of Units	Population Density (ppu)	Equivalent Population (persons)
Detached Dwellings	360	3.5	1,260
Street Townhomes	244	3.0	732
Apartments	192	2.0	384
School (Refer to Table B1)			538
Total	**796**		**2,914**

Demand:

	Equivalent Population (persons)	Domestic Demand (L/min)	Maximum Day Demand (L/min)	Peak Hour Demand (L/min)
Detached Dwellings	1,260	394	788	1,181
Street Townhomes	732	229	458	686
Apartments	384	120	240	360
School	538	168	336	504
Total	**2,914**	**911**	**1,821**	**2,732**

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741 Rowntree Dairy Road, Suite 2, Woodbridge, ON L4L 5T9
Tel: 905-264-0054 Fax: 905-264-0069 info@valdor-engineering.com
www.valdor-engineering.com

TABLE: A2-1

CALCULATION OF REQUIRED FIRE FLOW

In accordance to Water Supply for Public Fire Protection, Fire Underwriters Survey 1999

Project Name: **Millbrook Subdivision Phase 2**
File: 17125
Date: May 2020

Notes: **DETACHED DWELLING**
Assume:
- 3,500 sq.ft total floor area
- interior unit for max exposure

Type of Construction - Ordinary Construction

$C =$ 1.0

Total Floor Area: 325 sq.m

$A =$ 325 sq.m

(Total Floor Area includes all storeys, but excludes basements at least 50 percent below grade)

$F = 220\,C\,\sqrt{A}$

$F =$ 3,966 L/min

$F =$ 4,000 (to nearest 1,000 Lmin)

Occupancy Factor

		Charge
Type:	Non-Combustible	-25%
	$f_1 =$	-25%

$F' = F \times (1+f_1)$

$F' =$ 3,000 L/min

Sprinkler Credit

		Charge
NFPA 13 Sprinkler Standard:	NO	0%
Standard Water Supply:	NO	0%
Fully Supervised System:	NO	0%
Total Charge to Fire Flow:	$f_2 =$	0%

Exposure Factor		Charge
Side 1 - Distance to Building (m):	0 to 3m	25%
Side 2 - Distance to Building (m):	0 to 3m	25%
Side 3 - Distance to Building (m):	3.1 to 10m	20%
Side 4 - Distance to Building (m):	3.1 to 10m	20%
	$f_3 =$	75% (maximum of 75%)

$F'' = F' + F' \times f_2 + F' \times f_3$

$F'' =$ 5,250 L/min

REQUIRED FIRE FLOW

$F'' =$ **5,000** **L/min** (to nearest 1,000 L/min)

VALDOR ENGINEERING INC.
741 Rowntree Dairy Road, Suite 2, Woodbridge, ON L4L 5T9
Tel: 905-264-0054 Fax: 905-264-0069 info@valdor-engineering.com
www.valdor-engineering.com

TABLE: A2-2

CALCULATION OF REQUIRED FIRE FLOW

In accordance to Water Supply for Public Fire Protection, Fire Underwriters Survey 1999

Project Name: **Millbrook Subdivision Phase 2**
File: 17125
Date: May 2020

Notes: **STREET TOWNHOMES DWELLING**
Assume:
- 2,500 sq.ft total floor area per unit
-4 consecutive units maximum
-8 Unit Townhouse block with fire resistant separation

Type of Construction - Ordinary Construction

C = 1.0

Total Floor Area: 930 sq.m
A = 930 sq.m

(Total Floor Area includes all storeys, but excludes basements at least 50 percent below grade)

$F = 220\, C \sqrt{A}$

F = 6,709 L/min

F = 7,000 (to nearest 1,000 Lmin)

Occupancy Factor

		Charge
Type:	Non-Combustible	-25%
	f_1 =	-25%

$F' = F \times (1+f_1)$

F' = 5,250 L/min

Sprinkler Credit

		Charge
NFPA 13 Sprinkler Standard:	NO	0%
Standard Water Supply:	NO	0%
Fully Supervised System:	NO	0%
Total Charge to Fire Flow:	f_2 =	0%

Exposure Factor

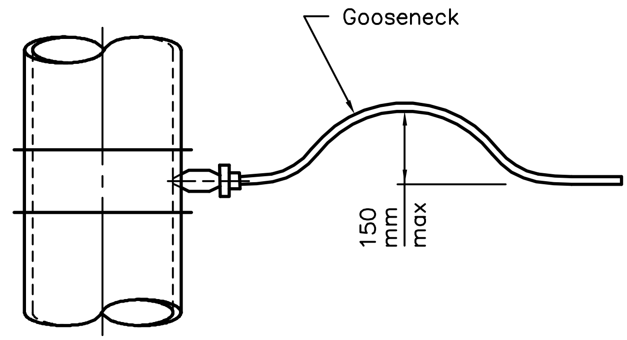
		Charge
Side 1 - Distance to Building (m):	0 to 3m	25%
Side 2 - Distance to Building (m):	0 to 3m	25%
Side 3 - Distance to Building (m):	3.1 to 10m	20%
Side 4 - Distance to Building (m):	3.1 to 10m	20%
	f_3 =	75% (maximum of 75%)

$F'' = F' + F' \times f_2 + F' \times f_3$

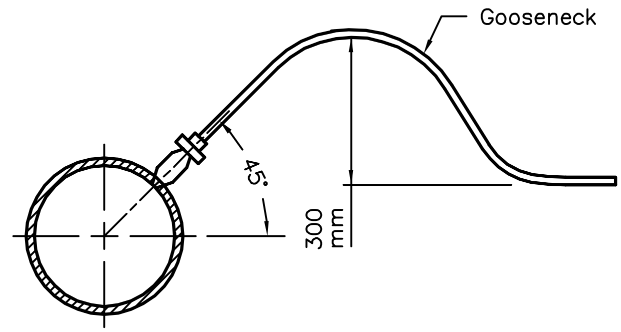
F'' = 9,188 L/min

REQUIRED FIRE FLOW

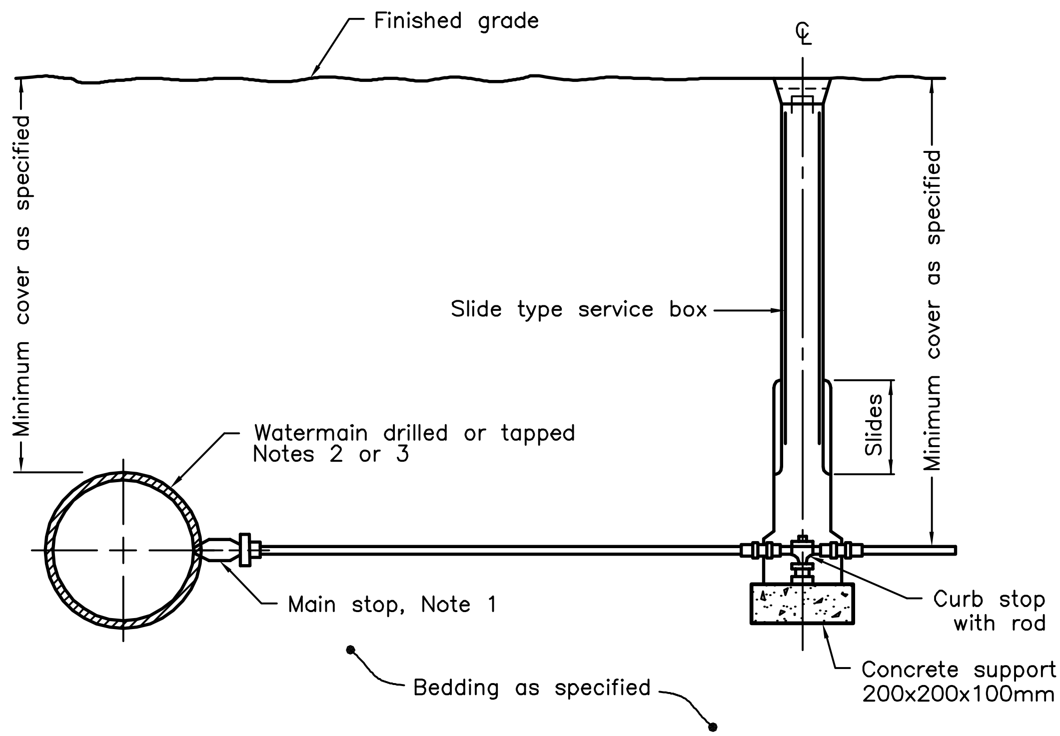
F'' = **9,000** **L/min** (to nearest 1,000 L/min)



HORIZONTAL GOOSENECK



VERTICAL GOOSENECK OPTION



VERTICAL SECTION

NOTES:

1 For plastic service pipes, install main stop at 15° above horizontal with a minimum 1.2m long gooseneck.

2 Direct tap ductile iron pipe with approved tool with standard AWWA inlet thread.

3 Service connections to plastic watermains shall be made using service saddles or factory made tees.

A When specified, the vertical gooseneck option shall be used.

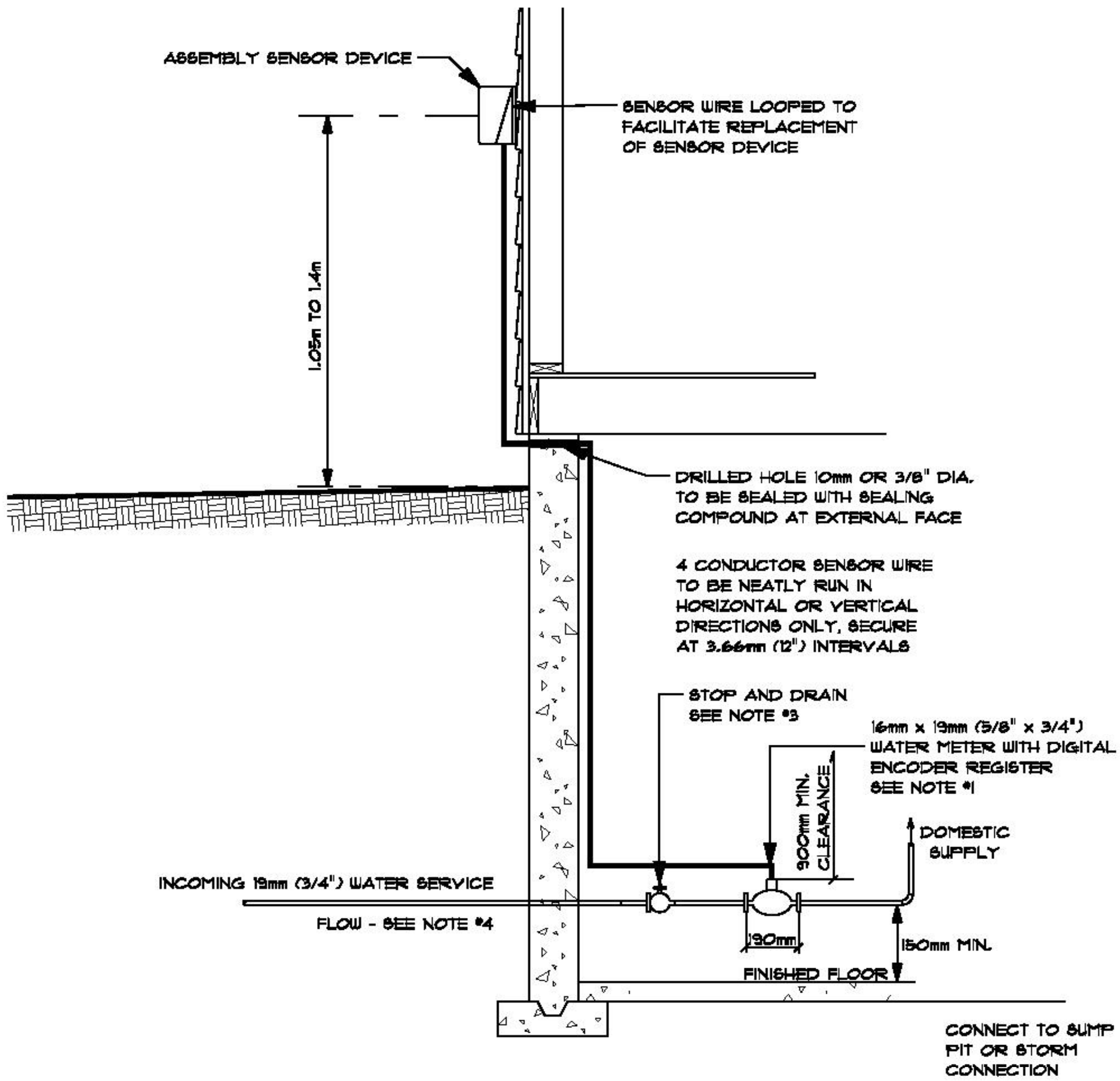
B Couplings shall not be permitted unless the service length exceeds 20m between the main stop and curb stop.

C All water services shall be installed 90° to the longitudinal axis of the watermain.

D Backfill material within 500mm of service box shall be native or imported, as specified.

E All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2013	Rev	3
WATER SERVICE CONNECTION 19 and 25mm DIAMETER SIZES			
	OPSD 1104.010		



NOTES:

1 - METER SHALL BE 16mm (5/8") METER, REGISTRATION IN CUBIC METERES. 19mm (3/4") THREADED CONNECTIONS

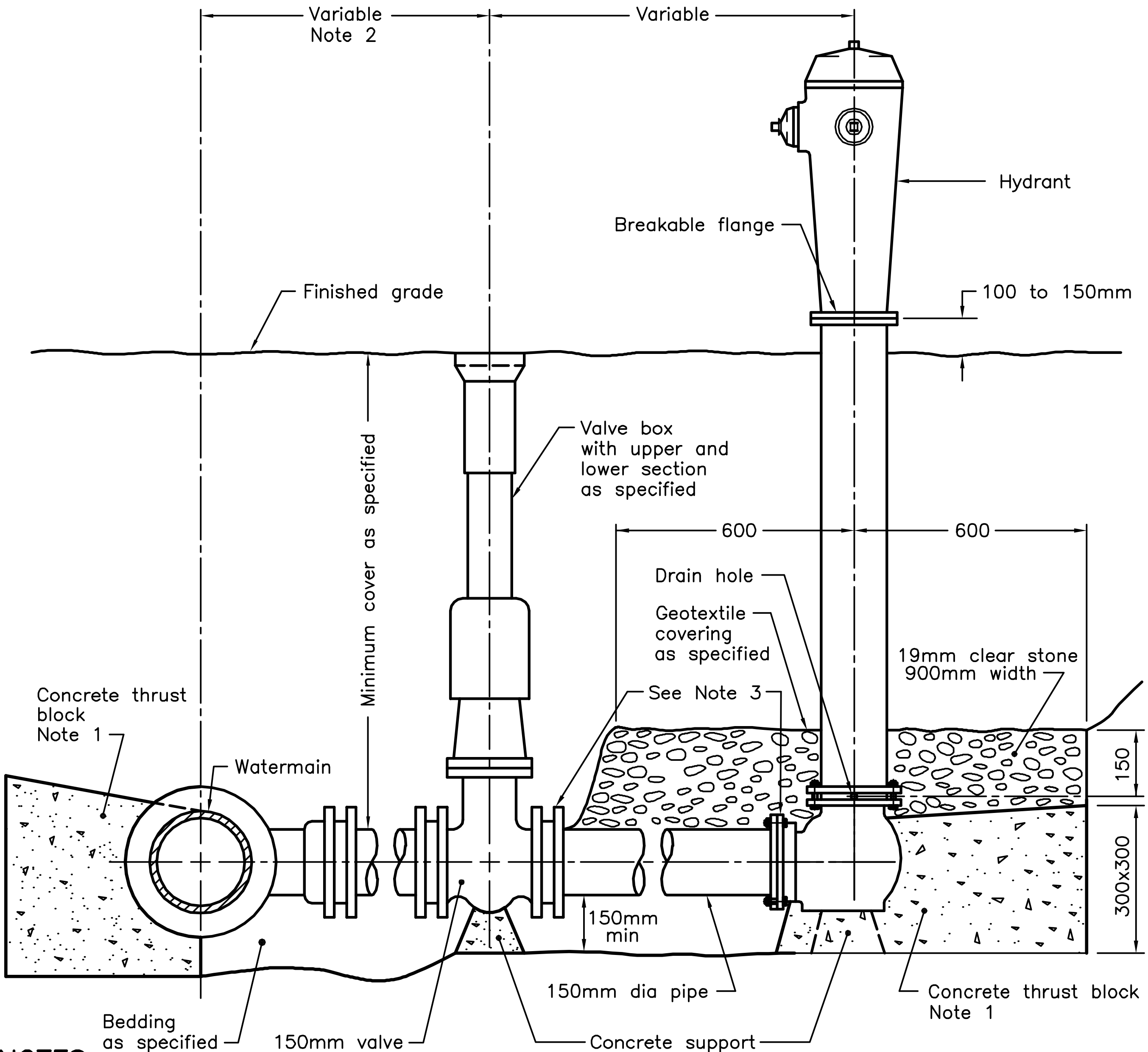
2 - SUPPLY AND INSTALL REMOTE READOUT DEVICE ON OUTSIDE WALL WITHIN 2.0m OF THE FROST WALL AND IN THE SAME SIDE AS THE HYDRO METER. REMOTE READOUT DEVICE SHALL BE SUITABLE FOR TOUCH READ AUTOMATED READING AND BULLING SYSTEM.

3 - STOP AND DRAIN VALVE TO BE THE SAME SIZE AS INCOMING PIPE

4 - IF HOT WATER TANK IS WITHIN 3.0m OF THE METER, A CHECK VALVE IS REQUIRED BETWEEN THE METER AND THE HOT WATER TANK.

5 - METER SHALL BE INSTALLED USING THREADED CONNECTIONS ONLY

TOWNSHIP OF CAVAN MONAGHAN	TYPICAL WATER METER INSTALLATION	STD.
	SCALE: NOT TO SCALE	S7
	DATE: AUGUST 2013	



NOTES:

1 All concrete thrust blocks shall be poured against undisturbed ground.

2 When specified, for watermains 400mm and less, locate valve within 1.0m of centreline of watermain. Retaining and restraining devices shall be utilized. For watermains 600mm and over, bolt valve with flanged end directly to flanged tee.

3 When specified, retaining and restraining devices shall be utilized, in addition to thrust blocks.

A Bond breaker shall be used between the concrete and the fittings and appurtenances.

B Bolts and nuts for buried flange to flange connections shall be stainless steel.

C When required, flange of standpipe extensions shall not be in frost zone.

D This OPSD shall be read in conjunction with OPSD 1103.010 and 1103.020.

E Backfill material within 500mm of service box shall be native or imported, as specified.

F All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2013	Rev 2
HYDRANT INSTALLATION		
	OPSD 1105.010	

APPENDIX “B”

Wastewater Calculations & Details

VALDOR ENGINEERING INC.
741 Rowntree Dairy Road, Suite 2, Woodbridge, ON L4L 5T9
Tel: 905-264-0054 Fax: 905-264-0069 info@valdor-engineering.com
www.valdor-engineering.com

TABLE: B1

WASTEWATER FLOW CALCULATIONS

Project Name: **Millbrook Subdivision Phase 2, Township of Cavan Monaghan**
File: 17125
Date: May 2020

Design Parameters

Residential Average Daily Flow:	450	L/person/day	0.0052 L/person/s
Residential Peaking Factor:	$K_H = 1 + \frac{14}{4+\sqrt{P}}$	where K_H = Harmon Peaking Factor (max. 4.0, min. 2.75) p = population in thousands	
Extraneous Flow (I):	0.28	L/s/ha. (infiltration)	
Design Flow (Q_D):	$Q \times K_H + I$		
Elementary School Average Flow:	0.35	L/s/100 students	
No. of Students:	800		
Peaking Factor:	1.5		

Population:

Land Use	No. of Units	Population Density (ppu)	Equivalent Population (persons)
Detached Dwellings	328	3.5	1,148
Street Townhomes	245	3.5	858
Apartments	192	2.0	384
Total	**765**		**2,390**

Wastewater Load:

Land Use	Area (ha.)	Equivalent Population (persons)	Average Daily Flow (L/s)	Harmon Peaking Factor	Peak Daily Flow (L/s)	Extraneous Flow (L/s)	Total Flow (L/s)
Detached Dwellings	16.121	1,148	5.98	3.76	22.48	4.51	27.00
Street Townhomes	5.549	858	4.47	3.84	17.16	1.55	18.71
Apartments	3.013	384	2.00	4.00	8.00	0.84	8.84
Elementary School	2.213	538	2.80	1.50	4.20	0.62	4.82
Roads	8.586					2.40	2.40
Total	**35.482**	**2,927**	**15.25**		**51.84**	**9.93**	**61.78**

Density - Single Family	3.5	p.p.u
Density - Townhouses	3.5	p.p.u
Density - Apartments	2.0	p.p.u
Peaking factor, M	2.75	min.
	4.0	max.
Per capita flow, q	450	l/cap/d
Infiltration rate, i	0.28	l/s/ha
Pipe Velocities	0.6	m/s min
	3.0	m/s max

School (800 stud)	2.8	L/s
Institutional	2.9	L/s/ha

TABLE: B2

SANITARY SEWER DESIGN SHEET

SANITARY FLOW

$M = 1 + \frac{14}{4+\sqrt{P}}$ where P in 1000's

$Q(p) = \frac{P \times q \times M}{86.4}$ in (l / s)

$Q(i) = i \times A$ in (l / s)

$Q(d) = Q(p) + Q(i)$ in (l / s)

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Design: **V.Lider**

Checked: **P. Zourntos, P.Eng**

Approved: **P. Zourntos, P.Eng**

Date: May 14, 2020

Street	from M.H.	to M.H.	Developable Area (ha)	Number of Houses (Low (Units)	Population (person)	Area (Ha) (ha)	Accum. Population P (person)	Peaking Factor M	School Institutional Commercial Flow (l/s)	Peak Flow Q(p) (l/s)	Accum. Area (ha)	Extraneous Flow Q(i) (l/s)	Design Flow Q(d) (l/s)	Pipe Length L (m)	Pipe Diameter d (mm)	Pipe Slope S (%)	Nominal Pipe Full Flow Cap. Q(f), (l/s)	Pipe Full Flow Vel. V(f) (m/s)	Actual Velocity V(a) (m/s)	Q(d) / Q(f)	COMMENTS
PROPOSED MILLBROOK SUBDIVISION, PHASE 2																					
Future School	PLUG	MH.15A	2.20			2.20		1.50	2.80	4.20	2.20	0.62	4.82								
Residential - Detached	PLUG	MH.15A	16.12	328	1148.0	16.12	1148.0	3.76		26.68	18.32	5.13	31.81								
Residential - Towns	PLUG	MH.15A	5.55	245	857.5	5.55	2005.5	3.58		41.64	23.87	6.68	48.33								
Residential - Apartments	PLUG	MH.15A	3.01	192	384.0	3.01	2389.5	3.52		48.06	26.88	7.53	55.59	19.8	375	0.30%	96.0	0.87	0.90	0.58	
Residential - Roads	PLUG	MH.15A	8.59			8.59	2389.5	3.52		48.06	35.47	9.93	57.99								
EX. MUNICIPAL OFFICE	MH.24A	MH.23A	2.40			2.40			6.96	6.96	2.40	0.67	7.63	112.7	200	1.00%	32.8	1.04	0.85	0.23	
EX EASEMENT	MH.23A	MH.22A	0.00	0	0.00	0.00	0.0	0.00		6.96	2.40	0.67	7.63	46.8	200	0.50%	23.2	0.74	0.66	0.33	
EX EASEMENT	MH.22A	MH.21A	1.65	0	0.00	1.65	0.0	0.00	4.79	11.75	4.05	1.13	12.88	53.1	200	0.50%	23.2	0.74	0.76	0.56	
EX EASEMENT	MH.21A	MH.20A	0.15	0	0.00	0.15	0.0	0.00		11.75	4.20	1.18	12.92	86.0	200	0.50%	23.2	0.74	0.76	0.56	
EX EASEMENT	MH.20A	MH.19A	2.33	0	0.00	2.33	0.0	0.00	6.76	18.50	6.53	1.83	20.33	53.5	200	0.50%	23.2	0.74	0.83	0.88	
EX EASEMENT	MH.19A	MH.18A	0.24	0	0.00	0.24	0.0	0.00		18.50	6.77	1.90	20.40	76.0	200	0.50%	23.2	0.74	0.83	0.88	
EXISTING MILLBROOK SUBDIVISION, PHASE 1																					
FALLIS LINE	MH.61A	MH.60A	0.93	5	17.50	0.93	17.5	4.00		0.36	0.93	0.26	0.62	73.1	200	2.00%	46.4	1.48	0.52	0.01	
FALLIS LINE	MH.60A	MH.18A	0.36	4	14.00	0.36	31.5	4.00		0.66	1.29	0.36	1.02	71.1	200	1.60%	41.5	1.32	0.55	0.02	
FALLIS LINE	MH.18A	MH.17A	1.07	3	10.50	1.07	42.0	4.00	18.50	19.38	9.13	2.56	21.93	102.6	200	0.50%	23.2	0.74	0.84	0.95	
FALLIS LINE	MH.17A	MH.16A	0.80	11	38.50	0.80	80.5	4.00		20.18	9.93	2.78	22.96	111.2	200	0.60%	25.4	0.81	0.92	0.90	
FALLIS LINE	MH.16A	MH.15A	0.75	12	42.00	0.75	122.5	4.00		21.05	10.68	2.99	24.04	103.7	200	1.30%	37.4	1.19	1.26	0.64	
FERNRIDGE HEIGHTS	MH.59A	MH.60A	0.94	21	73.50	0.94	73.5	4.00		1.53	0.94	0.26	1.79	107.2	200	1.10%	34.4	1.09	0.58	0.05	
FERNRIDGE HEIGHTS	MH.60A	MH.13A	0.94	19	66.50	0.94	140.0	4.00		2.92	1.88	0.53	3.44	117.7	200	2.10%	47.5	1.51	0.88	0.07	
NORTHHILL AVENUE	MH.56A	MH.57A	0.83	16	56.00	0.83	56.0	4.00		1.17	0.83	0.23	1.40	96.3	200	1.30%	37.4	1.19	0.57	0.04	
NORTHHILL AVENUE	MH.57A	MH.12A	0.78	14	49.00	0.78	105.0	4.00		2.19	1.61	0.45	2.64	85.1	200	2.00%	46.4	1.48	0.80	0.06	

Density - Single Family	3.5	p.p.u
Density - Townhouses	3.5	p.p.u
Density - Apartments	2.0	p.p.u
Peaking factor, M	2.75	min.
	4.0	max.
Per capita flow, q	450	l/cap/d
Infiltration rate, i	0.28	l/s/ha
Pipe Velocities	0.6	m/s min
	3.0	m/s max

School (800 stud)	2.8	L/s
Institutional	2.9	L/s/ha

TABLE: B2

SANITARY SEWER DESIGN SHEET

SANITARY FLOW

$M = 1 + \frac{14}{4+\sqrt{P}}$ where P in 1000's

$Q(p) = \frac{P \times q \times M}{86.4}$ in (l / s)

$Q(i) = i \times A$ in (l / s)

$Q(d) = Q(p) + Q(i)$ in (l / s)

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Design: **V.Lider**
Checked: **P. Zourntos, P.Eng**
Approved: **P. Zourntos, P.Eng**
Date: May 14, 2020

Street	from M.H.	to M.H.	Developable Area (ha)	Number of Houses (Low (Units)	Population (person)	Area (Ha) (ha)	Accum. Population P (person)	Peaking Factor M	School Institutional Commercial Flow (l/s)	Peak Flow Q(p) (l/s)	Accum. Area (ha)	Extraneous Flow Q(i) (l/s)	Design Flow Q(d) (l/s)	Pipe Length L (m)	Pipe Diameter d (mm)	Pipe Slope S (%)	Nominal Pipe Full Flow Cap. Q(f), (l/s)	Pipe Full Flow Vel. V(f) (m/s)	Actual Velocity V(a) (m/s)	Q(d) / Q(f)	COMMENTS
HIGHLANDS BLVD.	MH.15A	MH.14A	0.23	2	7.00	0.23	2519.0	3.51	18.50	64.50	46.38	12.99	77.48	47.5	375	0.30%	96.0	0.87	0.97	0.81	
HIGHLANDS BLVD.	MH.14A	MH.13A	0.25	3	10.50	0.25	2529.5	3.50		64.67	46.63	13.06	77.72	45.1	375	0.30%	96.0	0.87	0.97	0.81	
HIGHLANDS BLVD.	MH.13A	MH.12A	0.53	7	24.50	0.53	2694.0	3.48		67.35	49.04	13.73	81.08	86.0	375	0.30%	96.0	0.87	0.97	0.84	
HIGHLANDS BLVD.	MH.12A	MH.11A	0.47	5	17.50	0.47	2816.5	3.47		69.34	51.12	14.31	83.65	88.5	375	0.30%	96.0	0.87	0.98	0.87	
PRISTINE TRAIL	MH.53A	MH.52A	0.63	9	31.50	0.63	31.5	4.00		0.66	0.63	0.18	0.83	68.5	200	2.00%	46.4	1.48	0.57	0.02	
PRISTINE TRAIL	MH.52A	MH.51A	0.66	10	35.00	0.66	66.5	4.00		1.39	1.29	0.36	1.75	86.0	200	2.50%	51.9	1.65	0.76	0.03	
PRISTINE TRAIL	MH.51A	MH.50A	0.47	6	21.00	0.47	87.5	4.00		1.82	1.76	0.49	2.32	86.0	200	3.20%	58.7	1.87	0.90	0.04	
PRISTINE TRAIL	MH.41A	MH.50A	0.42	5	17.50	0.42	17.5	4.00		0.36	0.42	0.12	0.48	84.7	200	1.40%	38.8	1.24	0.42	0.01	
PARK	MH.70A	MH.45A	0.72	0	0.00	0.72	0.0	0.00		0.00	0.72	0.20	0.20	11.3	200	2.00%	46.4	1.48	0.36	0.00	
MELROSE DRIVE	MH.50A	MH.45A	0.45	6	21.00	0.45	126.0	4.00		2.63	2.63	0.74	3.36	93.6	200	3.80%	63.9	2.04	1.07	0.05	
MELROSE DRIVE	MH.45A	MH.5A	0.30	4	14.00	0.30	140.0	4.00		2.92	3.65	1.02	3.94	64.3	200	2.50%	51.9	1.65	0.97	0.08	
TIMBER DRIVE	MH.47A	MH.7A	0.92	10	35.00	0.92	35.0	4.00		0.73	0.92	0.26	0.99	116.6	200	3.00%	56.8	1.81	0.68	0.02	
STATION DRIVE	MH.46A	MH.6A	0.54	5	17.50	0.54	17.5	4.00		0.36	0.54	0.15	0.52	116.3	200	3.40%	60.5	1.93	0.59	0.01	
Future (Stub to MH11A)	Stub	EXMH11A	3.56	65	227.50	3.56	227.5	4.00		4.74	3.56	1.00	5.74	116.3	250	1.00%	59.5	1.21	0.76	0.10	
HIGHLANDS BLVD.	MH.11A	MH.10A	0.65	7	24.50	0.65	3068.5	3.43	18.50	73.38	51.77	14.49	87.88	83.1	375	0.30%	96.0	0.87	0.99	0.92	
HIGHLANDS BLVD.	MH.10A	MH.9A	0.49	6	21.00	0.49	3089.5	3.43		73.72	52.26	14.63	88.35	66.5	375	0.30%	96.0	0.87	0.99	0.92	
HIGHLANDS BLVD.	MH.9A	MH.8A	0.25	3	10.50	0.25	3100.0	3.43		73.89	52.51	14.70	88.59	11.7	375	0.30%	96.0	0.87	0.99	0.92	
HIGHLANDS BLVD.	MH.8A	MH.7A	0.67	10	35.00	0.67	3135.0	3.43		74.44	53.18	14.89	89.33	77.8	375	2.30%	265.9	2.41	2.17	0.34	
HIGHLANDS BLVD.	MH.7A	MH.6A	0.62	9	31.50	0.62	3201.5	3.42		75.50	54.72	15.32	90.82	86.0	375	3.00%	303.7	2.75	2.40	0.30	
HIGHLANDS BLVD.	MH.6A	MH.5A	0.66	9	31.50	0.66	3250.5	3.41		76.28	55.92	15.66	91.93	86.0	375	3.30%	318.5	2.88	2.49	0.29	
FERNRIDGE HEIGHTS	MH.59A	MH.58A	0.09	1	3.50	0.09	3.5	4.00		0.07	0.09	0.03	0.10	12.2	200	2.00%	46.4	1.48	0.29	0.00	
FERNRIDGE HEIGHTS	MH.58A	MH.55A	0.35	7	24.50	0.35	28.0	4.00		0.58	0.44	0.12	0.71	78.0	200	2.20%	48.6	1.55	0.56	0.01	

Density - Single Family	3.5	p.p.u
Density - Townhouses	3.5	p.p.u
Density - Apartments	2.0	p.p.u
Peaking factor, M	2.75	min.
	4.0	max.
Per capita flow, q	450	l/cap/d
Infiltration rate, i	0.28	l/s/ha
Pipe Velocities	0.6	m/s min
	3.0	m/s max

School (800 stud)	2.8	L/s
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SANITARY SEWER DESIGN SHEET

TABLE: B2

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$Q(i) = i \times A$ in (l / s)

$Q(d) = Q(p) + Q(i)$ in (l / s)

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NORTHHILL AVENUE	MH.56A	MH.55A	0.35	6	21.00	0.35	21.0	4.00		0.44	0.35	0.10	0.54	39.3	200	3.40%	60.5	1.93	0.59	0.01	
NORTHHILL AVENUE	MH.55A	MH.42A	0.65	12	42.00	0.65	91.0	4.00		1.90	1.44	0.40	2.30	107.0	200	2.70%	53.9	1.72	0.85	0.04	
BROMONT DRIVE	MH.44A	MH.43A	0.48	3	10.50	0.48	10.5	4.00		0.22	0.48	0.13	0.35	48.7	200	3.20%	58.7	1.87	0.51	0.01	
BROMONT DRIVE	MH.43A	MH.42A	0.08	0	0.00	0.08	10.5	4.00		0.22	0.56	0.16	0.38	43.7	200	4.50%	69.6	2.21	0.58	0.01	
BROMONT DRIVE	MH.42A	MH.41A	0.45	6	21.00	0.45	122.5	4.00		2.55	2.45	0.69	3.24	88.5	200	4.70%	71.1	2.26	1.15	0.05	
BROMONT DRIVE	MH.41A	MH.40A	0.61	10	35.00	0.61	157.5	4.00		3.28	3.06	0.86	4.14	78.4	200	4.20%	67.2	2.14	1.19	0.06	
BROMONT DRIVE	MH.40A	MH.26A	0.06	0	0.00	0.06	157.5	4.00		3.28	3.12	0.87	4.15	38.7	200	1.70%	42.8	1.36	0.86	0.10	
NORTHHILL AVENUE	MH.42A	MH.36A	0.32	4	14.00	0.32	14.0	4.00		0.29	0.32	0.09	0.38	85.9	200	1.20%	35.9	1.14	0.37	0.01	
HORIZON DRIVE	MH.44A	MH.39A	0.55	12	42.00	0.55	42.0	4.00		0.88	0.55	0.15	1.03	90.0	200	1.20%	35.9	1.14	0.50	0.03	
HORIZON DRIVE(Commerc	MH.39A	MH.38A	1.10	3	10.50	1.10	52.5	4.00	2.73	3.82	1.65	0.46	4.29	14.6	200	1.40%	38.8	1.24	0.81	0.11	
HORIZON DRIVE	MH.38A	MH.37A	0.18	4	14.00	0.18	66.5	4.00		4.12	1.83	0.51	4.63	38.2	200	2.00%	46.4	1.48	0.94	0.10	
HORIZON DRIVE	MH.37A	MH.36A	0.28	6	21.00	0.28	87.5	4.00		4.55	2.11	0.59	5.14	42.2	200	5.00%	73.3	2.33	1.34	0.07	
HORIZON DRIVE	MH.36A	MH.35A	0.53	9	31.50	0.53	133.0	4.00		5.50	2.96	0.83	6.33	64.9	200	4.30%	68.0	2.16	1.36	0.09	
HORIZON DRIVE	MH.35A	MH.34A	0.39	6	21.00	0.39	154.0	4.00		5.94	3.35	0.94	6.88	44.5	200	4.80%	71.9	2.29	1.44	0.10	
HORIZON DRIVE	MH.34A	MH.27A	0.07	0	0.00	0.07	154.0	4.00		5.94	3.42	0.96	6.90	41.9	200	2.00%	46.4	1.48	1.06	0.15	
HIGHLANDS BLVD.	MH.37A	MH.32A	0.37	8	28.00	0.37	28.0	4.00		0.58	0.37	0.10	0.69	73.0	200	1.60%	41.5	1.32	0.49	0.02	
HIGHLANDS BLVD.	MH.32A	MH.31A	0.14	2	7.00	0.14	35.0	4.00		0.73	0.51	0.14	0.87	11.0	200	2.30%	49.7	1.58	0.60	0.02	
HIGHLANDS BLVD.	MH.31A	MH.30A	0.43	9	31.50	0.43	66.5	4.00		1.39	0.94	0.26	1.65	74.7	200	4.00%	65.6	2.09	0.88	0.03	
HIGHLANDS BLVD.	MH.30A	MH.29A	0.33	6	21.00	0.33	87.5	4.00		1.82	1.27	0.36	2.18	60.9	200	4.00%	65.6	2.09	0.96	0.03	
HIGHLANDS BLVD.	MH.29A	MH.28A	0.04	0	0.00	0.04	87.5	4.00		1.82	1.31	0.37	2.19	10.3	200	3.70%	63.1	2.01	0.94	0.03	
HIGHLANDS BLVD.	MH.28A	MH.27A	0.51	7	24.50	0.51	266.0	4.00		5.54	1.82	0.51	6.05	63.5	200	1.60%	41.5	1.32	0.94	0.15	
HIGHLANDS BLVD.	MH.27A	MH.26A	0.82	12	42.00	0.82	462.0	3.99		9.60	6.06	1.70	11.30	100.9	200	1.70%	42.8	1.36	1.15	0.26	
HIGHLANDS BLVD.	MH.26A	MH.25A	0.66	9	31.50	0.66	651.0	3.91		13.27	9.84	2.76	16.02	86.6	200	1.30%	37.4	1.19	1.14	0.43	
HIGHLANDS BLVD.	MH.25A	MH.5A	0.16	2	7.00	0.16	672.0	3.90		13.67	10.00	2.80	16.47	34.4	200	1.50%	40.2	1.28	1.21	0.41	
EASEMENT	MH.5A	MH.4A	0.00	0	0.00	0.00	4062.5	3.33	21.23	91.63	69.57	19.48	111.11	47.6	375	3.80%	341.8	3.09	2.76	0.33	
EASEMENT	MH.4A	MH.3A	0.00	0	0.00	0.00	4062.5	3.33		91.63	69.57	19.48	111.11	52.0	375	3.34%	320.4	2.90	2.64	0.35	

TABLE: B2

SANITARY SEWER DESIGN SHEET

Density - Single Family	3.5	p.p.u
Density - Townhouses	3.5	p.p.u
Density - Apartments	2.0	p.p.u
Peaking factor, M	2.75	min.
	4.0	max.
Per capita flow, q	450	l/cap/d
Infiltration rate, i	0.28	l/s/ha
Pipe Velocities	0.6	m/s min
	3.0	m/s max

School (800 stud)	2.8	L/s
Institutional	2.9	L/s/ha

SANITARY FLOW

$M = 1 + \frac{14}{4+\sqrt{P}}$ where P in 1000's

$Q(p) = \frac{P \times q \times M}{86.4}$ in (l / s)

$Q(i) = i \times A$ in (l / s)

$Q(d) = Q(p) + Q(i)$ in (l / s)

VALDOR ENGINEERING INC.

741 Rowntree Dairy Road, Suite 2, Woodbridge, Ontario, L4L 5T9

Tel: 905-264-0054 Fax: 905-264-0069 info@valdor-engineering.com

Design: **V.Lider**

Checked: **P. Zourntos, P.Eng**

Approved: **P. Zourntos, P.Eng**

Date: May 14, 2020

Street	from M.H.	to M.H.	Developable Area (ha)	Number of Houses (Low (Units)	Population (person)	Area (Ha) (ha)	Accum. Population P (person)	Peaking Factor M	School Institutional Commercial Flow (l/s)	Peak Flow Q(p) (l/s)	Accum. Area (ha)	Extraneous Flow Q(i) (l/s)	Design Flow Q(d) (l/s)	Pipe Length L (m)	Pipe Diameter d (mm)	Pipe Slope S (%)	Nominal Pipe Full Flow Cap. Q(f), (l/s)	Pipe Full Flow Vel. V(f) (m/s)	Actual Velocity V(a) (m/s)	Q(d) / Q(f)	COMMENTS
EASEMENT	MH.3A	MH.2A	0.00	0	0.00	0.00	4062.5	3.33		91.63	69.57	19.48	111.11	207.2	369	4.30%	348.3	3.26	2.89	0.32	
EASEMENT	MH.2A	MH.1A	0.00	0	0.00	0.00	4062.5	3.33		91.63	69.57	19.48	111.11	13.6	375	2.70%	288.1	2.61	2.44	0.39	
Tupper Street	MH.1A	MH.27	0.00	0	0.00	0.00	4083.5	3.33	21.23	91.95	69.57	19.48	111.43	39.7	375	1.71%	229.3	2.08	2.06	0.49	
Buckland Dr. Future	MH.26	MH.27	0.98	0	0.00	0.98	0.0	0.00		0.00	0.98	0.27	0.27	10.1	200	1.00%	32.8	1.04	0.31	0.01	
Tupper St.	MH.27	MH.25	0.14	0	0.00	0.14	4083.5	3.33		91.95	70.69	19.79	111.75	64.8	375	2.00%	248.0	2.25	2.19	0.45	
Tupper St.	MH.25	MH.24	0.38	0	0.00	0.38	4083.5	3.33		91.95	71.07	19.90	111.85	74.5	375	0.90%	166.3	1.51	1.62	0.67	
Tupper St.	MH.24	MH.23	1.59	4	14.00	1.59	4097.5	3.32	0.37	92.54	72.66	20.34	112.88	106.6	375	0.90%	166.3	1.51	1.62	0.68	Instituyional flow added 0.37 l/s
Tupper St. School	MH.23	MH.22	2.17	0	120.00	2.17	4097.5	3.32	0.50	93.04	74.83	20.95	113.99	106.7	375	0.90%	166.3	1.51	1.62	0.69	200studentsx0.74l/s/100students
																					Instituytional flow of 0.50 l/s added
Centennial Lane	MH.22	MH.21	0.70	0	0.00	0.70	4097.5	3.32	21.23	93.04	75.53	21.15	114.19	73.6	375	1.75%	231.9	2.10	2.09	0.49	
Centennial Lane	MH.21	MH.20	0.50	0	0.00	0.50	4097.5	3.32		93.04	76.03	21.29	114.33	53.2	375	1.70%	228.6	2.07	2.07	0.50	
Centennial Lane	MH20	MH.19	0.70	0	0.00	0.70	4097.5	3.32		93.04	76.73	21.48	114.52	64.1	375	0.81%	157.8	1.43	1.56	0.73	
Centennial Lane	MH19	MH.160	0.06	0	130.00	0.06	4227.5	3.31		95.02	76.79	21.50	116.52	60.4	375	0.60%	135.8	1.23	1.38	0.86	
Retirement Home																					
Nina Court			2.00	34	119.00	2.00	119.0	4.00		2.48	2.00	0.56	3.04								
Centennial Lane	MH160	MH.3	2.16	34	119.00	2.16	4346.5	3.30		96.83	78.95	22.10	118.93	74.0	375	2.34%	268.2	2.43	2.35	0.44	
WWTP	MH3	MH.2	0.00	0	0.00	0.00	4346.5	3.30		96.83	78.95	22.10	118.93	63.0	375	1.60%	221.8	2.01	2.04	0.54	

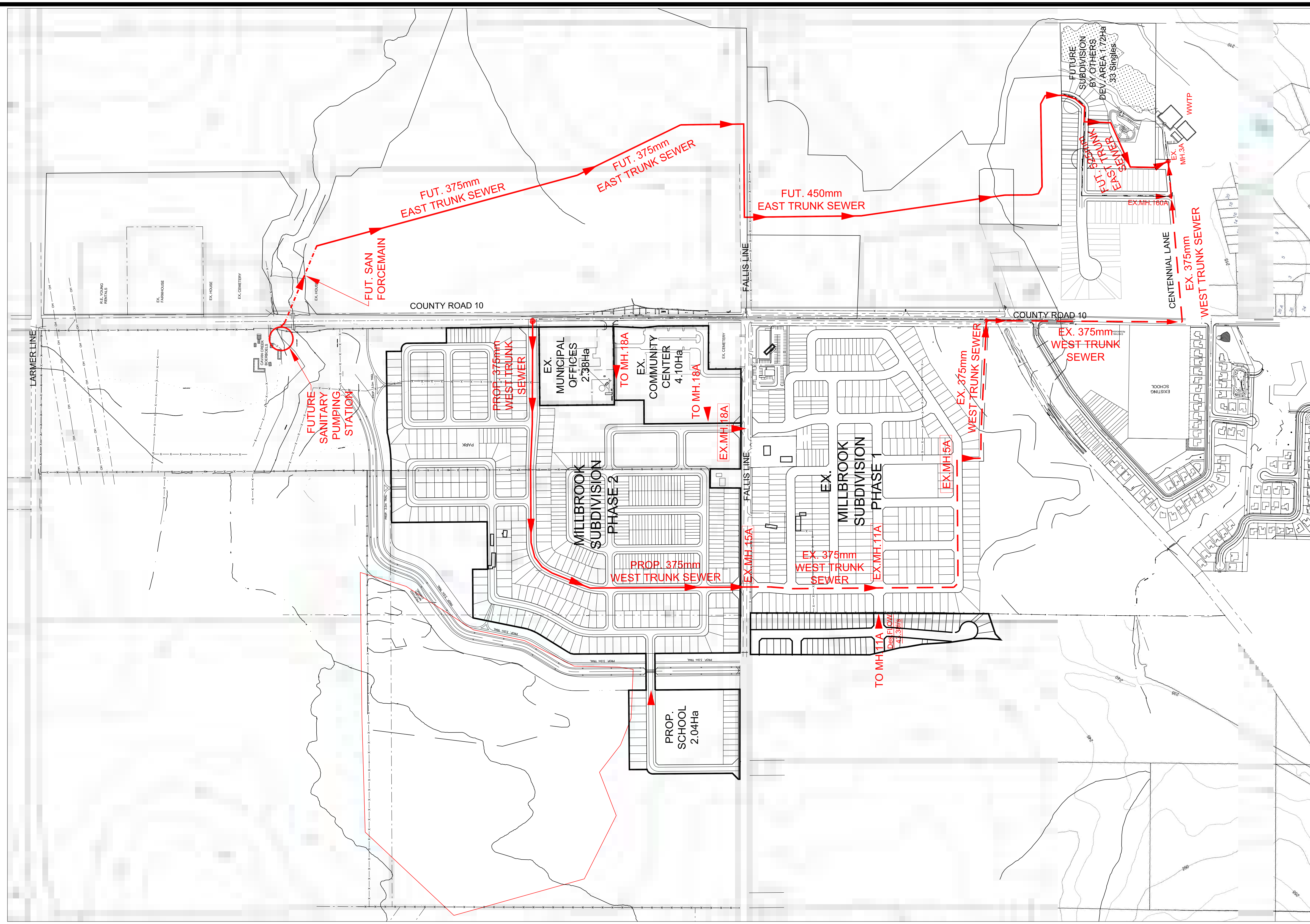
No.	REVISION	DATE	AUTH
2.0			
1.0			

Township of Cavan Monaghan
Engineering and Public Works Department

SANITARY SEWER DESIGN SHEET

SCALE: N.T.S.

DRAWN BY: DWG. No.



MILLBROOK SUBDIVISION, PHASE 2

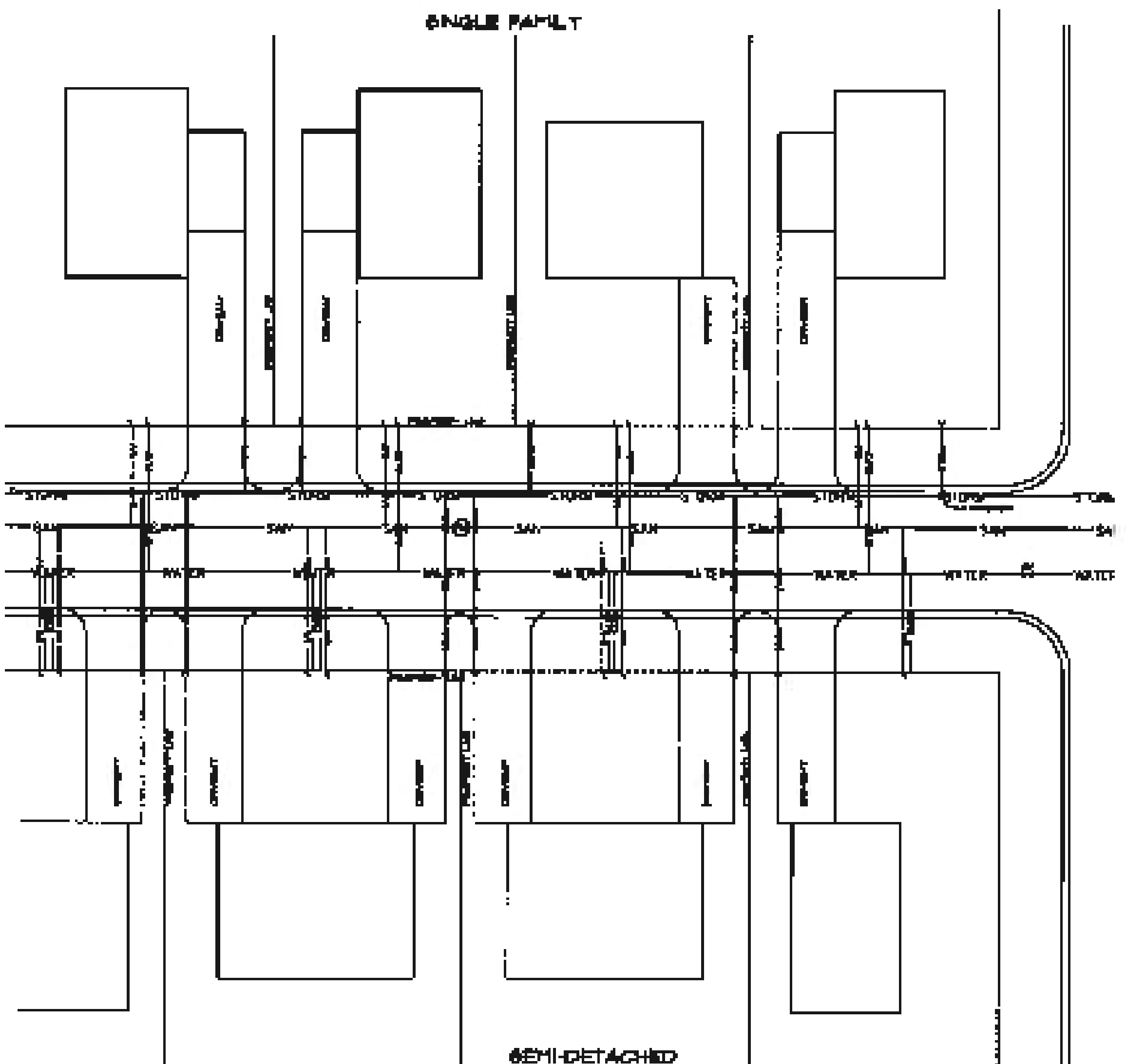
SANITARY DRAINAGE PLAN

DRAWN BY	V.L.
CKD. BY	D.G.
DATE	MAY, 2020
SCALE	N.T.S.
PROJECT	17125

FIGURE B-1

VALDOR ENGINEERING INC.
Consulting Engineers - Project Managers
741 ROWNTREE DAIRY ROAD, SUITE 2, WOODBRIDGE, ONTARIO, L4L 5T9
TEL (905)264-0054, FAX (905)264-0069
E-MAIL: info@valdor-engineering.com
www.valdor-engineering.com

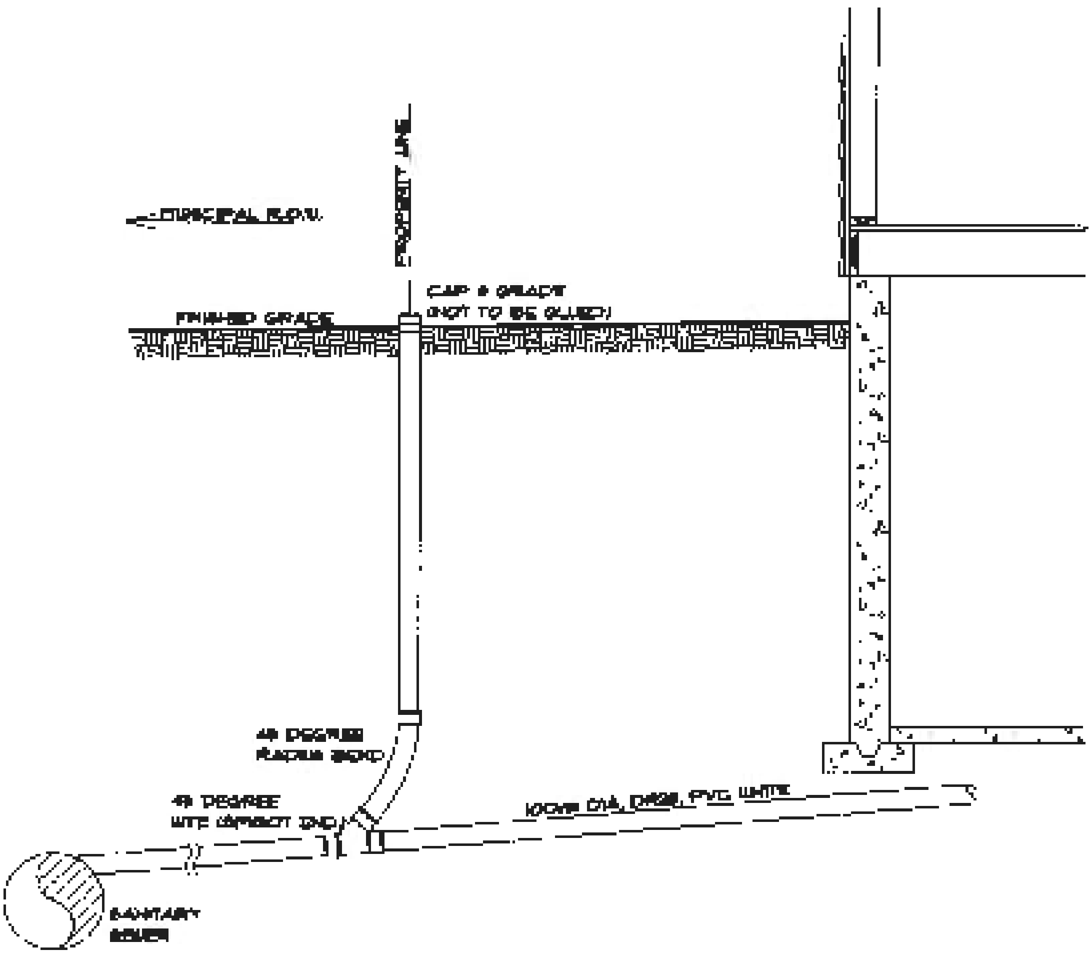
S:\Projects\2017\17125\Millbrook External SAN\17125+16119+19121-Millbrook Ext. SAN\17125-FIG-Millbrook-SAN-External-Apr15-2020.dwg, 6/4/2020 10:53:58 AM



NOTES:

1. [illegible] MIN. BETWEEN SEWER & WATER SERVICE CONNECTIONS AT CENTRE OF LOT.
2. STORM SEWER SERVICES 1.5m MIN. FROM LOT LINE.
3. GATEMAN VALVES, HYDRANTS & CATCHBASINS NOT TO BE LOCATED IN WALKWAYS OR DRIVEWAYS.
4. ALL SERVICES TO RUN IN A STRAIGHT LINE PERPENDICULAR TO CENTERLINE OF ROAD FROM MAIN TO PROPERTY LINE.

TOWNSHIP OF CAVAN MONAGHAN	TYPICAL SERVICING LAYOUT	STD. S1
	SCALE: NOT TO SCALE	
	DATE: AUGUST 2013	



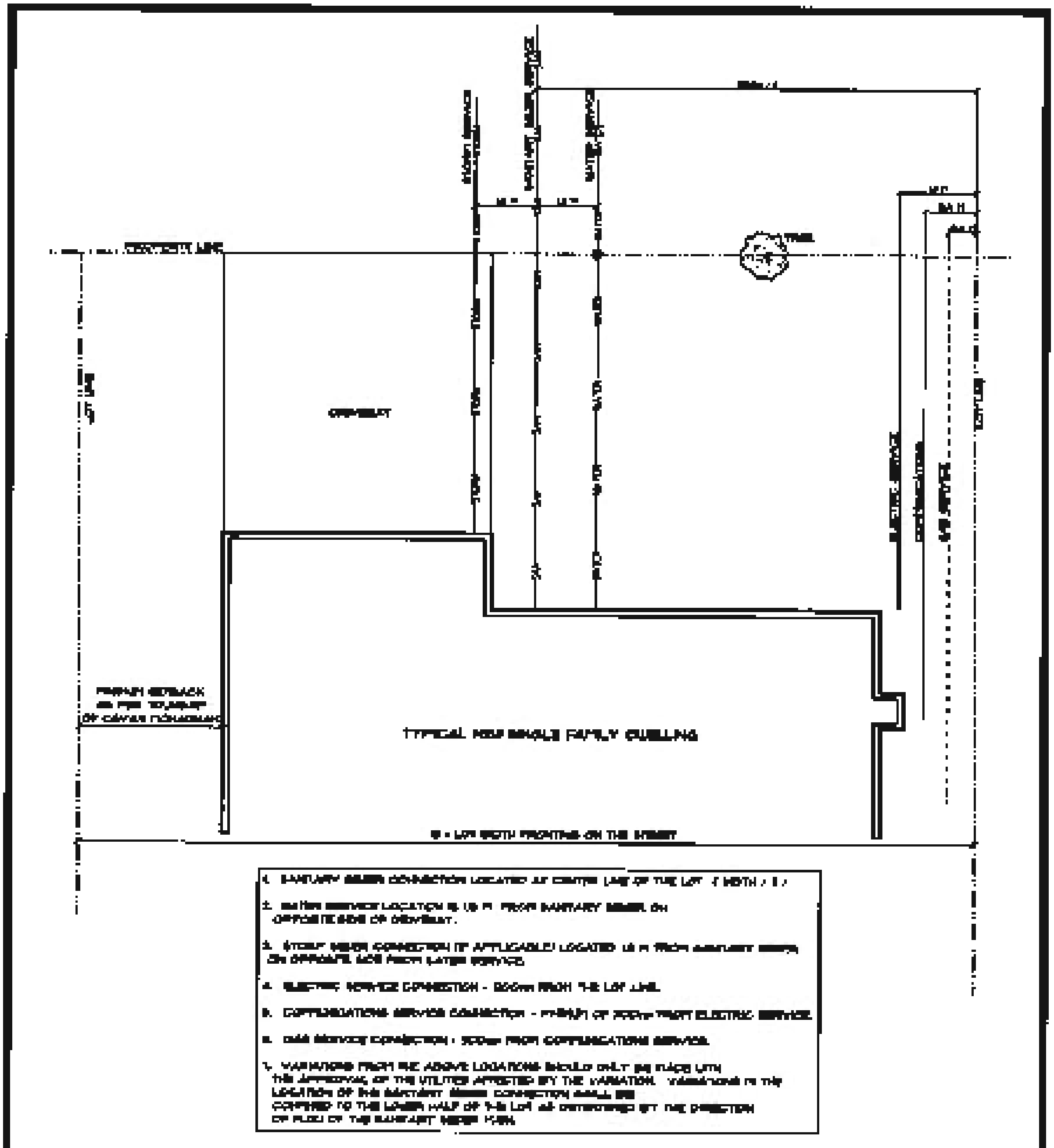
TOWNSHIP OF CAVAN MONAGHAN

SANITARY SERVICE CONNECTION WITH CLEAN-OUT

SCALE: NOT TO SCALE

DATE: AUGUST 2013

STD. S3



TOWNSHIP OF CAVAN MONAGHAN

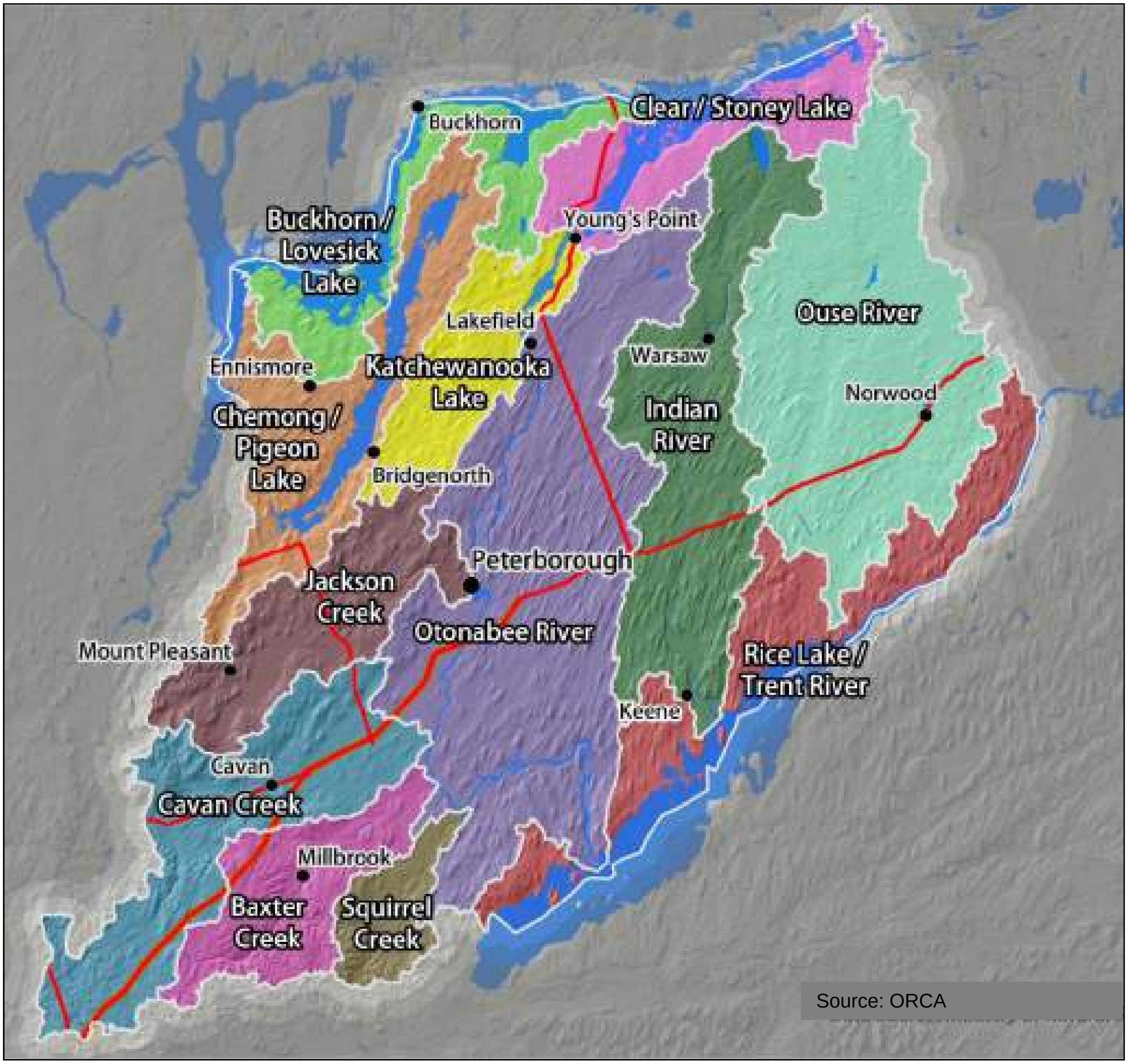
TYPICAL SERVICE CONNECTION LOCATIONS FOR SINGLE FAMILY DWELLING

SCALE: NOT TO SCALE

DATE: AUGUST 2013

APPENDIX "C"

Storm Drainage Details



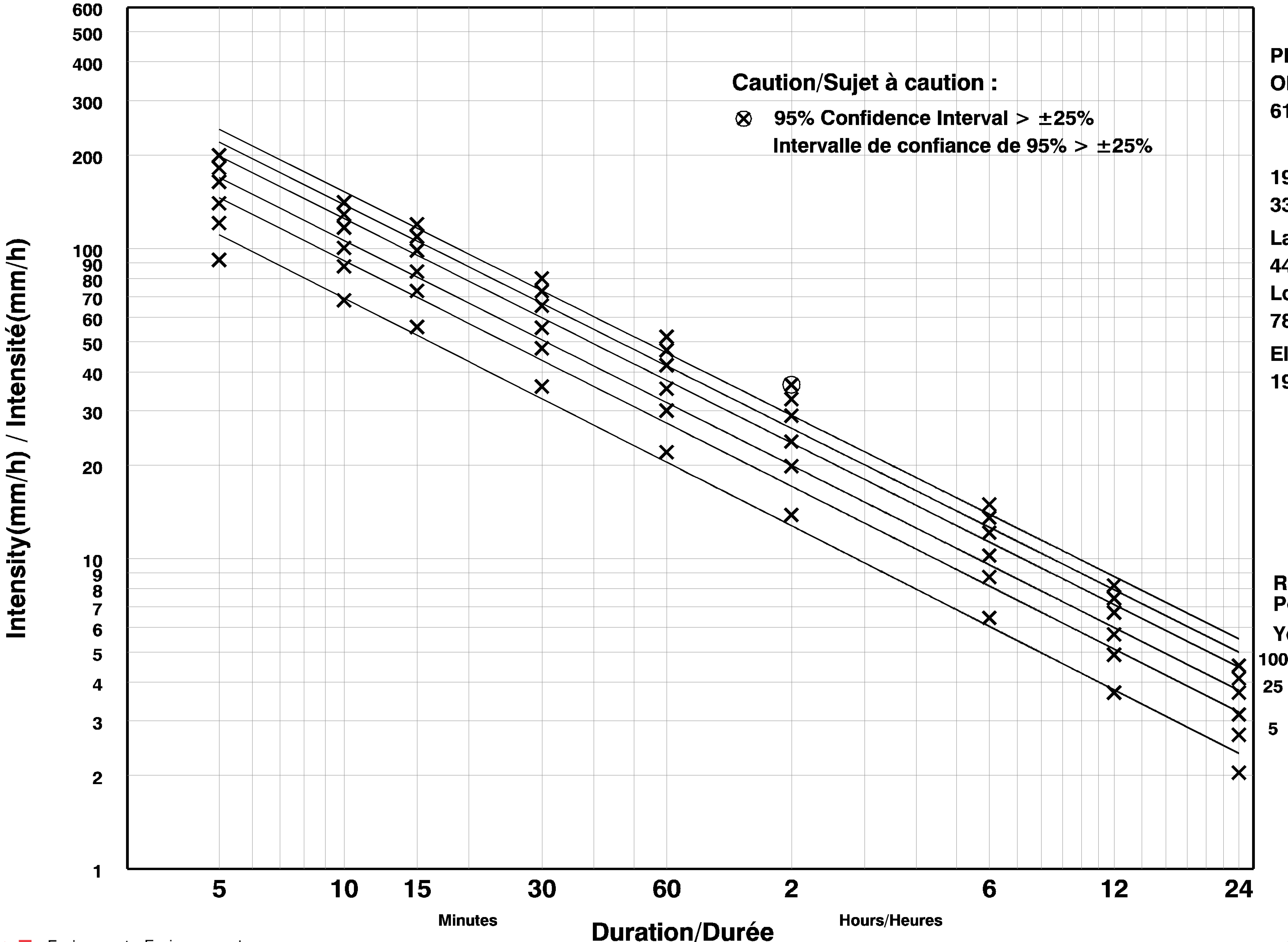
Clear / Stoney Lake
Buckhorn
Buckhorn / Lovesick Lake
Young's Point
Lakefield
Ouse River
Warsaw
Ennismore
Katchewanooka Lake
Norwood
Chemong / Pigeon Lake
Indian River
Bridgenorth
Peterborough
Jackson Creek
Otonabee River
Mount Pleasant
Rice Lake / Trent River
Keene
Cavan
Cavan Creek
Millbrook
Baxter Creek
Squirrel Creek
Source: ORCA

OTONABEE REGION CONSERVATION AUTHORITY LANDS

Short Duration Rainfall Intensity-Duration-Frequency Data

2014/12/21

Données sur l'intensité, la durée et la fréquence des chutes de pluie de courte durée



PETERBOROUGH A
ON
6166418

1971 - 2006
33 years / ans

Latitude
44° 14'N
Longitude
78° 22'W
Elevation / Altitude
191 m

Return Periods/
Périodes de retour
Years / ans

Intensity Duration Frequency Statistics for Peterborough

Location - Peterborough Airport 2014 Data

Rainfall Intensity = a/(Tc+b)^c

Tc = Time of Concentration

2 Year Return Period		
a	b	c
583.351	6.010	0.773
Duration	**Intensity**	
5	92.0	
10	68.2	
15	56.0	
30	35.9	
60	22.1	
120	13.9	
360	6.4	
720	3.7	
1440	2.0	

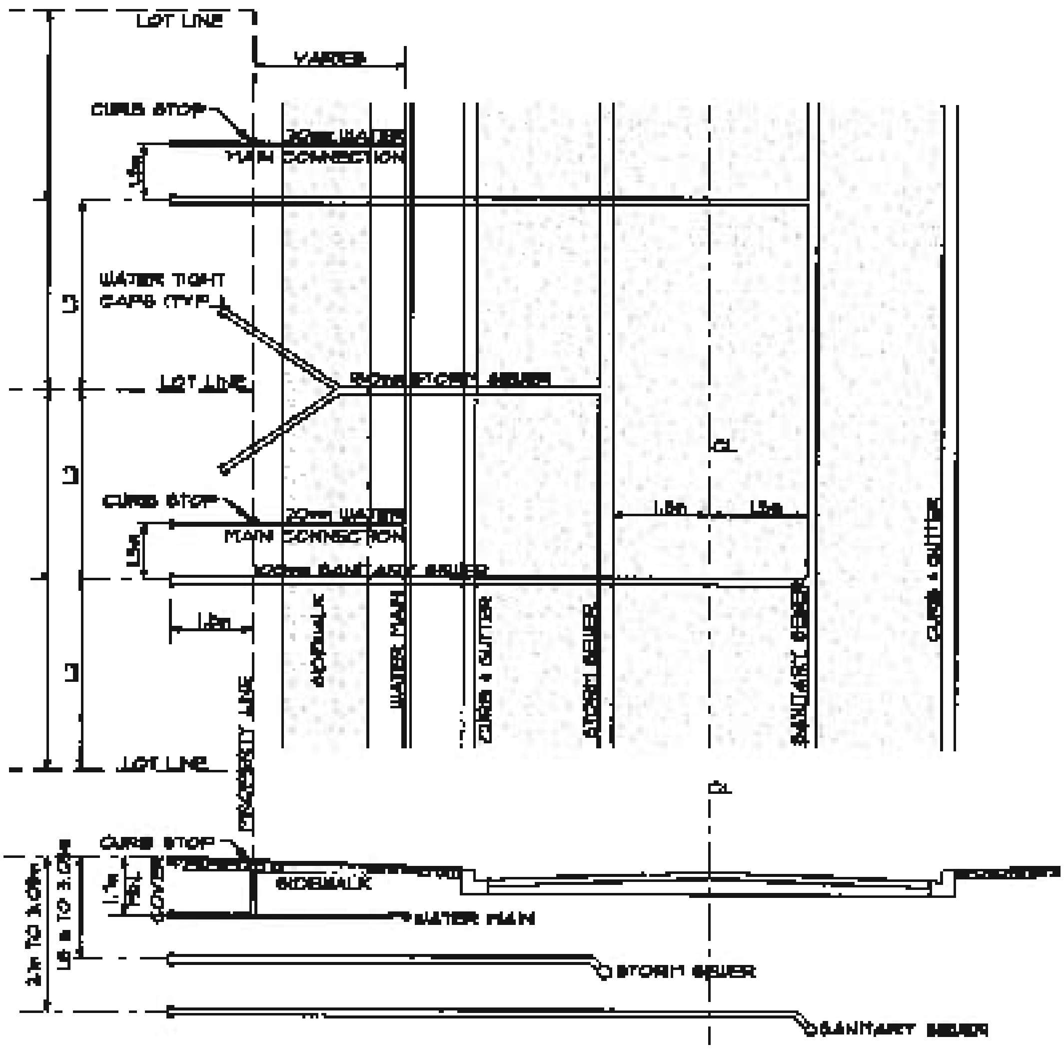
5 Year Return Period		
a	b	c
843.799	7.500	0.783
Duration	**Intensity**	
5	121.0	
10	87.7	
15	73.1	
30	47.8	
60	30.1	
120	19.9	
360	8.7	
720	4.9	
1440	2.7	

10 Year Return Period		
a	b	c
1034.243	8.265	0.791
Duration	**Intensity**	
5	140.2	
10	100.7	
15	84.5	
30	55.6	
60	35.4	
120	23.9	
360	10.2	
720	5.7	
1440	3.1	

25 Year Return Period		
a	b	c
1263.414	9.012	0.795
Duration	**Intensity**	
5	164.4	
10	117.0	
15	98.8	
30	65.5	
60	42.1	
120	29.0	
360	12.2	
720	6.7	
1440	3.7	

50 Year Return Period		
a	b	c
1468.915	9.751	0.801
Duration	**Intensity**	
5	182.3	
10	129.1	
15	109.4	
30	72.9	
60	47.1	
120	32.7	
360	13.6	
720	7.5	
1440	4.1	

100 Year Return Period		
a	b	c
1696.952	10.502	0.808
Duration	**Intensity**	
5	200.2	
10	141.1	
15	120.0	
30	80.2	
60	52.0	
120	36.4	
360	15.0	
720	8.2	
1440	4.5	



NOTES:

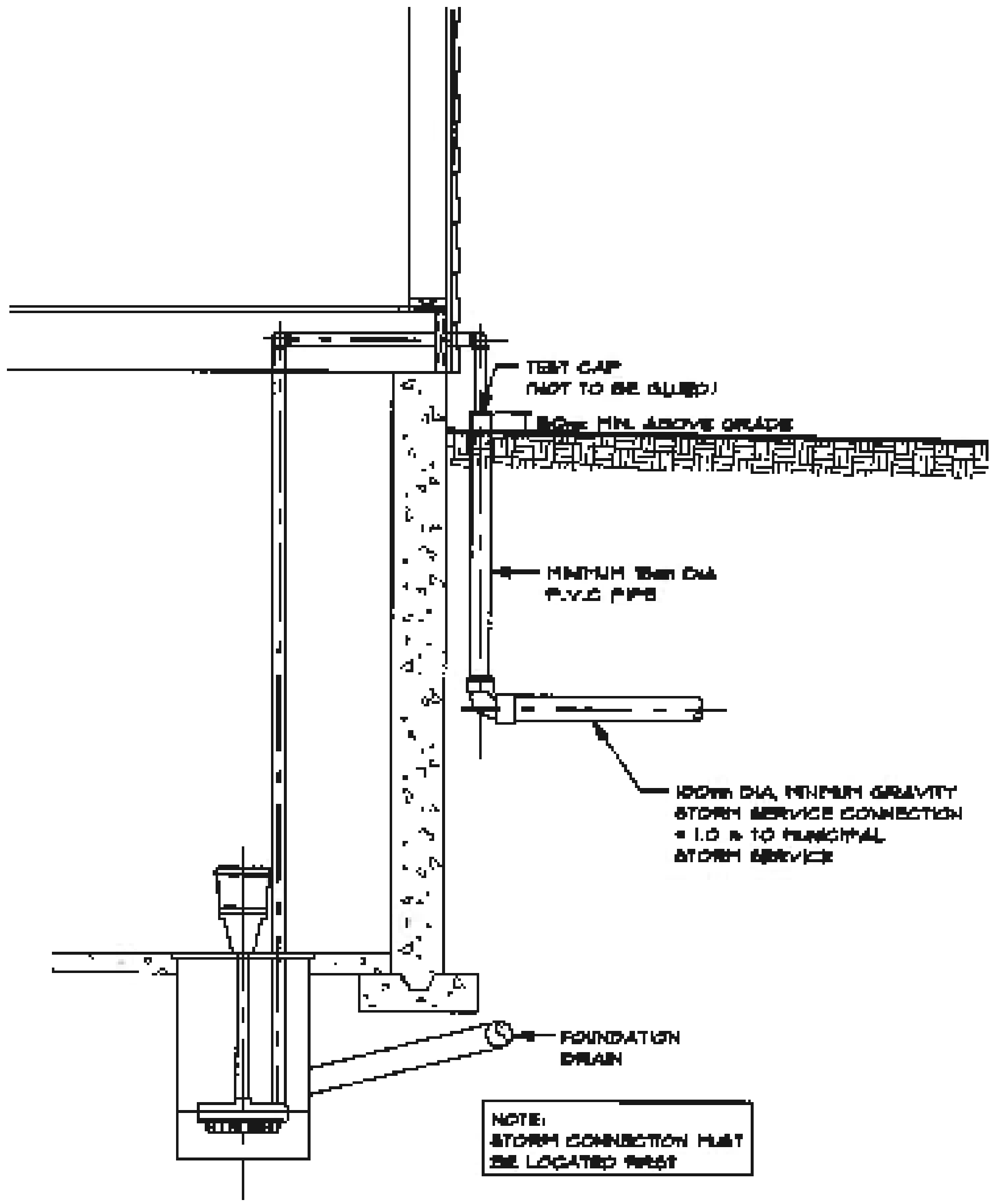
1. WATERTIGHT CAPS ON ALL SERVICES.
2. ALL DIMENSIONS SHOWN ARE CENTRE TO CENTRE.
3. STORM PIPE MATERIALS IS TO BE PVC SDR 28 AND WHITE IN COLOUR
4. L = FRONTAGE OF ONE UNIT

TOWNSHIP OF CAVAN MONAGHAN

STORM SERVICE RESIDENTIAL SERVICE CONNECTION

SCALE: NOT TO SCALE

DATE: AUGUST 2016



TOWNSHIP OF CAVAN MONAGHAN

SUMP PUMP TO STORM SEWER CONNECTION

SCALE: NOT TO SCALE

DATE: AUGUST 2013

STD. S2

APPENDIX "D"

Flood Plain Analysis

VALDOR ENGINEERING INC.
Project: Millbrook Subdivision, Phase 2
File: 17125
Date: April 2020

Table D.1: VO5 Model Parameters - Floodplain Drainage Area

Subcatchment	Area (ha)	VO5 Routine	TIMP	XIMP	CN II	IA (mm)	Tp (hr)
101	619.42	NasHyd	-	-	71	7.1	2.09
102	39.69	NasHyd	-	-	84	6.9	0.27
103	289.68	NasHyd	-	-	74	7.0	1.46
104	79.44	NasHyd	-	-	64	7.6	1.02
105	13.65	NasHyd	-	-	78	7.9	0.63
106	13.86	NasHyd	-	-	84	7.0	0.22
107	28.41	NasHyd	-	-	79	7.0	0.66
108	33.73	NasHyd	-	-	80	7.0	1.05
109	2.78	NasHyd	-	-	58	8.0	0.33
110	74.04	NasHyd	-	-	78	7.4	0.66
Total	**1,194.70**						

VALDOR ENGINEERING INC.
Project: Millbrook Subdivision, Phase 2
File: 17125
Date: April 2020

Table D.2: Calculation of CN Values, Initial Abstractions and Runoff Coefficients

Subcatchment	Area (ha)	Land Use and Land Cover		CN II	Area Weighted CN II	IA (mm)	Area Weighted IA (mm)	C-Value	Area Weighted C-Value
		Type	Area (ha)						
		Row Crops (HSG 'B')	289.42	81		**7**		0.35	
		Forest (HSG 'B')	105.02	55		**10**		0.25	
		Meadow (HSG 'B')	55.36	44		**8**		0.28	
		Low-Density Dev. (HSG 'B')	115.53	68		**4.4**		0.40	
101	619.42	Row Crops (HSG 'C')	41.37	88	**71**	**7**	**7.1**	0.55	**0.36**
		Forest (HSG 'C')	4.80	70		**10**		0.35	
		Meadow (HSG 'C')	1.08	58		**8**		0.40	
		Low-Density Dev. (HSG 'C')	0.00	79		**4.4**		0.50	
		Other Impervious	6.84	98		**2**		0.95	
		Row Crops (HSG 'B')	24.08	81		**7**		0.35	
		Forest (HSG 'B')	0.00	55		**10**		0.25	
		Meadow (HSG 'B')	0.00	44		**8**		0.28	
		Low-Density Dev. (HSG 'B')	0.00	68		**4.4**		0.40	
102	39.69	Row Crops (HSG 'C')	14.79	88	**84**	**7**	**6.9**	0.55	**0.44**
		Forest (HSG 'C')	0.00	70		**10**		0.35	
		Meadow (HSG 'C')	0.00	58		**8**		0.40	
		Low-Density Dev. (HSG 'C')	0.00	79		**4.4**		0.50	
		Other Impervious	0.82	98		**2**		0.95	
		Row Crops (HSG 'B')	165.41	81		**7**		0.35	
		Forest (HSG 'B')	28.02	55		**10**		0.25	
		Meadow (HSG 'B')	15.15	44		**8**		0.28	
		Low-Density Dev. (HSG 'B')	48.01	68		**4.4**		0.40	
103	289.68	Row Crops (HSG 'C')	9.77	88	**74**	**7**	**7.0**	0.55	**0.36**
		Forest (HSG 'C')	16.32	70		**10**		0.35	
		Meadow (HSG 'C')	1.04	58		**8**		0.40	
		Low-Density Dev. (HSG 'C')	2.16	79		**4.4**		0.50	
		Other Impervious	3.80	98		**2**		0.95	
		Row Crops (HSG 'B')	38.96	81		**7**		0.35	
		Forest (HSG 'B')	8.22	55		**10**		0.25	
		Meadow (HSG 'B')	31.24	44		**8**		0.28	
		Low-Density Dev. (HSG 'B')	0.00	68		**4.4**		0.40	
104	79.44	Row Crops (HSG 'C')	0.00	88	**64**	**7**	**7.6**	0.55	**0.32**
		Forest (HSG 'C')	0.00	70		**10**		0.35	
		Meadow (HSG 'C')	0.00	58		**8**		0.40	
		Low-Density Dev. (HSG 'C')	0.00	79		**4.4**		0.50	
		Other Impervious	1.02	98		**2**		0.95	
		Row Crops (HSG 'B')	6.02	81		**7**		0.35	
		Forest (HSG 'B')	0.43	55		**10**		0.25	
		Meadow (HSG 'B')	0.51	44		**8**		0.28	
		Low-Density Dev. (HSG 'B')	0.00	68		**4.4**		0.40	
105	13.65	Row Crops (HSG 'C')	3.20	88	**78**	**7**	**7.9**	0.55	**0.39**
		Forest (HSG 'C')	3.49	70		**10**		0.35	
		Meadow (HSG 'C')	0.00	58		**8**		0.40	
		Low-Density Dev. (HSG 'C')	0.00	79		**4.4**		0.50	
		Other Impervious	0.00	98		**2**		0.95	

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Table D.2 (Cont'd): Calculation of CN Values, Initial Abstractions and Runoff Coefficients

Subcatchment	Area (ha)	Land Use and Land Cover		CN II	Area Weighted CN II	IA (mm)	Area Weighted IA (mm)	C-Value	Area Weighted C-Value
		Type	Area (ha)						
		Row Crops (HSG 'B')	7.44	81		**7**		0.35	
		Forest (HSG 'B')	0.00	55		**10**		0.25	
		Meadow (HSG 'B')	0.00	44		**8**		0.28	
		Low-Density Dev. (HSG 'B')	0.00	68		**4.4**		0.40	
106	13.86	Row Crops (HSG 'C')	6.25	88	**84**	**7**	**7.0**	0.55	**0.44**
		Forest (HSG 'C')	0.17	70		**10**		0.35	
		Meadow (HSG 'C')	0.00	58		**8**		0.40	
		Low-Density Dev. (HSG 'C')	0.00	79		**4.4**		0.50	
		Other Impervious	0.00	98		**2**		0.95	
		Row Crops (HSG 'B')	24.64	81		**7**		0.35	
		Forest (HSG 'B')	0.00	55		**10**		0.25	
		Meadow (HSG 'B')	3.27	58		**8**		0.28	
		Low-Density Dev. (HSG 'B')	0.00	68		**4.4**		0.40	
107	28.41	Row Crops (HSG 'C')	0.00	88	**79**	**7**	**7.0**	0.55	**0.35**
		Forest (HSG 'C')	0.00	70		**10**		0.35	
		Meadow (HSG 'C')	0.00	58		**8**		0.40	
		Low-Density Dev. (HSG 'C')	0.00	79		**4.4**		0.50	
		Other Impervious	0.50	98		**2**		0.95	
		Row Crops (HSG 'B')	31.39	81		**7**		0.35	
		Forest (HSG 'B')	0.00	55		**10**		0.25	
		Meadow (HSG 'B')	1.70	58		**8**		0.28	
		Low-Density Dev. (HSG 'B')	0.00	68		**4.4**		0.40	
108	33.73	Row Crops (HSG 'C')	0.00	88	**80**	**7**	**7.0**	0.55	**0.36**
		Forest (HSG 'C')	0.00	70		**10**		0.35	
		Meadow (HSG 'C')	0.00	58		**8**		0.40	
		Low-Density Dev. (HSG 'C')	0.00	79		**4.4**		0.50	
		Other Impervious	0.64	98		**2**		0.95	
		Row Crops (HSG 'B')	0.00	81		**7**		0.35	
		Forest (HSG 'B')	0.00	55		**10**		0.25	
		Meadow (HSG 'B')	1.89	58		**8**		0.28	
		Low-Density Dev. (HSG 'B')	0.00	68		**4.4**		0.40	
109	2.78	Row Crops (HSG 'C')	0.00	88	**58**	**7**	**8.0**	0.55	**0.32**
		Forest (HSG 'C')	0.00	70		**10**		0.35	
		Meadow (HSG 'C')	0.89	58		**8**		0.40	
		Low-Density Dev. (HSG 'C')	0.00	79		**4.4**		0.50	
		Other Impervious	0.00	98		**2**		0.95	
		Row Crops (HSG 'B')	53.66	81		**7**		0.35	
		Forest (HSG 'B')	9.74	55		**10**		0.25	
		Meadow (HSG 'B')	0.00	58		**8**		0.28	
		Low-Density Dev. (HSG 'B')	0.00	68		**4.4**		0.40	
110	74.04	Row Crops (HSG 'C')	7.20	88	**78**	**7**	**7.4**	0.55	**0.37**
		Forest (HSG 'C')	2.33	70		**10**		0.35	
		Meadow (HSG 'C')	0.00	58		**8**		0.40	
		Low-Density Dev. (HSG 'C')	0.00	79		**4.4**		0.50	
		Other Impervious	1.12	98		**2**		0.95	

Note: All agricultural areas were assumed to have 2% imperviousness to account for roads, houses, etc., except for *Catchments 105, 106* and *109* .

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Table D.3: Calculation of Time to Peak									
Subcatchment	**A Area (ha)**	**C Runoff Coefficient**	**L Catchment Length (m)**	**Highest Elevation (m)**	**Lowest Elevation (m)**	**S Catchment Slope (%)**	**[1,2] T_c Method**	**T_c (min)**	**T_p (hr)**
101	619.42	0.36	6781	320.00	237.00	1.22	Airport	186.8	2.09
102	39.69	0.44	1010	354.00	237.00	11.58	Bransby-Williams	24.4	0.27
103	289.68	0.36	4294	316.00	240.40	1.76	Airport	131.0	1.46
104	79.44	0.32	2375	300.00	240.40	2.51	Airport	91.5	1.02
105	13.65	0.39	495	240.40	236.58	0.77	Airport	56.0	0.63
106	13.86	0.44	552	251.00	234.49	2.99	Bransby-Williams	19.4	0.22
107	28.41	0.35	1134	278.00	247.00	2.73	Airport	58.9	0.66
108	33.73	0.36	2303	278.00	234.49	1.89	Airport	94.1	1.05
109	2.78	0.32	309	245.20	234.03	3.61	Airport	29.3	0.33
110	74.04	0.37	710	234.03	225.00	1.27	Airport	58.9	0.66

Notes:
1) T_p calculation for catchments with C < 0.40 is based on the Airport Formula:

$$T_c = \frac{3.26 \times (1.1 - C) \times L^{0.5}}{S_w^{0.33}}$$

2) T_p calculation for catchments with C > 0.40 is based on the Bransby-Williams Formula:

$$T_c = \frac{(0.057)(L)}{(S_w)^{0.2}(A)^{0.1}}$$

$$T_P = 0.67 T_c$$

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Table D.4: Critical Storm Analysis

Return Period	Distribution	Peak Flow (m^3/s)					
		Flow Node #1	**Flow Node #2**	**Flow Node #3**	**Flow Node #4**	**Flow Node #5**	**Flow Node #6**
100-year	**6-hour AES**	4.873	14.520	26.162	28.572	31.279	1.851
	12-hour AES	3.515	14.457	25.218	27.333	29.792	1.598
	24-hour AES	2.183	13.349	22.894	24.749	26.921	1.250
	6-hour SCS	**5.881**	14.392	25.668	27.931	30.495	1.962
	12-hour SCS	5.777	14.562	25.882	28.127	30.783	1.959
	24-hour SCS	5.610	14.617	25.478	27.637	30.812	1.919
	4-hour Chicago	4.216	11.590	20.435	22.217	24.185	1.474
Regional	**Timmins Storm**	4.131	**29.637**	**49.855**	**53.519**	**57.571**	**2.228**

Notes:
1) 100-year storm files were created using the latest Peterborough Airport IDF data (1971-2006).
2) The Timmins storm is the Regulatory storm used to delineate the Regulatory floodlines.

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Table D.5: HEC-RAS Flow Input Summary

Flow Node #	HEC-RAS Flow Change Location	Regulatory Flow (cms)
1	XS-1.970	4.131
2	XS-1.637	29.637
3	XS-1.517	49.855
4	XS-1.259	53.519
5	XS-1.044	57.571

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Table D.6: HEC-RAS Output - Regional Flow

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	# Chl
North_Trib	1.970	Regional	4.13	240.40	241.10	241.10	241.17	0.007289	1.36	7.48	63.67	0.67
North_Trib	1.861	Regional	4.13	238.76	239.49	239.48	239.62	0.011036	1.68	3.41	21.2	0.82
North_Trib	1.774	Regional	4.13	238.07	238.53	238.53	238.62	0.011982	1.55	5.47	37.04	0.84
North_Trib	1.659	Regional	4.13	237.28	238.18		238.18	0.000046	0.17	73.74	151.51	0.06
North_Trib	1.637	Regional	29.64	236.23	238.17		238.17	0.00017	0.44	200.02	238.69	0.11
North_Trib	1.517	Regional	49.86	235.80	238.14		238.15	0.000171	0.62	260.06	215.42	0.13
North_Trib	1.352	Regional	49.86	235.50	238.12		238.13	0.000195	0.71	187.95	120.37	0.15
North_Trib	1.259	Regional	53.52	234.90	238.09		238.11	0.000302	1.01	165.61	117.24	0.19
North_Trib	1.136	Regional	53.52	234.04	238.09		238.09	0.000058	0.51	312.56	145.06	0.08
North_Trib	1.098	Regional	53.52	233.78	237.56	236.27	237.96	0.002074	2.92	20.72	108.18	0.5
North_Trib	1.071		Culvert									
North_Trib	1.044	Regional	57.57	233.62	236.66	236.16	237.39	0.005087	3.92	16.4	72.12	0.76
North_Trib	1.000	Regional	57.57	233.30	235.20		235.30	0.003281	2.15	57.1	50.02	0.55
North_Trib	0.798	Regional	57.57	231.49	233.73	233.73	234.19	0.013918	4.92	32.15	33.09	1.11
North_Trib	0.761	Regional	57.57	231.02	232.67	232.62	233.02	0.012613	4.2	35.11	39.42	1.07

Bypass Channel: 0.5% Slope, Uncontrolled Regional Flow

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.050	
Channel Slope	0.00500	m/m
Left Side Slope	3.00	m/m (H:V)
Right Side Slope	3.00	m/m (H:V)
Bottom Width	11.00	m
Discharge	6.415	m³/s

Results

Normal Depth	0.57	m
Flow Area	7.24	m²
Wetted Perimeter	14.60	m
Hydraulic Radius	0.50	m
Top Width	14.42	m
Critical Depth	0.32	m
Critical Slope	0.03729	m/m
Velocity	0.89	m/s
Velocity Head	0.04	m
Specific Energy	0.61	m
Froude Number	0.40	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	m
Length	0.00	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	m
Profile Description		
Profile Headloss	0.00	m
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	0.57	m
Critical Depth	0.32	m
Channel Slope	0.00500	m/m

Bypass Channel: 2.0% Slope, Uncontrolled Regional Flow

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.050	
Channel Slope	0.02000	m/m
Left Side Slope	3.00	m/m (H:V)
Right Side Slope	3.00	m/m (H:V)
Bottom Width	11.00	m
Discharge	6.415	m³/s

Results

Normal Depth	0.38	m
Flow Area	4.62	m²
Wetted Perimeter	13.40	m
Hydraulic Radius	0.34	m
Top Width	13.28	m
Critical Depth	0.32	m
Critical Slope	0.03729	m/m
Velocity	1.39	m/s
Velocity Head	0.10	m
Specific Energy	0.48	m
Froude Number	0.75	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	m
Length	0.00	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	m
Profile Description		
Profile Headloss	0.00	m
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	0.38	m
Critical Depth	0.32	m
Channel Slope	0.02000	m/m

Culvert Calculator Report
Bypass Channel: Street K Culvert (2x 2.4mW x 1.2mH)

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	0.00	m	Headwater Depth/Height	0.43	
Computed Headwater Elevation	245.19	m	Discharge	2.2280	m^3/s
Inlet Control HW Elev.	245.14	m	Tailwater Elevation	245.14	m
Outlet Control HW Elev.	245.19	m	Control Type	Outlet Control	

Grades

Upstream Invert	244.68	m	Downstream Invert	244.54	m
Length	20.00	m	Constructed Slope	0.007000	m/m

Hydraulic Profile

Profile	S1		Depth, Downstream	0.60	m
Slope Type	Steep		Normal Depth	0.22	m
Flow Regime	Subcritical		Critical Depth	0.28	m
Velocity Downstream	0.77	m/s	Critical Slope	0.003351	m/m

Section

Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	2.40	m
Section Size	2400 x 1200 mm		Rise	1.20	m
Number Sections	2				

Outlet Control Properties

Outlet Control HW Elev.	245.19	m	Upstream Velocity Head	0.06	m
Ke	0.20		Entrance Loss	0.01	m

Inlet Control Properties

Inlet Control HW Elev.	245.14	m	Flow Control	Unsubmerged	
Inlet Type	90° headwall w 45° bevels		Area Full	5.8	m^2
K	0.49500		HDS 5 Chart	10	
M	0.66700		HDS 5 Scale	2	
C	0.03140		Equation Form	2	
Y	0.82000				

Table 3: *Wildlife crossing and fencing recommendations for species and habitats commonly found within the Credit River watershed*

WILDLIFE GROUP	OPENNESS RATIO (m)	CROSSING STRUCTURE DIMENSIONS	PLACEMENT / SPACING OF CROSSING STRUCTURES	SUBSTRATE WITHIN CROSSING STRUCTURE[1]	APPROACH TO CROSSING STRUCTURE	FENCING *where fencing is to be used as standalone/ exclusion strategy, eliminate ramps/ gates/ fence openings from design	OTHER CONSIDERATIONS
Large mammals ***e.g. deer, coyote***	• 0.6-1.0 for ungulates • 0.2 for other large mammals	• Recommend width and height both ≥3 m, but no less than 2 m tall • For ungulates, length should not be > 90 m without an open median	• Dependent on topography (i.e. valley over 3 m), habitat and target species • Ideally spaced every 1.5 km	• Natural, dry substrate that is vegetated where possible • Avoid use of rip-rap • If medium-large sized stone is required, fill interstitial spaces with material appropriate for wildlife footing	• Natural vegetative cover adjacent to entrances, while maintaining clear line-of-sight	• Galvanized steel chain-link fencing, retaining wall or similar, 2.8 m tall with posts every 4-5 m • Bottom of fence buried 20-40 cm underground to prevent animals from digging under • Angling fence away from road may prevent animals from climbing over • Fence should extend a min. 500 m on either side of crossing and incorporate earthen ramps or one-way gates every 0.5-1 km	• Minimal or no human use of structure • On highways, an open median can increase light levels and reduce tunnel effect, encouraging use of structure by deer
Mid-sized mammals ***e.g. fox, raccoon, skunk***	• Recommend ≥0.4, but no less than 0.1	• Width and height each ≥1 m	• Ideally spaced every 150-300 m • Multiple crossings are typically not required for this wildlife group. Incorporate dry passage for mid-sized mammals into crossing structures for other wildlife where possible.	• For dry culverts, install natural substrate with some cover (e.g. branches, debris) to provide refuge from predators • If medium-large sized stone is required, fill interstitial spaces with material appropriate for wildlife footing	• Natural cover (e.g. woody debris, flat rocks), and native vegetation near to entrances and leading to adjacent habitat	• Galvanized steel chain-link fence, retaining wall or similar, 1-2 m high • Bottom of fence buried 20-40 cm underground to prevent animals from digging under • Fence should extend a minimum 500 m on either side of the crossing and incorporate escape routes (earthen ramps or one-way gates) every 0.5-1 km	• Incorporate dry terrestrial passage zone at least 0.5-0.7 m in width (preferably 1 m) on either side of a watercourse • Incorporate elevated ledges in structures with no terrestrial passage zone • Cutback adjacent vegetation from fencing structures to prevent arboreal species from climbing over the fencing and into the ROW
Small mammals ***e.g. mouse, vole, squirrel***	• 0.05	• Width and height each 0.3-1.0 m	• Ideally spaced every 50m • Multiple crossings are typically not required for this wildlife group. Incorporate dry passage for small mammals into crossing structures for other wildlife where possible.	• Dry culverts - install natural substrate with some cover (e.g. branches, debris) to provide refuge from predators • Avoid rip-rap as this can impede animal movement • If medium-large sized stone is required, fill interstitial spaces with material appropriate for wildlife footing	• Natural cover and native vegetation near to entrances and leading to adjacent habitat	• Solid permanent material (e.g. concrete, aluminum), Animex, ACO or equivalent fencing, or hardware cloth with ¼ inch mesh or less • 1-1.8 m tall, depending on the jumping/climbing ability of the target species, and with a 15 cm wide lip along the top edge angled away from the road at 45° to prevent animals from climbing over • Bottom of fence buried 10-20 cm • Cloth fencing can be attached to the bottom of fencing for larger wildlife • Consider backfilling with natural soil and plant materials on side of fence adjacent to road. This may decrease impacts from snow collection, allow animals that become trapped in the ROW to climb over and decrease any visual/ aesthetic concerns	• Many species prefer dark lighting conditions • Incorporate dry terrestrial passage zone at least 0.5-0.7 m in width (preferably 1 m) on either side of a watercourse • Incorporate elevated ledges in structures with no terrestrial passage zone • Cutback adjacent vegetation from fencing structures to prevent arboreal species from climbing over the fencing and into the ROW • Incorporate cover structures within dry passage area of crossing (i.e. brush piles, roots, rock, grass)
Amphibians and Reptiles ***e.g. frog, salamander, turtle, snake***	• Turtles recommend ≥0.25, but no less than 0.1 • Amphibians and snakes recommend ≥0.1, but no less than 0.07	• Recommend width and height both ≥1 m, but no less than 0.5 m • Length ideally less than 25 m	• Ideally aligned with predictable movement paths (e.g. annual migration routes) • Structures should be no more than 50-100 m apart for amphibians (depending on migration radius of species) and 150-300 m apart for reptiles	• For dry culverts, install natural substrate with some cover (e.g. native soil, leaf litter, branches, debris, sod) to provide refuge from predators • Many species prefer/require moist substrate • Avoid large rocks and rip-rap • If medium-large sized stone is required, fill interstitial spaces with material appropriate for wildlife footing	• Natural cover but not obstructing entrance • Minimal/low growing vegetation to maintain clear path and line-of-sight	• Solid permanent material (e.g. concrete, aluminum), Animex, ACO or equivalent fencing, or hardware cloth with ¼ inch mesh or less • Height 0.4-1.2 m, depending on jumping/climbing ability of the target species. MNRF recommends a minimum height of 30 cm for salamanders, 60cm for turtles and 100 cm for snakes and anurans • Include a curved design or a 15 cm wide lip along the top edge angled away from the road at 45° to prevent animals from climbing over • Bottom of fence buried 10-20 cm • Fence should extend 100 m on each side of crossing structure • Cloth can be attached to the bottom of tall fencing	• Ambient light, temperature and moisture conditions maintained where possible; can be facilitated through the addition of slots/grates • Utilize cover structure (i.e. brush piles) at entry and exit of structure while ensuring clear line of site through the structure is maintained. • Steel is not a desirable material for structures due to its conductivity, which makes it cold during the spring migratory period • Polymer concrete maintains temperature and moisture conditions • Turtles prefer crossings with standing water or moderate flow

[1] Any engineered substrate of culverts/bridges must meet hydraulic/geomorphological requirements

						• Consider backfilling with natural soil and plant materials on side of fence adjacent to road. This may decrease impacts from snow collection, allow animals that become trapped in the ROW to climb over and decrease any visual/ aesthetic concerns	• Incorporate 0.5-1.0 m of terrestrial/ riparian passage zone on either side of a watercourse • Incorporate ledges in structures with no terrestrial passage
Fish	• N/A	• Preferred hierarchy of crossing structure: bridge> open box> closed box > CSP • Minimum bankfull span • Culvert not perched	• All watercourses	• Open bottom is required to maintain natural stream substrate and processes • Native substrate if closed bottom • Backfill with native substrate consistent with the existing upstream substrate size and texture • If stone is part of the design rounded or sub-angular is required.	• 10-20% embedded • Vegetation to provide stream shading • Pools U/S & D/S of culvert • Natural stream gradient should be maintained U/S, D/S and through the watercourse crossing. • Ensure low flow channel provided within structure. Minimum depth of water in low flow 15-20cm.	• N/A	• Match habitat conditions (e.g. stone sizing) inside the structure to natural conditions. If not possible, ensure conditions (e.g. water velocity and depth) allow passage. • Consider baffles as part of design for retrofits • Design for 0% slope in culvert where feasible • For slopes > 5% contact CVC planning ecology • Consider fish passage capabilities in relation to flows through the structure and swimming speeds of target fish species/ groups.. Refer to table in Appendix 2 for swimming speeds of various species/groups of fish.

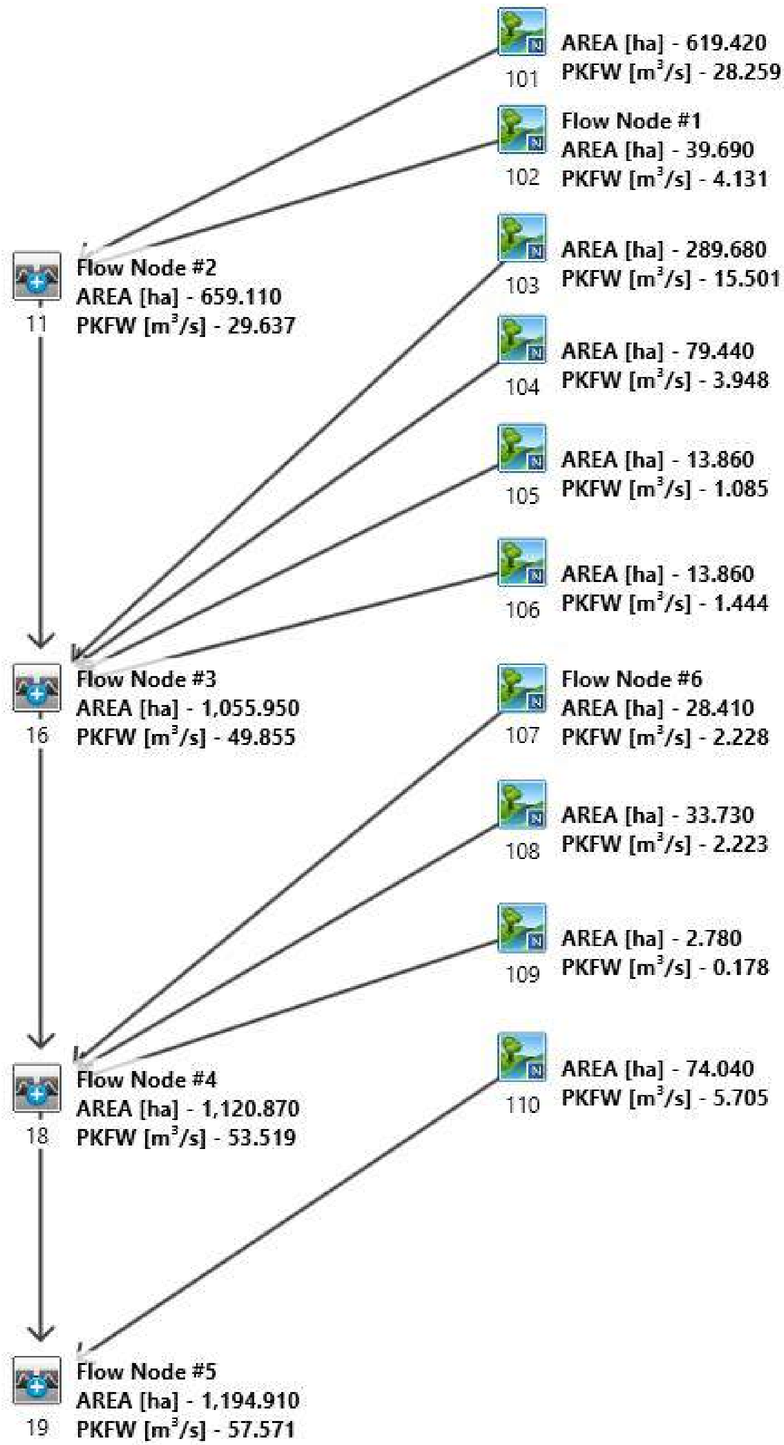

Figure D.1: VO5 Model Schematic – Floodplain Drainage Area

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==========================================================================================
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       V    V   I    SSSSS  U   U    A    L             (v 5.1.2000)
       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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                   *****  S U M M A R Y   O U T P U T  *****


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DATE: 04-16-2020                           TIME: 04:12:50

USER:


COMMENTS: ____________________________________________________________


  ************************************************
  ** SIMULATION : AES_06H_100Y                  **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                 15.0
    [ Ptot= 89.91 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\18d0c31e-dd18-495d-b10c-0705
    remark: AES_06H_100Y
*
 ** CALIB NASHYD         0101  1 10.0  619.42   14.24  5.00  36.76 0.41   0.000
    [CN=71.0         ]
    [ N = 3.0:Tp 2.09]
*
    READ STORM                 15.0
    [ Ptot= 89.91 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\18d0c31e-dd18-495d-b10c-0705
    remark: AES_06H_100Y
*
 ** CALIB NASHYD         0102  1 10.0   39.69    4.87  2.83  51.99 0.58   0.000
    [CN=84.0         ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0101+  0102]  0011  3 10.0  659.11   14.52  5.00  37.68  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 89.91 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\18d0c31e-dd18-495d-b10c-0705
    remark: AES_06H_100Y
*
 ** CALIB NASHYD         0103  1 10.0  289.68    9.57  4.33  39.93 0.44   0.000
    [CN=74.0         ]
    [ N = 3.0:Tp 1.46]
*
    READ STORM                 15.0
    [ Ptot= 89.91 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\18d0c31e-dd18-495d-b10c-0705
    remark: AES_06H_100Y
*
 ** CALIB NASHYD         0104  1 10.0   79.44    2.52  3.83  30.08 0.33   0.000
    [CN=64.0         ]
    [ N = 3.0:Tp 1.02]
*
    READ STORM                 15.0
    [ Ptot= 89.91 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\18d0c31e-dd18-495d-b10c-0705
    remark: AES_06H_100Y
*
 ** CALIB NASHYD         0105  1 10.0   13.86    0.89  3.33  43.76 0.49   0.000
    [CN=78.0         ]
    [ N = 3.0:Tp 0.63]
*
    READ STORM                 15.0
    [ Ptot= 89.91 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\18d0c31e-dd18-495d-b10c-0705
    remark: AES_06H_100Y
*
 ** CALIB NASHYD         0106  1 10.0   13.86    1.77  2.83  51.39 0.57   0.000
    [CN=84.0         ]
    [ N = 3.0:Tp 0.22]
*
    ADD [  0103+  0104]  0016  3 10.0  369.12   11.89  4.17  37.81  n/a   0.000
*
    ADD [  0016+  0105]  0016  1 10.0  382.98   12.42  4.17  38.03  n/a   0.000
*
    ADD [  0016+  0106]  0016  3 10.0  396.84   12.69  4.17  38.49  n/a   0.000
*
    ADD [  0016+  0011]  0016  1 10.0 1055.95   26.16  4.50  37.98  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 89.91 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\18d0c31e-dd18-495d-b10c-0705
    remark: AES_06H_100Y
*
 ** CALIB NASHYD         0107  1 10.0   28.41    1.85  3.33  45.68 0.51   0.000
    [CN=79.0         ]
    [ N = 3.0:Tp 0.66]
*
    READ STORM                 15.0
    [ Ptot= 89.91 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\18d0c31e-dd18-495d-b10c-0705
    remark: AES_06H_100Y
*
 ** CALIB NASHYD         0108  1 10.0   33.73    1.67  3.83  46.95 0.52   0.000
    [CN=80.0         ]
    [ N = 3.0:Tp 1.05]
*
    READ STORM                 15.0
    [ Ptot= 89.91 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\18d0c31e-dd18-495d-b10c-0705
```

```
    remark: AES_06H_100Y
*
 ** CALIB NASHYD         0109  1 10.0    2.78    0.14  2.83  25.14 0.28   0.000
    [CN=58.0         ]
    [ N = 3.0:Tp 0.33]
*
    ADD [  0107+  0108]  0018  3 10.0   62.14    3.37  3.50  46.37  n/a   0.000
*
    ADD [  0018+  0109]  0018  1 10.0   64.92    3.45  3.50  45.46  n/a   0.000
*
    ADD [  0018+  0016]  0018  3 10.0 1120.87   28.57  4.33  38.42  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 89.91 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\18d0c31e-dd18-495d-b10c-0705
    remark: AES_06H_100Y
*
 ** CALIB NASHYD         0110  1 10.0   74.04    4.65  3.33  44.15 0.49   0.000
    [CN=78.0         ]
    [ N = 3.0:Tp 0.66]
*
    ADD [  0110+  0018]  0019  3 10.0 1194.91   31.28  4.17  38.77  n/a   0.000
*
============================================================================================
==============


       V    V   I    SSSSS  U   U    A    L              (v 5.1.2000)
       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
Developed and Distributed by Civica Infrastructure
```



```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.1\VO2\voin.dat
  Output  filename: C:\Users\Valdor\AppData\Local\Civica\VH5\fc940250-ed07-412c-85e3-
c94b4cb6310f\50a00891-fbe2-400e-a0b9-72764faa6f8b\scena
  Summary filename: C:\Users\Valdor\AppData\Local\Civica\VH5\fc940250-ed07-412c-85e3-
c94b4cb6310f\50a00891-fbe2-400e-a0b9-72764faa6f8b\scena


DATE: 04-16-2020                           TIME: 04:12:50

USER:


COMMENTS: ______________________________________________________________


  ************************************************
  ** SIMULATION : AES_12H_100Y                  **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.    Qbase
                                  min     ha   '  cms   hrs     mm           cms

      START @  0.00 hrs
      --------------------
```

```
    READ STORM                 15.0
    [ Ptot= 98.38 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\f45c328c-4e82-4fdb-b741-0a29
    remark: AES_12H_100Y
*
 ** CALIB NASHYD         0101  1 10.0  619.42   13.89  7.50  42.72 0.43   0.000
    [CN=71.0         ]
    [ N = 3.0:Tp 2.09]
*
    READ STORM                 15.0
    [ Ptot= 98.38 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\f45c328c-4e82-4fdb-b741-0a29
    remark: AES_12H_100Y
*
 ** CALIB NASHYD         0102  1 10.0   39.69    3.52  5.17  59.32 0.60   0.000
    [CN=84.0         ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0101+  0102]  0011  3 10.0  659.11   14.46  7.33  43.72  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 98.38 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\f45c328c-4e82-4fdb-b741-0a29
    remark: AES_12H_100Y
*
 ** CALIB NASHYD         0103  1 10.0  289.68    8.94  6.67  46.23 0.47   0.000
    [CN=74.0         ]
    [ N = 3.0:Tp 1.46]
*
    READ STORM                 15.0
    [ Ptot= 98.38 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\f45c328c-4e82-4fdb-b741-0a29
    remark: AES_12H_100Y
*
 ** CALIB NASHYD         0104  1 10.0   79.44    2.27  6.17  35.27 0.36   0.000
    [CN=64.0         ]
    [ N = 3.0:Tp 1.02]
*
    READ STORM                 15.0
    [ Ptot= 98.38 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\f45c328c-4e82-4fdb-b741-0a29
    remark: AES_12H_100Y
*
 ** CALIB NASHYD         0105  1 10.0   13.86    0.77  5.50  50.48 0.51   0.000
    [CN=78.0         ]
    [ N = 3.0:Tp 0.63]
*
    READ STORM                 15.0
    [ Ptot= 98.38 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\f45c328c-4e82-4fdb-b741-0a29
    remark: AES_12H_100Y
*
 ** CALIB NASHYD         0106  1 10.0   13.86    1.26  5.17  58.65 0.60   0.000
    [CN=84.0         ]
    [ N = 3.0:Tp 0.22]
*
    ADD [  0103+  0104]  0016  3 10.0  369.12   11.06  6.50  43.87  n/a   0.000
*
    ADD [  0016+  0105]  0016  1 10.0  382.98   11.54  6.50  44.11  n/a   0.000
*
    ADD [  0016+  0106]  0016  3 10.0  396.84   11.85  6.33  44.62  n/a   0.000
*
    ADD [  0016+  0011]  0016  1 10.0 1055.95   25.22  7.00  44.06  n/a   0.000
*
```

```
    READ STORM                15.0
    [ Ptot= 98.38 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\f45c328c-4e82-4fdb-b741-0a29
    remark: AES_12H_100Y
*
 ** CALIB NASHYD         0107  1 10.0   28.41    1.60  5.50  52.54 0.53   0.000
    [CN=79.0         ]
    [ N = 3.0:Tp 0.66]
*
    READ STORM                15.0
    [ Ptot= 98.38 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\f45c328c-4e82-4fdb-b741-0a29
    remark: AES_12H_100Y
*
 ** CALIB NASHYD         0108  1 10.0   33.73    1.50  6.00  53.91 0.55   0.000
    [CN=80.0         ]
    [ N = 3.0:Tp 1.05]
*
    READ STORM                15.0
    [ Ptot= 98.38 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\f45c328c-4e82-4fdb-b741-0a29
    remark: AES_12H_100Y
*
 ** CALIB NASHYD         0109  1 10.0    2.78    0.11  5.33  29.66 0.30   0.000
    [CN=58.0         ]
    [ N = 3.0:Tp 0.33]
*
    ADD [  0107+  0108]  0018  3 10.0   62.14    2.98  5.67  53.28  n/a   0.000
*
    ADD [  0018+  0109]  0018  1 10.0   64.92    3.06  5.67  52.27  n/a   0.000
*
    ADD [  0018+  0016]  0018  3 10.0 1120.87   27.33  6.67  44.53  n/a   0.000
*
    READ STORM                15.0
    [ Ptot= 98.38 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\f45c328c-4e82-4fdb-b741-0a29
    remark: AES_12H_100Y
*
 ** CALIB NASHYD         0110  1 10.0   74.04    4.02  5.50  50.89 0.52   0.000
    [CN=78.0         ]
    [ N = 3.0:Tp 0.66]
*
    ADD [  0110+  0018]  0019  3 10.0 1194.91   29.79  6.50  44.93  n/a   0.000
*
============================================================================================
===============


       V    V   I    SSSSS  U   U    A    L             (v 5.1.2000)
       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
Developed and Distributed by Civica Infrastructure
```



```
                   *****  S U M M A R Y   O U T P U T  *****

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.1\VO2\voin.dat
  Output  filename: C:\Users\Valdor\AppData\Local\Civica\VH5\fc940250-ed07-412c-85e3-
c94b4cb6310f\787b7d4c-ba4b-4dd7-bbac-e94848b88fff\scena
  Summary filename: C:\Users\Valdor\AppData\Local\Civica\VH5\fc940250-ed07-412c-85e3-
c94b4cb6310f\787b7d4c-ba4b-4dd7-bbac-e94848b88fff\scena


DATE: 04-16-2020                           TIME: 04:12:50

USER:


COMMENTS: ____________________________________________________________


  ************************************************
  ** SIMULATION : AES_24H_100Y                  **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min     ha  '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                15.0
    [ Ptot=108.66 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\33a008b9-b049-483a-970d-8f7f
    remark: AES_24H_100Y
*
 ** CALIB NASHYD         0101  1 10.0  619.42   12.69 12.00  50.24 0.46   0.000
    [CN=71.0         ]
    [ N = 3.0:Tp 2.09]
*
    READ STORM                15.0
    [ Ptot=108.66 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\33a008b9-b049-483a-970d-8f7f
    remark: AES_24H_100Y
*
 ** CALIB NASHYD         0102  1 10.0   39.69    2.18 10.17  68.38 0.63   0.000
    [CN=84.0         ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0101+  0102]  0011  3 10.0  659.11   13.35 12.00  51.33  n/a   0.000
*
    READ STORM                15.0
    [ Ptot=108.66 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\33a008b9-b049-483a-970d-8f7f
    remark: AES_24H_100Y
*
 ** CALIB NASHYD         0103  1 10.0  289.68    7.93 11.17  54.14 0.50   0.000
    [CN=74.0         ]
    [ N = 3.0:Tp 1.46]
*
    READ STORM                15.0
    [ Ptot=108.66 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\33a008b9-b049-483a-970d-8f7f
    remark: AES_24H_100Y
*
 ** CALIB NASHYD         0104  1 10.0   79.44    1.99 10.67  41.87 0.39   0.000
    [CN=64.0         ]
    [ N = 3.0:Tp 1.02]
*
    READ STORM                15.0
    [ Ptot=108.66 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\33a008b9-b049-483a-970d-8f7f
```

```
    remark: AES_24H_100Y
*
 ** CALIB NASHYD        0105  1 10.0   13.86    0.60 10.33  58.87 0.54   0.000
    [CN=78.0         ]
    [ N = 3.0:Tp 0.63]
*
    READ STORM                15.0
    [ Ptot=108.66 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\33a008b9-b049-483a-970d-8f7f
    remark: AES_24H_100Y
*
 ** CALIB NASHYD        0106  1 10.0   13.86    0.76 10.17  67.61 0.62   0.000
    [CN=84.0         ]
    [ N = 3.0:Tp 0.22]
*
    ADD [  0103+  0104]  0016  3 10.0  369.12    9.82 11.00  51.49  n/a   0.000
*
    ADD [  0016+  0105]  0016  1 10.0  382.98   10.25 11.00  51.76  n/a   0.000
*
    ADD [  0016+  0106]  0016  3 10.0  396.84   10.49 11.00  52.32  n/a   0.000
*
    ADD [  0016+  0011]  0016  1 10.0 1055.95   22.89 11.50  51.70  n/a   0.000
*
    READ STORM                15.0
    [ Ptot=108.66 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\33a008b9-b049-483a-970d-8f7f
    remark: AES_24H_100Y
*
 ** CALIB NASHYD        0107  1 10.0   28.41    1.25 10.33  61.07 0.56   0.000
    [CN=79.0         ]
    [ N = 3.0:Tp 0.66]
*
    READ STORM                15.0
    [ Ptot=108.66 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\33a008b9-b049-483a-970d-8f7f
    remark: AES_24H_100Y
*
 ** CALIB NASHYD        0108  1 10.0   33.73    1.29 10.67  62.57 0.58   0.000
    [CN=80.0         ]
    [ N = 3.0:Tp 1.05]
*
    READ STORM                15.0
    [ Ptot=108.66 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\33a008b9-b049-483a-970d-8f7f
    remark: AES_24H_100Y
*
 ** CALIB NASHYD        0109  1 10.0    2.78    0.08 10.17  35.46 0.33   0.000
    [CN=58.0         ]
    [ N = 3.0:Tp 0.33]
*
    ADD [  0107+  0108]  0018  3 10.0   62.14    2.50 10.50  61.89  n/a   0.000
*
    ADD [  0018+  0109]  0018  1 10.0   64.92    2.56 10.50  60.75  n/a   0.000
*
    ADD [  0018+  0016]  0018  3 10.0 1120.87   24.75 11.33  52.23  n/a   0.000
*
    READ STORM                15.0
    [ Ptot=108.66 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\33a008b9-b049-483a-970d-8f7f
    remark: AES_24H_100Y
*
 ** CALIB NASHYD        0110  1 10.0   74.04    3.16 10.33  59.29 0.55   0.000
    [CN=78.0         ]
    [ N = 3.0:Tp 0.66]
*
```

```
    ADD [  0110+  0018]  0019  3 10.0 1194.91   26.92 11.00  52.66  n/a   0.000
*
==========================================================================================
===============

       V    V   I    SSSSS  U   U    A    L              (v 5.1.2000)
       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
```



```
                   *****  S U M M A R Y   O U T P U T  *****

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.1\VO2\voin.dat
  Output  filename: C:\Users\Valdor\AppData\Local\Civica\VH5\fc940250-ed07-412c-85e3-
c94b4cb6310f\78dcc635-f2c6-41ad-8070-422e86ac486c\scena
  Summary filename: C:\Users\Valdor\AppData\Local\Civica\VH5\fc940250-ed07-412c-85e3-
c94b4cb6310f\78dcc635-f2c6-41ad-8070-422e86ac486c\scena


DATE: 04-16-2020                           TIME: 04:12:50

USER:


COMMENTS: ____________________________________________________________

  ************************************************
  ** SIMULATION : Chicago_04H_100Y              **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min    ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    CHIC STORM               10.0
    [ Ptot= 78.18 mm ]
*
 ** CALIB NASHYD        0101  1 10.0  619.42   11.15  4.00  28.90 0.37   0.000
    [CN=71.0         ]
    [ N = 3.0:Tp 2.09]
*
    CHIC STORM               10.0
    [ Ptot= 78.18 mm ]
*
 ** CALIB NASHYD        0102  1 10.0   39.69    4.22  1.50  42.09 0.54   0.000
    [CN=84.0         ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0101+  0102]  0011  3 10.0  659.11   11.59  4.00  29.69  n/a   0.000
*
    CHIC STORM               10.0
    [ Ptot= 78.18 mm ]
*
 ** CALIB NASHYD        0103  1 10.0  289.68    7.41  3.17  31.58 0.40   0.000
    [CN=74.0         ]
    [ N = 3.0:Tp 1.46]
```

```
*
    CHIC STORM                 10.0
    [ Ptot= 78.18 mm ]
*
 ** CALIB NASHYD        0104  1 10.0   79.44    1.90  2.67  23.33 0.30   0.000
    [CN=64.0        ]
    [ N = 3.0:Tp 1.02]
*
    CHIC STORM                 10.0
    [ Ptot= 78.18 mm ]
*
 ** CALIB NASHYD        0105  1 10.0   13.86    0.70  2.00  34.79 0.45   0.000
    [CN=78.0        ]
    [ N = 3.0:Tp 0.63]
*
    CHIC STORM                 10.0
    [ Ptot= 78.18 mm ]
*
 ** CALIB NASHYD        0106  1 10.0   13.86    1.68  1.50  41.59 0.53   0.000
    [CN=84.0        ]
    [ N = 3.0:Tp 0.22]
*
    ADD [  0103+  0104]  0016  3 10.0  369.12    9.15  3.00  29.81  n/a   0.000
*
    ADD [  0016+  0105]  0016  1 10.0  382.98    9.55  3.00  29.99  n/a   0.000
*
    ADD [  0016+  0106]  0016  3 10.0  396.84    9.79  3.00  30.39  n/a   0.000
*
    ADD [  0016+  0011]  0016  1 10.0 1055.95   20.44  3.50  29.95  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 78.18 mm ]
*
 ** CALIB NASHYD        0107  1 10.0   28.41    1.47  2.17  36.52 0.47   0.000
    [CN=79.0        ]
    [ N = 3.0:Tp 0.66]
*
    CHIC STORM                 10.0
    [ Ptot= 78.18 mm ]
*
 ** CALIB NASHYD        0108  1 10.0   33.73    1.31  2.67  37.62 0.48   0.000
    [CN=80.0        ]
    [ N = 3.0:Tp 1.05]
*
    CHIC STORM                 10.0
    [ Ptot= 78.18 mm ]
*
 ** CALIB NASHYD        0109  1 10.0    2.78    0.11  1.67  19.30 0.25   0.000
    [CN=58.0        ]
    [ N = 3.0:Tp 0.33]
*
    ADD [  0107+  0108]  0018  3 10.0   62.14    2.66  2.33  37.11  n/a   0.000
*
    ADD [  0018+  0109]  0018  1 10.0   64.92    2.72  2.33  36.35  n/a   0.000
*
    ADD [  0018+  0016]  0018  3 10.0 1120.87   22.22  3.33  30.32  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 78.18 mm ]
*
 ** CALIB NASHYD        0110  1 10.0   74.04    3.68  2.17  35.16 0.45   0.000
    [CN=78.0        ]
    [ N = 3.0:Tp 0.66]
*
    ADD [  0110+  0018]  0019  3 10.0 1194.91   24.19  3.00  30.62  n/a   0.000
*
==============================================================================================
===============
```

```
     V    V   I    SSSSS  U   U    A    L              (v 5.1.2000)
     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
```



```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.1\VO2\voin.dat
  Output  filename: C:\Users\Valdor\AppData\Local\Civica\VH5\fc940250-ed07-412c-85e3-
c94b4cb6310f\eafb628b-280d-4f39-90bf-793af59bdab3\scena
  Summary filename: C:\Users\Valdor\AppData\Local\Civica\VH5\fc940250-ed07-412c-85e3-
c94b4cb6310f\eafb628b-280d-4f39-90bf-793af59bdab3\scena


DATE: 04-16-2020                           TIME: 04:12:51

USER:


COMMENTS: ____________________________________________________________


  ************************************************
  ** SIMULATION : SCS_06H_100Y                  **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                15.0
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\c90ad3c2-a919-48f5-8269-fb8b
    remark: SCS_06H_100Y
*
 ** CALIB NASHYD        0101  1 10.0  619.42   13.97  5.67  36.75 0.41   0.000
    [CN=71.0        ]
    [ N = 3.0:Tp 2.09]
*
    READ STORM                15.0
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\c90ad3c2-a919-48f5-8269-fb8b
    remark: SCS_06H_100Y
*
 ** CALIB NASHYD        0102  1 10.0   39.69    5.88  3.33  51.98 0.58   0.000
    [CN=84.0        ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0101+  0102]  0011  3 10.0  659.11   14.39  5.50  37.67  n/a   0.000
*
    READ STORM                15.0
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\c90ad3c2-a919-48f5-8269-fb8b
    remark: SCS_06H_100Y
*
```

```
 ** CALIB NASHYD        0103  1 10.0  289.68    9.42  4.83  39.92 0.44   0.000
    [CN=74.0        ]
    [ N = 3.0:Tp 1.46]
*
    READ STORM                15.0
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\c90ad3c2-a919-48f5-8269-fb8b
    remark: SCS_06H_100Y
*
 ** CALIB NASHYD        0104  1 10.0   79.44    2.53  4.33  30.08 0.33   0.000
    [CN=64.0        ]
    [ N = 3.0:Tp 1.02]
*
    READ STORM                15.0
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\c90ad3c2-a919-48f5-8269-fb8b
    remark: SCS_06H_100Y
*
 ** CALIB NASHYD        0105  1 10.0   13.86    0.94  3.83  43.75 0.49   0.000
    [CN=78.0        ]
    [ N = 3.0:Tp 0.63]
*
    READ STORM                15.0
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\c90ad3c2-a919-48f5-8269-fb8b
    remark: SCS_06H_100Y
*
 ** CALIB NASHYD        0106  1 10.0   13.86    2.31  3.33  51.39 0.57   0.000
    [CN=84.0        ]
    [ N = 3.0:Tp 0.22]
*
    ADD [  0103+  0104]  0016  3 10.0  369.12   11.72  4.67  37.80  n/a   0.000
*
    ADD [  0016+  0105]  0016  1 10.0  382.98   12.23  4.67  38.02  n/a   0.000
*
    ADD [  0016+  0106]  0016  3 10.0  396.84   12.47  4.67  38.49  n/a   0.000
*
    ADD [  0016+  0011]  0016  1 10.0 1055.95   25.67  5.00  37.98  n/a   0.000
*
    READ STORM                15.0
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\c90ad3c2-a919-48f5-8269-fb8b
    remark: SCS_06H_100Y
*
 ** CALIB NASHYD        0107  1 10.0   28.41    1.96  3.83  45.68 0.51   0.000
    [CN=79.0        ]
    [ N = 3.0:Tp 0.66]
*
    READ STORM                15.0
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\c90ad3c2-a919-48f5-8269-fb8b
    remark: SCS_06H_100Y
*
 ** CALIB NASHYD        0108  1 10.0   33.73    1.68  4.33  46.94 0.52   0.000
    [CN=80.0        ]
    [ N = 3.0:Tp 1.05]
*
    READ STORM                15.0
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\c90ad3c2-a919-48f5-8269-fb8b
    remark: SCS_06H_100Y
*
 ** CALIB NASHYD        0109  1 10.0    2.78    0.16  3.50  25.13 0.28   0.000
    [CN=58.0        ]
    [ N = 3.0:Tp 0.33]
*
    ADD [  0107+  0108]  0018  3 10.0   62.14    3.48  4.00  46.36  n/a   0.000
*
    ADD [  0018+  0109]  0018  1 10.0   64.92    3.56  4.00  45.45  n/a   0.000
*
    ADD [  0018+  0016]  0018  3 10.0 1120.87   27.93  4.83  38.41  n/a   0.000
*
    READ STORM                15.0
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\c90ad3c2-a919-48f5-8269-fb8b
    remark: SCS_06H_100Y
*
 ** CALIB NASHYD        0110  1 10.0   74.04    4.93  3.83  44.14 0.49   0.000
    [CN=78.0        ]
    [ N = 3.0:Tp 0.66]
*
    ADD [  0110+  0018]  0019  3 10.0 1194.91   30.50  4.67  38.76  n/a   0.000
*
============================================================================================
===============


       V    V   I    SSSSS  U   U    A    L              (v 5.1.2000)
       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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                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.1\VO2\voin.dat
  Output  filename: C:\Users\Valdor\AppData\Local\Civica\VH5\fc940250-ed07-412c-85e3-
c94b4cb6310f\bd39010c-1463-4444-a5cf-533585f87d24\scena
  Summary filename: C:\Users\Valdor\AppData\Local\Civica\VH5\fc940250-ed07-412c-85e3-
c94b4cb6310f\bd39010c-1463-4444-a5cf-533585f87d24\scena


DATE: 04-16-2020                           TIME: 04:12:51

USER:


COMMENTS: ____________________________________________________________


  ************************************************
  ** SIMULATION : SCS_12H_100Y                  **
  ************************************************

  W/E COMMAND            HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha  '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                15.0
    [ Ptot= 98.39 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\bea2a157-eca0-44af-8e97-4724
```

```
    remark: SCS_12H_100Y
*
 ** CALIB NASHYD        0101  1 10.0  619.42   14.11  8.50  42.73 0.43   0.000
    [CN=71.0        ]
    [ N = 3.0:Tp 2.09]
*
    READ STORM                15.0
    [ Ptot= 98.39 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\bea2a157-eca0-44af-8e97-4724
    remark: SCS_12H_100Y
*
 ** CALIB NASHYD        0102  1 10.0   39.69    5.78  6.33  59.33 0.60   0.000
    [CN=84.0        ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0101+  0102]  0011  3 10.0  659.11   14.56  8.50  43.73  n/a   0.000
*
    READ STORM                15.0
    [ Ptot= 98.39 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\bea2a157-eca0-44af-8e97-4724
    remark: SCS_12H_100Y
*
 ** CALIB NASHYD        0103  1 10.0  289.68    9.49  7.67  46.24 0.47   0.000
    [CN=74.0        ]
    [ N = 3.0:Tp 1.46]
*
    READ STORM                15.0
    [ Ptot= 98.39 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\bea2a157-eca0-44af-8e97-4724
    remark: SCS_12H_100Y
*
 ** CALIB NASHYD        0104  1 10.0   79.44    2.57  7.17  35.27 0.36   0.000
    [CN=64.0        ]
    [ N = 3.0:Tp 1.02]
*
    READ STORM                15.0
    [ Ptot= 98.39 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\bea2a157-eca0-44af-8e97-4724
    remark: SCS_12H_100Y
*
 ** CALIB NASHYD        0105  1 10.0   13.86    0.94  6.83  50.49 0.51   0.000
    [CN=78.0        ]
    [ N = 3.0:Tp 0.63]
*
    READ STORM                15.0
    [ Ptot= 98.39 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\bea2a157-eca0-44af-8e97-4724
    remark: SCS_12H_100Y
*
 ** CALIB NASHYD        0106  1 10.0   13.86    2.24  6.33  58.66 0.60   0.000
    [CN=84.0        ]
    [ N = 3.0:Tp 0.22]
*
    ADD [  0103+  0104]  0016  3 10.0  369.12   11.84  7.67  43.88  n/a   0.000
*
    ADD [  0016+  0105]  0016  1 10.0  382.98   12.38  7.50  44.12  n/a   0.000
*
    ADD [  0016+  0106]  0016  3 10.0  396.84   12.60  7.50  44.63  n/a   0.000
*
    ADD [  0016+  0011]  0016  1 10.0 1055.95   25.88  8.00  44.07  n/a   0.000
*
    READ STORM                15.0
    [ Ptot= 98.39 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\bea2a157-eca0-44af-8e97-4724
    remark: SCS_12H_100Y
*
 ** CALIB NASHYD        0107  1 10.0   28.41    1.96  6.83  52.55 0.53   0.000
    [CN=79.0        ]
    [ N = 3.0:Tp 0.66]
*
    READ STORM                15.0
    [ Ptot= 98.39 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\bea2a157-eca0-44af-8e97-4724
    remark: SCS_12H_100Y
*
 ** CALIB NASHYD        0108  1 10.0   33.73    1.69  7.17  53.92 0.55   0.000
    [CN=80.0        ]
    [ N = 3.0:Tp 1.05]
*
    READ STORM                15.0
    [ Ptot= 98.39 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\bea2a157-eca0-44af-8e97-4724
    remark: SCS_12H_100Y
*
 ** CALIB NASHYD        0109  1 10.0    2.78    0.16  6.50  29.66 0.30   0.000
    [CN=58.0        ]
    [ N = 3.0:Tp 0.33]
*
    ADD [  0107+  0108]  0018  3 10.0   62.14    3.49  7.00  53.29  n/a   0.000
*
    ADD [  0018+  0109]  0018  1 10.0   64.92    3.57  7.00  52.28  n/a   0.000
*
    ADD [  0018+  0016]  0018  3 10.0 1120.87   28.13  7.83  44.54  n/a   0.000
*
    READ STORM                15.0
    [ Ptot= 98.39 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\bea2a157-eca0-44af-8e97-4724
    remark: SCS_12H_100Y
*
 ** CALIB NASHYD        0110  1 10.0   74.04    4.94  6.83  50.89 0.52   0.000
    [CN=78.0        ]
    [ N = 3.0:Tp 0.66]
*
    ADD [  0110+  0018]  0019  3 10.0 1194.91   30.78  7.50  44.94  n/a   0.000
*
============================================================================================
===============


       V    V   I    SSSSS  U   U    A    L              (v 5.1.2000)
       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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                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.1\VO2\voin.dat
  Output  filename: C:\Users\Valdor\AppData\Local\Civica\VH5\fc940250-ed07-412c-85e3-
c94b4cb6310f\1703e436-fb5e-4a9b-9300-6f1566aa8aa3\scena
```

```
  Summary filename: C:\Users\Valdor\AppData\Local\Civica\VH5\fc940250-ed07-412c-85e3-
c94b4cb6310f\1703e436-fb5e-4a9b-9300-6f1566aa8aa3\scena


DATE: 04-16-2020                           TIME: 04:12:51

USER:


COMMENTS: ____________________________________________________________


  ************************************************
  ** SIMULATION : SCS_24H_100Y                  **
  ************************************************

  W/E COMMAND            HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                 min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                 15.0
    [ Ptot=108.68 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\66439c18-cbce-4ddc-a123-48e8
    remark: SCS_24H_100Y
*
 ** CALIB NASHYD         0101  1 10.0  619.42   13.98 14.50  50.25 0.46   0.000
    [CN=71.0        ]
    [ N = 3.0:Tp 2.09]
*
    READ STORM                 15.0
    [ Ptot=108.68 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\66439c18-cbce-4ddc-a123-48e8
    remark: SCS_24H_100Y
*
 ** CALIB NASHYD         0102  1 10.0   39.69    5.61 12.33  68.39 0.63   0.000
    [CN=84.0        ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0101+  0102]  0011  3 10.0  659.11   14.62 14.33  51.34  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot=108.68 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\66439c18-cbce-4ddc-a123-48e8
    remark: SCS_24H_100Y
*
 ** CALIB NASHYD         0103  1 10.0  289.68    9.43 13.67  54.15 0.50   0.000
    [CN=74.0        ]
    [ N = 3.0:Tp 1.46]
*
    READ STORM                 15.0
    [ Ptot=108.68 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\66439c18-cbce-4ddc-a123-48e8
    remark: SCS_24H_100Y
*
 ** CALIB NASHYD         0104  1 10.0   79.44    2.58 13.17  41.88 0.39   0.000
    [CN=64.0        ]
    [ N = 3.0:Tp 1.02]
*
    READ STORM                 15.0
    [ Ptot=108.68 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\66439c18-cbce-4ddc-a123-48e8
    remark: SCS_24H_100Y
*
 ** CALIB NASHYD         0105  1 10.0   13.86    0.93 12.67  58.88 0.54   0.000
    [CN=78.0        ]
    [ N = 3.0:Tp 0.63]
*
    READ STORM                 15.0
    [ Ptot=108.68 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\66439c18-cbce-4ddc-a123-48e8
    remark: SCS_24H_100Y
*
 ** CALIB NASHYD         0106  1 10.0   13.86    2.16 12.33  67.63 0.62   0.000
    [CN=84.0        ]
    [ N = 3.0:Tp 0.22]
*
    ADD [  0103+  0104]  0016  3 10.0  369.12   11.82 13.50  51.51  n/a   0.000
*
    ADD [  0016+  0105]  0016  1 10.0  382.98   12.36 13.50  51.78  n/a   0.000
*
    ADD [  0016+  0106]  0016  3 10.0  396.84   12.51 13.33  52.33  n/a   0.000
*
    ADD [  0016+  0011]  0016  1 10.0 1055.95   25.48 14.00  51.71  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot=108.68 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\66439c18-cbce-4ddc-a123-48e8
    remark: SCS_24H_100Y
*
 ** CALIB NASHYD         0107  1 10.0   28.41    1.92 12.83  61.09 0.56   0.000
    [CN=79.0        ]
    [ N = 3.0:Tp 0.66]
*
    READ STORM                 15.0
    [ Ptot=108.68 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\66439c18-cbce-4ddc-a123-48e8
    remark: SCS_24H_100Y
*
 ** CALIB NASHYD         0108  1 10.0   33.73    1.67 13.17  62.59 0.58   0.000
    [CN=80.0        ]
    [ N = 3.0:Tp 1.05]
*
    READ STORM                 15.0
    [ Ptot=108.68 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\66439c18-cbce-4ddc-a123-48e8
    remark: SCS_24H_100Y
*
 ** CALIB NASHYD         0109  1 10.0    2.78    0.16 12.50  35.47 0.33   0.000
    [CN=58.0        ]
    [ N = 3.0:Tp 0.33]
*
    ADD [  0107+  0108]  0018  3 10.0   62.14    3.43 13.00  61.90  n/a   0.000
*
    ADD [  0018+  0109]  0018  1 10.0   64.92    3.52 12.83  60.77  n/a   0.000
*
    ADD [  0018+  0016]  0018  3 10.0 1120.87   27.64 13.50  52.24  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot=108.68 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\66439c18-cbce-4ddc-a123-48e8
    remark: SCS_24H_100Y
*
 ** CALIB NASHYD         0110  1 10.0   74.04    4.85 12.83  59.30 0.55   0.000
    [CN=78.0        ]
    [ N = 3.0:Tp 0.66]
*
    ADD [  0110+  0018]  0019  3 10.0 1194.91   30.81 13.33  52.68  n/a   0.000
*
```

```
==========================================================================================
===============

       V    V   I    SSSSS  U   U    A    L             (v 5.1.2000)
       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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                   *****  S U M M A R Y   O U T P U T  *****

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.1\VO2\voin.dat
  Output  filename: C:\Users\Valdor\AppData\Local\Civica\VH5\fc940250-ed07-412c-85e3-
c94b4cb6310f\f433b504-7c7e-4816-9319-f294e19ddee0\scena
  Summary filename: C:\Users\Valdor\AppData\Local\Civica\VH5\fc940250-ed07-412c-85e3-
c94b4cb6310f\f433b504-7c7e-4816-9319-f294e19ddee0\scena

DATE: 04-16-2020                           TIME: 04:12:51

USER:

COMMENTS: ____________________________________________________________

  ************************************************
  ** SIMULATION : TIMMINS                       **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                 15.0
    [ Ptot=193.00 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\e2c3a379-de84-4204-9e38-978b
    remark: * Timmins Storm
*
 ** CALIB NASHYD         0101  1 10.0  619.42   28.26  9.83 119.31 0.62   0.000
    [CN=71.0         ]
    [ N = 3.0:Tp 2.09]
*
    READ STORM                 15.0
    [ Ptot=193.00 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\e2c3a379-de84-4204-9e38-978b
    remark: * Timmins Storm
*
 ** CALIB NASHYD         0102  1 10.0   39.69    4.13  7.00 146.43 0.76   0.000
    [CN=84.0         ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0101+  0102]  0011  3 10.0  659.11   29.64  9.83 120.95  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot=193.00 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\e2c3a379-de84-4204-9e38-978b
    remark: * Timmins Storm
*
 ** CALIB NASHYD         0103  1 10.0  289.68   15.50  9.17 125.69 0.65   0.000
    [CN=74.0         ]
    [ N = 3.0:Tp 1.46]
*
    READ STORM                 15.0
    [ Ptot=193.00 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\e2c3a379-de84-4204-9e38-978b
    remark: * Timmins Storm
*
 ** CALIB NASHYD         0104  1 10.0   79.44    3.95  7.83 104.70 0.54   0.000
    [CN=64.0         ]
    [ N = 3.0:Tp 1.02]
*
    READ STORM                 15.0
    [ Ptot=193.00 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\e2c3a379-de84-4204-9e38-978b
    remark: * Timmins Storm
*
 ** CALIB NASHYD         0105  1 10.0   13.86    1.08  7.17 133.41 0.69   0.000
    [CN=78.0         ]
    [ N = 3.0:Tp 0.63]
*
    READ STORM                 15.0
    [ Ptot=193.00 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\e2c3a379-de84-4204-9e38-978b
    remark: * Timmins Storm
*
 ** CALIB NASHYD         0106  1 10.0   13.86    1.44  7.00 144.89 0.75   0.000
    [CN=84.0         ]
    [ N = 3.0:Tp 0.22]
*
    ADD [  0103+  0104]  0016  3 10.0  369.12   19.21  9.00 121.17  n/a   0.000
*
    ADD [  0016+  0105]  0016  1 10.0  382.98   19.98  9.00 121.62  n/a   0.000
*
    ADD [  0016+  0106]  0016  3 10.0  396.84   20.79  9.00 122.43  n/a   0.000
*
    ADD [  0016+  0011]  0016  1 10.0 1055.95   49.86  9.17 121.50  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot=193.00 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\e2c3a379-de84-4204-9e38-978b
    remark: * Timmins Storm
*
 ** CALIB NASHYD         0107  1 10.0   28.41    2.23  7.33 136.43 0.71   0.000
    [CN=79.0         ]
    [ N = 3.0:Tp 0.66]
*
    READ STORM                 15.0
    [ Ptot=193.00 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\e2c3a379-de84-4204-9e38-978b
    remark: * Timmins Storm
*
 ** CALIB NASHYD         0108  1 10.0   33.73    2.22  7.83 138.66 0.72   0.000
    [CN=80.0         ]
    [ N = 3.0:Tp 1.05]
*
    READ STORM                 15.0
    [ Ptot=193.00 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\e2c3a379-de84-4204-9e38-978b
```

```
    remark: * Timmins Storm
*
 ** CALIB NASHYD         0109  1 10.0    2.78    0.18  7.00  92.40 0.48   0.000
    [CN=58.0         ]
    [ N = 3.0:Tp 0.33]
*
    ADD [  0107+  0108]  0018  3 10.0   62.14    4.33  7.50 137.64  n/a   0.000
*
    ADD [  0018+  0109]  0018  1 10.0   64.92    4.46  7.33 135.70  n/a   0.000
*
    ADD [  0018+  0016]  0018  3 10.0 1120.87   53.52  9.17 122.33  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot=193.00 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0693206a-483c-4eba-94cf-
0cec1e63814b\e2c3a379-de84-4204-9e38-978b
    remark: * Timmins Storm
*
 ** CALIB NASHYD         0110  1 10.0   74.04    5.70  7.33 133.88 0.69   0.000
    [CN=78.0         ]
    [ N = 3.0:Tp 0.66]
*
    ADD [  0110+  0018]  0019  3 10.0 1194.91   57.57  9.17 123.04  n/a   0.000
*
 FINISH

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APPENDIX “E”

Stormwater Management Calculations

VALDOR ENGINEERING INC.
Project: Millbrook Subdivision, Phase 2
File: 17125
Date: April 2020

Table E.1: Existing Condition - VO Model Parameters

Subcatchment	Area (ha)	VO Routine	TIMP	XIMP	CN II	IA (mm)	Tp (hr)
101	2.11	StandHyd	0.25	0.15	61	5.0	-
102	0.23	StandHyd	0.35	0.25	61	5.0	-
103	38.54	NasHyd	-	-	79	7.1	0.94
104	12.18	NasHyd	-	-	78	7.1	1.23
[1]105	5.60	NasHyd	-	-	81	7.0	1.17
Total	**58.66**						

Notes:
1) At the request of the Township of Cavan Monaghan, additional land to the west of the subject site (*Catchment 105)* has been included in the pre-development modelling to account for possible future development of this area (it is not currently within the settlement area).

VALDOR ENGINEERING INC.
Project: Millbrook Subdivision, Phase 2
File: 17125
Date: April 2020

Table E.2: Proposed Condition - VO Model Parameters							
Subcatchment	**Area (ha)**	**VO Routine**	**TIMP**	**XIMP**	**CN II**	**IA (mm)**	**Tp (hr)**
101	2.11	StandHyd	0.25	0.15	61	5.0	-
102	0.23	StandHyd	0.35	0.25	61	5.0	-
106	0.59	NasHyd	-	-	61	5.0	0.19
201	2.84	StandHyd	0.75	0.60	61	5.0	-
202	33.75	StandHyd	0.70	0.55	61	5.0	-
203	1.97	StandHyd	0.50	0.50	61	5.0	-
204	1.32	StandHyd	0.60	0.45	61	5.0	-
205	0.97	StandHyd	0.60	0.45	61	5.0	-
[1]206	1.09	N/A					
207	12.68	NasHyd	-	-	61	5.5	1.16
[2]208	1.78	StandHyd	0.65	0.40	61	5.0	-
[3]209	4.95	StandHyd	0.70	0.55	61	5.0	-
[3]210	0.65	StandHyd	0.60	0.45	61	5.0	-
Total	**64.93**						

Notes:
1) Drainage from *Catchment 206* will be captured and conveyed to the *Phase 1 SWM Pond* via the Fallis Line major and minor system. The *Phase 1 SWM Pond* has been sized to accomadate this area (refer to *Stormwater Management Report, Millbrook Subdivision, Phase 1*, Valdor Engineering Inc., October 2016). *Catchment 206* is therefore not included in the modelling for the *Phase 2 SWM Pond*.
2) The minor system flows (up to and including the 5-year flow) for *Catchment 208* will be captured and conveyed via the site's storm sewer system to a culvert under County Road 10. The major system flows (the 100- minus 5-year flows) will discharge overland to the SWM pond. This is simulated using a *DuHyd* routine in the VO model.
3) At the request of the Township of Cavan Monaghan, additional land to the west of the subject site (Catchments 209 & 210) has been included in the post-development modelling to account for possible future development of this area (it is not currently within the settlement area).

VALDOR ENGINEERING INC.
Project: Millbrook Subdivision, Phase 2
File: 17125
Date: April 2020

Table E.3: Calculation of CN Values, Initial Abstractions and Runoff Coefficients

Subcatchment	Area (ha)	Land Use and Land Cover		CN II	Area Weighted CN II	IA (mm)	Area Weighted IA (mm)	C-Value	Area Weighted C-Value
		Type	Area (ha)						
103	38.54	Row Crops (HSG 'B')	34.58	81	**79**	**7**	**7.1**	0.35	**0.34**
		Meadow (HSG 'B')	3.96	58		**8**		0.28	
		Open Space (HSG 'B')	0.00	61		**5**		0.16	
		Other Impervious	0.00	98		**2**		0.95	
104	12.18	Row Crops (HSG 'B')	10.49	81	**78**	**7**	**7.1**	0.35	**0.34**
		Meadow (HSG 'B')	1.69	58		**8**		0.28	
		Open Space (HSG 'B')	0.00	61		**5**		0.16	
		Other Impervious	0.00	98		**2**		0.95	
105	5.60	Row Crops (HSG 'B')	5.60	81	**81**	**7**	**7.0**	0.35	**0.35**
		Meadow (HSG 'B')	0.00	58		**8**		0.28	
		Open Space (HSG 'B')	0.00	61		**5**		0.16	
		Other Impervious	0.00	98		**2**		0.95	
106	0.59	Row Crops (HSG 'B')	0.00	81	**61**	**7**	**5.0**	0.35	**0.16**
		Meadow (HSG 'B')	0.00	58		**8**		0.28	
		Open Space (HSG 'B')	0.59	61		**5**		0.16	
		Other Impervious	0.00	98		**2**		0.95	
207	12.68	Row Crops (HSG 'B')	0.00	81	**61**	**7**	**5.5**	0.35	**0.18**
		Meadow (HSG 'B')	2.06	58		**8**		0.28	
		Open Space (HSG 'B')	10.62	61		**5**		0.16	
		Other Impervious	0.00	98		**2**		0.95	

VALDOR ENGINEERING INC.
Project: Millbrook Subdivision, Phase 2
File: 17125
Date: April 2020

Table E.4: Calculation of Time to Peak (Airport Method)

Subcatchment	C Runoff Coefficient (Area Weighted)	L(m) Catchment Length	Highest Elevation (m)	Lowest Elevation (m)	S(%) Catchment Slope	T_c (min)	T_p (hr)
103	0.34	1220	247.40	234.00	1.10	83.8	0.94
104	0.34	1675	247.20	234.00	0.79	109.9	1.23
105	0.35	2120	260.75	234.00	1.26	104.5	1.17
106	0.16	80	257.00	253.60	4.25	17.0	0.19
207	0.18	1275	248.00	234.00	1.10	104.2	1.16

Note:

1) T_p calculation is based on the Airport Method: $T_c = 3.26 \times (1.1 - C) \times L^{0.5} / S_w^{0.33}$ and $T_P = 0.67 T_c$

Table E.5
SWM POND STAGE-STORAGE TABLE

Project Name: Millbrook Subdivision, Phase 2
Municipality: Township of Cavan Monaghan
Project No.: 17125
Date: April 2020

Stage Storage Curve						Outlet Structure								Comments:
Elevation (m)	Sec Area (m^2)	Avg Area (m^2)	Sec Volume (m^3)	Cumulative Volume (m^3)	Volume Above NWL (m^3)		Stage Active (m)	Discharge m^3/s Orifice #1	Orifice #2 (Weir Flow)	Orifice #2 (Orifice Flow)	Spillway	Total Flow		
						Invert Elevation(m)		241.50	242.35	242.35	243.50			
						Diameter(mm)/Length(m)		180	1.40	1.40	35.00			
						Box Orifice Height (m)		-	0.60	0.60				
						Orifice Area (m^2)		0.0254	0.8400	0.8400				
														Spillway Design: $Q=1.67xLxH^{1.5}$ Orifice Eq'n: $Q = 0.6A(2gH)^{0.5}$
Forebay Below NWL														
239.50	**435**	**-**	**-**	**0**		**Bottom of Forebay**								
240.00	**652**	**544**	**272**	**272**										
240.90	**1,064**	**858**	**772**	**1,044**		-								
241.50	**1,550**	**1,307**	**784**	**1,828**		**NWL**								
Main Cell Below NWL														
239.50	**2,342**	**-**	**-**	**0**		**Bottom of Main Cell**								
240.00	**2,816**	**2,579**	**1,290**	**1,290**		**-**								
240.90	**3,722**	**3,269**	**2,942**	**4,232**		-								
241.50	**4,820**	**4,271**	**2,563**	**6,794**		**NWL**								
Forebay & Main Cell Above NWL														
241.50	**6,370**	**-**	**-**	**8,622**	**0**	**NWL**	0.00	0.000				**0.000**		**Permanent Pool Provided**
242.00	**7,781**	**7,076**	**3,538**	**12,160**	**3,538**	**-**	0.50	0.043				**0.043**		
242.20	8,373	8,077	1,615	13,776	5,153	**-**	0.70	0.053				**0.053**		
242.35	8,818	8,596	1,289	15,065	6,443	**Extended Detention**	0.85	0.059	0.000	-		**0.059**		**Extended Detention Provided**
242.50	**9,262**	**9,040**	**1,356**	**16,421**	**7,799**		1.00	0.065	0.136	-		**0.200**		
242.70	10,171	9,717	1,943	18,364	9,742	**-**	1.20	0.071	0.484	-		**0.555**		
242.90	11,080	10,626	2,125	20,489	11,867	**-**	1.40	0.077	0.954	-		**1.031**		
243.00	**11,535**	**11,308**	**1,131**	**21,620**	**12,998**	**-**	1.50	0.080	1.225	-		**1.306**		
243.20	12,051	11,793	2,359	23,979	15,356	**-**	1.70	0.086	-	1.656		**1.741**		
243.40	12,567	12,309	2,462	26,440	17,818	**-**	1.90	0.091	-	1.933		**2.024**		
243.50	12,825	12,696	1,270	27,710	19,088	**Emergency Spillway**	2.00	0.093	-	2.058	0.000	**2.152**		**100-year Storage Provided**
243.60	13,082	12,953	1,295	29,005	20,383	**-**	2.10	0.096	-	2.176	1.848	**4.120**		
243.80	13,598	13,340	2,668	31,673	23,051	**-**	2.30	0.101	-	2.394	9.604	**12.099**		
244.00	**14,114**	**13,856**	**2,771**	**34,445**	**25,822**	**Top of Berm**	2.50	0.105	-	2.594	20.665	**23.364**		**Top of Berm**

Millbrook Subdivision
SWM Facility (South Pond)
TOWNSHIP OF CAVAN MONAGHAN
File: 17125
Date: April 2020

VALDOR ENGINEERING INC.
741 Rowntree Dairy Road, Suite 2, Woodbridge, Ontario. L4L 5T9
Tel: 905-264-0054 Fax: 905-264-0069
www.valdor-engineering.com

TABLE E.6-A: SWM FACILITY SIZING FOR WATER QUALITY CONTROL CURRENT DEVELOPMENT CONDITION

Source: Stormwater Management Planning and Design Manual (Table 3.2),
Ministry of the Environment, Ontario, March 2003

Protection Level	SWMP Type	Storage Volume (m^3/ha) for Impervious Level			
		35%	55%	70%	85%
Level 1	*Infiltration*	25	30	35	40
	Wetlands [2]	80	105	120	140
	Wet Pond [2]	140	190	225	250
	Hybrid Wet Pond/Wetland [4]	110	150	175	195
Level 2	*Infiltration*	20	20	25	30
	Wetlands	60	70	80	90
	Wet Pond	90	110	130	150
	Hybrid Wet Pond/Wetland	75	90	105	120
Level 3	*Infiltration*	20	20	20	20
	Wetlands	60	60	60	60
	Wet Pond	60	75	85	95
	Hybrid Wet Pond/Wetland	60	70	75	80
	Dry Pond	90	150	200	240

1. Table 3.2 was based on specific design parameters (depth, length to width ratio) for each type of end-of-pipe stormwater management facility. The values of these parameters are provided in Appendix I of the Manual. All values in Table 4.1 are based on a 24 hour detention.
2. For wetlands, wet ponds and hybrid ponds, all of the storage, except 40 m^3/ha, in Table 3.2 represents the permanent pool volume. The 40 m^3/ha represents the extended detention storage.
3. For hybrid ponds, 50% to 60% of the permanent pool volume shall be contained in deeper portions of the facility.

PERMANENT POOL CALCULATOR

SWMP Type:	WET POND	(IN - infiltration, WET - wetlands, WP - wet pond, HYB - hybrid wet pond/wetland, DP - dry pond)
Protection Level:	1	(1 - 80% TSS, 2 - 70% TSS, 3 - 60% TSS)
Average Imperviousness:	66.0 %	
Volume Level:	175.7 m^3/ha	Excluding 40 m^3/ha Extended Detention
Area:	41.49 ha	
Total Required Volume:	**7,288** m^3	

EXTENDED DETENTION CALCULATOR

Volume Level:	40.0 m^3/ha	Only Extended Detention
Area:	41.49 ha	
Total Required Volume:	**1,660** m^3	

Millbrook Subdivision
SWM Facility (South Pond)

TOWNSHIP OF CAVAN MONAGHAN

File: 17125

Date: April 2020

VALDOR ENGINEERING INC.
741 Rowntree Dairy Road, Suite 2, Woodbridge, Ontario. L4L 5T9
Tel: 905-264-0054 Fax: 905-264-0069
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TABLE E.6-B: SWM FACILITY SIZING FOR WATER QUALITY CONTROL POTENTIAL FUTURE DEVELOPMENT CONDITION

Source: Stormwater Management Planning and Design Manual (Table 3.2), Ministry of the Environment, Ontario, March 2003

Protection Level	SWMP Type	Storage Volume (m^3/ha) for Impervious Level			
		35%	55%	70%	85%
Level 1	*Infiltration*	25	30	35	40
	Wetlands [2]	80	105	120	140
	Wet Pond [2]	140	190	225	250
	Hybrid Wet Pond/Wetland [4]	110	150	175	195
Level 2	*Infiltration*	20	20	25	30
	Wetlands	60	70	80	90
	Wet Pond	90	110	130	150
	Hybrid Wet Pond/Wetland	75	90	105	120
Level 3	*Infiltration*	20	20	20	20
	Wetlands	60	60	60	60
	Wet Pond	60	75	85	95
	Hybrid Wet Pond/Wetland	60	70	75	80
	Dry Pond	90	150	200	240

1. Table 3.2 was based on specific design parameters (depth, length to width ratio) for each type of end-of-pipe stormwater management facility. The values of these parameters are provided in Appendix I of the Manual. All values in Table 4.1 are based on a 24 hour detention.
2. For wetlands, wet ponds and hybrid ponds, all of the storage, except 40 m^3/ha, in Table 3.2 represents the permanent pool volume. The 40 m^3/ha represents the extended detention storage.
3. For hybrid ponds, 50% to 60% of the permanent pool volume shall be contained in deeper portions of the facility.

PERMANENT POOL CALCULATOR

SWMP Type:	WET POND	(IN - infiltration, WET - wetlands, WP - wet pond, HYB - hybrid wet pond/wetland, DP - dry pond)
Protection Level:	1	(1 - 80% TSS, 2 - 70% TSS, 3 - 60% TSS)
Average Imperviousness:	66.0 %	
Volume Level:	175.7 m^3/ha	Excluding 40 m^3/ha Extended Detention
Area:	46.44 ha	
Total Required Volume:	**8,158** m^3	

EXTENDED DETENTION CALCULATOR

Volume Level:	40.0 m^3/ha	Only Extended Detention
Area:	46.44 ha	
Total Required Volume:	**1,858** m^3	

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Project: Millbrook Subdivision
File: 17125
Date: April 2020

Table E.7-A: SWM Pond Extended Detention Requirements
Current Development Condition

Event	Area (ha)	R.V. (mm)	Required Ext. Det. Volume (m^3)	Provided Ext. Det. Volume (m^3)
25mm 4-hour Chicago Storm	41.49	13.64	5,659	6,443

VALDOR ENGINEERING INC.
Project: Millbrook Subdivision
File: 17125
Date: April 2020

Table E.7-B: SWM Pond Extended Detention Requirements Potential Future Development Condition

Event	Area (ha)	R.V. (mm)	Required Ext. Det. Volume (m^3)	Provided Ext. Det. Volume (m^3)
25mm 4-hour Chicago Storm	46.44	13.71	6,367	6,443

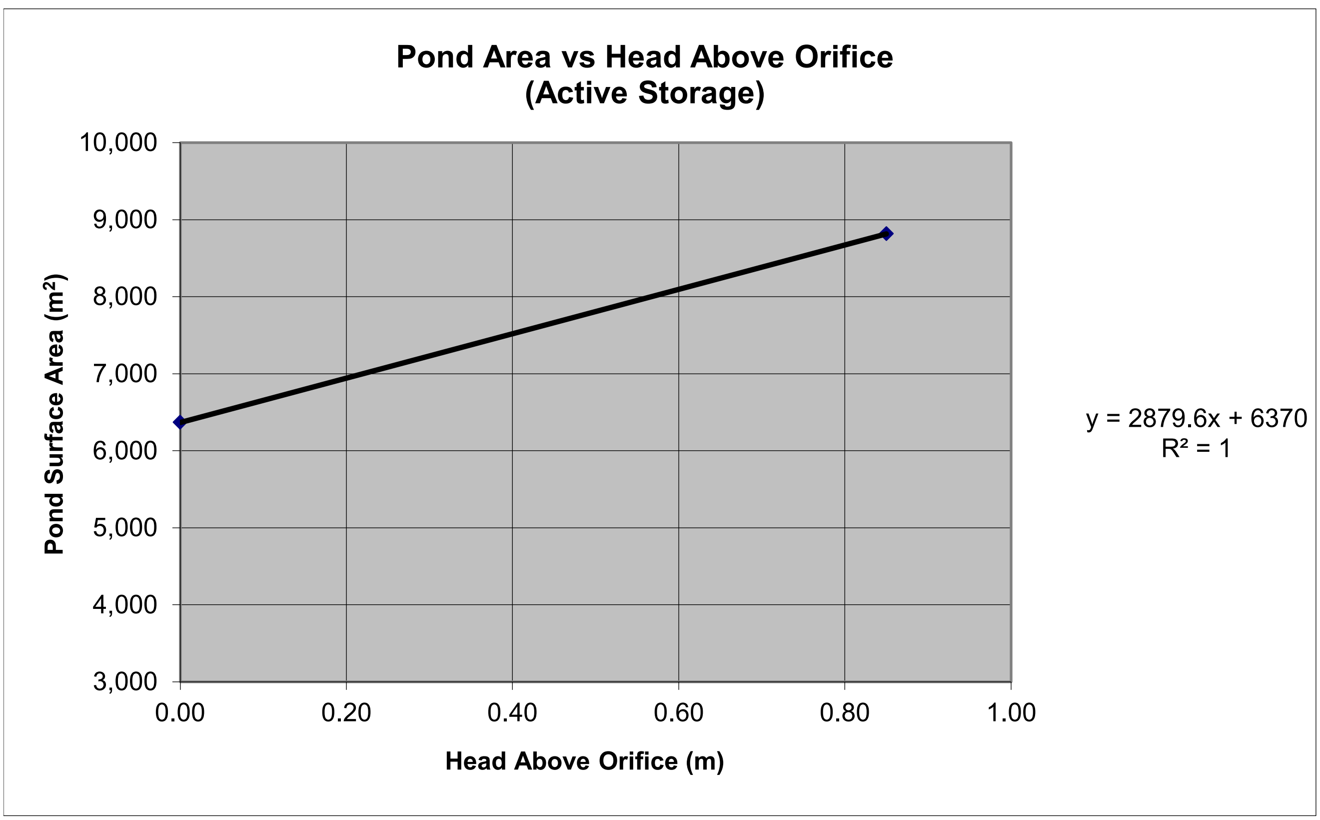
Table E.8: SWM Facility Operation - Extended Detention
Erosion Control Drawdown Time

Project Name: Millbrook Subdivision, Phase 2
Municipality: Township of Cavan Monaghan
Project No.: 17125
Date: April 2020

Extended Detention - SWM Pond

Orifice Sizing		
Orifice Size	180	mm
Orifice Invert	241.50	m
Orifice Area	0.0254469	sq. m
$EDL_{erosion}$	242.35	m
NWL	241.50	m
C_2	2879.6	
C_3	6370.0	
h	0.7600	m
Drawdown Time	49.1	hr

$y = mx + b$
$C_2 = m$
$C_3 = b$



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Project: Millbrook Subdivision
File: 17125
Date: April 2020

Table E.9: Critical Storm Analysis

100-Year Storm Distribution	Target Flow (m^3/s)	Storage Provided (m^3)	Proposed Flow (m^3/s)	Storage Used (m^3)	Note
6-hour AES	2.043	11900	2.042	11,925	
12-hour AES	1.820	10300	1.814	10,278	
24-hour AES	1.521	8000	1.520	7,997	
6-hour SCS	**2.078**	**12600**	**2.075**	**12,585**	**Critical Storm**
12-hour SCS	2.080	11900	2.074	11,884	
24-hour SCS	2.048	10900	2.038	10,862	
4-hour Chicago	1.618	11100	1.609	11,042	

SWM Pond: Forebay Weir

Project Description

Solve For	Discharge

Input Data

Headwater Elevation		242.35	m
Crest Elevation		241.50	m
Tailwater Elevation		241.50	m
Crest Surface Type	Gravel		
Crest Breadth		11.00	m
Crest Length		6.00	m

Results

Discharge	7.85	m^3/s
Headwater Height Above Crest	0.85	m
Tailwater Height Above Crest	0.00	m
Weir Coefficient	1.67	SI
Submergence Factor	1.00	
Adjusted Weir Coefficient	1.67	SI
Flow Area	5.10	m^2
Velocity	1.54	m/s
Wetted Perimeter	7.70	m
Top Width	6.00	m

Culvert Calculator Report
SWM Pond: Bottom Draw Pipe

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	242.35 m	Headwater Depth/Height	7.64
Computed Headwater Elevation	241.83 m	Discharge	0.0560 m³/s
Inlet Control HW Elev.	241.79 m	Tailwater Elevation	241.50 m
Outlet Control HW Elev.	241.83 m	Control Type	Outlet Control

Grades

Upstream Invert	239.50 m	Downstream Invert	241.50 m
Length	21.00 m	Constructed Slope	-0.095238 m/m

Hydraulic Profile

Profile	CompositeA2PressureProfile	Depth, Downstream	0.18 m
Slope Type	Adverse	Normal Depth	0.00 m
Flow Regime	Subcritical	Critical Depth	0.18 m
Velocity Downstream	1.23 m/s	Critical Slope	0.005821 m/m

Section

Section Shape	Circular	Mannings Coefficient	0.012
Section Material	Corrugated HDPE (Smooth Interior)	Span	0.30 m
Section Size	300 mm	Rise	0.30 m
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev.	241.83 m	Upstream Velocity Head	0.03 m
Ke	0.50	Entrance Loss	0.02 m

Inlet Control Properties

Inlet Control HW Elev.	241.79 m	Flow Control	Unsubmerged
Inlet Type	Square edge w/headwall	Area Full	0.1 m²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Calculator Report
SWM Pond: Outlet Pipe_100-yr Controlled Flow

Solve For: Headwater Elevation

Culvert Summary			
Allowable HW Elevation	0.00 m	Headwater Depth/Height	1.08
Computed Headwater Elevation	242.12 m	Discharge	2.1140 m^3/s
Inlet Control HW Elev.	242.05 m	Tailwater Elevation	241.00 m
Outlet Control HW Elev.	242.12 m	Control Type	Entrance Control

Grades			
Upstream Invert	240.80 m	Downstream Invert	240.50 m
Length	60.00 m	Constructed Slope	0.005000 m/m

Hydraulic Profile			
Profile	S2	Depth, Downstream	0.78 m
Slope Type	Steep	Normal Depth	0.78 m
Flow Regime	Supercritical	Critical Depth	0.80 m
Velocity Downstream	2.69 m/s	Critical Slope	0.004645 m/m

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	1.22 m
Section Size	1200 mm	Rise	1.22 m
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	242.12 m	Upstream Velocity Head	0.35 m
Ke	0.50	Entrance Loss	0.17 m

Inlet Control Properties			
Inlet Control HW Elev.	242.05 m	Flow Control	Unsubmerged
Inlet Type	Square edge w/headwall	Area Full	1.2 m^2
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

SWM Pond: Emergency Spillway, Uncontrolled 100-year Flow

Project Description

Solve For	Headwater Elevation

Input Data

Discharge	12.03	m³/s
Crest Elevation	243.50	m
Tailwater Elevation	242.25	m
Crest Surface Type	Gravel	
Crest Breadth	4.00	m
Crest Length	35.00	m

Results

Headwater Elevation	243.86	m
Headwater Height Above Crest	0.36	m
Tailwater Height Above Crest	-1.25	m
Weir Coefficient	1.58	SI
Submergence Factor	1.00	
Adjusted Weir Coefficient	1.58	SI
Flow Area	12.64	m²
Velocity	0.95	m/s
Wetted Perimeter	35.72	m
Top Width	35.00	m

SWM Pond: Emergency Spillway, Uncontrolled Regional Flow

Project Description

Solve For	Headwater Elevation

Input Data

Discharge	4.70	m^3/s
Crest Elevation	243.50	m
Tailwater Elevation	242.25	m
Crest Surface Type	Gravel	
Crest Breadth	4.00	m
Crest Length	35.00	m

Results

Headwater Elevation	243.70	m
Headwater Height Above Crest	0.20	m
Tailwater Height Above Crest	-1.25	m
Weir Coefficient	1.51	SI
Submergence Factor	1.00	
Adjusted Weir Coefficient	1.51	SI
Flow Area	6.97	m^2
Velocity	0.67	m/s
Wetted Perimeter	35.40	m
Top Width	35.00	m

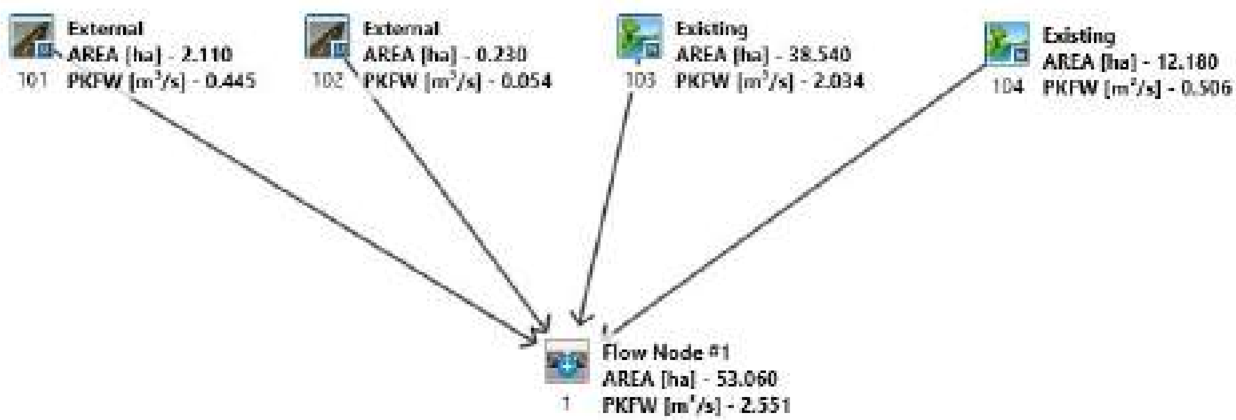

Figure E.1-A: VO5 Model Schematic – Pre-Development Storm Drainage Current Development Condition

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COMMENTS: ____________________________________________________________


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d13e4a4c543d\76197674-7e12-413b-9cac-039f
    remark: SCS_06H_025Y
*
 ** CALIB NASHYD         0103  1  5.0   38.54    1.43  4.17  32.48 0.45   0.000
    [CN=79.0        ]
    [ N = 3.0:Tp 0.94]
*
    READ STORM                15.0
    [ Ptot= 72.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\e0becfd4-12b5-4130-b7fc-
d13e4a4c543d\76197674-7e12-413b-9cac-039f
    remark: SCS_06H_025Y
*
 ** CALIB NASHYD         0104  1  5.0   12.18    0.36  4.58  31.50 0.43   0.000
    [CN=78.0        ]
    [ N = 3.0:Tp 1.23]
*
    READ STORM                15.0
    [ Ptot= 72.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\e0becfd4-12b5-4130-b7fc-
d13e4a4c543d\76197674-7e12-413b-9cac-039f
    remark: SCS_06H_025Y
*
 *  CALIB STANDHYD       0102  1  5.0    0.23    0.04  3.25  34.57 0.47   0.000
    [I%=25.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 72.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\e0becfd4-12b5-4130-b7fc-
d13e4a4c543d\76197674-7e12-413b-9cac-039f
    remark: SCS_06H_025Y
*
 *  CALIB STANDHYD       0101  1  5.0    2.11    0.32  3.25  29.46 0.40   0.000
    [I%=15.0:S%= 2.00]
*
    ADD [  0101+  0102]  0001  3  5.0    2.34    0.36  3.25  29.96  n/a   0.000
*
    ADD [  0001+  0103]  0001  1  5.0   40.88    1.46  4.17  32.33  n/a   0.000
*
    ADD [  0001+  0104]  0001  3  5.0   53.06    1.80  4.25  32.14  n/a   0.000
*
==============================================================================================
===============


       V    V   I    SSSSS  U   U    A    L             (v 5.1.2000)
       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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                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.1\VO2\voin.dat
  Output  filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\2845786c-d07d-406f-8f15-ebe177051908\scena
  Summary filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\2845786c-d07d-406f-8f15-ebe177051908\scena


DATE: 04-29-2020                           TIME: 01:50:31

USER:


COMMENTS: ____________________________________________________________


  ************************************************
  ** SIMULATION : SCS_06H_050Y                  **
  ************************************************

  W/E COMMAND            HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                 min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                15.0
    [ Ptot= 81.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\e0becfd4-12b5-4130-b7fc-
d13e4a4c543d\a55243cf-90fe-4730-b73b-2015
    remark: SCS_06H_050Y
*
 ** CALIB NASHYD         0103  1  5.0   38.54    1.73  4.17  38.93 0.48   0.000
    [CN=79.0        ]
    [ N = 3.0:Tp 0.94]
*
    READ STORM                15.0
    [ Ptot= 81.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\e0becfd4-12b5-4130-b7fc-
d13e4a4c543d\a55243cf-90fe-4730-b73b-2015
```

```
    remark: SCS_06H_050Y
*
 ** CALIB NASHYD        0104  1  5.0   12.18    0.43  4.58  37.83 0.46   0.000
    [CN=78.0         ]
    [ N = 3.0:Tp 1.23]
*
    READ STORM                15.0
    [ Ptot= 81.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\e0becfd4-12b5-4130-b7fc-
d13e4a4c543d\a55243cf-90fe-4730-b73b-2015
    remark: SCS_06H_050Y
*
 *  CALIB STANDHYD      0102  1  5.0    0.23    0.05  3.25  40.30 0.50   0.000
    [I%=25.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 81.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\e0becfd4-12b5-4130-b7fc-
d13e4a4c543d\a55243cf-90fe-4730-b73b-2015
    remark: SCS_06H_050Y
*
 *  CALIB STANDHYD      0101  1  5.0    2.11    0.38  3.25  34.78 0.43   0.000
    [I%=15.0:S%= 2.00]
*
    ADD [  0101+  0102] 0001  3  5.0    2.34    0.43  3.25  35.32  n/a   0.000
*
    ADD [  0001+  0103] 0001  1  5.0   40.88    1.76  4.17  38.72  n/a   0.000
*
    ADD [  0001+  0104] 0001  3  5.0   53.06    2.17  4.25  38.51  n/a   0.000
*
============================================================================================
===============


       V    V   I    SSSSS  U   U    A    L             (v 5.1.2000)
       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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                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.1\VO2\voin.dat
  Output  filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\a851414f-5234-4fa9-a513-e19bd2211eae\scena
  Summary filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\a851414f-5234-4fa9-a513-e19bd2211eae\scena


DATE: 04-29-2020                           TIME: 01:50:31

USER:


COMMENTS: ____________________________________________________________


  ************************************************
  ** SIMULATION : SCS_06H_100Y                  **
  ************************************************
```

```
  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                15.0
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\e0becfd4-12b5-4130-b7fc-
d13e4a4c543d\33e70cb9-9264-4fe4-aedf-ad51
    remark: SCS_06H_100Y
*
 ** CALIB NASHYD        0103  1  5.0   38.54    2.03  4.17  45.61 0.51   0.000
    [CN=79.0         ]
    [ N = 3.0:Tp 0.94]
*
    READ STORM                15.0
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\e0becfd4-12b5-4130-b7fc-
d13e4a4c543d\33e70cb9-9264-4fe4-aedf-ad51
    remark: SCS_06H_100Y
*
 ** CALIB NASHYD        0104  1  5.0   12.18    0.51  4.50  44.39 0.49   0.000
    [CN=78.0         ]
    [ N = 3.0:Tp 1.23]
*
    READ STORM                15.0
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\e0becfd4-12b5-4130-b7fc-
d13e4a4c543d\33e70cb9-9264-4fe4-aedf-ad51
    remark: SCS_06H_100Y
*
 *  CALIB STANDHYD      0102  1  5.0    0.23    0.05  3.25  46.24 0.51   0.000
    [I%=25.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\e0becfd4-12b5-4130-b7fc-
d13e4a4c543d\33e70cb9-9264-4fe4-aedf-ad51
    remark: SCS_06H_100Y
*
 *  CALIB STANDHYD      0101  1  5.0    2.11    0.44  3.25  40.34 0.45   0.000
    [I%=15.0:S%= 2.00]
*
    ADD [  0101+  0102] 0001  3  5.0    2.34    0.50  3.25  40.92  n/a   0.000
*
    ADD [  0001+  0103] 0001  1  5.0   40.88    2.07  4.17  45.34  n/a   0.000
*
    ADD [  0001+  0104] 0001  3  5.0   53.06    2.55  4.25  45.12  n/a   0.000
*
 FINISH

============================================================================================
===============
```

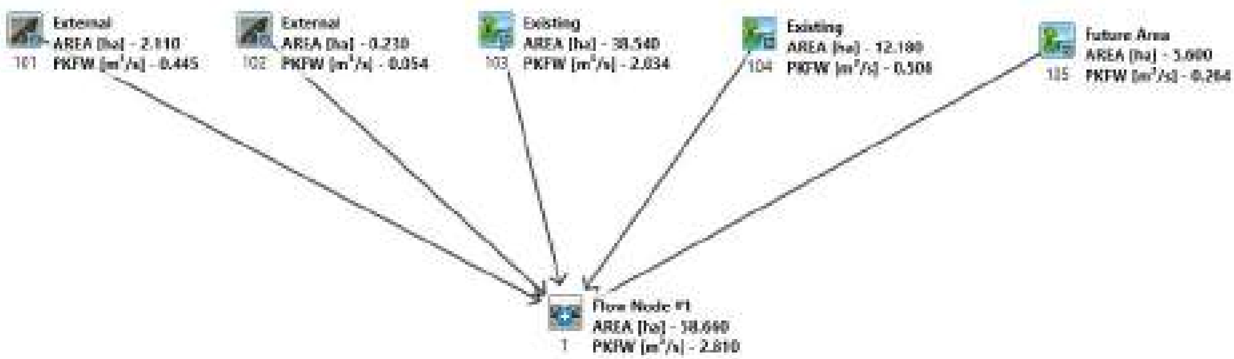

Figure E.1-B: VO5 Model Schematic – Pre-Development Storm Drainage
Potential Future Development Condition

```
===========================================================================================
===============

       V    V   I    SSSSS  U   U    A    L              (v 5.1.2000)
       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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                   *****  S U M M A R Y   O U T P U T  *****

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.1\VO2\voin.dat
  Output  filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\83ad536f-658c-444c-8a59-28df95e1cb6f\scena
  Summary filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\83ad536f-658c-444c-8a59-28df95e1cb6f\scena

DATE: 04-29-2020                           TIME: 01:51:36

USER:

COMMENTS: ____________________________________________________________

  ***********************************************
  ** SIMULATION : SCS_06H_002Y                  **
  ***********************************************

  W/E COMMAND            HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                 min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                15.0
    [ Ptot= 38.70 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0b16df7f-610a-4830-9add-
c12701c35536\04261804-c4e4-4cc5-8794-db36
    remark: SCS_06H_002Y
*
 ** CALIB NASHYD         0103  1  5.0   38.54    0.43  4.25  10.07 0.26   0.000
    [CN=79.0        ]
    [ N = 3.0:Tp 0.94]
*
    READ STORM                15.0
    [ Ptot= 38.70 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0b16df7f-610a-4830-9add-
c12701c35536\04261804-c4e4-4cc5-8794-db36
    remark: SCS_06H_002Y
*
 ** CALIB NASHYD         0104  1  5.0   12.18    0.11  4.67   9.67 0.25   0.000
    [CN=78.0        ]
    [ N = 3.0:Tp 1.23]
*
    READ STORM                15.0
    [ Ptot= 38.70 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0b16df7f-610a-4830-9add-
c12701c35536\04261804-c4e4-4cc5-8794-db36
    remark: SCS_06H_002Y
*
 ** CALIB NASHYD         0105  1  5.0    5.60    0.06  4.58  11.01 0.28   0.000
    [CN=81.0        ]
    [ N = 3.0:Tp 1.17]
*
    READ STORM                15.0
    [ Ptot= 38.70 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0b16df7f-610a-4830-9add-
c12701c35536\04261804-c4e4-4cc5-8794-db36
    remark: SCS_06H_002Y
*
 *  CALIB STANDHYD       0102  1  5.0    0.23    0.02  3.25  14.22 0.37   0.000
    [I%=25.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 38.70 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0b16df7f-610a-4830-9add-
c12701c35536\04261804-c4e4-4cc5-8794-db36
    remark: SCS_06H_002Y
*
 *  CALIB STANDHYD       0101  1  5.0    2.11    0.12  3.25  11.13 0.29   0.000
    [I%=15.0:S%= 2.00]
*
    ADD [  0101+  0102]  0001  3  5.0    2.34    0.13  3.25  11.43  n/a   0.000
*
    ADD [  0001+  0103]  0001  1  5.0   40.88    0.44  4.25  10.15  n/a   0.000
*
    ADD [  0001+  0104]  0001  3  5.0   53.06    0.53  4.33  10.04  n/a   0.000
*
    ADD [  0001+  0105]  0001  1  5.0   58.66    0.59  4.33  10.13  n/a   0.000
*
===========================================================================================
===============

       V    V   I    SSSSS  U   U    A    L              (v 5.1.2000)
       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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                   *****  S U M M A R Y   O U T P U T  *****

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.1\VO2\voin.dat
  Output  filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\2494c28d-02d1-4d40-90c9-3e93b9ab6240\scena
  Summary filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\2494c28d-02d1-4d40-90c9-3e93b9ab6240\scena

DATE: 04-29-2020                           TIME: 01:51:36

USER:

COMMENTS: ____________________________________________________________

  ***********************************************
```

```
  ** SIMULATION : SCS_06H_005Y                  **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min    ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM               15.0
    [ Ptot= 52.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0b16df7f-610a-4830-9add-
c12701c35536\99364209-6155-4a53-b2ce-593f
    remark: SCS_06H_005Y
*
 ** CALIB NASHYD         0103  1  5.0   38.54    0.79  4.25  18.19 0.35   0.000
    [CN=79.0        ]
    [ N = 3.0:Tp 0.94]
*
    READ STORM               15.0
    [ Ptot= 52.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0b16df7f-610a-4830-9add-
c12701c35536\99364209-6155-4a53-b2ce-593f
    remark: SCS_06H_005Y
*
 ** CALIB NASHYD         0104  1  5.0   12.18    0.20  4.58  17.55 0.33   0.000
    [CN=78.0        ]
    [ N = 3.0:Tp 1.23]
*
    READ STORM               15.0
    [ Ptot= 52.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0b16df7f-610a-4830-9add-
c12701c35536\99364209-6155-4a53-b2ce-593f
    remark: SCS_06H_005Y
*
 ** CALIB NASHYD         0105  1  5.0    5.60    0.11  4.50  19.63 0.37   0.000
    [CN=81.0        ]
    [ N = 3.0:Tp 1.17]
*
    READ STORM               15.0
    [ Ptot= 52.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0b16df7f-610a-4830-9add-
c12701c35536\99364209-6155-4a53-b2ce-593f
    remark: SCS_06H_005Y
*
 *  CALIB STANDHYD       0102  1  5.0    0.23    0.03  3.25  21.76 0.42   0.000
    [I%=25.0:S%= 2.00]
*
    READ STORM               15.0
    [ Ptot= 52.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0b16df7f-610a-4830-9add-
c12701c35536\99364209-6155-4a53-b2ce-593f
    remark: SCS_06H_005Y
*
 *  CALIB STANDHYD       0101  1  5.0    2.11    0.19  3.25  17.79 0.34   0.000
    [I%=15.0:S%= 2.00]
*
    ADD [  0101+  0102]  0001  3  5.0    2.34    0.22  3.25  18.18  n/a   0.000
*
    ADD [  0001+  0103]  0001  1  5.0   40.88    0.81  4.25  18.19  n/a   0.000
*
    ADD [  0001+  0104]  0001  3  5.0   53.06    0.99  4.25  18.04  n/a   0.000
*
    ADD [  0001+  0105]  0001  1  5.0   58.66    1.09  4.33  18.19  n/a   0.000
*
============================================================================================
==============


       V    V   I    SSSSS  U    U    A    L              (v 5.1.2000)
       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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```



```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.1\VO2\voin.dat
  Output  filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\87a3e80a-9481-4bd4-9ff6-d4da7efcd25f\scena
  Summary filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\87a3e80a-9481-4bd4-9ff6-d4da7efcd25f\scena


DATE: 04-29-2020                           TIME: 01:51:36

USER:


COMMENTS: ____________________________________________________________


  ************************************************
  ** SIMULATION : SCS_06H_010Y                  **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min    ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM               15.0
    [ Ptot= 61.50 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0b16df7f-610a-4830-9add-
c12701c35536\0488384e-0286-411c-a7ce-9f5e
    remark: SCS_06H_010Y
*
 ** CALIB NASHYD         0103  1  5.0   38.54    1.06  4.25  24.27 0.39   0.000
    [CN=79.0        ]
    [ N = 3.0:Tp 0.94]
*
    READ STORM               15.0
    [ Ptot= 61.50 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0b16df7f-610a-4830-9add-
c12701c35536\0488384e-0286-411c-a7ce-9f5e
    remark: SCS_06H_010Y
*
 ** CALIB NASHYD         0104  1  5.0   12.18    0.26  4.58  23.48 0.38   0.000
    [CN=78.0        ]
    [ N = 3.0:Tp 1.23]
*
    READ STORM               15.0
    [ Ptot= 61.50 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0b16df7f-610a-4830-9add-
c12701c35536\0488384e-0286-411c-a7ce-9f5e
    remark: SCS_06H_010Y
*
 ** CALIB NASHYD         0105  1  5.0    5.60    0.14  4.50  26.04 0.42   0.000
    [CN=81.0        ]
    [ N = 3.0:Tp 1.17]
*
```

```
    READ STORM                15.0
    [ Ptot= 61.50 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0b16df7f-610a-4830-9add-
c12701c35536\0488384e-0286-411c-a7ce-9f5e
    remark: SCS_06H_010Y
*
 *  CALIB STANDHYD       0102  1  5.0    0.23    0.03  3.25  27.26 0.44   0.000
    [I%=25.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 61.50 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0b16df7f-610a-4830-9add-
c12701c35536\0488384e-0286-411c-a7ce-9f5e
    remark: SCS_06H_010Y
*
 *  CALIB STANDHYD       0101  1  5.0    2.11    0.25  3.25  22.75 0.37   0.000
    [I%=15.0:S%= 2.00]
*
    ADD [  0101+  0102]  0001  3  5.0    2.34    0.28  3.25  23.19  n/a   0.000
*
    ADD [  0001+  0103]  0001  1  5.0   40.88    1.08  4.25  24.21  n/a   0.000
*
    ADD [  0001+  0104]  0001  3  5.0   53.06    1.33  4.25  24.04  n/a   0.000
*
    ADD [  0001+  0105]  0001  1  5.0   58.66    1.47  4.25  24.23  n/a   0.000
*
===========================================================================================
===============


       V    V   I    SSSSS  U   U    A    L              (v 5.1.2000)
       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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                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.1\VO2\voin.dat
  Output  filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\59577654-a5f4-4553-b395-18aabc69d804\scena
  Summary filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\59577654-a5f4-4553-b395-18aabc69d804\scena


DATE: 04-29-2020                           TIME: 01:51:36

USER:


COMMENTS: ____________________________________________________________


  ************************************************
  ** SIMULATION : SCS_06H_025Y                  **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms
      START @  0.00 hrs
      --------------------
    READ STORM                15.0
    [ Ptot= 72.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0b16df7f-610a-4830-9add-
c12701c35536\76197674-7e12-413b-9cac-039f
    remark: SCS_06H_025Y
*
 ** CALIB NASHYD         0103  1  5.0   38.54    1.43  4.17  32.48 0.45   0.000
    [CN=79.0         ]
    [ N = 3.0:Tp 0.94]
*
    READ STORM                15.0
    [ Ptot= 72.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0b16df7f-610a-4830-9add-
c12701c35536\76197674-7e12-413b-9cac-039f
    remark: SCS_06H_025Y
*
 ** CALIB NASHYD         0104  1  5.0   12.18    0.36  4.58  31.50 0.43   0.000
    [CN=78.0         ]
    [ N = 3.0:Tp 1.23]
*
    READ STORM                15.0
    [ Ptot= 72.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0b16df7f-610a-4830-9add-
c12701c35536\76197674-7e12-413b-9cac-039f
    remark: SCS_06H_025Y
*
 ** CALIB NASHYD         0105  1  5.0    5.60    0.19  4.50  34.61 0.47   0.000
    [CN=81.0         ]
    [ N = 3.0:Tp 1.17]
*
    READ STORM                15.0
    [ Ptot= 72.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0b16df7f-610a-4830-9add-
c12701c35536\76197674-7e12-413b-9cac-039f
    remark: SCS_06H_025Y
*
 *  CALIB STANDHYD       0102  1  5.0    0.23    0.04  3.25  34.57 0.47   0.000
    [I%=25.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 72.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0b16df7f-610a-4830-9add-
c12701c35536\76197674-7e12-413b-9cac-039f
    remark: SCS_06H_025Y
*
 *  CALIB STANDHYD       0101  1  5.0    2.11    0.32  3.25  29.46 0.40   0.000
    [I%=15.0:S%= 2.00]
*
    ADD [  0101+  0102]  0001  3  5.0    2.34    0.36  3.25  29.96  n/a   0.000
*
    ADD [  0001+  0103]  0001  1  5.0   40.88    1.46  4.17  32.33  n/a   0.000
*
    ADD [  0001+  0104]  0001  3  5.0   53.06    1.80  4.25  32.14  n/a   0.000
*
    ADD [  0001+  0105]  0001  1  5.0   58.66    1.98  4.25  32.38  n/a   0.000
*
===========================================================================================
===============


       V    V   I    SSSSS  U   U    A    L              (v 5.1.2000)
       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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                   *****  S U M M A R Y   O U T P U T  *****

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.1\VO2\voin.dat
  Output  filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\b9b53986-c928-4dfd-b69c-ec8b342958ae\scena
  Summary filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\b9b53986-c928-4dfd-b69c-ec8b342958ae\scena

DATE: 04-29-2020                          TIME: 01:51:36

USER:

COMMENTS: ____________________________________________________________

  ************************************************
  ** SIMULATION : SCS_06H_050Y                  **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                 15.0
    [ Ptot= 81.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0b16df7f-610a-4830-9add-
c12701c35536\a55243cf-90fe-4730-b73b-2015
    remark: SCS_06H_050Y
*
 ** CALIB NASHYD         0103  1  5.0   38.54    1.73  4.17  38.93 0.48   0.000
    [CN=79.0        ]
    [ N = 3.0:Tp 0.94]
*
    READ STORM                 15.0
    [ Ptot= 81.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0b16df7f-610a-4830-9add-
c12701c35536\a55243cf-90fe-4730-b73b-2015
    remark: SCS_06H_050Y
*
 ** CALIB NASHYD         0104  1  5.0   12.18    0.43  4.58  37.83 0.46   0.000
    [CN=78.0        ]
    [ N = 3.0:Tp 1.23]
*
    READ STORM                 15.0
    [ Ptot= 81.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0b16df7f-610a-4830-9add-
c12701c35536\a55243cf-90fe-4730-b73b-2015
    remark: SCS_06H_050Y
*
 ** CALIB NASHYD         0105  1  5.0    5.60    0.23  4.50  41.31 0.51   0.000
    [CN=81.0        ]
    [ N = 3.0:Tp 1.17]
*
    READ STORM                 15.0
    [ Ptot= 81.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0b16df7f-610a-4830-9add-
c12701c35536\a55243cf-90fe-4730-b73b-2015
    remark: SCS_06H_050Y
*
  *  CALIB STANDHYD       0102  1  5.0    0.23    0.05  3.25  40.30 0.50   0.000
    [I%=25.0:S%= 2.00]
*
    READ STORM                 15.0
    [ Ptot= 81.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0b16df7f-610a-4830-9add-
c12701c35536\a55243cf-90fe-4730-b73b-2015
    remark: SCS_06H_050Y
*
  *  CALIB STANDHYD       0101  1  5.0    2.11    0.38  3.25  34.78 0.43   0.000
    [I%=15.0:S%= 2.00]
*
    ADD [  0101+  0102]  0001  3  5.0    2.34    0.43  3.25  35.32  n/a   0.000
*
    ADD [  0001+  0103]  0001  1  5.0   40.88    1.76  4.17  38.72  n/a   0.000
*
    ADD [  0001+  0104]  0001  3  5.0   53.06    2.17  4.25  38.51  n/a   0.000
*
    ADD [  0001+  0105]  0001  1  5.0   58.66    2.39  4.25  38.78  n/a   0.000
*
 FINISH

============================================================================================
==============

============================================================================================
==============

       V    V   I    SSSSS  U   U    A    L              (v 5.1.2000)
       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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                   *****  S U M M A R Y   O U T P U T  *****

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.1\VO2\voin.dat
  Output  filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\b4ae7ff0-b2ec-4699-8baf-fb496665dff9\scena
  Summary filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\b4ae7ff0-b2ec-4699-8baf-fb496665dff9\scena

DATE: 04-29-2020                          TIME: 01:51:36

USER:

COMMENTS: ____________________________________________________________

  ************************************************
  ** SIMULATION : SCS_06H_100Y                  **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
```

```
     --------------------
    READ STORM                15.0
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0b16df7f-610a-4830-9add-
c12701c35536\33e70cb9-9264-4fe4-aedf-ad51
    remark: SCS_06H_100Y
*
 ** CALIB NASHYD         0103  1  5.0   38.54    2.03  4.17  45.61 0.51   0.000
    [CN=79.0         ]
    [ N = 3.0:Tp 0.94]
*
    READ STORM                15.0
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0b16df7f-610a-4830-9add-
c12701c35536\33e70cb9-9264-4fe4-aedf-ad51
    remark: SCS_06H_100Y
*
 ** CALIB NASHYD         0104  1  5.0   12.18    0.51  4.50  44.39 0.49   0.000
    [CN=78.0         ]
    [ N = 3.0:Tp 1.23]
*
    READ STORM                15.0
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0b16df7f-610a-4830-9add-
c12701c35536\33e70cb9-9264-4fe4-aedf-ad51
    remark: SCS_06H_100Y
*
 ** CALIB NASHYD         0105  1  5.0    5.60    0.26  4.42  48.23 0.54   0.000
    [CN=81.0         ]
    [ N = 3.0:Tp 1.17]
*
    READ STORM                15.0
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0b16df7f-610a-4830-9add-
c12701c35536\33e70cb9-9264-4fe4-aedf-ad51
    remark: SCS_06H_100Y
*
 *  CALIB STANDHYD       0102  1  5.0    0.23    0.05  3.25  46.24 0.51   0.000
    [I%=25.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\0b16df7f-610a-4830-9add-
c12701c35536\33e70cb9-9264-4fe4-aedf-ad51
    remark: SCS_06H_100Y
*
 *  CALIB STANDHYD       0101  1  5.0    2.11    0.44  3.25  40.34 0.45   0.000
    [I%=15.0:S%= 2.00]
*
    ADD [  0101+  0102]  0001  3  5.0    2.34    0.50  3.25  40.92  n/a   0.000
*
    ADD [  0001+  0103]  0001  1  5.0   40.88    2.07  4.17  45.34  n/a   0.000
*
    ADD [  0001+  0104]  0001  3  5.0   53.06    2.55  4.25  45.12  n/a   0.000
*
    ADD [  0001+  0105]  0001  1  5.0   58.66    2.81  4.25  45.42  n/a   0.000
*
```

Valdor Engineering Inc.
File: 17125
Date: April 2020

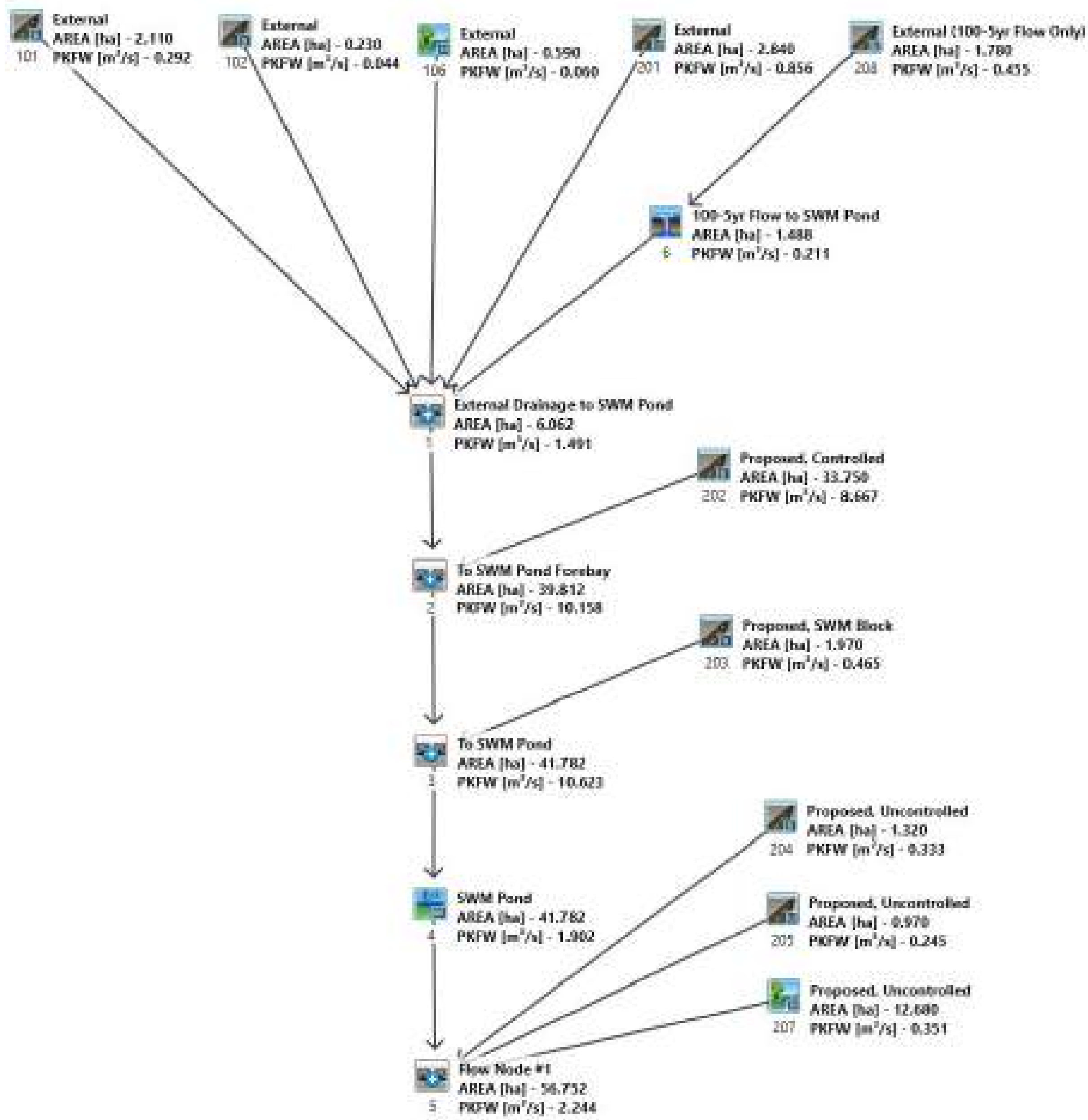

Figure E.2-A: VO5 Model Schematic – Post-Development Storm Drainage Current Development Condition

```
==========================================================================================
===============

       V    V   I    SSSSS  U    U    A    L               (v 5.1.2000)
       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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```



```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.1\VO2\voin.dat
  Output  filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\3e549367-ffd3-4a6c-a354-2e0bc2ae4344\scena
  Summary filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\3e549367-ffd3-4a6c-a354-2e0bc2ae4344\scena


DATE: 04-29-2020                           TIME: 01:52:33

USER:


COMMENTS: ____________________________________________________________


  ************************************************
  ** SIMULATION : 25mmchi                       **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min    ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 25.02 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\c8e47b32-cfe3-4ee5-b83e-4a3c
    remark: 25mm CHICAGO Storm
*
 ** CALIB NASHYD         0106  1  5.0    0.59    0.00  1.75   2.19 0.09   0.000
    [CN=61.0        ]
    [ N = 3.0:Tp 0.19]
*
    READ STORM                10.0
    [ Ptot= 25.02 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\c8e47b32-cfe3-4ee5-b83e-4a3c
    remark: 25mm CHICAGO Storm
*
 *  CALIB STANDHYD       0101  1  5.0    2.11    0.03  1.50   5.65 0.23   0.000
    [I%=15.0:S%= 2.00]
*
    READ STORM                10.0
    [ Ptot= 25.02 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\c8e47b32-cfe3-4ee5-b83e-4a3c
    remark: 25mm CHICAGO Storm
*
 *  CALIB STANDHYD       0102  1  5.0    0.23    0.01  1.50   7.66 0.31   0.000
    [I%=25.0:S%= 2.00]
*
    READ STORM                10.0
    [ Ptot= 25.02 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\c8e47b32-cfe3-4ee5-b83e-4a3c
    remark: 25mm CHICAGO Storm
*
 *  CALIB STANDHYD       0201  1  5.0    2.84    0.18  1.50  15.36 0.61   0.000
    [I%=60.0:S%= 2.00]
*
    READ STORM                10.0
    [ Ptot= 25.02 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\c8e47b32-cfe3-4ee5-b83e-4a3c
    remark: 25mm CHICAGO Storm
*
 *  CALIB STANDHYD       0208  1  5.0    1.78    0.08  1.50  11.71 0.47   0.000
    [I%=40.0:S%= 2.00]
*
    DUHYD                0006  1  5.0    1.78    0.08  1.50  11.71  n/a   0.000
       MAJOR SYSTEM:     0006  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:     0006  3  5.0    1.78    0.08  1.50  11.71  n/a   0.000
*
    ADD [  0101+  0102]  0001  3  5.0    2.34    0.04  1.50   5.84  n/a   0.000
*
    ADD [  0001+  0106]  0001  1  5.0    2.93    0.04  1.50   5.11  n/a   0.000
*
    ADD [  0001+  0201]  0001  3  5.0    5.77    0.23  1.50  10.16  n/a   0.000
*
    ADD [  0001+  0006]  0001  1  5.0    5.77    0.23  1.50  10.16  n/a   0.000
*
    READ STORM                10.0
    [ Ptot= 25.02 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\c8e47b32-cfe3-4ee5-b83e-4a3c
    remark: 25mm CHICAGO Storm
*
 *  CALIB STANDHYD       0202  1  5.0   33.75    1.47  1.58  14.29 0.57   0.000
    [I%=55.0:S%= 2.00]
*
    ADD [  0001+  0202]  0002  3  5.0   39.52    1.61  1.58  13.69  n/a   0.000
*
    READ STORM                10.0
    [ Ptot= 25.02 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\c8e47b32-cfe3-4ee5-b83e-4a3c
    remark: 25mm CHICAGO Storm
*
 *  CALIB STANDHYD       0203  1  5.0    1.97    0.11  1.50  12.60 0.50   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0002+  0203]  0003  3  5.0   41.49    1.70  1.50  13.64  n/a   0.000
*
    RESRVR [ 2:  0003]   0004  1  5.0   41.49    0.05  4.33  13.59  n/a   0.000
      {ST=  0.51 ha.m }
*
    READ STORM                10.0
    [ Ptot= 25.02 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\c8e47b32-cfe3-4ee5-b83e-4a3c
    remark: 25mm CHICAGO Storm
*
 *  CALIB NASHYD         0207  1  5.0   12.68    0.02  3.58   2.10 0.08   0.000
    [CN=61.0        ]
    [ N = 3.0:Tp 1.16]
*
    READ STORM                10.0
```

```
    [ Ptot= 25.02 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\c8e47b32-cfe3-4ee5-b83e-4a3c
    remark: 25mm CHICAGO Storm
*
 *  CALIB STANDHYD       0204  1  5.0    1.32    0.07  1.50  12.15 0.49   0.000
    [I%=45.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 25.02 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\c8e47b32-cfe3-4ee5-b83e-4a3c
    remark: 25mm CHICAGO Storm
*
 *  CALIB STANDHYD       0205  1  5.0    0.97    0.05  1.50  12.15 0.49   0.000
    [I%=45.0:S%= 2.00]
*
    ADD [  0204+  0205]  0005  3  5.0    2.29    0.12  1.50  12.15  n/a   0.000
*
    ADD [  0005+  0207]  0005  1  5.0   14.97    0.12  1.50   3.63  n/a   0.000
*
    ADD [  0005+  0004]  0005  3  5.0   56.46    0.13  1.50  10.95  n/a   0.000
*
============================================================================================
===============

       V    V   I    SSSSS  U   U    A    L              (v 5.1.2000)
       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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                   *****  S U M M A R Y   O U T P U T  *****

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.1\VO2\voin.dat
  Output  filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\c70348ce-3867-46e5-94b9-2d5f87a2df2f\scena
  Summary filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\c70348ce-3867-46e5-94b9-2d5f87a2df2f\scena

DATE: 04-29-2020                           TIME: 01:52:34

USER:

COMMENTS: ____________________________________________________________

  ************************************************
  ** SIMULATION : SCS_06H_002Y                  **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min     ha  '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                15.0
    [ Ptot= 38.70 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\04261804-c4e4-4cc5-8794-db36
    remark: SCS_06H_002Y
*
 ** CALIB NASHYD         0106  1  5.0    0.59    0.01  3.33   5.78 0.15   0.000
    [CN=61.0         ]
    [ N = 3.0:Tp 0.19]
*
    READ STORM                15.0
    [ Ptot= 38.70 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\04261804-c4e4-4cc5-8794-db36
    remark: SCS_06H_002Y
*
 *  CALIB STANDHYD       0101  1  5.0    2.11    0.07  3.25  11.13 0.29   0.000
    [I%=15.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 38.70 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\04261804-c4e4-4cc5-8794-db36
    remark: SCS_06H_002Y
*
 *  CALIB STANDHYD       0102  1  5.0    0.23    0.01  3.25  14.18 0.37   0.000
    [I%=25.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 38.70 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\04261804-c4e4-4cc5-8794-db36
    remark: SCS_06H_002Y
*
 *  CALIB STANDHYD       0201  1  5.0    2.84    0.30  3.25  25.71 0.66   0.000
    [I%=60.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 38.70 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\04261804-c4e4-4cc5-8794-db36
    remark: SCS_06H_002Y
*
 *  CALIB STANDHYD       0208  1  5.0    1.78    0.14  3.25  20.56 0.53   0.000
    [I%=40.0:S%= 2.00]
*
    DUHYD                0006  1  5.0    1.78    0.14  3.25  20.56  n/a   0.000
       MAJOR SYSTEM:     0006  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:     0006  3  5.0    1.78    0.14  3.25  20.56  n/a   0.000
*
    ADD [  0101+  0102]  0001  3  5.0    2.34    0.08  3.25  11.43  n/a   0.000
*
    ADD [  0001+  0106]  0001  1  5.0    2.93    0.09  3.25  10.29  n/a   0.000
*
    ADD [  0001+  0201]  0001  3  5.0    5.77    0.39  3.25  17.88  n/a   0.000
*
    ADD [  0001+  0006]  0001  1  5.0    5.77    0.39  3.25  17.88  n/a   0.000
*
    READ STORM                15.0
    [ Ptot= 38.70 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\04261804-c4e4-4cc5-8794-db36
    remark: SCS_06H_002Y
*
 *  CALIB STANDHYD       0202  1  5.0   33.75    2.79  3.25  24.10 0.62   0.000
    [I%=55.0:S%= 2.00]
*
    ADD [  0001+  0202]  0002  3  5.0   39.52    3.18  3.25  23.19  n/a   0.000
*
    READ STORM                15.0
    [ Ptot= 38.70 mm ]
```

```
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\04261804-c4e4-4cc5-8794-db36
    remark: SCS_06H_002Y
*
 *  CALIB STANDHYD       0203  1  5.0    1.97    0.17  3.25  21.24 0.55   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0002+  0203]  0003  3  5.0   41.49    3.35  3.25  23.10  n/a   0.000
*
    RESRVR [ 2:  0003]   0004  1  5.0   41.49    0.20  5.25  23.05  n/a   0.000
      {ST=  0.78 ha.m }
*
    READ STORM                 15.0
    [ Ptot= 38.70 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\04261804-c4e4-4cc5-8794-db36
    remark: SCS_06H_002Y
*
 *  CALIB NASHYD         0207  1  5.0   12.68    0.07  4.58   5.63 0.15   0.000
    [CN=61.0         ]
    [ N = 3.0:Tp 1.16]
*
    READ STORM                 15.0
    [ Ptot= 38.70 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\04261804-c4e4-4cc5-8794-db36
    remark: SCS_06H_002Y
*
 *  CALIB STANDHYD       0204  1  5.0    1.32    0.11  3.25  20.92 0.54   0.000
    [I%=45.0:S%= 2.00]
*
    READ STORM                 15.0
    [ Ptot= 38.70 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\04261804-c4e4-4cc5-8794-db36
    remark: SCS_06H_002Y
*
 *  CALIB STANDHYD       0205  1  5.0    0.97    0.08  3.25  20.92 0.54   0.000
    [I%=45.0:S%= 2.00]
*
    ADD [  0204+  0205]  0005  3  5.0    2.29    0.19  3.25  20.92  n/a   0.000
*
    ADD [  0005+  0207]  0005  1  5.0   14.97    0.20  3.25   7.97  n/a   0.000
*
    ADD [  0005+  0004]  0005  3  5.0   56.46    0.27  4.75  19.05  n/a   0.000
*
===========================================================================================
===============

       V    V   I    SSSSS  U   U    A    L              (v 5.1.2000)
       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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                   *****  S U M M A R Y   O U T P U T  *****

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.1\VO2\voin.dat
  Output  filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\8df85823-7570-47eb-98f5-a5fd5d244c3b\scena
  Summary filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\8df85823-7570-47eb-98f5-a5fd5d244c3b\scena


DATE: 04-29-2020                           TIME: 01:52:33

USER:


COMMENTS: ____________________________________________________________

  ************************************************
  ** SIMULATION : SCS_06H_005Y                  **
  ************************************************

  W/E COMMAND            HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                 min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      -------------------
    READ STORM                 15.0
    [ Ptot= 52.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\99364209-6155-4a53-b2ce-593f
    remark: SCS_06H_005Y
*
 ** CALIB NASHYD         0106  1  5.0    0.59    0.02  3.33  10.68 0.20   0.000
    [CN=61.0         ]
    [ N = 3.0:Tp 0.19]
*
    READ STORM                 15.0
    [ Ptot= 52.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\99364209-6155-4a53-b2ce-593f
    remark: SCS_06H_005Y
*
 *  CALIB STANDHYD       0101  1  5.0    2.11    0.11  3.25  17.79 0.34   0.000
    [I%=15.0:S%= 2.00]
*
    READ STORM                 15.0
    [ Ptot= 52.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\99364209-6155-4a53-b2ce-593f
    remark: SCS_06H_005Y
*
 *  CALIB STANDHYD       0102  1  5.0    0.23    0.02  3.25  21.74 0.41   0.000
    [I%=25.0:S%= 2.00]
*
    READ STORM                 15.0
    [ Ptot= 52.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\99364209-6155-4a53-b2ce-593f
    remark: SCS_06H_005Y
*
 *  CALIB STANDHYD       0201  1  5.0    2.84    0.43  3.25  36.68 0.70   0.000
    [I%=60.0:S%= 2.00]
*
    READ STORM                 15.0
    [ Ptot= 52.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\99364209-6155-4a53-b2ce-593f
    remark: SCS_06H_005Y
*
 *  CALIB STANDHYD       0208  1  5.0    1.78    0.21  3.25  30.34 0.58   0.000
    [I%=40.0:S%= 2.00]
*
    DUHYD                0006  1  5.0    1.78    0.21  3.25  30.34  n/a   0.000
```

```
       MAJOR SYSTEM:     0006  2  5.0    0.00    0.00  3.25  30.34  n/a   0.000
       MINOR SYSTEM:     0006  3  5.0    1.78    0.21  3.25  30.34  n/a   0.000
*
    ADD [  0101+  0102]  0001  3  5.0    2.34    0.13  3.25  18.18  n/a   0.000
*
    ADD [  0001+  0106]  0001  1  5.0    2.93    0.15  3.25  16.67  n/a   0.000
*
    ADD [  0001+  0201]  0001  3  5.0    5.77    0.58  3.25  26.52  n/a   0.000
*
    ADD [  0001+  0006]  0001  1  5.0    5.77    0.58  3.25  26.52  n/a   0.000
*
    READ STORM                15.0
    [ Ptot= 52.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\99364209-6155-4a53-b2ce-593f
    remark: SCS_06H_005Y
*
 *  CALIB STANDHYD       0202  1  5.0   33.75    4.29  3.25  34.61 0.66   0.000
    [I%=55.0:S%= 2.00]
*
    ADD [  0001+  0202]  0002  3  5.0   39.52    4.87  3.25  33.42  n/a   0.000
*
    READ STORM                15.0
    [ Ptot= 52.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\99364209-6155-4a53-b2ce-593f
    remark: SCS_06H_005Y
*
 *  CALIB STANDHYD       0203  1  5.0    1.97    0.24  3.25  30.55 0.58   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0002+  0203]  0003  3  5.0   41.49    5.11  3.25  33.29  n/a   0.000
*
    RESRVR [ 2:  0003]   0004  1  5.0   41.49    0.59  4.08  33.24  n/a   0.000
      {ST=  0.99 ha.m }
*
    READ STORM                15.0
    [ Ptot= 52.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\99364209-6155-4a53-b2ce-593f
    remark: SCS_06H_005Y
*
 *  CALIB NASHYD         0207  1  5.0   12.68    0.13  4.58  10.51 0.20   0.000
    [CN=61.0         ]
    [ N = 3.0:Tp 1.16]
*
    READ STORM                15.0
    [ Ptot= 52.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\99364209-6155-4a53-b2ce-593f
    remark: SCS_06H_005Y
*
 *  CALIB STANDHYD       0204  1  5.0    1.32    0.16  3.25  30.51 0.58   0.000
    [I%=45.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 52.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\99364209-6155-4a53-b2ce-593f
    remark: SCS_06H_005Y
*
 *  CALIB STANDHYD       0205  1  5.0    0.97    0.12  3.25  30.51 0.58   0.000
    [I%=45.0:S%= 2.00]
*
    ADD [  0204+  0205]  0005  3  5.0    2.29    0.28  3.25  30.51  n/a   0.000
*
    ADD [  0005+  0207]  0005  1  5.0   14.97    0.29  3.25  13.57  n/a   0.000
*
    ADD [  0005+  0004]  0005  3  5.0   56.46    0.73  4.17  28.02  n/a   0.000
*
```

```
==============================================================================================
===============

       V    V   I    SSSSS  U   U    A    L              (v 5.1.2000)
       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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```



```
                   *****  S U M M A R Y   O U T P U T  *****

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.1\VO2\voin.dat
  Output  filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\010d61ba-6a0e-4a58-a54b-1db501d31e76\scena
  Summary filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\010d61ba-6a0e-4a58-a54b-1db501d31e76\scena

DATE: 04-29-2020                           TIME: 01:52:33

USER:

COMMENTS: ____________________________________________________________

  ************************************************
  ** SIMULATION : SCS_06H_010Y                  **
  ************************************************

  W/E COMMAND             HYD ID   DT     AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                15.0
    [ Ptot= 61.50 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\0488384e-0286-411c-a7ce-9f5e
    remark: SCS_06H_010Y
*
 ** CALIB NASHYD         0106  1  5.0    0.59    0.03  3.33  14.55 0.24   0.000
    [CN=61.0         ]
    [ N = 3.0:Tp 0.19]
*
    READ STORM                15.0
    [ Ptot= 61.50 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\0488384e-0286-411c-a7ce-9f5e
    remark: SCS_06H_010Y
*
 *  CALIB STANDHYD       0101  1  5.0    2.11    0.16  3.25  22.75 0.37   0.000
    [I%=15.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 61.50 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\0488384e-0286-411c-a7ce-9f5e
    remark: SCS_06H_010Y
```

```
*
 * CALIB STANDHYD      0102  1  5.0    0.23    0.02  3.25  27.23 0.44   0.000
   [I%=25.0:S%= 2.00]
*
   READ STORM                15.0
   [ Ptot= 61.50 mm ]
   fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\0488384e-0286-411c-a7ce-9f5e
   remark: SCS_06H_010Y
*
 * CALIB STANDHYD      0201  1  5.0    2.84    0.52  3.25  44.22 0.72   0.000
   [I%=60.0:S%= 2.00]
*
   READ STORM                15.0
   [ Ptot= 61.50 mm ]
   fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\0488384e-0286-411c-a7ce-9f5e
   remark: SCS_06H_010Y
*
 * CALIB STANDHYD      0208  1  5.0    1.78    0.26  3.25  37.23 0.61   0.000
   [I%=40.0:S%= 2.00]
*
   DUHYD               0006  1  5.0    1.78    0.26  3.25  37.23  n/a   0.000
      MAJOR SYSTEM:    0006  2  5.0    0.05    0.05  3.25  37.23  n/a   0.000
      MINOR SYSTEM:    0006  3  5.0    1.73    0.21  3.17  37.23  n/a   0.000
*
   ADD [  0101+  0102] 0001  3  5.0    2.34    0.18  3.25  23.19  n/a   0.000
*
   ADD [  0001+  0106] 0001  1  5.0    2.93    0.21  3.25  21.45  n/a   0.000
*
   ADD [  0001+  0201] 0001  3  5.0    5.77    0.73  3.25  32.66  n/a   0.000
*
   ADD [  0001+  0006] 0001  1  5.0    5.82    0.78  3.25  32.70  n/a   0.000
*
   READ STORM                15.0
   [ Ptot= 61.50 mm ]
   fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\0488384e-0286-411c-a7ce-9f5e
   remark: SCS_06H_010Y
*
 * CALIB STANDHYD      0202  1  5.0   33.75    5.19  3.25  41.87 0.68   0.000
   [I%=55.0:S%= 2.00]
*
   ADD [  0001+  0202] 0002  3  5.0   39.57    5.97  3.25  40.52  n/a   0.000
*
   READ STORM                15.0
   [ Ptot= 61.50 mm ]
   fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\0488384e-0286-411c-a7ce-9f5e
   remark: SCS_06H_010Y
*
 * CALIB STANDHYD      0203  1  5.0    1.97    0.30  3.25  37.04 0.60   0.000
   [I%=50.0:S%= 2.00]
*
   ADD [  0002+  0203] 0003  3  5.0   41.54    6.26  3.25  40.36  n/a   0.000
*
   RESRVR [ 2:  0003]  0004  1  5.0   41.54    0.92  3.92  40.31  n/a   0.000
     {ST=  1.14 ha.m }
*
   READ STORM                15.0
   [ Ptot= 61.50 mm ]
   fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\0488384e-0286-411c-a7ce-9f5e
   remark: SCS_06H_010Y
*
 * CALIB NASHYD        0207  1  5.0   12.68    0.17  4.50  14.36 0.23   0.000
   [CN=61.0        ]
   [ N = 3.0:Tp 1.16]
*
   READ STORM                15.0
   [ Ptot= 61.50 mm ]
   fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\0488384e-0286-411c-a7ce-9f5e
   remark: SCS_06H_010Y
*
 * CALIB STANDHYD      0204  1  5.0    1.32    0.20  3.25  37.24 0.61   0.000
   [I%=45.0:S%= 2.00]
*
   READ STORM                15.0
   [ Ptot= 61.50 mm ]
   fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\0488384e-0286-411c-a7ce-9f5e
   remark: SCS_06H_010Y
*
 * CALIB STANDHYD      0205  1  5.0    0.97    0.14  3.25  37.23 0.61   0.000
   [I%=45.0:S%= 2.00]
*
   ADD [  0204+  0205] 0005  3  5.0    2.29    0.34  3.25  37.23  n/a   0.000
*
   ADD [  0005+  0207] 0005  1  5.0   14.97    0.36  3.25  17.86  n/a   0.000
*
   ADD [  0005+  0004] 0005  3  5.0   56.51    1.10  4.00  34.36  n/a   0.000
*
==========================================================================================
==============

       V    V   I    SSSSS  U   U    A    L              (v 5.1.2000)
       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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                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.1\VO2\voin.dat
  Output  filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\98e0ec9e-e1dd-4f23-8e5c-ca5f6529dfe3\scena
  Summary filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\98e0ec9e-e1dd-4f23-8e5c-ca5f6529dfe3\scena


DATE: 04-29-2020                           TIME: 01:52:33

USER:


COMMENTS: ____________________________________________________________

  ************************************************
  ** SIMULATION : SCS_06H_025Y                  **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min    ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                15.0
```

```
    [ Ptot= 72.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\76197674-7e12-413b-9cac-039f
    remark: SCS_06H_025Y
*
 ** CALIB NASHYD         0106  1  5.0    0.59    0.04  3.33  19.97 0.27   0.000
    [CN=61.0         ]
    [ N = 3.0:Tp 0.19]
*
    READ STORM                15.0
    [ Ptot= 72.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\76197674-7e12-413b-9cac-039f
    remark: SCS_06H_025Y
*
 *  CALIB STANDHYD       0101  1  5.0    2.11    0.21  3.25  29.46 0.40   0.000
    [I%=15.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 72.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\76197674-7e12-413b-9cac-039f
    remark: SCS_06H_025Y
*
 *  CALIB STANDHYD       0102  1  5.0    0.23    0.03  3.25  34.54 0.47   0.000
    [I%=25.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 72.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\76197674-7e12-413b-9cac-039f
    remark: SCS_06H_025Y
*
 *  CALIB STANDHYD       0201  1  5.0    2.84    0.67  3.25  53.91 0.74   0.000
    [I%=60.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 72.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\76197674-7e12-413b-9cac-039f
    remark: SCS_06H_025Y
*
 *  CALIB STANDHYD       0208  1  5.0    1.78    0.34  3.25  46.20 0.63   0.000
    [I%=40.0:S%= 2.00]
*
    DUHYD                0006  1  5.0    1.78    0.34  3.25  46.20  n/a   0.000
       MAJOR SYSTEM:     0006  2  5.0    0.18    0.13  3.25  46.20  n/a   0.000
       MINOR SYSTEM:     0006  3  5.0    1.60    0.21  3.08  46.20  n/a   0.000
*
    ADD [  0101+  0102]  0001  3  5.0    2.34    0.24  3.25  29.96  n/a   0.000
*
    ADD [  0001+  0106]  0001  1  5.0    2.93    0.27  3.25  27.95  n/a   0.000
*
    ADD [  0001+  0201]  0001  3  5.0    5.77    0.94  3.25  40.73  n/a   0.000
*
    ADD [  0001+  0006]  0001  1  5.0    5.95    1.08  3.25  40.89  n/a   0.000
*
    READ STORM                15.0
    [ Ptot= 72.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\76197674-7e12-413b-9cac-039f
    remark: SCS_06H_025Y
*
 *  CALIB STANDHYD       0202  1  5.0   33.75    6.60  3.25  51.24 0.70   0.000
    [I%=55.0:S%= 2.00]
*
    ADD [  0001+  0202]  0002  3  5.0   39.70    7.68  3.25  49.69  n/a   0.000
*
    READ STORM                15.0
    [ Ptot= 72.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\76197674-7e12-413b-9cac-039f
    remark: SCS_06H_025Y
*
 *  CALIB STANDHYD       0203  1  5.0    1.97    0.36  3.25  45.46 0.62   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0002+  0203]  0003  3  5.0   41.67    8.04  3.25  49.49  n/a   0.000
*
    RESRVR [ 2:  0003]   0004  1  5.0   41.67    1.38  3.83  49.44  n/a   0.000
      {ST=  1.34 ha.m }
*
    READ STORM                15.0
    [ Ptot= 72.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\76197674-7e12-413b-9cac-039f
    remark: SCS_06H_025Y
*
 *  CALIB NASHYD         0207  1  5.0   12.68    0.24  4.50  19.77 0.27   0.000
    [CN=61.0         ]
    [ N = 3.0:Tp 1.16]
*
    READ STORM                15.0
    [ Ptot= 72.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\76197674-7e12-413b-9cac-039f
    remark: SCS_06H_025Y
*
 *  CALIB STANDHYD       0204  1  5.0    1.32    0.24  3.25  45.98 0.63   0.000
    [I%=45.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 72.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\76197674-7e12-413b-9cac-039f
    remark: SCS_06H_025Y
*
 *  CALIB STANDHYD       0205  1  5.0    0.97    0.18  3.25  45.98 0.63   0.000
    [I%=45.0:S%= 2.00]
*
    ADD [  0204+  0205]  0005  3  5.0    2.29    0.42  3.25  45.98  n/a   0.000
*
    ADD [  0005+  0207]  0005  1  5.0   14.97    0.45  3.25  23.78  n/a   0.000
*
    ADD [  0005+  0004]  0005  3  5.0   56.64    1.61  3.75  42.66  n/a   0.000
*
==============================================================================================
===============

       V    V   I    SSSSS  U   U    A    L              (v 5.1.2000)
       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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```



```
                   *****  S U M M A R Y   O U T P U T  *****

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.1\VO2\voin.dat
```

```
  Output  filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\b981b373-7fdd-4bcf-b9bd-3629c06934a6\scena
  Summary filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\b981b373-7fdd-4bcf-b9bd-3629c06934a6\scena


DATE: 04-29-2020                          TIME: 01:52:34

USER:


COMMENTS: ____________________________________________________________


  ************************************************
  ** SIMULATION : SCS_06H_050Y                  **
  ************************************************

  W/E COMMAND            HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.    Qbase
                                 min     ha   '  cms   hrs     mm           cms

      START @  0.00 hrs
      --------------------
    READ STORM                15.0
    [ Ptot= 81.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\a55243cf-90fe-4730-b73b-2015
    remark: SCS_06H_050Y
*
 ** CALIB NASHYD        0106  1  5.0    0.59    0.05  3.33  24.39 0.30   0.000
    [CN=61.0        ]
    [ N = 3.0:Tp 0.19]
*
    READ STORM                15.0
    [ Ptot= 81.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\a55243cf-90fe-4730-b73b-2015
    remark: SCS_06H_050Y
*
 *  CALIB STANDHYD      0101  1  5.0    2.11    0.25  3.25  34.78 0.43   0.000
    [I%=15.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 81.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\a55243cf-90fe-4730-b73b-2015
    remark: SCS_06H_050Y
*
 *  CALIB STANDHYD      0102  1  5.0    0.23    0.04  3.25  40.28 0.49   0.000
    [I%=25.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 81.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\a55243cf-90fe-4730-b73b-2015
    remark: SCS_06H_050Y
*
 *  CALIB STANDHYD      0201  1  5.0    2.84    0.76  3.25  61.27 0.75   0.000
    [I%=60.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 81.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\a55243cf-90fe-4730-b73b-2015
    remark: SCS_06H_050Y
*
 *  CALIB STANDHYD      0208  1  5.0    1.78    0.40  3.25  53.09 0.65   0.000
    [I%=40.0:S%= 2.00]
*
    DUHYD               0006  1  5.0    1.78    0.40  3.25  53.09  n/a   0.000
       MAJOR SYSTEM:    0006  2  5.0    0.23    0.19  3.25  53.09  n/a   0.000
       MINOR SYSTEM:    0006  3  5.0    1.55    0.21  3.08  53.09  n/a   0.000
*
    ADD [  0101+  0102] 0001  3  5.0    2.34    0.29  3.25  35.32  n/a   0.000
*
    ADD [  0001+  0106] 0001  1  5.0    2.93    0.33  3.25  33.12  n/a   0.000
*
    ADD [  0001+  0201] 0001  3  5.0    5.77    1.09  3.25  46.97  n/a   0.000
*
    ADD [  0001+  0006] 0001  1  5.0    6.00    1.28  3.25  47.21  n/a   0.000
*
    READ STORM                15.0
    [ Ptot= 81.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\a55243cf-90fe-4730-b73b-2015
    remark: SCS_06H_050Y
*
 *  CALIB STANDHYD      0202  1  5.0   33.75    7.56  3.25  58.39 0.72   0.000
    [I%=55.0:S%= 2.00]
*
    ADD [  0001+  0202] 0002  3  5.0   39.75    8.84  3.25  56.70  n/a   0.000
*
    READ STORM                15.0
    [ Ptot= 81.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\a55243cf-90fe-4730-b73b-2015
    remark: SCS_06H_050Y
*
 *  CALIB STANDHYD      0203  1  5.0    1.97    0.41  3.25  51.92 0.64   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0002+  0203] 0003  3  5.0   41.72    9.25  3.25  56.47  n/a   0.000
*
    RESRVR [ 2:  0003]  0004  1  5.0   41.72    1.67  3.83  56.42  n/a   0.000
      {ST=  1.50 ha.m }
*
    READ STORM                15.0
    [ Ptot= 81.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\a55243cf-90fe-4730-b73b-2015
    remark: SCS_06H_050Y
*
 *  CALIB NASHYD        0207  1  5.0   12.68    0.29  4.50  24.18 0.30   0.000
    [CN=61.0        ]
    [ N = 3.0:Tp 1.16]
*
    READ STORM                15.0
    [ Ptot= 81.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\a55243cf-90fe-4730-b73b-2015
    remark: SCS_06H_050Y
*
 *  CALIB STANDHYD      0204  1  5.0    1.32    0.29  3.25  52.70 0.65   0.000
    [I%=45.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 81.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\a55243cf-90fe-4730-b73b-2015
    remark: SCS_06H_050Y
*
 *  CALIB STANDHYD      0205  1  5.0    0.97    0.22  3.25  52.71 0.65   0.000
    [I%=45.0:S%= 2.00]
*
    ADD [  0204+  0205] 0005  3  5.0    2.29    0.51  3.25  52.71  n/a   0.000
*
    ADD [  0005+  0207] 0005  1  5.0   14.97    0.55  3.25  28.54  n/a   0.000
*
    ADD [  0005+  0004] 0005  3  5.0   56.69    1.96  3.75  49.06  n/a   0.000
*
```

```
============================================================================================
===============

       V    V   I    SSSSS  U   U    A    L             (v 5.1.2000)
       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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```



```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.1\VO2\voin.dat
  Output  filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\ed3e1f50-c917-4185-b65f-1bfc96d674c9\scena
  Summary filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\ed3e1f50-c917-4185-b65f-1bfc96d674c9\scena


DATE: 04-29-2020                           TIME: 01:52:34

USER:


COMMENTS: ____________________________________________________________


  ***********************************************
  ** SIMULATION : SCS_06H_100Y                 **
  ***********************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                 15.0
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\33e70cb9-9264-4fe4-aedf-ad51
    remark: SCS_06H_100Y
*
 ** CALIB NASHYD         0106  1  5.0    0.59    0.06  3.33  29.08 0.32   0.000
    [CN=61.0        ]
    [ N = 3.0:Tp 0.19]
*
    READ STORM                 15.0
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\33e70cb9-9264-4fe4-aedf-ad51
    remark: SCS_06H_100Y
*
 *  CALIB STANDHYD       0101  1  5.0    2.11    0.29  3.25  40.34 0.45   0.000
    [I%=15.0:S%= 2.00]
*
    READ STORM                 15.0
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\33e70cb9-9264-4fe4-aedf-ad51
    remark: SCS_06H_100Y
*
 *  CALIB STANDHYD       0102  1  5.0    0.23    0.04  3.25  46.22 0.51   0.000
    [I%=25.0:S%= 2.00]
*
    READ STORM                 15.0
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\33e70cb9-9264-4fe4-aedf-ad51
    remark: SCS_06H_100Y
*
 *  CALIB STANDHYD       0201  1  5.0    2.84    0.86  3.25  68.74 0.76   0.000
    [I%=60.0:S%= 2.00]
*
    READ STORM                 15.0
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\33e70cb9-9264-4fe4-aedf-ad51
    remark: SCS_06H_100Y
*
 *  CALIB STANDHYD       0208  1  5.0    1.78    0.45  3.25  60.14 0.67   0.000
    [I%=40.0:S%= 2.00]
*
    DUHYD                0006  1  5.0    1.78    0.45  3.25  60.14  n/a   0.000
       MAJOR SYSTEM:     0006  2  5.0    0.29    0.24  3.25  60.14  n/a   0.000
       MINOR SYSTEM:     0006  3  5.0    1.49    0.21  3.08  60.14  n/a   0.000
*
    ADD [  0101+  0102]  0001  3  5.0    2.34    0.34  3.25  40.91  n/a   0.000
*
    ADD [  0001+  0106]  0001  1  5.0    2.93    0.39  3.25  38.53  n/a   0.000
*
    ADD [  0001+  0201]  0001  3  5.0    5.77    1.25  3.25  53.40  n/a   0.000
*
    ADD [  0001+  0006]  0001  1  5.0    6.06    1.49  3.25  53.72  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\33e70cb9-9264-4fe4-aedf-ad51
    remark: SCS_06H_100Y
*
 *  CALIB STANDHYD       0202  1  5.0   33.75    8.67  3.25  65.65 0.73   0.000
    [I%=55.0:S%= 2.00]
*
    ADD [  0001+  0202]  0002  3  5.0   39.81   10.16  3.25  63.84  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\33e70cb9-9264-4fe4-aedf-ad51
    remark: SCS_06H_100Y
*
 *  CALIB STANDHYD       0203  1  5.0    1.97    0.46  3.25  58.52 0.65   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0002+  0203]  0003  3  5.0   41.78   10.62  3.25  63.59  n/a   0.000
*
    RESRVR [ 2:  0003]   0004  1  5.0   41.78    1.90  3.75  63.54  n/a   0.000
      {ST=  1.68 ha.m }
*
    READ STORM                 15.0
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\33e70cb9-9264-4fe4-aedf-ad51
    remark: SCS_06H_100Y
*
 *  CALIB NASHYD         0207  1  5.0   12.68    0.35  4.50  28.86 0.32   0.000
    [CN=61.0        ]
    [ N = 3.0:Tp 1.16]
*
    READ STORM                 15.0
```

```
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\33e70cb9-9264-4fe4-aedf-ad51
    remark: SCS_06H_100Y
*
 *  CALIB STANDHYD       0204  1  5.0    1.32    0.33  3.25  59.58 0.66   0.000
    [I%=45.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\33e70cb9-9264-4fe4-aedf-ad51
    remark: SCS_06H_100Y
*
 *  CALIB STANDHYD       0205  1  5.0    0.97    0.25  3.25  59.58 0.66   0.000
    [I%=45.0:S%= 2.00]
*
    ADD [  0204+  0205]  0005  3  5.0    2.29    0.58  3.25  59.58  n/a   0.000
*
    ADD [  0005+  0207]  0005  1  5.0   14.97    0.63  3.25  33.56  n/a   0.000
*
    ADD [  0005+  0004]  0005  3  5.0   56.75    2.24  3.75  55.63  n/a   0.000
*
 FINISH

=============================================================================================
===============

=============================================================================================
===============


       V    V   I    SSSSS  U   U    A    L             (v 5.1.2000)
       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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                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.1\VO2\voin.dat
  Output  filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\7a24d8fa-8f00-4279-8713-c08600f7de4a\scena
  Summary filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\7a24d8fa-8f00-4279-8713-c08600f7de4a\scena


DATE: 04-29-2020                           TIME: 01:52:33

USER:

COMMENTS: ____________________________________________________________


  ************************************************
  ** SIMULATION : Timmins                       **
  ************************************************

  W/E COMMAND            HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha  '  cms   hrs     mm          cms
      START @  0.00 hrs
      --------------------
    READ STORM                15.0
    [ Ptot=193.00 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\50758f93-5b19-437c-bd5a-bd75
    remark: * Timmins Storm
*
 ** CALIB NASHYD         0106  1  5.0    0.59    0.04  7.00 100.63 0.52   0.000
    [CN=61.0         ]
    [ N = 3.0:Tp 0.19]
*
    READ STORM                15.0
    [ Ptot=193.00 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\50758f93-5b19-437c-bd5a-bd75
    remark: * Timmins Storm
*
 *  CALIB STANDHYD       0101  1  5.0    2.11    0.17  7.00 119.74 0.62   0.000
    [I%=15.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot=193.00 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\50758f93-5b19-437c-bd5a-bd75
    remark: * Timmins Storm
*
 *  CALIB STANDHYD       0102  1  5.0    0.23    0.02  7.00 128.76 0.67   0.000
    [I%=25.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot=193.00 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\50758f93-5b19-437c-bd5a-bd75
    remark: * Timmins Storm
*
 *  CALIB STANDHYD       0201  1  5.0    2.84    0.30  7.00 164.09 0.85   0.000
    [I%=60.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot=193.00 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\50758f93-5b19-437c-bd5a-bd75
    remark: * Timmins Storm
*
 *  CALIB STANDHYD       0208  1  5.0    1.78    0.18  7.00 152.51 0.79   0.000
    [I%=40.0:S%= 2.00]
*
    DUHYD                0006  1  5.0    1.78    0.18  7.00 152.51  n/a   0.000
       MAJOR SYSTEM:     0006  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:     0006  3  5.0    1.78    0.18  7.00 152.51  n/a   0.000
*
    ADD [  0101+  0102]  0001  3  5.0    2.34    0.19  7.00 120.62  n/a   0.000
*
    ADD [  0001+  0106]  0001  1  5.0    2.93    0.24  7.00 116.60  n/a   0.000
*
    ADD [  0001+  0201]  0001  3  5.0    5.77    0.54  7.00 139.97  n/a   0.000
*
    ADD [  0001+  0006]  0001  1  5.0    5.77    0.54  7.00 139.97  n/a   0.000
*
    READ STORM                15.0
    [ Ptot=193.00 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\50758f93-5b19-437c-bd5a-bd75
    remark: * Timmins Storm
*
 *  CALIB STANDHYD       0202  1  5.0   33.75    3.46  7.00 159.38 0.83   0.000
    [I%=55.0:S%= 2.00]
```

```
*
    ADD [  0001+  0202]  0002  3  5.0   39.52    4.00  7.00 156.55  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot=193.00 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\50758f93-5b19-437c-bd5a-bd75
    remark: * Timmins Storm
*
 *  CALIB STANDHYD       0203  1  5.0    1.97    0.19  7.00 145.93 0.76   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0002+  0203]  0003  3  5.0   41.49    4.19  7.00 156.05  n/a   0.000
*
    RESRVR [ 2:  0003]   0004  1  5.0   41.49    2.91  7.25 156.00  n/a   0.000
      {ST=  1.96 ha.m }
*
    READ STORM                 15.0
    [ Ptot=193.00 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\50758f93-5b19-437c-bd5a-bd75
    remark: * Timmins Storm
*
 *  CALIB NASHYD         0207  1  5.0   12.68    0.57  8.25 100.48 0.52   0.000
    [CN=61.0         ]
    [ N = 3.0:Tp 1.16]
*
    READ STORM                 15.0
    [ Ptot=193.00 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\50758f93-5b19-437c-bd5a-bd75
    remark: * Timmins Storm
*
 *  CALIB STANDHYD       0204  1  5.0    1.32    0.13  7.00 150.09 0.78   0.000
    [I%=45.0:S%= 2.00]
*
    READ STORM                 15.0
    [ Ptot=193.00 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\33e69197-2079-4def-b3df-
ebaad02a7c89\50758f93-5b19-437c-bd5a-bd75
    remark: * Timmins Storm
*
 *  CALIB STANDHYD       0205  1  5.0    0.97    0.10  7.00 150.09 0.78   0.000
    [I%=45.0:S%= 2.00]
*
    ADD [  0204+  0205]  0005  3  5.0    2.29    0.23  7.00 150.09  n/a   0.000
*
    ADD [  0005+  0207]  0005  1  5.0   14.97    0.70  8.50 108.07  n/a   0.000
*
    ADD [  0005+  0004]  0005  3  5.0   56.46    3.51  7.25 143.29  n/a   0.000
*
```

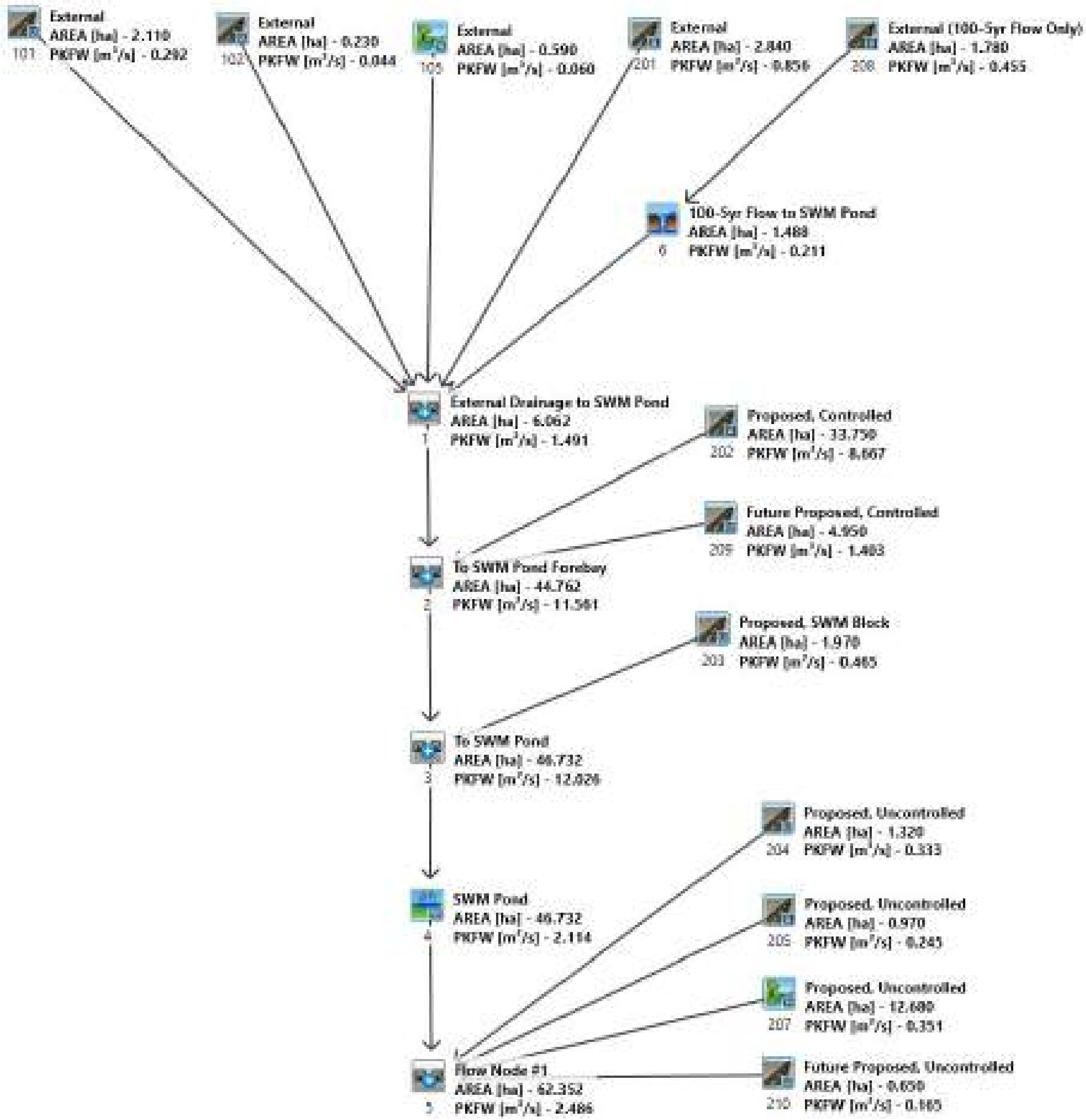

Figure E.2-B: VO5 Model Schematic – Post-Development Storm Drainage Potential Future Development Condition

```
=========================================================================================
===============

       V    V   I    SSSSS  U   U    A    L              (v 5.1.2000)
       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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                   *****  S U M M A R Y   O U T P U T  *****

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.1\VO2\voin.dat
  Output  filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\ee460bce-d5c4-46fe-aa77-21eb0eb40d7c\scena
  Summary filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\ee460bce-d5c4-46fe-aa77-21eb0eb40d7c\scena

DATE: 04-29-2020                          TIME: 01:53:38

USER:

COMMENTS: ____________________________________________________________

  ************************************************
  ** SIMULATION : 25mmchi                        **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 25.02 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\c8e47b32-cfe3-4ee5-b83e-4a3c
    remark: 25mm CHICAGO Storm
*
 ** CALIB NASHYD        0105  1  5.0    0.59    0.00  1.75   2.19 0.09   0.000
    [CN=61.0        ]
    [ N = 3.0:Tp 0.19]
*
    READ STORM                10.0
    [ Ptot= 25.02 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\c8e47b32-cfe3-4ee5-b83e-4a3c
    remark: 25mm CHICAGO Storm
*
 *  CALIB STANDHYD      0101  1  5.0    2.11    0.03  1.50   5.65 0.23   0.000
    [I%=15.0:S%= 2.00]
*
    READ STORM                10.0
    [ Ptot= 25.02 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\c8e47b32-cfe3-4ee5-b83e-4a3c
    remark: 25mm CHICAGO Storm
*
 *  CALIB STANDHYD      0102  1  5.0    0.23    0.01  1.50   7.66 0.31   0.000
    [I%=25.0:S%= 2.00]
*
    READ STORM                10.0
    [ Ptot= 25.02 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\c8e47b32-cfe3-4ee5-b83e-4a3c
    remark: 25mm CHICAGO Storm
*
 *  CALIB STANDHYD      0201  1  5.0    2.84    0.18  1.50  15.36 0.61   0.000
    [I%=60.0:S%= 2.00]
*
    READ STORM                10.0
    [ Ptot= 25.02 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\c8e47b32-cfe3-4ee5-b83e-4a3c
    remark: 25mm CHICAGO Storm
*
 *  CALIB STANDHYD      0208  1  5.0    1.78    0.08  1.50  11.71 0.47   0.000
    [I%=40.0:S%= 2.00]
*
    DUHYD               0006  1  5.0    1.78    0.08  1.50  11.71  n/a   0.000
       MAJOR SYSTEM:    0006  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:    0006  3  5.0    1.78    0.08  1.50  11.71  n/a   0.000
*
    ADD [  0101+  0102] 0001  3  5.0    2.34    0.04  1.50   5.84  n/a   0.000
*
    ADD [  0001+  0105] 0001  1  5.0    2.93    0.04  1.50   5.11  n/a   0.000
*
    ADD [  0001+  0201] 0001  3  5.0    5.77    0.23  1.50  10.16  n/a   0.000
*
    ADD [  0001+  0006] 0001  1  5.0    5.77    0.23  1.50  10.16  n/a   0.000
*
    READ STORM                10.0
    [ Ptot= 25.02 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\c8e47b32-cfe3-4ee5-b83e-4a3c
    remark: 25mm CHICAGO Storm
*
 *  CALIB STANDHYD      0202  1  5.0   33.75    1.47  1.58  14.29 0.57   0.000
    [I%=55.0:S%= 2.00]
*
    READ STORM                10.0
    [ Ptot= 25.02 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\c8e47b32-cfe3-4ee5-b83e-4a3c
    remark: 25mm CHICAGO Storm
*
 *  CALIB STANDHYD      0209  1  5.0    4.95    0.28  1.50  14.29 0.57   0.000
    [I%=55.0:S%= 2.00]
*
    ADD [  0001+  0202] 0002  3  5.0   39.52    1.61  1.58  13.69  n/a   0.000
*
    ADD [  0002+  0209] 0002  1  5.0   44.47    1.88  1.50  13.75  n/a   0.000
*
    READ STORM                10.0
    [ Ptot= 25.02 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\c8e47b32-cfe3-4ee5-b83e-4a3c
    remark: 25mm CHICAGO Storm
*
 *  CALIB STANDHYD      0203  1  5.0    1.97    0.11  1.50  12.60 0.50   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0002+  0203] 0003  3  5.0   46.44    1.99  1.50  13.71  n/a   0.000
*
    RESRVR [ 2:  0003]  0004  1  5.0   46.44    0.06  4.33  13.66  n/a   0.000
      {ST=  0.58 ha.m }
*
```

```
    READ STORM                10.0
    [ Ptot= 25.02 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\c8e47b32-cfe3-4ee5-b83e-4a3c
    remark: 25mm CHICAGO Storm
*
 *  CALIB NASHYD         0207  1  5.0   12.68    0.02  3.58   2.10 0.08   0.000
    [CN=61.0         ]
    [ N = 3.0:Tp 1.16]
*
    READ STORM                10.0
    [ Ptot= 25.02 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\c8e47b32-cfe3-4ee5-b83e-4a3c
    remark: 25mm CHICAGO Storm
*
 *  CALIB STANDHYD       0204  1  5.0    1.32    0.07  1.50  12.15 0.49   0.000
    [I%=45.0:S%= 2.00]
*
    READ STORM                10.0
    [ Ptot= 25.02 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\c8e47b32-cfe3-4ee5-b83e-4a3c
    remark: 25mm CHICAGO Storm
*
 *  CALIB STANDHYD       0205  1  5.0    0.97    0.05  1.50  12.15 0.49   0.000
    [I%=45.0:S%= 2.00]
*
    READ STORM                10.0
    [ Ptot= 25.02 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\c8e47b32-cfe3-4ee5-b83e-4a3c
    remark: 25mm CHICAGO Storm
*
 *  CALIB STANDHYD       0210  1  5.0    0.65    0.03  1.50  12.14 0.49   0.000
    [I%=45.0:S%= 2.00]
*
    ADD [  0204+  0205]  0005  3  5.0    2.29    0.12  1.50  12.15  n/a   0.000
*
    ADD [  0005+  0207]  0005  1  5.0   14.97    0.12  1.50   3.63  n/a   0.000
*
    ADD [  0005+  0210]  0005  3  5.0   15.62    0.15  1.50   3.99  n/a   0.000
*
    ADD [  0005+  0004]  0005  1  5.0   62.06    0.17  1.50  11.23  n/a   0.000
*
 FINISH

============================================================================================
==============

============================================================================================
==============


       V    V   I    SSSSS  U   U    A    L              (v 5.1.2000)
       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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```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.1\VO2\voin.dat
  Output  filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\a81a5993-1b9e-44a0-91d9-baf4d0b79840\scena
  Summary filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\a81a5993-1b9e-44a0-91d9-baf4d0b79840\scena


DATE: 04-29-2020                           TIME: 01:53:38

USER:


COMMENTS: ____________________________________________________________


  ************************************************
  ** SIMULATION : SCS_06H_002Y                  **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                15.0
    [ Ptot= 38.70 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\04261804-c4e4-4cc5-8794-db36
    remark: SCS_06H_002Y
*
 ** CALIB NASHYD         0105  1  5.0    0.59    0.01  3.33   5.78 0.15   0.000
    [CN=61.0         ]
    [ N = 3.0:Tp 0.19]
*
    READ STORM                15.0
    [ Ptot= 38.70 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\04261804-c4e4-4cc5-8794-db36
    remark: SCS_06H_002Y
*
 *  CALIB STANDHYD       0101  1  5.0    2.11    0.07  3.25  11.13 0.29   0.000
    [I%=15.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 38.70 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\04261804-c4e4-4cc5-8794-db36
    remark: SCS_06H_002Y
*
 *  CALIB STANDHYD       0102  1  5.0    0.23    0.01  3.25  14.18 0.37   0.000
    [I%=25.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 38.70 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\04261804-c4e4-4cc5-8794-db36
    remark: SCS_06H_002Y
*
 *  CALIB STANDHYD       0201  1  5.0    2.84    0.30  3.25  25.71 0.66   0.000
    [I%=60.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 38.70 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\04261804-c4e4-4cc5-8794-db36
    remark: SCS_06H_002Y
*
 *  CALIB STANDHYD       0208  1  5.0    1.78    0.14  3.25  20.56 0.53   0.000
```

```
    [I%=40.0:S%= 2.00]
*
    DUHYD               0006  1  5.0    1.78    0.14  3.25  20.56  n/a   0.000
       MAJOR SYSTEM:    0006  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:    0006  3  5.0    1.78    0.14  3.25  20.56  n/a   0.000
*
    ADD [  0101+  0102] 0001  3  5.0    2.34    0.08  3.25  11.43  n/a   0.000
*
    ADD [  0001+  0105] 0001  1  5.0    2.93    0.09  3.25  10.29  n/a   0.000
*
    ADD [  0001+  0201] 0001  3  5.0    5.77    0.39  3.25  17.88  n/a   0.000
*
    ADD [  0001+  0006] 0001  1  5.0    5.77    0.39  3.25  17.88  n/a   0.000
*
    READ STORM                15.0
    [ Ptot= 38.70 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\04261804-c4e4-4cc5-8794-db36
    remark: SCS_06H_002Y
*
 *  CALIB STANDHYD       0202  1  5.0   33.75    2.79  3.25  24.10 0.62   0.000
    [I%=55.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 38.70 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\04261804-c4e4-4cc5-8794-db36
    remark: SCS_06H_002Y
*
 *  CALIB STANDHYD       0209  1  5.0    4.95    0.48  3.25  24.10 0.62   0.000
    [I%=55.0:S%= 2.00]
*
    ADD [  0001+  0202] 0002  3  5.0   39.52    3.18  3.25  23.19  n/a   0.000
*
    ADD [  0002+  0209] 0002  1  5.0   44.47    3.66  3.25  23.29  n/a   0.000
*
    READ STORM                15.0
    [ Ptot= 38.70 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\04261804-c4e4-4cc5-8794-db36
    remark: SCS_06H_002Y
*
 *  CALIB STANDHYD       0203  1  5.0    1.97    0.17  3.25  21.24 0.55   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0002+  0203] 0003  3  5.0   46.44    3.83  3.25  23.21  n/a   0.000
*
    RESRVR [ 2:  0003]  0004  1  5.0   46.44    0.30  4.75  23.16  n/a   0.000
      {ST=  0.84 ha.m }
*
    READ STORM                15.0
    [ Ptot= 38.70 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\04261804-c4e4-4cc5-8794-db36
    remark: SCS_06H_002Y
*
 *  CALIB NASHYD         0207  1  5.0   12.68    0.07  4.58   5.63 0.15   0.000
    [CN=61.0        ]
    [ N = 3.0:Tp 1.16]
*
    READ STORM                15.0
    [ Ptot= 38.70 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\04261804-c4e4-4cc5-8794-db36
    remark: SCS_06H_002Y
*
 *  CALIB STANDHYD       0204  1  5.0    1.32    0.11  3.25  20.92 0.54   0.000
    [I%=45.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 38.70 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\04261804-c4e4-4cc5-8794-db36
    remark: SCS_06H_002Y
*
 *  CALIB STANDHYD       0205  1  5.0    0.97    0.08  3.25  20.92 0.54   0.000
    [I%=45.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 38.70 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\04261804-c4e4-4cc5-8794-db36
    remark: SCS_06H_002Y
*
 *  CALIB STANDHYD       0210  1  5.0    0.65    0.05  3.25  20.91 0.54   0.000
    [I%=45.0:S%= 2.00]
*
    ADD [  0204+  0205] 0005  3  5.0    2.29    0.19  3.25  20.92  n/a   0.000
*
    ADD [  0005+  0207] 0005  1  5.0   14.97    0.20  3.25   7.97  n/a   0.000
*
    ADD [  0005+  0210] 0005  3  5.0   15.62    0.25  3.25   8.51  n/a   0.000
*
    ADD [  0005+  0004] 0005  1  5.0   62.06    0.39  4.67  19.47  n/a   0.000
*
=============================================================================================
==============


       V    V   I    SSSSS  U   U    A    L              (v 5.1.2000)
       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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                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.1\VO2\voin.dat
  Output  filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\ad926714-30ea-4464-8397-6b4a25fac371\scena
  Summary filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\ad926714-30ea-4464-8397-6b4a25fac371\scena


DATE: 04-29-2020                           TIME: 01:53:38

USER:


COMMENTS: ____________________________________________________________


  ************************************************
  ** SIMULATION : SCS_06H_005Y                  **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
```

```
     --------------------
    READ STORM                15.0
    [ Ptot= 52.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\99364209-6155-4a53-b2ce-593f
    remark: SCS_06H_005Y
*
 ** CALIB NASHYD         0105  1  5.0    0.59    0.02  3.33  10.68 0.20   0.000
    [CN=61.0        ]
    [ N = 3.0:Tp 0.19]
*
    READ STORM                15.0
    [ Ptot= 52.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\99364209-6155-4a53-b2ce-593f
    remark: SCS_06H_005Y
*
 *  CALIB STANDHYD       0101  1  5.0    2.11    0.11  3.25  17.79 0.34   0.000
    [I%=15.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 52.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\99364209-6155-4a53-b2ce-593f
    remark: SCS_06H_005Y
*
 *  CALIB STANDHYD       0102  1  5.0    0.23    0.02  3.25  21.74 0.41   0.000
    [I%=25.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 52.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\99364209-6155-4a53-b2ce-593f
    remark: SCS_06H_005Y
*
 *  CALIB STANDHYD       0201  1  5.0    2.84    0.43  3.25  36.68 0.70   0.000
    [I%=60.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 52.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\99364209-6155-4a53-b2ce-593f
    remark: SCS_06H_005Y
*
 *  CALIB STANDHYD       0208  1  5.0    1.78    0.21  3.25  30.34 0.58   0.000
    [I%=40.0:S%= 2.00]
*
    DUHYD                0006  1  5.0    1.78    0.21  3.25  30.34  n/a   0.000
       MAJOR SYSTEM:     0006  2  5.0    0.00    0.00  3.25  30.34  n/a   0.000
       MINOR SYSTEM:     0006  3  5.0    1.78    0.21  3.25  30.34  n/a   0.000
*
    ADD [  0101+  0102]  0001  3  5.0    2.34    0.13  3.25  18.18  n/a   0.000
*
    ADD [  0001+  0105]  0001  1  5.0    2.93    0.15  3.25  16.67  n/a   0.000
*
    ADD [  0001+  0201]  0001  3  5.0    5.77    0.58  3.25  26.52  n/a   0.000
*
    ADD [  0001+  0006]  0001  1  5.0    5.77    0.58  3.25  26.52  n/a   0.000
*
    READ STORM                15.0
    [ Ptot= 52.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\99364209-6155-4a53-b2ce-593f
    remark: SCS_06H_005Y
*
 *  CALIB STANDHYD       0202  1  5.0   33.75    4.29  3.25  34.61 0.66   0.000
    [I%=55.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 52.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\99364209-6155-4a53-b2ce-593f
    remark: SCS_06H_005Y
*
 *  CALIB STANDHYD       0209  1  5.0    4.95    0.70  3.25  34.60 0.66   0.000
    [I%=55.0:S%= 2.00]
*
    ADD [  0001+  0202]  0002  3  5.0   39.52    4.87  3.25  33.42  n/a   0.000
*
    ADD [  0002+  0209]  0002  1  5.0   44.47    5.57  3.25  33.56  n/a   0.000
*
    READ STORM                15.0
    [ Ptot= 52.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\99364209-6155-4a53-b2ce-593f
    remark: SCS_06H_005Y
*
 *  CALIB STANDHYD       0203  1  5.0    1.97    0.24  3.25  30.55 0.58   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0002+  0203]  0003  3  5.0   46.44    5.81  3.25  33.43  n/a   0.000
*
    RESRVR [ 2:  0003]   0004  1  5.0   46.44    0.78  4.00  33.38  n/a   0.000
      {ST=  1.07 ha.m }
*
    READ STORM                15.0
    [ Ptot= 52.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\99364209-6155-4a53-b2ce-593f
    remark: SCS_06H_005Y
*
 *  CALIB NASHYD         0207  1  5.0   12.68    0.13  4.58  10.51 0.20   0.000
    [CN=61.0        ]
    [ N = 3.0:Tp 1.16]
*
    READ STORM                15.0
    [ Ptot= 52.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\99364209-6155-4a53-b2ce-593f
    remark: SCS_06H_005Y
*
 *  CALIB STANDHYD       0204  1  5.0    1.32    0.16  3.25  30.51 0.58   0.000
    [I%=45.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 52.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\99364209-6155-4a53-b2ce-593f
    remark: SCS_06H_005Y
*
 *  CALIB STANDHYD       0205  1  5.0    0.97    0.12  3.25  30.51 0.58   0.000
    [I%=45.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 52.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\99364209-6155-4a53-b2ce-593f
    remark: SCS_06H_005Y
*
 *  CALIB STANDHYD       0210  1  5.0    0.65    0.08  3.25  30.51 0.58   0.000
    [I%=45.0:S%= 2.00]
*
    ADD [  0204+  0205]  0005  3  5.0    2.29    0.28  3.25  30.51  n/a   0.000
*
    ADD [  0005+  0207]  0005  1  5.0   14.97    0.29  3.25  13.57  n/a   0.000
*
    ADD [  0005+  0210]  0005  3  5.0   15.62    0.37  3.25  14.27  n/a   0.000
*
    ADD [  0005+  0004]  0005  1  5.0   62.06    0.92  4.00  28.57  n/a   0.000
*
```

```
===========================================================================================
===============

       V    V   I    SSSSS  U   U    A    L              (v 5.1.2000)
       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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                   *****  S U M M A R Y   O U T P U T  *****

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.1\VO2\voin.dat
  Output  filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\6bd52519-de4e-4d3a-b230-a7f2680b82bd\scena
  Summary filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\6bd52519-de4e-4d3a-b230-a7f2680b82bd\scena

DATE: 04-29-2020                           TIME: 01:53:38

USER:

COMMENTS: ____________________________________________________________

  ************************************************
  ** SIMULATION : SCS_06H_010Y                 **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.    Qbase
                                   min    ha   '  cms   hrs     mm           cms

      START @  0.00 hrs
      --------------------
    READ STORM                 15.0
    [ Ptot= 61.50 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\0488384e-0286-411c-a7ce-9f5e
    remark: SCS_06H_010Y
*
 ** CALIB NASHYD         0105  1  5.0    0.59    0.03  3.33  14.55 0.24   0.000
    [CN=61.0        ]
    [ N = 3.0:Tp 0.19]
*
    READ STORM                 15.0
    [ Ptot= 61.50 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\0488384e-0286-411c-a7ce-9f5e
    remark: SCS_06H_010Y
*
 *  CALIB STANDHYD       0101  1  5.0    2.11    0.16  3.25  22.75 0.37   0.000
    [I%=15.0:S%= 2.00]
*
    READ STORM                 15.0
    [ Ptot= 61.50 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\0488384e-0286-411c-a7ce-9f5e
    remark: SCS_06H_010Y
*
 *  CALIB STANDHYD       0102  1  5.0    0.23    0.02  3.25  27.23 0.44   0.000
    [I%=25.0:S%= 2.00]
*
    READ STORM                 15.0
    [ Ptot= 61.50 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\0488384e-0286-411c-a7ce-9f5e
    remark: SCS_06H_010Y
*
 *  CALIB STANDHYD       0201  1  5.0    2.84    0.52  3.25  44.22 0.72   0.000
    [I%=60.0:S%= 2.00]
*
    READ STORM                 15.0
    [ Ptot= 61.50 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\0488384e-0286-411c-a7ce-9f5e
    remark: SCS_06H_010Y
*
 *  CALIB STANDHYD       0208  1  5.0    1.78    0.26  3.25  37.23 0.61   0.000
    [I%=40.0:S%= 2.00]
*
    DUHYD                0006  1  5.0    1.78    0.26  3.25  37.23  n/a   0.000
       MAJOR SYSTEM:     0006  2  5.0    0.05    0.05  3.25  37.23  n/a   0.000
       MINOR SYSTEM:     0006  3  5.0    1.73    0.21  3.17  37.23  n/a   0.000
*
    ADD [  0101+  0102]  0001  3  5.0    2.34    0.18  3.25  23.19  n/a   0.000
*
    ADD [  0001+  0105]  0001  1  5.0    2.93    0.21  3.25  21.45  n/a   0.000
*
    ADD [  0001+  0201]  0001  3  5.0    5.77    0.73  3.25  32.66  n/a   0.000
*
    ADD [  0001+  0006]  0001  1  5.0    5.82    0.78  3.25  32.70  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 61.50 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\0488384e-0286-411c-a7ce-9f5e
    remark: SCS_06H_010Y
*
 *  CALIB STANDHYD       0202  1  5.0   33.75    5.19  3.25  41.87 0.68   0.000
    [I%=55.0:S%= 2.00]
*
    READ STORM                 15.0
    [ Ptot= 61.50 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\0488384e-0286-411c-a7ce-9f5e
    remark: SCS_06H_010Y
*
 *  CALIB STANDHYD       0209  1  5.0    4.95    0.84  3.25  41.87 0.68   0.000
    [I%=55.0:S%= 2.00]
*
    ADD [  0001+  0202]  0002  3  5.0   39.57    5.97  3.25  40.52  n/a   0.000
*
    ADD [  0002+  0209]  0002  1  5.0   44.52    6.81  3.25  40.67  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 61.50 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\0488384e-0286-411c-a7ce-9f5e
    remark: SCS_06H_010Y
*
 *  CALIB STANDHYD       0203  1  5.0    1.97    0.30  3.25  37.04 0.60   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0002+  0203]  0003  3  5.0   46.49    7.10  3.25  40.52  n/a   0.000
*
    RESRVR [ 2:  0003]   0004  1  5.0   46.49    1.17  3.83  40.47  n/a   0.000
      {ST=  1.24 ha.m }
*
```

```
    READ STORM                15.0
    [ Ptot= 61.50 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\0488384e-0286-411c-a7ce-9f5e
    remark: SCS_06H_010Y
*
 *  CALIB NASHYD         0207  1  5.0   12.68    0.17  4.50  14.36 0.23   0.000
    [CN=61.0         ]
    [ N = 3.0:Tp 1.16]
*
    READ STORM                15.0
    [ Ptot= 61.50 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\0488384e-0286-411c-a7ce-9f5e
    remark: SCS_06H_010Y
*
 *  CALIB STANDHYD       0204  1  5.0    1.32    0.20  3.25  37.24 0.61   0.000
    [I%=45.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 61.50 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\0488384e-0286-411c-a7ce-9f5e
    remark: SCS_06H_010Y
*
 *  CALIB STANDHYD       0205  1  5.0    0.97    0.14  3.25  37.23 0.61   0.000
    [I%=45.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 61.50 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\0488384e-0286-411c-a7ce-9f5e
    remark: SCS_06H_010Y
*
 *  CALIB STANDHYD       0210  1  5.0    0.65    0.10  3.25  37.23 0.61   0.000
    [I%=45.0:S%= 2.00]
*
    ADD [  0204+  0205]  0005  3  5.0    2.29    0.34  3.25  37.23  n/a   0.000
*
    ADD [  0005+  0207]  0005  1  5.0   14.97    0.36  3.25  17.86  n/a   0.000
*
    ADD [  0005+  0210]  0005  3  5.0   15.62    0.46  3.25  18.66  n/a   0.000
*
    ADD [  0005+  0004]  0005  1  5.0   62.11    1.35  3.92  34.99  n/a   0.000
*
==========================================================================================
===============

       V    V   I    SSSSS  U   U    A    L              (v 5.1.2000)
       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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```



```
                   *****  S U M M A R Y   O U T P U T  *****

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.1\VO2\voin.dat
  Output  filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\77f51487-36e8-4e92-a154-37d91f539eea\scena
  Summary filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\77f51487-36e8-4e92-a154-37d91f539eea\scena

DATE: 04-29-2020                           TIME: 01:53:38

USER:

COMMENTS: ____________________________________________________________

  **************************************************
  ** SIMULATION : SCS_06H_025Y                    **
  **************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min     ha  '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                15.0
    [ Ptot= 72.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\76197674-7e12-413b-9cac-039f
    remark: SCS_06H_025Y
*
 ** CALIB NASHYD         0105  1  5.0    0.59    0.04  3.33  19.97 0.27   0.000
    [CN=61.0         ]
    [ N = 3.0:Tp 0.19]
*
    READ STORM                15.0
    [ Ptot= 72.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\76197674-7e12-413b-9cac-039f
    remark: SCS_06H_025Y
*
 *  CALIB STANDHYD       0101  1  5.0    2.11    0.21  3.25  29.46 0.40   0.000
    [I%=15.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 72.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\76197674-7e12-413b-9cac-039f
    remark: SCS_06H_025Y
*
 *  CALIB STANDHYD       0102  1  5.0    0.23    0.03  3.25  34.54 0.47   0.000
    [I%=25.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 72.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\76197674-7e12-413b-9cac-039f
    remark: SCS_06H_025Y
*
 *  CALIB STANDHYD       0201  1  5.0    2.84    0.67  3.25  53.91 0.74   0.000
    [I%=60.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 72.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\76197674-7e12-413b-9cac-039f
    remark: SCS_06H_025Y
*
 *  CALIB STANDHYD       0208  1  5.0    1.78    0.34  3.25  46.20 0.63   0.000
    [I%=40.0:S%= 2.00]
*
    DUHYD                0006  1  5.0    1.78    0.34  3.25  46.20  n/a   0.000
       MAJOR SYSTEM:     0006  2  5.0    0.18    0.13  3.25  46.20  n/a   0.000
       MINOR SYSTEM:     0006  3  5.0    1.60    0.21  3.08  46.20  n/a   0.000
```

```
*
   ADD [  0101+  0102]  0001  3  5.0    2.34    0.24  3.25  29.96  n/a   0.000
*
   ADD [  0001+  0105]  0001  1  5.0    2.93    0.27  3.25  27.95  n/a   0.000
*
   ADD [  0001+  0201]  0001  3  5.0    5.77    0.94  3.25  40.73  n/a   0.000
*
   ADD [  0001+  0006]  0001  1  5.0    5.95    1.08  3.25  40.89  n/a   0.000
*
   READ STORM                15.0
   [ Ptot= 72.90 mm ]
   fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\76197674-7e12-413b-9cac-039f
   remark: SCS_06H_025Y
*
 * CALIB STANDHYD       0202  1  5.0   33.75    6.60  3.25  51.24 0.70   0.000
   [I%=55.0:S%= 2.00]
*
   READ STORM                15.0
   [ Ptot= 72.90 mm ]
   fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\76197674-7e12-413b-9cac-039f
   remark: SCS_06H_025Y
*
 * CALIB STANDHYD       0209  1  5.0    4.95    1.03  3.25  51.24 0.70   0.000
   [I%=55.0:S%= 2.00]
*
   ADD [  0001+  0202]  0002  3  5.0   39.70    7.68  3.25  49.69  n/a   0.000
*
   ADD [  0002+  0209]  0002  1  5.0   44.65    8.71  3.25  49.86  n/a   0.000
*
   READ STORM                15.0
   [ Ptot= 72.90 mm ]
   fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\76197674-7e12-413b-9cac-039f
   remark: SCS_06H_025Y
*
 * CALIB STANDHYD       0203  1  5.0    1.97    0.36  3.25  45.46 0.62   0.000
   [I%=50.0:S%= 2.00]
*
   ADD [  0002+  0203]  0003  3  5.0   46.62    9.07  3.25  49.68  n/a   0.000
*
   RESRVR [ 2:  0003]   0004  1  5.0   46.62    1.62  3.83  49.63  n/a   0.000
     {ST=  1.48 ha.m }
*
   READ STORM                15.0
   [ Ptot= 72.90 mm ]
   fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\76197674-7e12-413b-9cac-039f
   remark: SCS_06H_025Y
*
 * CALIB NASHYD         0207  1  5.0   12.68    0.24  4.50  19.77 0.27   0.000
   [CN=61.0        ]
   [ N = 3.0:Tp 1.16]
*
   READ STORM                15.0
   [ Ptot= 72.90 mm ]
   fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\76197674-7e12-413b-9cac-039f
   remark: SCS_06H_025Y
*
 * CALIB STANDHYD       0204  1  5.0    1.32    0.24  3.25  45.98 0.63   0.000
   [I%=45.0:S%= 2.00]
*
   READ STORM                15.0
   [ Ptot= 72.90 mm ]
   fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\76197674-7e12-413b-9cac-039f
   remark: SCS_06H_025Y
*
 * CALIB STANDHYD       0205  1  5.0    0.97    0.18  3.25  45.98 0.63   0.000
   [I%=45.0:S%= 2.00]
*
   READ STORM                15.0
   [ Ptot= 72.90 mm ]
   fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\76197674-7e12-413b-9cac-039f
   remark: SCS_06H_025Y
*
 * CALIB STANDHYD       0210  1  5.0    0.65    0.12  3.25  45.98 0.63   0.000
   [I%=45.0:S%= 2.00]
*
   ADD [  0204+  0205]  0005  3  5.0    2.29    0.42  3.25  45.98  n/a   0.000
*
   ADD [  0005+  0207]  0005  1  5.0   14.97    0.45  3.25  23.78  n/a   0.000
*
   ADD [  0005+  0210]  0005  3  5.0   15.62    0.57  3.25  24.70  n/a   0.000
*
   ADD [  0005+  0004]  0005  1  5.0   62.24    1.89  3.75  43.37  n/a   0.000
*
==============================================================================================
===============

       V    V   I    SSSSS  U   U    A    L              (v 5.1.2000)
       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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                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.1\VO2\voin.dat
  Output  filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\bae9a428-1e74-4299-b355-9378800915bf\scena
  Summary filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\bae9a428-1e74-4299-b355-9378800915bf\scena


DATE: 04-29-2020                           TIME: 01:53:38

USER:


COMMENTS: ____________________________________________________________


  ************************************************
  ** SIMULATION : SCS_06H_050Y                  **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                15.0
    [ Ptot= 81.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\a55243cf-90fe-4730-b73b-2015
```

```
    remark: SCS_06H_050Y
*
 ** CALIB NASHYD        0105  1  5.0    0.59    0.05  3.33  24.39 0.30   0.000
    [CN=61.0         ]
    [ N = 3.0:Tp 0.19]
*
    READ STORM                15.0
    [ Ptot= 81.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\a55243cf-90fe-4730-b73b-2015
    remark: SCS_06H_050Y
*
 *  CALIB STANDHYD      0101  1  5.0    2.11    0.25  3.25  34.78 0.43   0.000
    [I%=15.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 81.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\a55243cf-90fe-4730-b73b-2015
    remark: SCS_06H_050Y
*
 *  CALIB STANDHYD      0102  1  5.0    0.23    0.04  3.25  40.28 0.49   0.000
    [I%=25.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 81.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\a55243cf-90fe-4730-b73b-2015
    remark: SCS_06H_050Y
*
 *  CALIB STANDHYD      0201  1  5.0    2.84    0.76  3.25  61.27 0.75   0.000
    [I%=60.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 81.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\a55243cf-90fe-4730-b73b-2015
    remark: SCS_06H_050Y
*
 *  CALIB STANDHYD      0208  1  5.0    1.78    0.40  3.25  53.09 0.65   0.000
    [I%=40.0:S%= 2.00]
*
    DUHYD               0006  1  5.0    1.78    0.40  3.25  53.09  n/a   0.000
       MAJOR SYSTEM:    0006  2  5.0    0.23    0.19  3.25  53.09  n/a   0.000
       MINOR SYSTEM:    0006  3  5.0    1.55    0.21  3.08  53.09  n/a   0.000
*
    ADD [  0101+  0102] 0001  3  5.0    2.34    0.29  3.25  35.32  n/a   0.000
*
    ADD [  0001+  0105] 0001  1  5.0    2.93    0.33  3.25  33.12  n/a   0.000
*
    ADD [  0001+  0201] 0001  3  5.0    5.77    1.09  3.25  46.97  n/a   0.000
*
    ADD [  0001+  0006] 0001  1  5.0    6.00    1.28  3.25  47.21  n/a   0.000
*
    READ STORM                15.0
    [ Ptot= 81.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\a55243cf-90fe-4730-b73b-2015
    remark: SCS_06H_050Y
*
 *  CALIB STANDHYD      0202  1  5.0   33.75    7.56  3.25  58.39 0.72   0.000
    [I%=55.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 81.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\a55243cf-90fe-4730-b73b-2015
    remark: SCS_06H_050Y
*
 *  CALIB STANDHYD      0209  1  5.0    4.95    1.17  3.25  58.39 0.72   0.000
    [I%=55.0:S%= 2.00]
*
    ADD [  0001+  0202] 0002  3  5.0   39.75    8.84  3.25  56.70  n/a   0.000
*
    ADD [  0002+  0209] 0002  1  5.0   44.70   10.01  3.25  56.89  n/a   0.000
*
    READ STORM                15.0
    [ Ptot= 81.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\a55243cf-90fe-4730-b73b-2015
    remark: SCS_06H_050Y
*
 *  CALIB STANDHYD      0203  1  5.0    1.97    0.41  3.25  51.92 0.64   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0002+  0203] 0003  3  5.0   46.67   10.42  3.25  56.68  n/a   0.000
*
    RESRVR [ 2:  0003]  0004  1  5.0   46.67    1.88  3.83  56.63  n/a   0.000
      {ST=  1.66 ha.m }
*
    READ STORM                15.0
    [ Ptot= 81.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\a55243cf-90fe-4730-b73b-2015
    remark: SCS_06H_050Y
*
 *  CALIB NASHYD        0207  1  5.0   12.68    0.29  4.50  24.18 0.30   0.000
    [CN=61.0         ]
    [ N = 3.0:Tp 1.16]
*
    READ STORM                15.0
    [ Ptot= 81.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\a55243cf-90fe-4730-b73b-2015
    remark: SCS_06H_050Y
*
 *  CALIB STANDHYD      0204  1  5.0    1.32    0.29  3.25  52.70 0.65   0.000
    [I%=45.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 81.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\a55243cf-90fe-4730-b73b-2015
    remark: SCS_06H_050Y
*
 *  CALIB STANDHYD      0205  1  5.0    0.97    0.22  3.25  52.71 0.65   0.000
    [I%=45.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 81.40 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\a55243cf-90fe-4730-b73b-2015
    remark: SCS_06H_050Y
*
 *  CALIB STANDHYD      0210  1  5.0    0.65    0.15  3.25  52.70 0.65   0.000
    [I%=45.0:S%= 2.00]
*
    ADD [  0204+  0205] 0005  3  5.0    2.29    0.51  3.25  52.71  n/a   0.000
*
    ADD [  0005+  0207] 0005  1  5.0   14.97    0.55  3.25  28.54  n/a   0.000
*
    ADD [  0005+  0210] 0005  3  5.0   15.62    0.70  3.25  29.54  n/a   0.000
*
    ADD [  0005+  0004] 0005  1  5.0   62.29    2.20  3.75  49.84  n/a   0.000
*
============================================================================================
===============


       V    V   I    SSSSS  U   U    A    L              (v 5.1.2000)
```

```
      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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                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.1\VO2\voin.dat
  Output  filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\1d1b48f4-d0e0-4838-86f4-2905bf509a09\scena
  Summary filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\1d1b48f4-d0e0-4838-86f4-2905bf509a09\scena


DATE: 04-29-2020                           TIME: 01:53:38

USER:


COMMENTS: ____________________________________________________________


  ************************************************
  ** SIMULATION : SCS_06H_100Y                  **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.    Qbase
                                   min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                 15.0
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\33e70cb9-9264-4fe4-aedf-ad51
    remark: SCS_06H_100Y
*
 ** CALIB NASHYD         0105  1  5.0    0.59    0.06  3.33  29.08 0.32   0.000
    [CN=61.0         ]
    [ N = 3.0:Tp 0.19]
*
    READ STORM                 15.0
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\33e70cb9-9264-4fe4-aedf-ad51
    remark: SCS_06H_100Y
*
 *  CALIB STANDHYD       0101  1  5.0    2.11    0.29  3.25  40.34 0.45   0.000
    [I%=15.0:S%= 2.00]
*
    READ STORM                 15.0
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\33e70cb9-9264-4fe4-aedf-ad51
    remark: SCS_06H_100Y
*
 *  CALIB STANDHYD       0102  1  5.0    0.23    0.04  3.25  46.22 0.51   0.000
    [I%=25.0:S%= 2.00]
*
    READ STORM                 15.0
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\33e70cb9-9264-4fe4-aedf-ad51
    remark: SCS_06H_100Y
*
 *  CALIB STANDHYD       0201  1  5.0    2.84    0.86  3.25  68.74 0.76   0.000
    [I%=60.0:S%= 2.00]
*
    READ STORM                 15.0
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\33e70cb9-9264-4fe4-aedf-ad51
    remark: SCS_06H_100Y
*
 *  CALIB STANDHYD       0208  1  5.0    1.78    0.45  3.25  60.14 0.67   0.000
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*
    DUHYD                0006  1  5.0    1.78    0.45  3.25  60.14  n/a   0.000
       MAJOR SYSTEM:     0006  2  5.0    0.29    0.24  3.25  60.14  n/a   0.000
       MINOR SYSTEM:     0006  3  5.0    1.49    0.21  3.08  60.14  n/a   0.000
*
    ADD [  0101+  0102]  0001  3  5.0    2.34    0.34  3.25  40.91  n/a   0.000
*
    ADD [  0001+  0105]  0001  1  5.0    2.93    0.39  3.25  38.53  n/a   0.000
*
    ADD [  0001+  0201]  0001  3  5.0    5.77    1.25  3.25  53.40  n/a   0.000
*
    ADD [  0001+  0006]  0001  1  5.0    6.06    1.49  3.25  53.72  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 89.90 mm ]
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eafa63311886\33e70cb9-9264-4fe4-aedf-ad51
    remark: SCS_06H_100Y
*
 *  CALIB STANDHYD       0202  1  5.0   33.75    8.67  3.25  65.65 0.73   0.000
    [I%=55.0:S%= 2.00]
*
    READ STORM                 15.0
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\33e70cb9-9264-4fe4-aedf-ad51
    remark: SCS_06H_100Y
*
 *  CALIB STANDHYD       0209  1  5.0    4.95    1.40  3.25  65.65 0.73   0.000
    [I%=55.0:S%= 2.00]
*
    ADD [  0001+  0202]  0002  3  5.0   39.81   10.16  3.25  63.84  n/a   0.000
*
    ADD [  0002+  0209]  0002  1  5.0   44.76   11.56  3.25  64.04  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\33e70cb9-9264-4fe4-aedf-ad51
    remark: SCS_06H_100Y
*
 *  CALIB STANDHYD       0203  1  5.0    1.97    0.46  3.25  58.52 0.65   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0002+  0203]  0003  3  5.0   46.73   12.03  3.25  63.80  n/a   0.000
*
    RESRVR [ 2:  0003]   0004  1  5.0   46.73    2.11  3.75  63.76  n/a   0.000
      {ST=  1.87 ha.m }
*
    READ STORM                 15.0
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\33e70cb9-9264-4fe4-aedf-ad51
    remark: SCS_06H_100Y
```

```
*
 *  CALIB NASHYD        0207  1  5.0   12.68    0.35  4.50  28.86 0.32   0.000
    [CN=61.0        ]
    [ N = 3.0:Tp 1.16]
*
    READ STORM                15.0
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\33e70cb9-9264-4fe4-aedf-ad51
    remark: SCS_06H_100Y
*
 *  CALIB STANDHYD      0204  1  5.0    1.32    0.33  3.25  59.58 0.66   0.000
    [I%=45.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\33e70cb9-9264-4fe4-aedf-ad51
    remark: SCS_06H_100Y
*
 *  CALIB STANDHYD      0205  1  5.0    0.97    0.25  3.25  59.58 0.66   0.000
    [I%=45.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot= 89.90 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\33e70cb9-9264-4fe4-aedf-ad51
    remark: SCS_06H_100Y
*
 *  CALIB STANDHYD      0210  1  5.0    0.65    0.16  3.25  59.57 0.66   0.000
    [I%=45.0:S%= 2.00]
*
    ADD [  0204+  0205]  0005  3  5.0    2.29    0.58  3.25  59.58  n/a   0.000
*
    ADD [  0005+  0207]  0005  1  5.0   14.97    0.63  3.25  33.56  n/a   0.000
*
    ADD [  0005+  0210]  0005  3  5.0   15.62    0.80  3.25  34.64  n/a   0.000
*
    ADD [  0005+  0004]  0005  1  5.0   62.35    2.49  3.75  56.47  n/a   0.000
*
===========================================================================================
===============

       V    V   I    SSSSS  U   U    A    L              (v 5.1.2000)
       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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                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.1\VO2\voin.dat
  Output  filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\22d47936-8808-4098-810b-c9205774ad80\scena
  Summary filename: C:\Users\Valdor\AppData\Local\Civica\VH5\c7e9b9dc-2878-4b8a-9d26-
5e475049aa89\22d47936-8808-4098-810b-c9205774ad80\scena


DATE: 04-29-2020                          TIME: 01:53:38
```

```
USER:


COMMENTS: ____________________________________________________________


  **********************************************
  ** SIMULATION : Timmins                     **
  **********************************************

  W/E COMMAND            HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min    ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                15.0
    [ Ptot=193.00 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\50758f93-5b19-437c-bd5a-bd75
    remark: * Timmins Storm
*
 ** CALIB NASHYD        0105  1  5.0    0.59    0.04  7.00 100.63 0.52   0.000
    [CN=61.0        ]
    [ N = 3.0:Tp 0.19]
*
    READ STORM                15.0
    [ Ptot=193.00 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\50758f93-5b19-437c-bd5a-bd75
    remark: * Timmins Storm
*
 *  CALIB STANDHYD      0101  1  5.0    2.11    0.17  7.00 119.74 0.62   0.000
    [I%=15.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot=193.00 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\50758f93-5b19-437c-bd5a-bd75
    remark: * Timmins Storm
*
 *  CALIB STANDHYD      0102  1  5.0    0.23    0.02  7.00 128.76 0.67   0.000
    [I%=25.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot=193.00 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\50758f93-5b19-437c-bd5a-bd75
    remark: * Timmins Storm
*
 *  CALIB STANDHYD      0201  1  5.0    2.84    0.30  7.00 164.09 0.85   0.000
    [I%=60.0:S%= 2.00]
*
    READ STORM                15.0
    [ Ptot=193.00 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\50758f93-5b19-437c-bd5a-bd75
    remark: * Timmins Storm
*
 *  CALIB STANDHYD      0208  1  5.0    1.78    0.18  7.00 152.51 0.79   0.000
    [I%=40.0:S%= 2.00]
*
    DUHYD               0006  1  5.0    1.78    0.18  7.00 152.51  n/a   0.000
       MAJOR SYSTEM:    0006  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
       MINOR SYSTEM:    0006  3  5.0    1.78    0.18  7.00 152.51  n/a   0.000
*
    ADD [  0101+  0102]  0001  3  5.0    2.34    0.19  7.00 120.62  n/a   0.000
*
    ADD [  0001+  0105]  0001  1  5.0    2.93    0.24  7.00 116.60  n/a   0.000
*
```

```
    ADD [  0001+  0201]  0001  3  5.0    5.77    0.54  7.00 139.97  n/a   0.000
*
    ADD [  0001+  0006]  0001  1  5.0    5.77    0.54  7.00 139.97  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot=193.00 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\50758f93-5b19-437c-bd5a-bd75
    remark: * Timmins Storm
*
 *  CALIB STANDHYD       0202  1  5.0   33.75    3.46  7.00 159.38 0.83   0.000
    [I%=55.0:S%= 2.00]
*
    READ STORM                 15.0
    [ Ptot=193.00 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\50758f93-5b19-437c-bd5a-bd75
    remark: * Timmins Storm
*
 *  CALIB STANDHYD       0209  1  5.0    4.95    0.52  7.00 159.38 0.83   0.000
    [I%=55.0:S%= 2.00]
*
    ADD [  0001+  0202]  0002  3  5.0   39.52    4.00  7.00 156.55  n/a   0.000
*
    ADD [  0002+  0209]  0002  1  5.0   44.47    4.52  7.00 156.87  n/a   0.000
*
    READ STORM                 15.0
    [ Ptot=193.00 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\50758f93-5b19-437c-bd5a-bd75
    remark: * Timmins Storm
*
 *  CALIB STANDHYD       0203  1  5.0    1.97    0.19  7.00 145.93 0.76   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0002+  0203]  0003  3  5.0   46.44    4.70  7.00 156.40  n/a   0.000
*
    RESRVR [ 2:  0003]   0004  1  5.0   46.44    3.90  7.17 156.36  n/a   0.000
      {ST=  2.03 ha.m }
*
    READ STORM                 15.0
    [ Ptot=193.00 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\50758f93-5b19-437c-bd5a-bd75
    remark: * Timmins Storm
*
 *  CALIB NASHYD         0207  1  5.0   12.68    0.57  8.25 100.48 0.52   0.000
    [CN=61.0         ]
    [ N = 3.0:Tp 1.16]
*
    READ STORM                 15.0
    [ Ptot=193.00 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\50758f93-5b19-437c-bd5a-bd75
    remark: * Timmins Storm
*
 *  CALIB STANDHYD       0204  1  5.0    1.32    0.13  7.00 150.09 0.78   0.000
    [I%=45.0:S%= 2.00]
*
    READ STORM                 15.0
    [ Ptot=193.00 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\50758f93-5b19-437c-bd5a-bd75
    remark: * Timmins Storm
*
 *  CALIB STANDHYD       0205  1  5.0    0.97    0.10  7.00 150.09 0.78   0.000
    [I%=45.0:S%= 2.00]
*
    READ STORM                 15.0
    [ Ptot=193.00 mm ]
    fname : C:\Users\Valdor\AppData\Local\Temp\122bc0c9-20d9-4781-97ef-
eafa63311886\50758f93-5b19-437c-bd5a-bd75
    remark: * Timmins Storm
*
 *  CALIB STANDHYD       0210  1  5.0    0.65    0.06  7.00 150.08 0.78   0.000
    [I%=45.0:S%= 2.00]
*
    ADD [  0204+  0205]  0005  3  5.0    2.29    0.23  7.00 150.09  n/a   0.000
*
    ADD [  0005+  0207]  0005  1  5.0   14.97    0.70  8.50 108.07  n/a   0.000
*
    ADD [  0005+  0210]  0005  3  5.0   15.62    0.73  9.00 109.81  n/a   0.000
*
    ADD [  0005+  0004]  0005  1  5.0   62.06    4.54  7.17 144.64  n/a   0.000
*
```

APPENDIX “F”

Site Water Balance Calculations

VALDOR ENGINEERING INC.
Project: Millbrook Subdivision, Phase 2
File: 17125
Date: April 2020

Table F.1: Site Water Balance Calculations (Annual)

Condition	Site Area (ha)	Water Balance Components	Pervious Area Without Infiltration BMPs	Impervious Area Without Infiltration BMPs	Impervious Area With Basic Infiltration BMPs	TOTAL SITE VOLUMES Precipitation (m^3)	Evapotranspiration (m^3)	Surplus (m^3)	Runoff (m^3)	Infiltration (m^3)	Percent of Existing Infiltration (%)
		Area (ha)	51.78	0.00	0.00						
		HSG	B	n/a	B						
		Weighted WHC (mm)	150	n/a	150						
		Infiltration Factor	0.510	0.00	0.454						
Existing	**51.78**	Precipitation (mm)	855.3	855.3	855.3	442,874	301,035	155,524	76,207	79,317	100.0
		Evapotranspiration (mm)	581.4	0.0	581.4						
		Surplus (mm)	300.4	855.3	300.4						
		Infiltration (mm)	153.2	0.0	136.4						
		Runoff (mm)	147.2	855.3	163.9						
		Area (ha)	24.41	27.37	0.00						
		HSG	B	n/a	B						
		Weighted WHC (mm)	104	n/a	104						
		Infiltration Factor	0.575	0.00	0.454						
Proposed (No Infiltration BMPs)	**51.78**	Precipitation (mm)	855.3	855.3	855.3	442,874	135,867	313,711	267,932	45,779	57.7
		Evapotranspiration (mm)	556.6	0.0	556.6						
		Surplus (mm)	326.2	855.3	326.2						
		Infiltration (mm)	187.5	0.0	148.2						
		Runoff (mm)	138.6	855.3	178.0						
		Area (ha)	24.41	20.62	6.75						
		HSG	B	n/a	B						
		Weighted WHC (mm)	104	n/a	104						
		Infiltration Factor	0.575	0.00	0.454						
Proposed (With Basic Infiltration BMPs)	**51.78**	Precipitation (mm)	855.3	855.3	855.3	442,874	173,437	277,994	222,214	55,779	70.3
		Evapotranspiration (mm)	556.6	0.0	556.6						
		Surplus (mm)	326.2	855.3	326.2						
		Infiltration (mm)	187.5	0.0	148.2						
		Runoff (mm)	138.6	855.3	178.0						
Proposed (With Enhanced Infiltration BMP's)	**51.78**		**See Table D.6**						**55779 + 23871 =**	79,650	100.4

Notes:
1. Site water balance calculations based on methodology per the **Stormwater Management Planning and Design Manual** (MOE, March 2003).
2. Basic Infiltration BMPs consist of roof runoff directed to pervious areas (single detached roof areas were assumed to be $150m^2$).
3. Enhanced Infiltration BMPs consist of roof runoff from proposed buildings directed to infiltration trenches.

VALDOR ENGINEERING INC.
Project: Millbrook Subdivision, Phase 2
File: 17125
Date: April 2020

Table F.2: Water Holding Capacity (WHC) Calculations

Per MOE Methodology (SWM Planning & Design Manual, MOE, March 2003)

Existing Conditions (Pervious Area)			
Land Use	**Area (ha)**	**HSG**	**WHC**
Pasture and Shrubs	5.65	B	150
Moderately Rooted Crops	46.13	B	150
Total (Area-Weighted):	51.78		**150**

Proposed Conditions (Pervious Area)			
Land Use	**Area (ha)**	**HSG**	**WHC**
Pasture and Shrubs	2.06	B	150
Lawn (Channel and Open Space)	10.62	B	100
Lawn (Residential Development)	11.73	B	100
Total (Area-Weighted):	24.41		**104**

Table 3.1: Hydrologic Cycle Component Values

	Water Holding Capacity mm	Hydrologic Soil Group	Precipitation mm	Evapo-transpiration mm	Runoff mm	Infiltration* mm
Urban Lawns/Shallow Rooted Crops (spinach, beans, beets, carrots)						
Fine Sand	50	A	940	515	149	276
Fine Sandy Loam	75	B	940	525	187	228
Silt Loam	125	C	940	536	222	182
Clay Loam	100	CD	940	531	245	164
Clay	75	D	940	525	270	145
Moderately Rooted Crops (corn and cereal grains)						
Fine Sand	75	A	940	525	125	291
Fine Sandy Loam	150	B	940	539	160	241
Silt Loam	200	C	940	543	199	199
Clay Loam	200	CD	940	543	218	179
Clay	150	D	940	539	241	160
Pasture and Shrubs						
Fine Sand	100	A	940	531	102	307
Fine Sandy Loam	150	B	940	539	140	261
Silt Loam	250	C	940	546	177	217
Clay Loam	250	CD	940	546	197	197
Clay	200	D	940	543	218	179
Mature Forests						
Fine Sand	250	A	940	546	79	315
Fine Sandy Loam	300	B	940	548	118	274
Silt Loam	400	C	940	550	126	264
Clay Loam	400	CD	940	550	176	215
Clay	350	D	940	549	196	196

Notes: Hydrologic Soil Group A represents soils with low runoff potential and Soil Group D represents soils with high runoff potential. The evapotranspiration values are for mature vegetation. Streamflow is composed of baseflow and runoff.

* *This is the total infiltration of which some discharges back to the stream as base flow. The infiltration factor is determined by summing a factor for topography, soils and cover.*

Topography	Flat Land, average slope < 0.6 m/km	0.3
	Rolling Land, average slope 2.8 m to 3.8 m/km	0.2
	Hilly Land, average slope 28 m to 47 m/km	0.1
Soils	Tight impervious clay	0.1
	Medium combinations of clay and loam	0.2
	Open Sandy loam	0.4
Cover	Cultivated Land	0.1
	Woodland	0.2

SWM Planning & Design Manual - 3-4 - *Environmental Design Criteria*

VALDOR ENGINEERING INC.
File: 17125
Date: April 2020

Table F.3: Infiltration Factor Calculations
Per MOE Methodology (SWM Planning & Design Manual, MOE, March 2003)

Topography

0.3	Flat Land (avg slope < 0.06%)
0.225	0.06% to 0.27%
0.15	Rolling Land (avg slope between 0.28% and 0.38%)
0.125	0.39% to 2.7%
0.1	Hilly Land (avg slope between 2.8% and 4.7%)

Soils

0.4	HSG A - open sandy loam
0.35	HSG AB
0.3	HSG B
0.27	HSG BC
0.23	HSG C
0.2	HSG CD - medium combinations of clay and loam
0.1	HSG D - tight impervious clay

Cover

0.1	cultivated land (crops)
0.15	pasture, lawns
0.2	woodland (forest)

Infiltration Factor Calculations

Existing Conditions

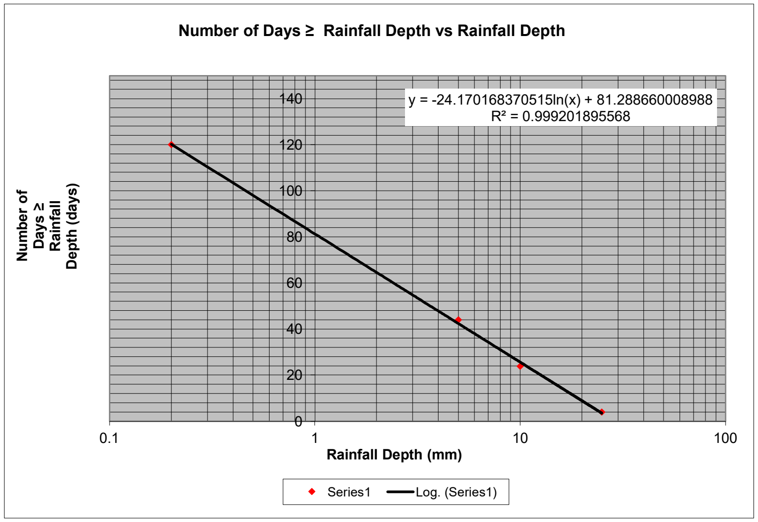
0.1	Topography
0.3	Soils
0.11	Cover
0.510	Total Infiltration Factor (Existing Conditions)

Proposed Conditions

0.125	Topography
0.3	Soils
0.15	Cover
0.575	Total Infiltration Factor (Proposed Conditions)

Table F.4: Rainfall Analysis

VALDOR ENGINEERING INC.
File: 17125
Date: April 2020



Peterborough Airport Climate Normals (1981 - 2010)
712.5 Normal Annual Rainfall Depth (mm)
120 Normal Annual Days with Rainfall (≥ 0.2 mm)
855.3 Normal Annual Precipitation Depth (mm)

Normal Rainfall Depth (mm)	Normal Days ≥ Rainfall Depth (days)
0.2	120
5	44
10	23.8
25	3.9

Simulated Depth (mm)	Simulated Days ≥ Sim Depth (days)	Average Event Depth (mm)	Simulated Days Equal to Avg Depth (days)	Assumed IA (mm)	Runoff (Rain - IA) (mm)	INF Design Storm (mm)	Event Based Maximum Design INF Depth (mm)	Event Based Design INF Depth (mm)	Annual Incremental Design INF Depth (mm)	Annual Cumulative Design INF Depth (mm)	Annual Incremental Total Rain Depth (mm)	Annual Percent of Total Rain (%)	Annual Cumulative Total Rain Depth (mm)	Annual Cumulative Percent of Total Depth (%)
0.2	126.44													
0.5	103.06	0.2 - 0.5	23.38	**5.00**	0.00	**15.00**	10.00	0.00	0.00	0.00		0.000	0.0	0.000
1.5	75.03	1	28.03	5.00	0.00	15.00	10.00	0.00	0.00	0.00	28.03	0.039	28.0	0.039
2.5	61.99	2	13.04	5.00	0.00	15.00	10.00	0.00	0.00	0.00	26.07	0.037	54.1	0.076
3.5	53.41	3	8.59	5.00	0.00	15.00	10.00	0.00	0.00	0.00	25.76	0.036	79.9	0.112
4.5	46.99	4	6.41	5.00	0.00	15.00	10.00	0.00	0.00	0.00	25.65	0.036	105.5	0.148
5.5	41.87	5	5.12	5.00	0.00	15.00	10.00	0.00	0.00	0.00	25.60	0.036	131.1	0.184
6.5	37.61	6	4.26	5.00	1.00	15.00	10.00	1.00	4.26	4.26	25.58	0.036	156.7	0.220
7.5	33.96	7	3.65	5.00	2.00	15.00	10.00	2.00	7.30	11.57	25.56	0.036	182.3	0.256
8.5	30.76	8	3.19	5.00	3.00	15.00	10.00	3.00	9.58	21.15	25.55	0.036	207.8	0.292
9.5	27.93	9	2.84	5.00	4.00	15.00	10.00	4.00	11.35	32.50	25.54	0.036	233.4	0.328
10.5	25.37	10	2.55	5.00	5.00	15.00	10.00	5.00	12.77	45.27	25.54	0.036	258.9	0.363
11.5	23.05	11	2.32	5.00	6.00	15.00	10.00	6.00	13.93	59.20	25.54	0.036	284.4	0.399
12.5	20.92	12	2.13	5.00	7.00	15.00	10.00	7.00	14.89	74.09	25.53	0.036	310.0	0.435
13.5	18.96	13	1.96	5.00	8.00	15.00	10.00	8.00	15.71	89.81	25.53	0.036	335.5	0.471
14.5	17.13	14	1.82	5.00	9.00	15.00	10.00	9.00	16.41	106.22	25.53	0.036	361.0	0.507
15.5	15.43	15	1.70	5.00	10.00	15.00	10.00	10.00	17.02	123.24	25.53	0.036	386.6	0.543
16.5	13.84	16	1.60	5.00	11.00	15.00	10.00	10.00	15.95	139.19	25.53	0.036	412.1	0.578
17.5	12.34	17	1.50	5.00	12.00	15.00	10.00	10.00	15.02	154.20	25.53	0.036	437.6	0.614
18.5	10.92	18	1.42	5.00	13.00	15.00	10.00	10.00	14.18	168.38	25.52	0.036	463.1	0.650
19.5	9.57	19	1.34	5.00	14.00	15.00	10.00	10.00	13.43	181.82	25.52	0.036	488.7	0.686
20.5	8.30	20	1.28	5.00	15.00	15.00	10.00	10.00	12.76	194.58	25.52	0.036	514.2	0.722
21.5	7.08	21	1.22	5.00	16.00	15.00	10.00	10.00	12.15	206.73	25.52	0.036	539.7	0.757
22.5	5.92	22	1.16	5.00	17.00	15.00	10.00	10.00	11.60	218.34	25.52	0.036	565.2	0.793
23.5	4.81	23	1.11	5.00	18.00	15.00	10.00	10.00	11.10	229.43	25.52	0.036	590.7	0.829
24.5	3.75	24	1.06	5.00	19.00	15.00	10.00	10.00	10.63	240.07	25.52	0.036	616.3	0.865
25.5	2.73	25	1.02	5.00	20.00	15.00	10.00	10.00	10.21	250.27	25.52	0.036	641.8	0.901
26.5	1.75	26	0.98	5.00	21.00	15.00	10.00	10.00	9.82	260.09	25.52	0.036	667.3	0.937
27.5	0.80	27	0.95	5.00	22.00	15.00	10.00	10.00	9.45	269.54	25.52	0.036	692.8	0.972
28.5	0.00	28	0.80	5.00	23.00	15.00	10.00	10.00	8.02	277.57	22.46	0.032	715.3	1.004
29	0.00	≥ 29	0.00	5.00	24.00	15.00	10.00	10.00	0.00	**277.57**	-2.79	-0.004	712.5	1.000

Table F.5: Infiltration Trench Calculation

VALDOR ENGINEERING INC.
741 Rowntree Dairy Road, Suite 2, Woodbridge, Ontario L4L 5T9
Tel: 905-264-0054 Fax: 905-264-0069
info@valdor-engineering.com www.valdor-engineering.com

Project No: 17125
Date: April 2020

Total Req'd Annual Infiltration Volume to Achieve Target (m^3)	*Total Actual Annual Infiltration Volume per Design (m^3)*	*Soil Infiltration Rate (mm/h)*	*Minimum Total Drainage Area to Infiltration Facilities (ha)*	*Maximum Trench Length per Site Plan (m)*	*Initial Abstraction (Trench Drainage Area) (mm)*	*Retention Time (hr)*	*Total Annual Rainfall Depth (Per 1981-2010 Climate Normals for Lindsay) (mm)*	*Total Rainfall Depth Available for Infiltration Per Rainfall Analysis Assuming Ia=5.0mm (mm)*	*Annual Rainfall Depth Needed to Achieve Target Infiltration (mm)*	*[1] Req'd Design Storm Depth to Achieve Annual Infiltration Requirements (Assuming Ia=5.0 mm) (mm)*	*Provided Event-Based Runoff Volume to be Infiltrated (Based on Req'd Design Storm Depth (m^3)*
23,538	23,871	30	8.60	-	5.0	48	712.5	277.57	273.7	15.0	860.0

Maximum Allowable Depth	
P, Design Soil Infiltration Rate (mm/h):	**30**
T, Drawdown Time (hr):	**48**
d, Maximum Allowable Depth (m):	**1.44**

Minimum Bottom Area	
V, Runoff Volume to Infiltrated (m^3):	**860**
P, Design Soil Infiltration Rate (mm/h):	**30**
n, Void Ratio (clear stone):	**0.40**
Δt, Drawdown Time (hr):	**48**
A, Minimum Bottom Area (m^2):	**1,493**

$$d = \frac{P \cdot T}{1000} \quad \textit{Equation 4.2, Stormwater Management Planning and Design Manual, MOE, 2003}$$

$$A = \frac{1000 \cdot V}{P \cdot n \cdot \Delta t} \quad \textit{Equation 4.3, Stormwater Management Planning and Design Manual, MOE, 2003}$$

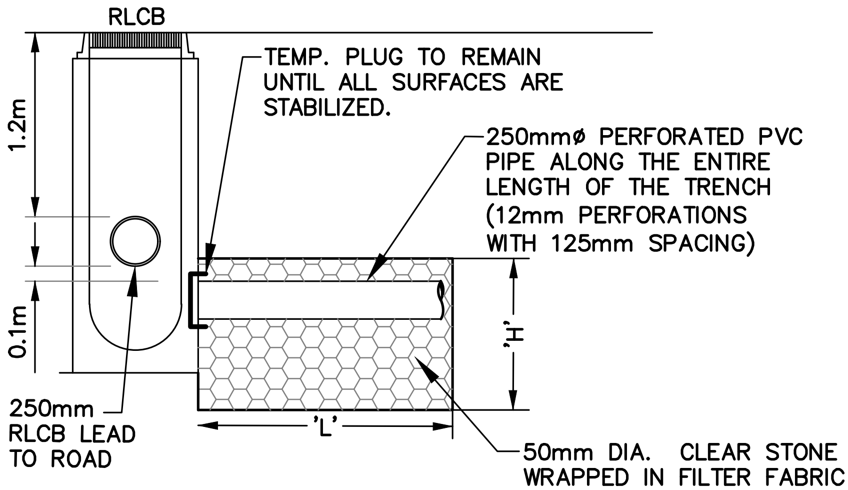
Infiltration Trench Design

Infiltration Trench Location	Drainage Area (ha)	Available Infiltration Volume (m³)	Length (m)	Width (m)	[3]Design Depth (m)	Bottom Area (m²)	Void Ratio	Storage Volume Provided (m³)	Lesser of Available Infiltration Volume or Storage Volume Provided (m³)
RLCB Infiltration Trench	6.60	660.0	1,200.0	1.0	1.40	1,200	0.40	672.0	660.0
Rear-of-Lot Infiltration Trench	2.00	200.0	950.0	0.6	1.00	570	0.40	228.0	200.0

Total drainage area to infiltration trenches (ha):	**8.60**
Total Bottom Area Provided (m²):	**1,770**
Total Infiltration Volume Used (m³):	**860.0**

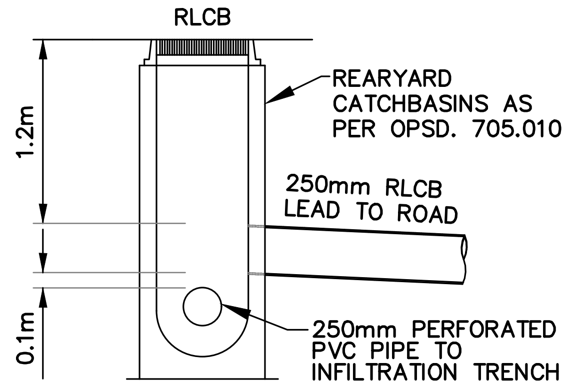
Notes:

Infiltration facilities are sized based on the following criteria (SWMPDM, MOE, 2003) and/or assumptions:
(1) Infiltration trench volume should be sized based on the runoff generated by a 4-hr 15-mm event or smaller.
(2) Drainage areas should be sufficient to provide required runoff quantity.
(3) The maximum allowable depth of the infiltration facility is based on the soil infiltrate rate and the retention time.
(4) It is feasible to convey the runoff to the infiltration facility.
(5) The seasonal high water table should be at least 1 m below the infiltration trench.



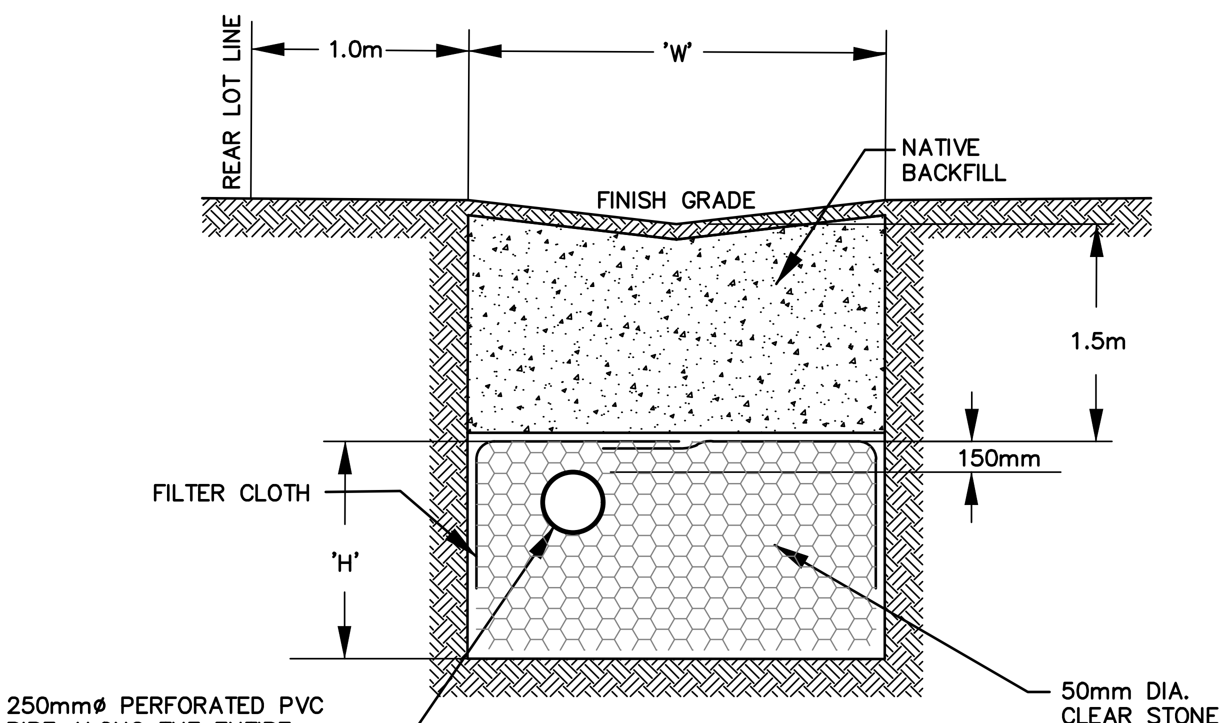
TRENCH PROFILE

N.T.S.



RLCB DETAIL

N.T.S.



TRENCH SECTION

N.T.S.

MILLBROOK SUBDIVISION

PHASE 2

TOWERHILL DEVELOPMENT INC.

INFILTRATION TRENCH DETAILS - REAR LOT

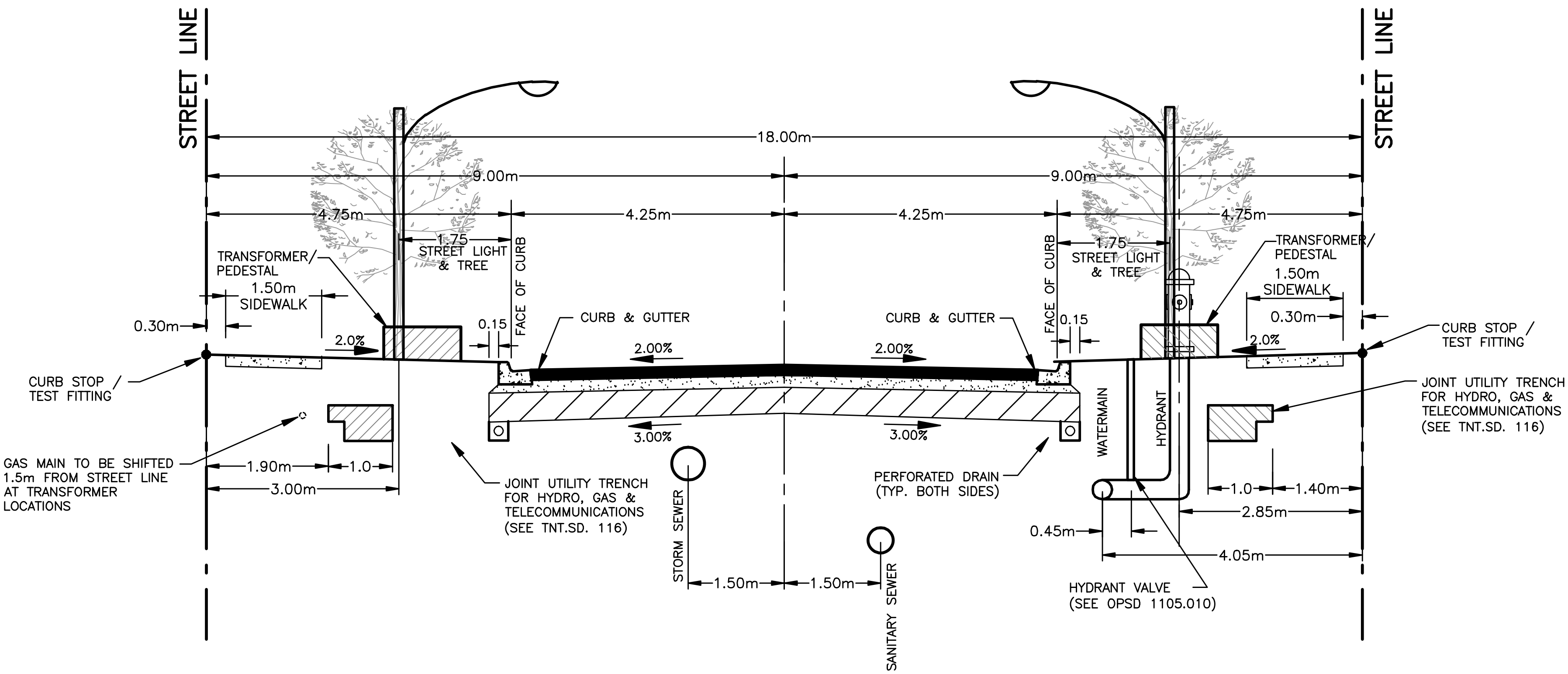
VALDOR ENGINEERING INC.
Consulting Engineers - Project Managers
741 ROWNTREE DAIRY ROAD, SUITE 2, WOODBRIDGE, ONTARIO, L4L 5T9
TEL (905)264-0054, FAX (905)264-0069
E-MAIL: info@valdor-engineering.com
www.valdor-engineering.com

SCALE	N.T.S.	CKD. BY	D.G.	DWG.	F1
DATE	SEP 2018	DRAWN BY	J.K.	PROJECT	17125

APPENDIX "G"

Standard Road & Sidewalk Cross Sections

METRIC
ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE SHOWN



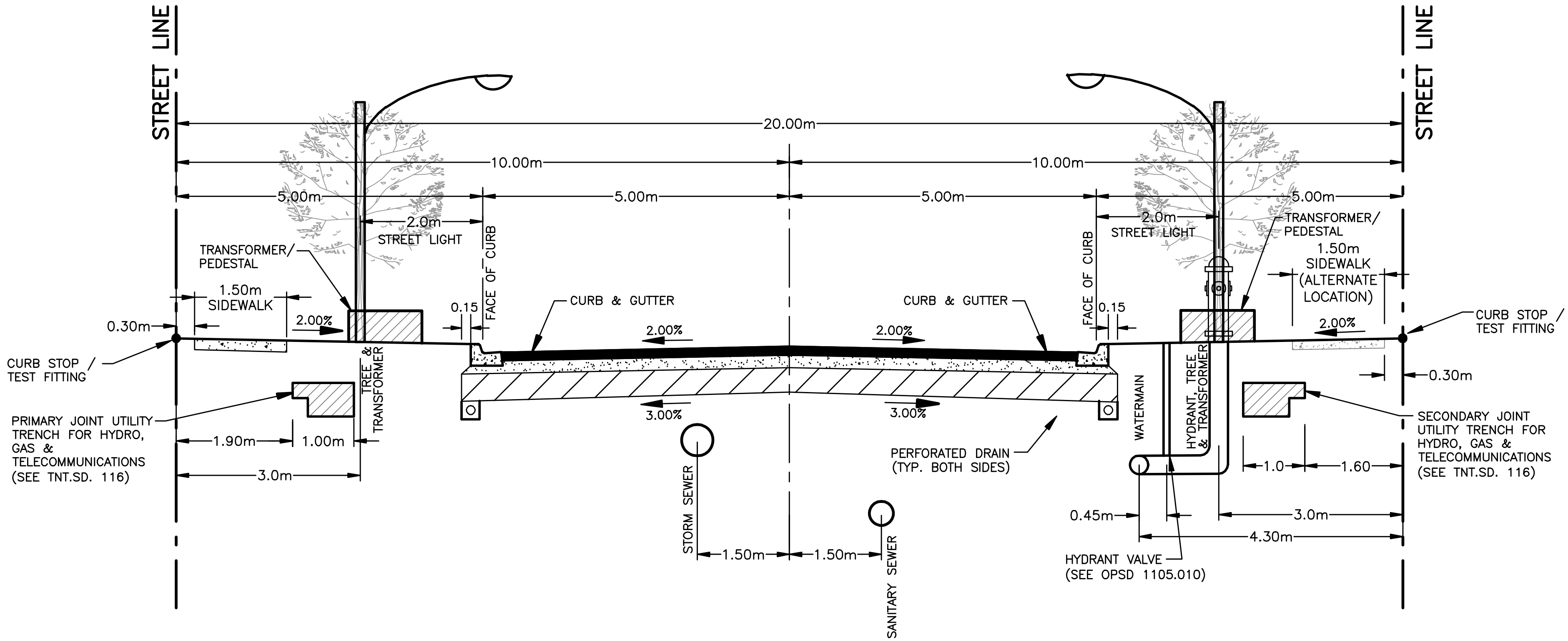
NO.	REVISIONS	DATE	APR'D

SCALE: N.T.S.

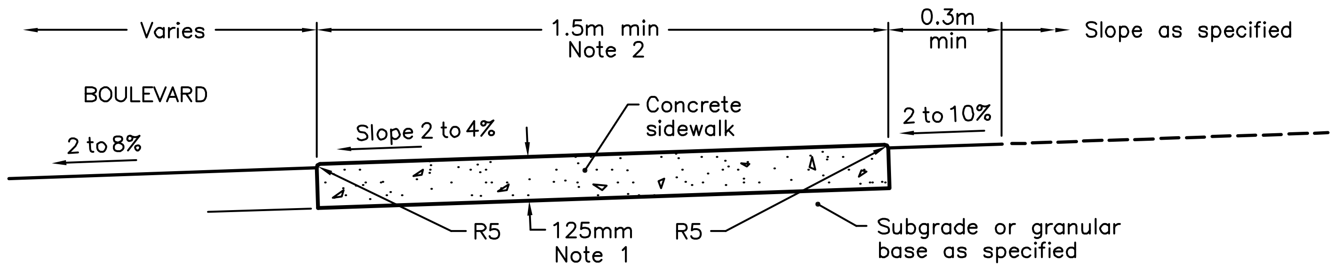
DATE: FEB. 2015

URBAN MINOR LOCAL
18.0m RIGHT-OF-WAY (8.5m ROAD)

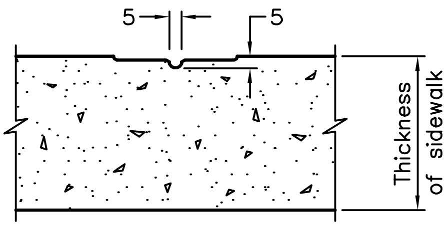
FIGURE 5



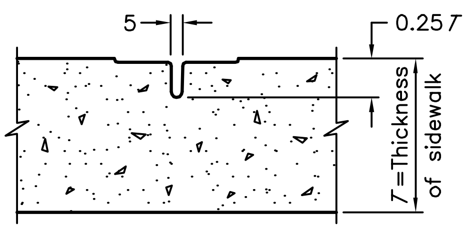
					SCALE: N.T.S.
					DATE: FEB. 2015
URBAN LOCAL 20.0m RIGHT–OF–WAY (10.0m ROAD)	NO.	REVISIONS	DATE	APR'D	FIGURE 6



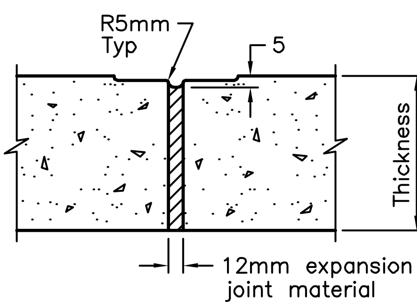
TYPICAL SECTION



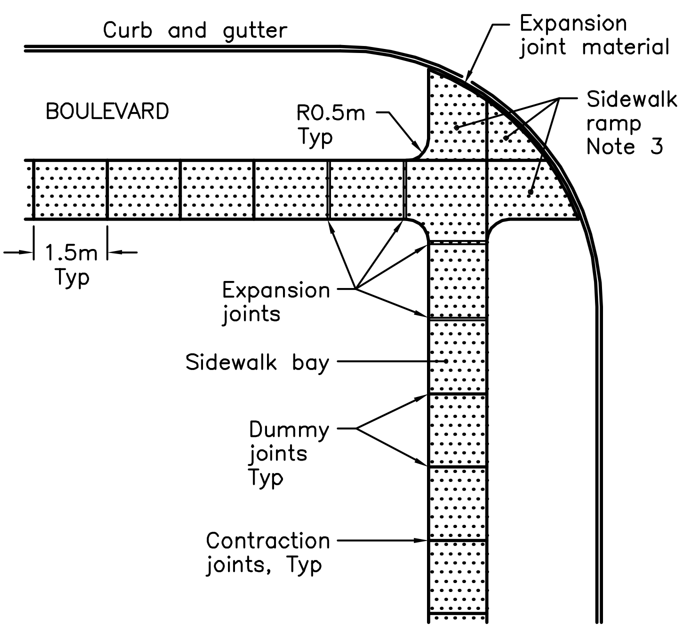
DUMMY JOINT (OPTIONAL)



CONTRACTION JOINT



EXPANSION JOINT



JOINT LAYOUT

NOTES:

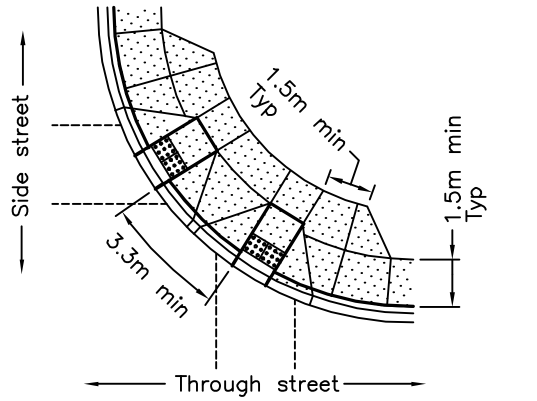
1 Sidewalk thickness at residential driveways and adjacent to curb shall be 150mm. At commercial and industrial driveways, the thickness shall be 200mm.

2 Sidewalk width shall be wider when specified.

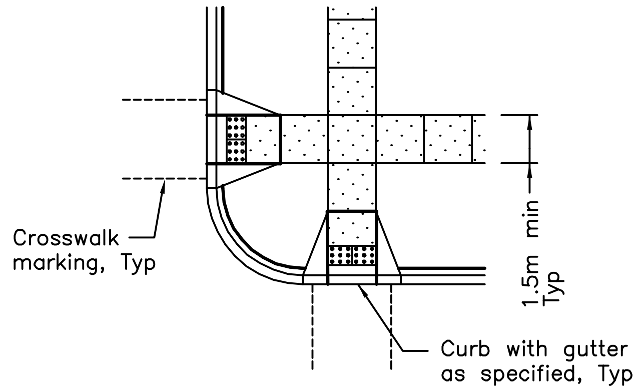
3 This OPSD shall be read in conjunction with OPSD 310.030, 310.031, 310.032, 310.033 and 310.039.

A All dimensions are in millimetres unless otherwise shown.

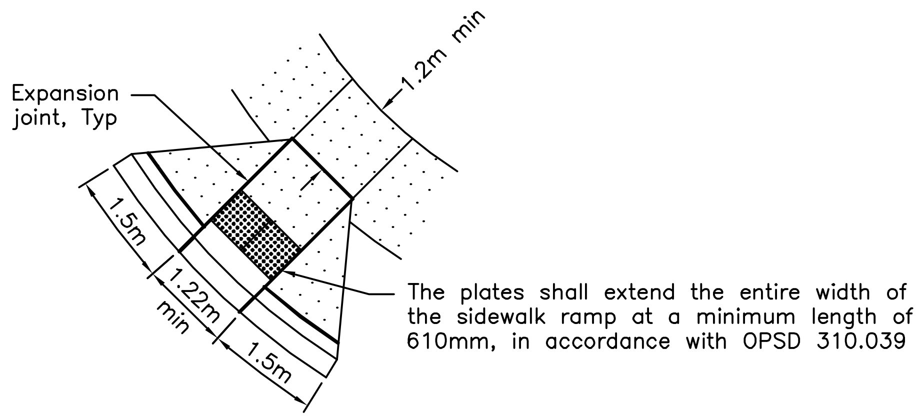
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev 2
CONCRETE SIDEWALK	OPSD 310.010	



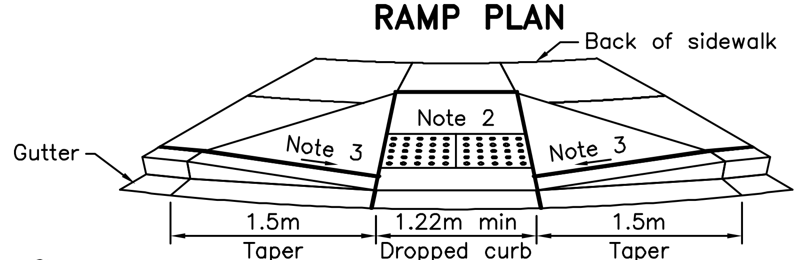
DOUBLE RAMP WITHOUT BOULEVARD



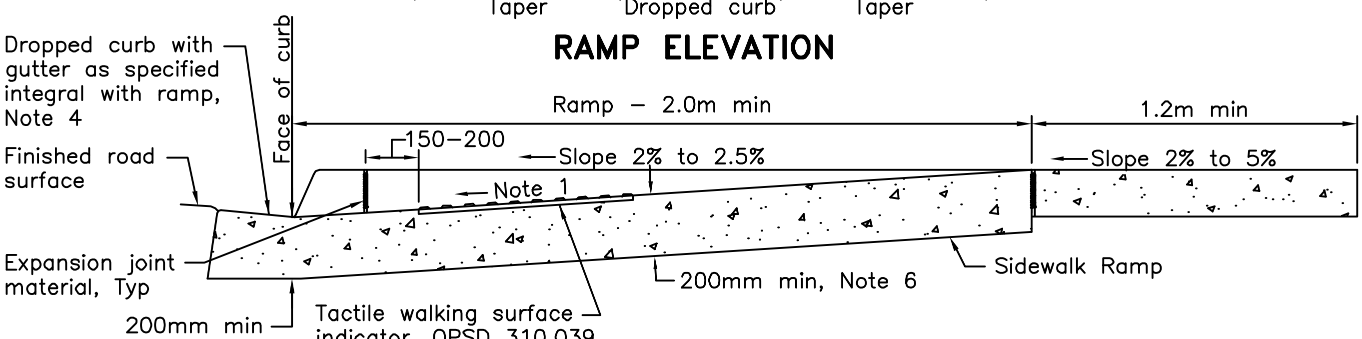
RAMPS WITH BOULEVARD



RAMP PLAN



RAMP ELEVATION

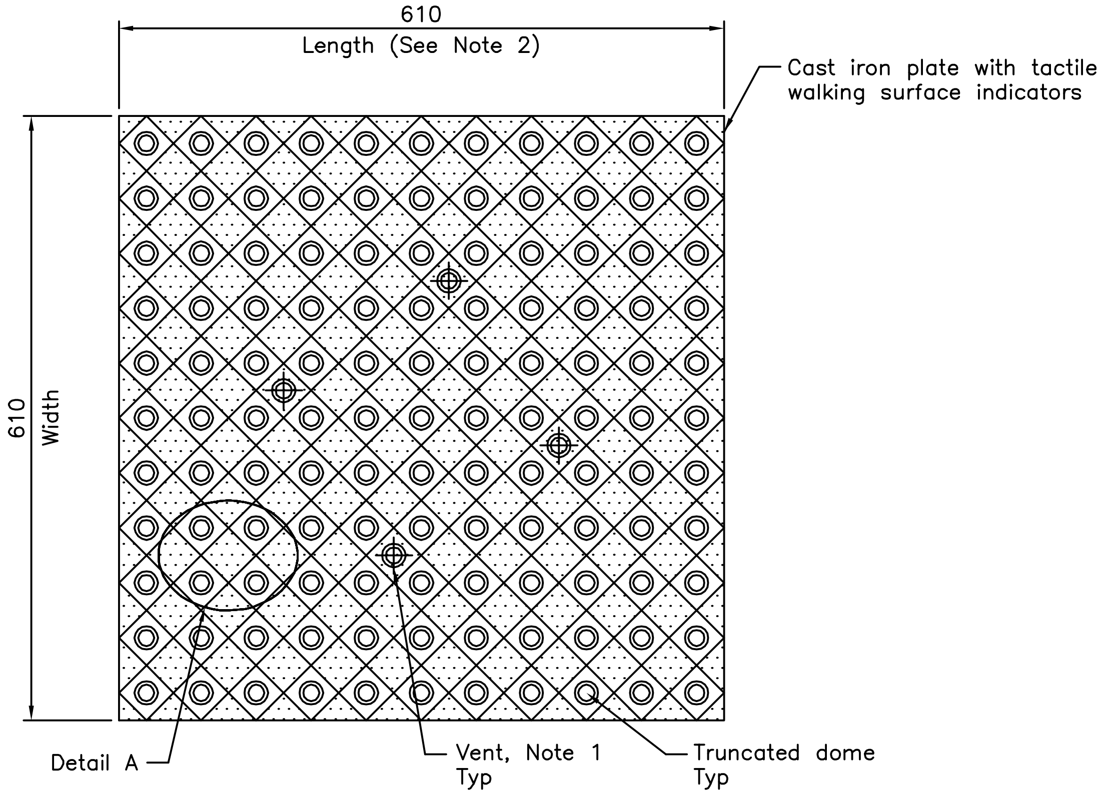


RAMP SECTION

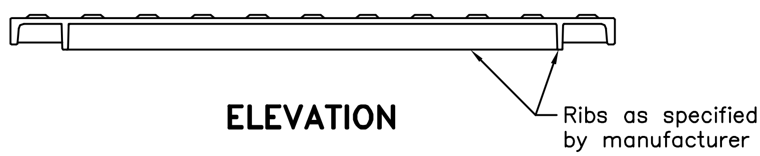
NOTES:

1 Slope of ramp shall not exceed 8%.
2 Cross slope of ramp shall not exceed 2% in either direction.
3 Cross slope of flared side of ramp shall not exceed 8%.
4 Dropped curb at ramp shall be modified to eliminate 30 mm step at gutter line.
5 Minimum thickness of ramp is 200mm. Minimum thickness of sidewalk and flared sides adjacent to ramp is 150mm.
A All dimensions are in millimetres unless otherwise shown.

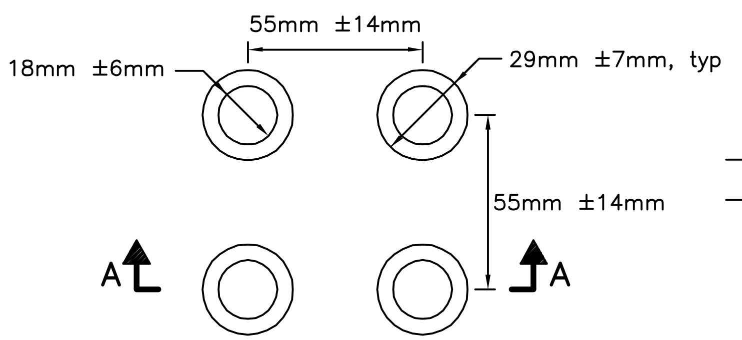
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev 0
CONCRETE SIDEWALK RAMPS AT UNSIGNALIZED INTERSECTIONS		**OPSD 310.033**



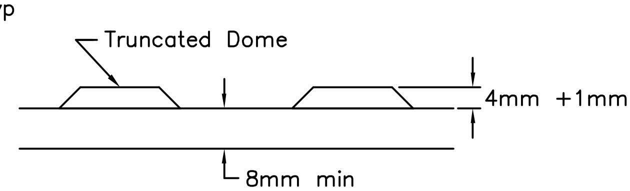
PLAN



ELEVATION



DETAIL A
TRUNCATED DOMES PLAN



SECTION A–A

NOTES:

1 Vents shall be as specified by the manufacturer.
2 Length of plate may be increased to suit the curb depression width.

A Adjacent cast iron plates shall be permanently connected using a locking mechanism and any hardware shall be hot dipped galvanized.
B All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev	0
CONCRETE SIDEWALK RAMPS TACTILE WALKING SURFACE INDICATORS COMPONENT	OPSD 310.039		

APPENDIX "H"

Geotechnical Bore Holes

Source:
Portion of drawing prepared by Valdor Engineering Inc., entitled "preliminary Sewer Alignment", provided to Geo-Logic on February 27, 2014.

TEST HOLE LOCATION PLAN

HYDROGEOLOGICAL ASSESSMENT
PROPOSED RESIDENTIAL DEVELOPMENT
FALLIS LINE
CAVAN-MONAGHAN, ONTARIO

PROJECT NO. :	G024822A1
SCALE :	1:10,000
DATE :	APRIL, 2014
PLATE NO. :	4

GEO-LOGIC INC.
347 PIDO ROAD, UNIT 29
PETERBOROUGH, ON K9J 6X7

REFERENCE No. G0248224A1 | ENCLOSURE No.: A-1

www.geo-logic.ca

BOREHOLE No.: BH-1
ELEVATION: 230.8 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Towerrill Development

PROJECT: Proposed Falls Line Residential Development

LOGGED BY: B. McFarlane | DATE: March 14, 2014

DRILLING COMPANY: Eastern Soil Investigation | METHOD: Track mounted drilling

NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

LEGEND

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- WATER LEVEL

Shear test (Cu) / Sensitivity (S): △ Field, □ Lab; ○ Water content (%); Atterberg limits (%); × SPT N Value (blows / 0.3 m); ◆ RQD; ● CONE

Depth (m)	m Below Existing Grade	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Recovery (%)	Moisture Content (%)	Blows per 6 in / 15 cm	Penetration Index N	Comments
	0.0	GROUND SURFACE						
		TOPSOIL (300 mm)						WL - 0.1 m 4/15/2014
	0.3	TILL - Light brown Clayey Silt, trace Sand, moist to wet, compact						WL - 0.4 m 3/25/2014
1.0			SS-1	100	18	1 3 5	8	
2.0			SS-2	100	21	5 7 11	18	
3.0			SS-3	100	20	7 11 15	16	
4.0			AS-4		26			
5.0								WL - 4.6 m 3/14/2014 Upon completion of drilling
6.0	6.1	END OF BOREHOLE	AS-5		19			Borehole caved at 5.9 m

Depth scale: ft 0–34; m 1.0–10.0. Graph scale: 10 20 30 40 50 60 70 80 90

BOREHOLE LOG GEOTECH G0248224A1. 14-04-22 TEST HOLE LOGS.GPJ GEOLOGIC.GDT 4/21/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-2

www.geo-logic.ca

BOREHOLE No.: BH-2
ELEVATION: 238.1 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Towerhill Development

PROJECT: Proposed Falls Line Residential Development

LOGGED BY: B. McFarlane DATE: March 14, 2014

DRILLING COMPANY: Eastern Soil Investigation METHOD: Track mounted drilling

NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

LEGEND

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- WATER LEVEL

m Below Existing Grade	Description of Soil and Bedrock	Type and Number	Recovery (%)	Moisture Content (%)	Blows per 6 in. / 15 cm	Penetration Index (N)	Shear test / Water content / N Value	Comments
0.0	GROUND SURFACE							
	TOPSOIL (300 mm)							Open borehole remained dry throughout drilling operation.
0.3	TILL - Light brown Clayey Silt, with Sand, trace Gravel, moist, compact							
1.5	Dense	SS-1	50	12	16 / 17 / 11	28		
		SS-2	100	10	23 / 30 / 17	47		
		AS-3		15				
		AS-4		13				
6.1	END OF BOREHOLE							

Chart legend: Shear test (Cu) Sensitivity (S) — △ Field, ⊐ Lab; ○ Water content (%); Atterberg limits (%); × "N" Value (blows / 0.3 m); ● RQD; ⊘ CONE. Scale: 10 20 30 40 50 60 70 80 90

Depth scale: ft 0–34; m 0.0–10.0

BOREHOLE LOG PROTECH G024822A1 ... TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/21/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A.3

www.geo-logic.ca

BOREHOLE No.: BH-3
ELEVATION: 242.9 m

BOREHOLE REPORT

Page 1 of 1

CLIENT: Towerhill Development

PROJECT: Proposed Fallis Line Residential Development

LOGGED BY: B. McFarlane DATE: March 14, 2014

DRILLING COMPANY: Eastern Soil Investigation METHOD: Track mounted drill rig

NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

LEGEND

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- ▼ - WATER LEVEL

Plot legend: Shear test (Cu); Sensitivity (S); △ Field; ○ Lab; ○ Water content (%); Atterberg limits (%); × "N" Value (blows / 0.3 m); ● RQD; ⊗ CONE

Depth (m)	m Below Existing Grade	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Recovery (%)	Moisture Content (%)	Blows per 6 in. / 15 cm	Penetration Index (N)	COMMENTS
	0.0	GROUND SURFACE						
	0.2	**TOPSOIL** (200 mm)						
		TILL - Light brown Clayey Silt, with Sand, trace Gravel, moist, compact						
1.0			SS-1	100	14	6 / 7 / 9	16	
	1.5	Brown Silty Sand, moist, very dense to dense	SS-2	100	9	15 / 29 / 41	70	
2.0								WL - 2.2 m 4/15/2014
			SS-3	100	13	18 / 21 / 19	40	WL - 2.2 m 4/15/2014
3.0	3.0	Wet	SS-4	100	17	10 / 19 / 21	40	WL - 2.8 m 3/14/2014 Upon completion of drilling
4.0								Borehole caved at 3.4 m
	4.5	Trace Gravel, compact	SS-5	100	19	11 / 23 / 34	57	
5.0								
6.0			SS-6	100	17	7 / 7 / 21	28	
	6.6	END OF BOREHOLE						

REFERENCE No. G024822A1 ENCLOSURE No.: A-4

www.geo-logic.ca

BOREHOLE No.: BH-4

ELEVATION: 251.4 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Towerhill Development

PROJECT: Proposed Falls Line Residential Development

LOGGED BY: B. McFarlane DATE: March 14, 2014

DRILLING COMPANY: Eastern Soil Investigation METHOD: Track mounted drilling

NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

LEGEND

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- WATER LEVEL

Depth (ft)	Depth (m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Recovery (%)	Moisture Content (%)	Blows per 6 in. / 15 cm	Penetration Index (N)	Shear test (Cu) / Sensitivity (S) / Water content (%) / Atterberg limits (%) / "N" Value (blows / 0.3 m) / RQD / CONE (10 20 30 40 50 60 70 80 90)	COMMENTS
		0.0		GROUND SURFACE							
				TOPSOIL (300 mm)							Open borehole remained dry throughout drilling operation
1		0.3		TILL - Light brown Clayey Silt, with Sand, trace Gravel, moist, compact to very dense							
5					SS-1	100	5	50=4"	100+		
11					SS-2	100	8	14 17 16	33		
15		4.6		Light brown Silty Sand, trace Gravel, damp, very dense	SS-3	100	8	50=5"	100+		
20					SS-4	100	4	50=5"	100+		
25					SS-5	100	5	28 50=5"	100+		
30		9.3		END OF BOREHOLE	SS-6	100	6	50=5"	100+		

BOREHOLE LOG GEOTECH G024822A1 140402 TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/7/14

REFERENCE No: G02482241 ENCLOSURE No.: A-5

www.geo-logic.ca

BOREHOLE No.: BH-5

ELEVATION: 249.3 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Towerhill Development

PROJECT: Proposed Falls Line Residence' Development

LOGGED BY: B. McFarlane DATE: March 14, 2014

DRILLING COMPANY: Eastern Soil Investigation METHOD: Track mounted drill rig

NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

LEGEND

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- ▼ - WATER LEVEL

Shear test (Cu) / Sensitivity (S): ○ Field, □ Lab; ○ Water content (%); ⊢⊣ Atterberg limits (%); × "N" Value (blows / 0.3 m); ◆ RQD; ● CONE

m Below Existing Grade	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Recovery %	Moisture Content %	Blows per 6 in. / 15 cm	Penetration Index N	COMMENTS
0.0	GROUND SURFACE						
	TOPSOIL (350 mm)						WL - 0.0 m 4/15/2014
0.4	TILL - Light brown Clayey Silt, with Sand, moist compact	SS-1	100	27	2 3 7	10	WL - 0.1 m 3/25/2014
1.5	Moist to wet	SS-2	100	19	12 13 11	24	
2.3	Wet, very dense	SS-3	100	9	11 15 17	32	WL - 2.4 m 3/14/2014 Upon completion of drilling
3.0	Light brown Silty Clay, wet firm to hard	SS-4	100	11	17 23 26	49	
4.6	Trace Gravel	SS-5	100	31	3 4 3	7	
6.1	Light brown Silty Sand, with Clay and Gravel, wet, compact to dense	SS-6	100	9	5 18 7	26	
		SS-7	100	10	9 21 18	39	
		SS-8	50	8	11 8 8 7	16	SS-8: 26% Gravel, 34% Sand, 40% Silt and Clay, 23% between 5-75 μm
9.8	END OF BOREHOLE						

Depth scale: ft 0–34; m 0–10.0

BOREHOLE LOG GEOTECH G02482241, 14 BH-5, TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/21/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-11

www.geo-logic.ca

BOREHOLE No.: BH-11
ELEVATION: 248.8 m

BOREHOLE REPORT

Page 1 of 1

CLIENT: Towerhill Development
PROJECT: Proposed Falls Line Residential Development
LOGGED BY: B. McFarlane DATE: March 14, 2014
DRILLING COMPANY: Eastern Soil Investigation METHOD: Track mounted drill rig
NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

LEGEND
SS - SPLIT SPOON
AS - AUGER SAMPLE
ST - SHELBY TUBE
CS - CORE SAMPLE
▼ - WATER LEVEL

Shear test (Cu), Sensitivity (S) △ Field □ Lab; ○ Water content (%); Atterberg limits (%); × "N" Value (blows / 0.3 m); ● RQD; ⊗ CONE

m Below Existing Grade	Description of Soil and Bedrock	Type and Number	Recovery %	Moisture Content %	Blows per 6 in / 15 cm	Penetration Index N	Comments
0.0	GROUND SURFACE						
	TOPSOIL (250 mm)						Open borehole remained dry throughout drilling operation
0.3	TILL - Brown Clayey Silt with Sand, trace Gravel, moist, compact to very dense						
		SS-1	100	18	4 6 7	13	
		SS-2	75	18	21 16 17	33	
		SS-3	100	14	9 15 18	33	
		SS-4	100	11	8 20 31	51	
		AS-5		8			
		AS-6		8			
6.1	END OF BOREHOLE						

BOREHOLE LOG REPORT G024822A1_14.04.02 TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/2/14

REFERENCE No.: G324822A1 ENCLOSURE No.: A-12

www.geo-logic.ca

BOREHOLE No.: BH-12
ELEVATION: 246.2 m

BOREHOLE REPORT

Page 1 of 1

CLIENT: Towerhil Development

PROJECT: Proposed Fallis Line Residential Development

LOGGED BY: B. McFarlane DATE: March 14, 2014

DRILLING COMPANY: Eastern Soil Investigation METHOD: Track mounted drilling

NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

LEGEND
- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- WATER LEVEL

Shear test (Cu) / Sensitivity (S): △ Field, □ Lab; ○ Water content (%); Atterberg limits (%); × 'N' Value (blows / 0.3 m); ● RQD; CONE

Depth (ft)	Depth (m)	m Below Existing Grade	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Recovery (%)	Moisture Content (%)	Blows per 6 in. / 15 cm	Penetration Index N	COMMENTS
		0.0	GROUND SURFACE						
			TOPSOIL (300 mm)						Open borehole remained dry throughout drilling operation
1		0.3	TILL - Brown Clayey Silt, with Sand, trace Gravel, moist, compact to very dense						
3	1.0			SS-1	100	23	3 3 7	10	
6	2.0			SS-2	100	11	5 7 15	22	
8				SS-3	100	9	50+2"	100+	
11	3.0			SS-4	100	9	13 17 17	34	
15	4.0			AS-5		9			
20	6.0	6.1		AS-6		9			
20			END OF BOREHOLE						

Depth scale: 1–34 ft; 1.0–10.0 m

BOREHOLE LOG GEOTECH G324822A1 14-04-02 TESTHOLE LOGS.GPJ

REFERENCE No.: G024822A1 ENCLOSURE No.: A-17

www.geo-logic.ca

TEST PIT No.: TP-17
ELEVATION: 233.8 m

TEST PIT REPORT

Page 1 of 1

CLIENT: Towerhill Development
PROJECT: Proposed Fallis Line Residential Development
LOGGED BY: P. Hynes DATE: March 18, 2014
EXCAVATION COMPANY: Terry Dunford Excavating METHOD: Track mounted excavator
NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

LEGEND
GS - GRAB SAMPLE
▼ - WATER LEVEL

Depth (ft)	Depth (m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Moisture Content (%)	Shear test (Cu) / Sensitivity (S) / Water content (%) / Atterberg limits (%)	COMMENTS
		0.0		GROUND SURFACE				
				TOPSOIL (200 mm)				
		0.2		TILL - Brown to grey Clayey Silty Sand, with Gravel, mottled, moist, compact				
					GS-1	23		No seepage observed during the excavation of the test pit
		2.1		Brown Clayey Silt, trace Sand, occasional Cobbles and Boulders, moist, compact				
					GS-2	21		GS-2 1% Gravel 3% Sand 96% Silt and Clay 46% between 5-75 µm
		3.7		With Gravel, moist to wet				
					GS-3	12		
		4.9		END OF TEST PIT				

Depth scale: ft 1–34; m 1.0–10.0. Chart scale: 10 20 30 40 50 60 70 80 90

TEST PIT LOG GEOTECH G024822A1 140408, TEST HOLE LOGS.GPJ GEOLOGIC.GDT 4/9/14

REFERENCE No. G024822A1 ENCLOSURE No.: A-25

www.geo-logic.ca

TEST PIT No.: TP-25
ELEVATION: 253.3 m

TEST PIT REPORT

Page: 1 of 1

CLIENT: Towerhill Development
PROJECT: Proposed Falls Line Residential Development
LOGGED BY: P. Hynes DATE: March 18, 2014
EXCAVATION COMPANY: Terry Quinlord Excavating METHOD: Track mounted excavator
NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

LEGEND
GS - GRAB SAMPLE
WATER LEVEL

Shear test (Cu): △ Field, □ Lab; Sensitivity (S); ○ Water content (%); Atterberg limits (%)

m Below Existing Grade	Description of Soil and Bedrock	Type and Number	Moisture Content (%)	Comments
0.0	GROUND SURFACE			
	TOPSOIL (250 mm)			No seepage observed during the excavation of the test pit
0.3	TILL - Brown Silty Sand, with Gravel, trace Clay, occasional Cobbles and Boulders, moist, compact	GS-1	26	
2.3	With Clay, very dense	GS-2	12	
		GS-3	8	
4.6	END OF TEST PIT			Test pit terminated at practical refusal (due to presence of very dense till)

TEST PIT LOG GEOTECH G024822A1, 14:24:00, TEST HOLE LOGS.GPJ GEOLOGIC.GDT 4/2/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-26

www.geo-logic.ca

TEST PIT No.: TP-26
ELEVATION: 253.4 m

TEST PIT REPORT

Page 1 of 1

CLIENT: Towerhill Development

PROJECT: Proposed Fallis Line Residential Development

LOGGED BY: P. Hynes DATE: March 18, 2014

EXCAVATION COMPANY: Terry Dunford Excavating METHOD: Track mounted excavator

NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

LEGEND
GS - GRAB SAMPLE
WATER LEVEL

Depth (ft)	Depth (m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Moisture Content (%)	Shear test (Cu) / Sensitivity (S) / Water content (%) / Atterberg limits (%) (△ Field, □ Lab)	COMMENTS
		0.0		GROUND SURFACE				
				TOPSOIL (300 mm)				No seepage observed during the excavation of the test pit
		0.3		TILL - Brown Silty Sand, with Gravel, trace Clay, occasional Cobbles and Boulders, moist, compact				
					GS-1	8		GS-1: 9% Gravel, 40% Sand, 51% Silt and Clay, 30% between 5-75 µm
		3.7		With Clay				
					GS-2	10		
					GS-3	12		
		6.1		END OF TEST PIT				

TEST PIT LOG PRETTECH G024822A1 14-04-02 TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/2/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-27

www.geo-logic.ca

TEST PIT No.: TP-27
ELEVATION: 249.2 m

TEST PIT REPORT

Page: 1 of 1

CLIENT: Towerhill Development

PROJECT: Proposed Falls Line Residential Development

LOGGED BY: P. Hynes DATE: March 18, 2014

EXCAVATION COMPANY: Terry Durford Excavating METHOD: Track mounted excavator

NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

LEGEND

GS - GRAB SAMPLE

WATER LEVEL

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
Atterberg limits (%)

Depth (ft / m)	m Below Existing Grade	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Moisture Content (%)	COMMENTS
	0.0	GROUND SURFACE			
		TOPSOIL (300 mm)			No seepage observed during the excavation of the test pit
	0.3	TILL - Brown Silty Sand, with Gravel trace Clay, occasional Cobbles and Boulders, moist, compact			
			GS-1	14	
	3.7	With Clay			
			GS-2	6	
			GS-3	7	
	6.1	END OF TEST PIT			

REFERENCE No. G024822A1 ENCLOSURE No.: A-28

www.geo-logic.ca

TEST PIT No.: TP-28
ELEVATION: 243.4 m

TEST PIT REPORT

Page: 1 of 1

CLIENT: Townhill Developments

PROJECT: Proposed Fallis Line Residential Development

LOGGED BY: P. Hynes DATE: March 18, 2014

EXCAVATION COMPANY: Terry Durford Excavating METHOD: Track mounted excavator

NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

LEGEND
- GS - GRAB SAMPLE
- ▼ - WATER LEVEL

Depth (m)	m Below Existing Grade	Description of Soil and Bedrock	Type and Number	Moisture Content (%)	Comments
	0.0	GROUND SURFACE			
		TOPSOIL (300 mm)			No seepage observed during the excavation of the test pit
	0.3	TILL - Brown Silty Sand with Gravel, trace Clay, occasional Cobbles and Boulders, moist, compact			
1.5			GS-1	14	
	3.7	With Clay			
4.6			GS-2	8	
6.0			GS-3	8	
	6.1	END OF TEST PIT			

Shear test (Cu) △ Field ○ Lab; Sensitivity (S); ○ Water content (%); Atterberg limits (%)

10 20 30 40 50 60 70 80 90

REFERENCE No. G024822A1 ENCLOSURE No.: A-29

www.geo-logic.ca

TEST PIT No.: TP-29

ELEVATION: 246.9 m

TEST PIT REPORT

Page: 1 of 1

CLIENT: Towerhill Development

PROJECT: Proposed Fallis Line Residential Development

LOGGED BY: P. Hynes DATE: March 18, 2014

EXCAVATION COMPANY: Terry Dunford Excavating METHOD: Track mounted excavator

NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

LEGEND

GS - GRAB SAMPLE

▼ - WATER LEVEL

Depth (ft)	Depth (m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Moisture Content (%)	Shear test (Cu) / Sensitivity (S) / Water content (%) / Atterberg limits (%) (Δ Field, □ Lab)	COMMENTS
		0.0		GROUND SURFACE		%	10 20 30 40 50 60 70 80 90	
				TOPSOIL (250 mm)				No seepage observed during the excavation of the test pit
1		0.3		TILL - Brown Silty Sand, with Gravel, trace Clay, occasional Cobbles and Boulders, moist, compact				
4–5					GS-1	19	O	
9		2.7		With Clay	GS-2	22	O	
15					GS-3	7	O	
20	6.0	6.1		END OF TEST PIT				

REFERENCE No.: G024822A1 | ENCLOSURE No.: A-30

www.geo-logic.ca

TEST PIT No.: TP-30
ELEVATION: 237.5 m

TEST PIT REPORT

Page: 1 of 1

CLIENT: Towerhill Development

PROJECT: Proposed Falls Line Residential Development

LOGGED BY: P. Hynes DATE: March 18, 2014

EXCAVATION COMPANY: Terry Dunford Excavating METHOD: Track mounted excavator

NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment" provided on February 27, 2014

LEGEND
- GS - GRAB SAMPLE
- WATER LEVEL

Depth (m)	m Below Existing Grade	Description of Soil and Bedrock	Type and Number	Moisture Content (%)	Comments
	0.0	GROUND SURFACE			
		TOPSOIL (350 mm)			
	0.4	TILL - Brown to grey Clayey Silty Sand, with Gravel, occasional Cobbles, mottled, moist, compact			
			GS-1	10	
	1.5	Grey Sandy Silt, with Gravel, trace Clay, occasional Cobbles and Boulders, moist to wet, compact			Slight seepage observed at 1.5 m
			GS-2	6	
			GS-3	9	
			GS-4	10	
	6.1	END OF TEST PIT			

Shear test (Cu) / Sensitivity (S): △ Field, □ Lab; ○ Water content (%); Atterberg limits (%)

REFERENCE No.: G024822A1 ENCLOSURE No.: A-33

www.geo-logic.ca

TEST PIT No.: TP-33
ELEVATION: 250.7 m

TEST PIT REPORT

Page: 1 of 1

CLIENT: Towerhill Development

PROJECT: Proposed Falls Line Residential Development

LOGGED BY: P. Hynes DATE: March 18, 2014

EXCAVATION COMPANY: Terry Dunford Excavating METHOD: Track mounted excavator

NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

LEGEND
- GS - GRAB SAMPLE
- ▼ - WATER LEVEL

Depth (ft / m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Moisture Content (%)	Shear test (Cu) △ Field □ Lab; Sensitivity (S); ○ Water content (%); Atterberg limits (%) — 10 20 30 40 50 60 70 80 90	COMMENTS
	0.0		GROUND SURFACE				
			TOPSOIL (375 mm)				No seepage observed during the excavation of the test pit
	0.4		TILL: Brown Clayey Silty Sand with Gravel, occasional Cobbles and Boulders, mottled, moist, compact				
5 ft				GS-1	12	○	
10 ft / 3.0				GS-2	13	○	
15 ft				GS-3	13	○	
20 ft / 6.0	6.1		END OF TEST PIT				

February 24, 2015

Towerhill Developments Inc.
c/o Innovative Planning Solutions
150 Dunlop Street East, Suite 201
Barrie, Ontario L4M 1H2

Attn: Mr. Cameron Sellers

Re: Addendum #1 - Geotechnical Investigation Report
Proposed Residential Development
Fallis Line, Cavan-Millbrook, Ontario
Geo-Logic Project No. G024822A1

Dear Mr. Sellers:

This letter should be considered Addendum No. 1 to the Geo-Logic report entitled "Geotechnical Investigation Report – Proposed Residential Development – Fallis Line, Cavan-Millbrook, Ontario", dated April 2014, under Geo-Logic Project No. G024822A1.

Commentary was received from the Township of Cavan-Monaghan by letter addressed to IPS and dated December 11, 2014. The following points provide the Township's comments in relation to the Geotechnical Report in *italics*, and Geo-Logic's response to each:

- *"The geotechnical report should comment on whether the Township's pavement structures standard is sufficient or should be upgraded."*

  Based on the soil encountered during our fieldwork, and based on appropriate preparation of the subgrade throughout (see recommendations in our Report), the Township's pavement structures standard (for both asphalt depths and granular depths) are considered sufficient.

- *"The Geotechnical Investigation Report anticipates that groundwater encountered during construction can be controlled by pumping. However, the Report also refers to other more intensive means of dewatering. The Report should provide more definite analysis of the groundwater issue."*

  Based on information provided by Mr. Peter Zourntos of Valdor Engineering by phone-call dated Feb 23, 2015, Geo-Logic understands that the trenching for utilities shall be a maximum depth of only 6 to 7m below existing grade (versus the max. 10m previously referenced in our Report). It is recommended that the depth of servicing and corresponding trenching be minimized as much as possible, to minimize the groundwater control measures required.

It is recommended that a Permit to Take Water (PTTW) be obtained from the MOECC in advance of construction, to allow for dewatering in excess of 50,000 litres/day.

It is recommended that trench plugs be installed at appropriate locations along the trench alignments, to minimize and control any flow of groundwater along the trench bedding and backfill materials. Note that concrete plugs for the shallower watermain trench are susceptible to differential movement and heaving in relation to surrounding soils, particularly where the plugs are located within the frost penetration depth (1.5 to 1.6m). Clay plugs should be used in such instances, utilizing frost tapers to minimize differential movement within the frost zone.

If trenching encounters overly wet or loose bedding subgrade, bedding material should consist of High Performance Bedding (HPB) or HL-8 stone, wrapped in non-woven geotextile fabric equivalent to Terrafix 200R and placed in accordance with manufacturer's specifications. Based on local knowledge and previous experience in the area, it is expected that artesian (pressurized) groundwater conditions exist in a confined aquifer located at depth below this area. It is also known that the aquitard (ie, confining) soil layer within which excavations for this construction will occur, can be "leaky", in that it can allow upwards leakage of the pressurized groundwater into excavations via hydraulically-conductive seams/lenses of sand. If such conditions are encountered within the trenching subgrade, it is recommended that the bedding layer consist of HPB or HL-8 stone.

Past construction experiences in the area encountered groundwater conducted through localized sand and/or gravel lensing and seams within the till material, in a lateral and down-gradient flow that became evident once excavations intersected such lensing/seams. It is noted that previous excavations encountering such inflows of groundwater have dealt with it through excavation pumping and re-direction of flows on a temporary basis (during construction), and installation of subdrains channelled to appropriate, frost-free outlets on a longer-term basis. As an example of such a zone, see BH-5 at 4.6 to 6.1m depth – this suggests a zone of increased grain size including gravel, that exhibits an elevated moisture content indicating saturation and possibly a zone that would conduct increased levels of groundwater inflow into an excavation that intersects it. It is noted that well points are not generally considered feasible in such highly-localized lateral groundwater flow conditions.

Based on the test pitting, isolated and localized zones of groundwater infiltration were encountered in some test pits, but the majority of them remained free of any seepage during their excavation. Test pit TP-20 exhibited seepage throughout the full depth of the test pit, and caving of its walls. In this area, and any others encountering saturated sandy soils, such soils will be considered Type 4 by OHSA, and unsupported excavations in such soils require sloping of 3H:1V to the base of the excavation.

To maximize the ability to control groundwater flow into the trenching as it progresses, consideration should be given to beginning the trenching in the most down-gradient areas of the project.

It is recommended that a test dig be performed during construction tendering, to allow interested contractors the opportunity to view for themselves the subsurface conditions at representative locations of the project. This will increase the ability for them to assess their own capabilities regarding such conditions. It is strongly recommended that the contractor retain an appropriate groundwater / dewatering professional to make their own assessments regarding groundwater conditions, its potential impacts on construction, and strategies to appropriately control such groundwater.

We trust that this letter report meets with your immediate requirements. Should you have any questions, please contact our office.

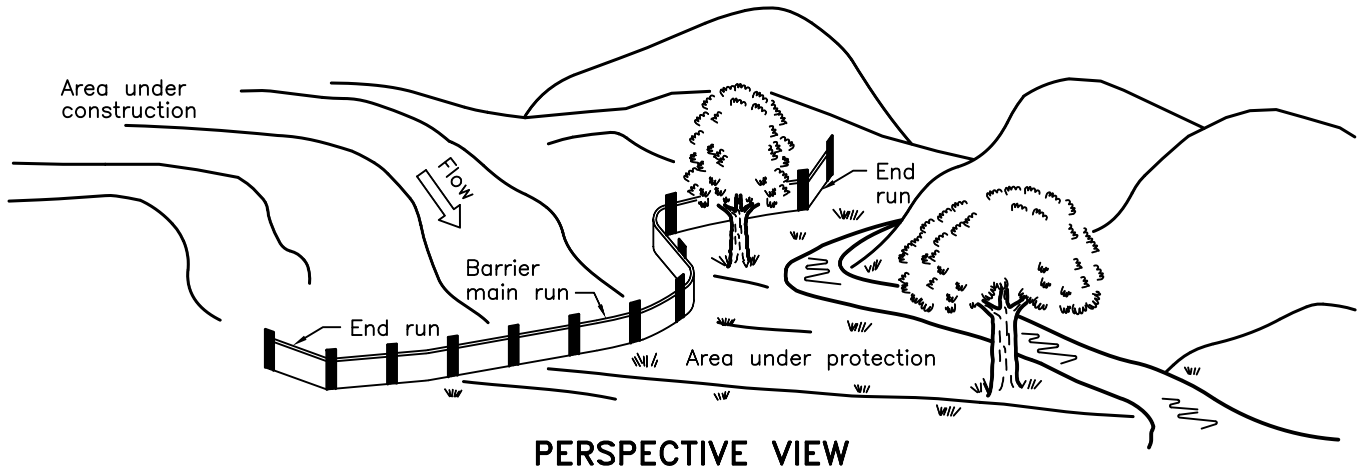
LICENSED PROFESSIONAL ENGINEER
15/2/24
G. BRENCHLEY
PROVINCE OF ONTARIO

Yours Truly,
Geo-Logic

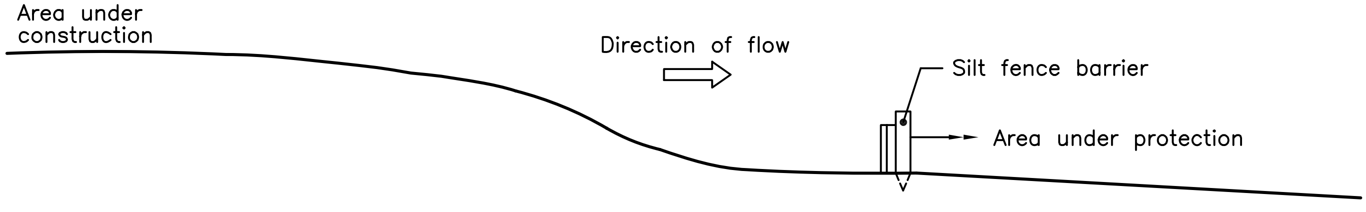
Garnet Brenchley, P.Eng.

APPENDIX "I"

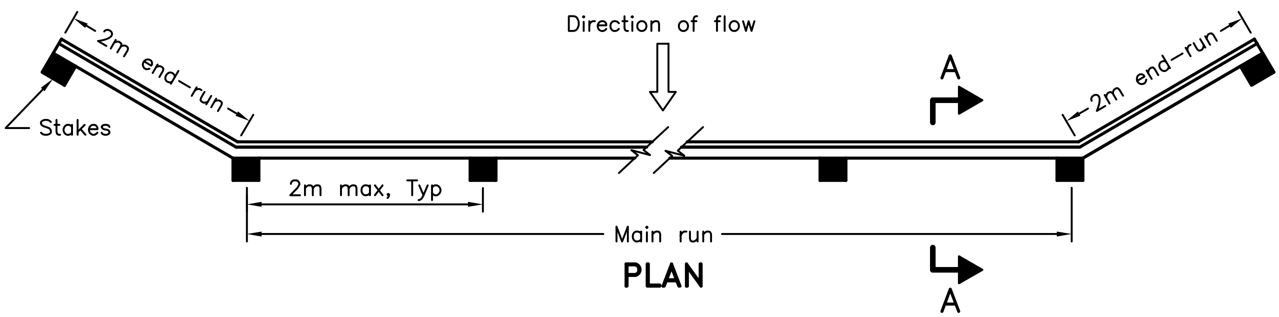
Erosion & Sediment Control Details



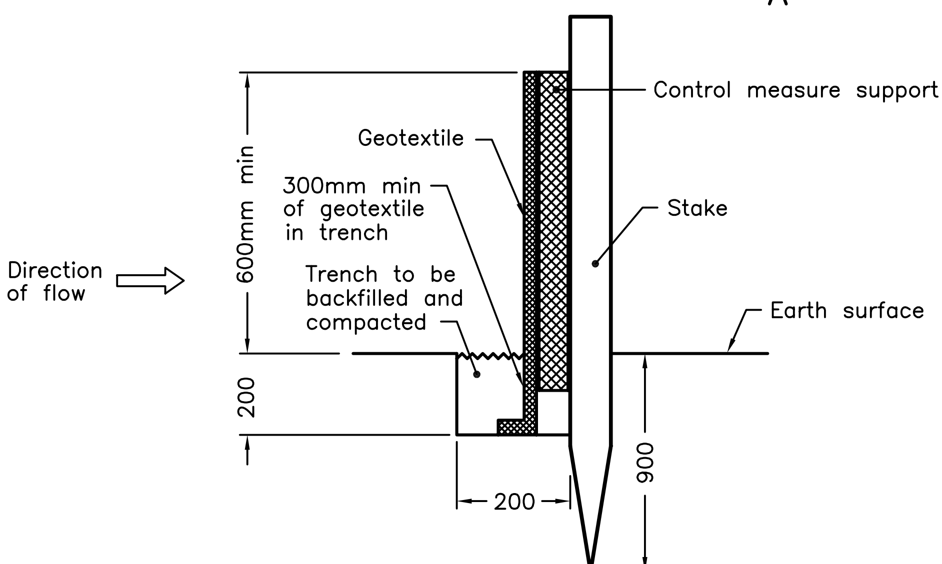
PERSPECTIVE VIEW



SECTION



PLAN

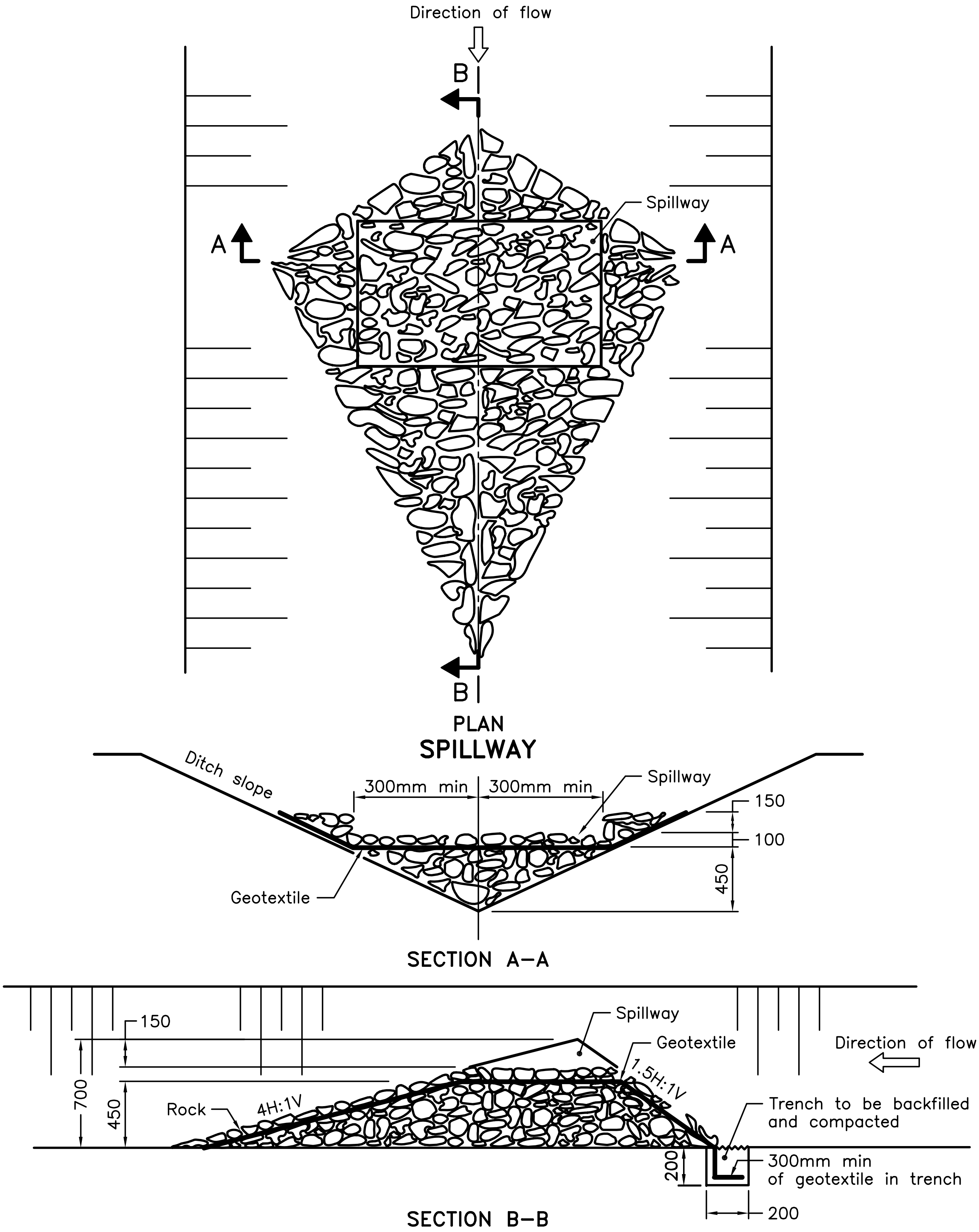


SECTION A–A

NOTE:

A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2006	Rev 1
HEAVY–DUTY SILT FENCE BARRIER		**OPSD 219.130**



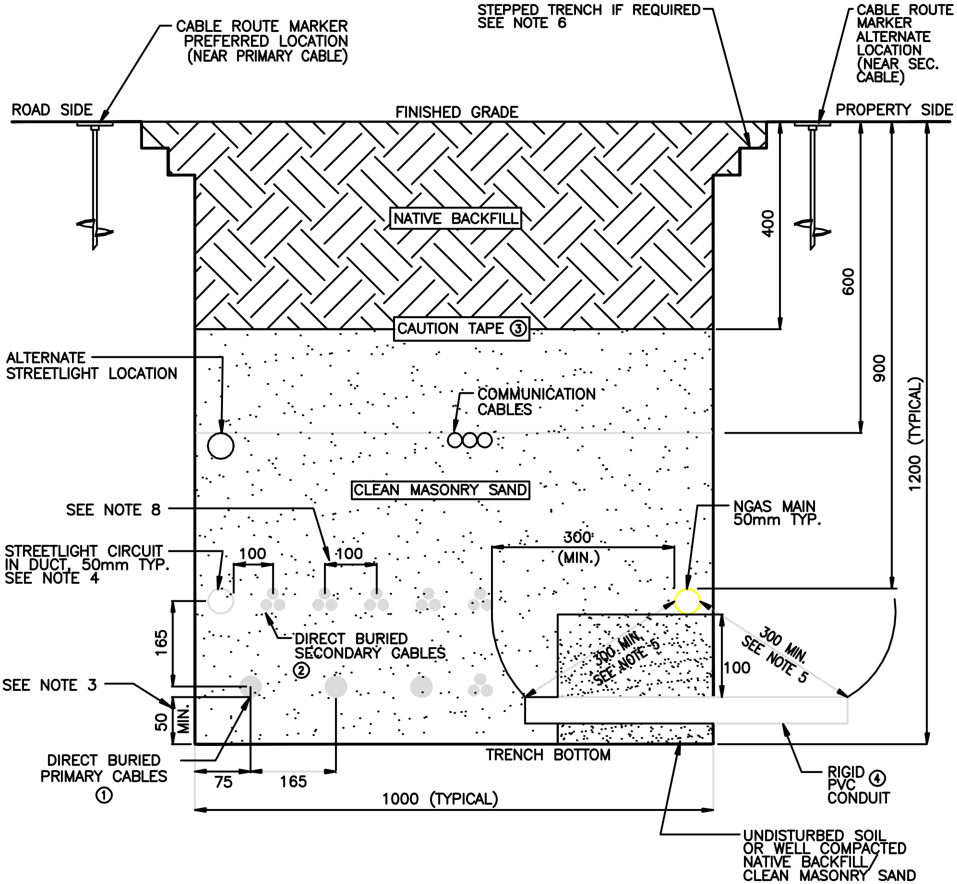
NOTE:

A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2006	Rev 1
ROCK FLOW CHECK DAM V–DITCH		
	OPSD 219.210	

APPENDIX “J”

Typical Joint Utility Trench & Street Light Detail



NOTES:

1. ALL DIMENSIONS ARE IN mm UNLESS STATED OTHERWISE.
2. ALL SEPARATIONS AND DEPTHS OF BURIAL ARE MINIMUM.
3. IN THE PRESENCE OF SHARP ROCK, DEBRIS OR RUBBLE, INCREASE SAND PADDING TO 100mm
4. STREETLIGHT WIRE DUCT MAY BE INSTALLED AT A REDUCED BURIAL DEPTH, UP TO A MINIMUM DEPTH OF 600mm. SEPARATIONS TO SUPPLY CABLE BASED ON MAXIMUM STREETLIGHT DUCT DIAMETER OF 50mm.
5. MUST MAINTAIN 300mm MINIMUM FROM ALL EXPOSED SUPPLY CABLES TO GAS MAIN. WHEN CROSSING GAS MAIN AND IF 300mm OF CLEAR VERTICAL SEPARATION IS NOT ACHIEVABLE, SECONDARY CABLES SHALL BE INSTALLED IN SHORT LENGTH OF RIGID PVC CONDUIT.
6. CONSTRUCTION, STEPPING AND/OR SUPPORTING OF THE TRENCH WALL TO CONFORM TO THE REQUIREMENTS OF THE OCCUPATIONAL HEALTH AND SAFETY ACT.
7. NON-REQUIRED CIRCUITS OR JOINT USE COMPONENTS MAY BE OMITTED PROVIDED THAT CLEARANCES AND SEPARATIONS ARE MAINTAINED. PRIMARY CABLES (IF PRESENT) MUST BE INSTALLED ON THE BOTTOM ROW OF SUPPLY CABLES. SECONDARY CABLE BUNDLES MAY BE SUBSTITUTED IN PLACE OF PRIMARY CABLE(S) WHEN REQUIRED.
8. INTERMITTENT CONTACT IS ALLOWABLE BETWEEN SECONDAY CABLES WHERE REQUIRED.

PART #	MASTER MATERIAL #	DESCRIPTION	QTY.
①	30010134 30006080	CABLE PRIMARY, 28kV, UGROUND, 2/0 AWG, AL CABLE PRIMARY, 28kV, UGROUND, 350 KCMIL, CU	
②	30005908 30005915	SERVICE CABLE, UGROUND, 3/0AWG, 3 COND, AL SERVICE CABLE, UGROUND, 250KCMIL, 3 COND, AL	
③	20002181	CAUTION TAPE	
④	30007542	RIGID PVC CONDUIT	

REFERENCES:

SECTION 1 – DEFINITIONS
SECTION 3C – CONSTRUCTION GUIDE
SECTION 16 – MATERIALS

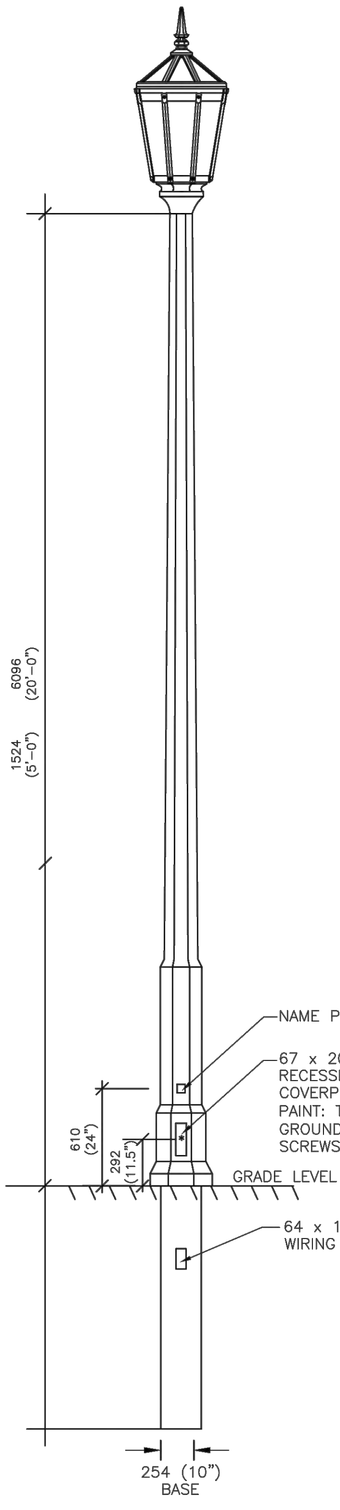
Rev. No.	Issue Date	Revision	Dwn	Chk	Approved By	Date
02	JULY 2011	GENERAL REVISIONS	PC			

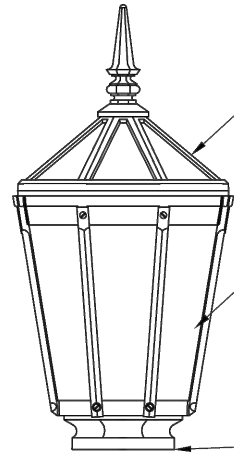
hydro one — Hydro One Networks Inc.

Drawn: P.CIARMOLI | Approved: * | Date: JULY.20,2011

JOINT TRENCH - POWER, COMMUNICATION & GAS DISTRIBUTION LINES - TYPICAL

Dwg. No. DU-03-206.1 | Rev. 02





LUMINAIRE

8-SIDED OCTAGONAL POST-TOP LUMINAIRE, TYPE III DISTRIBUTION, 75W LED, RIPPLED ACRYLIC LENS, TEXTURED BLACK IN COLOUR, 120VAC, C/W TWISTLOCK RECEPTACLE AND K24 CAPITAL POLE ADAPTER.

KING LUMINAIRE CATALOGUE NO:
K56-S-K24-FAAR-III-75(SSL)-5000-120-PR-#6
OR APPROVED EQUAL

POLE

DIRECT BURIED CONCRETE POLE, BLACK POLISHED AND, OCTAGONAL TAPPERED SECTION, COMPLETE WITH 76mm (3") O.D. BY 102mm (4") LONG TENON

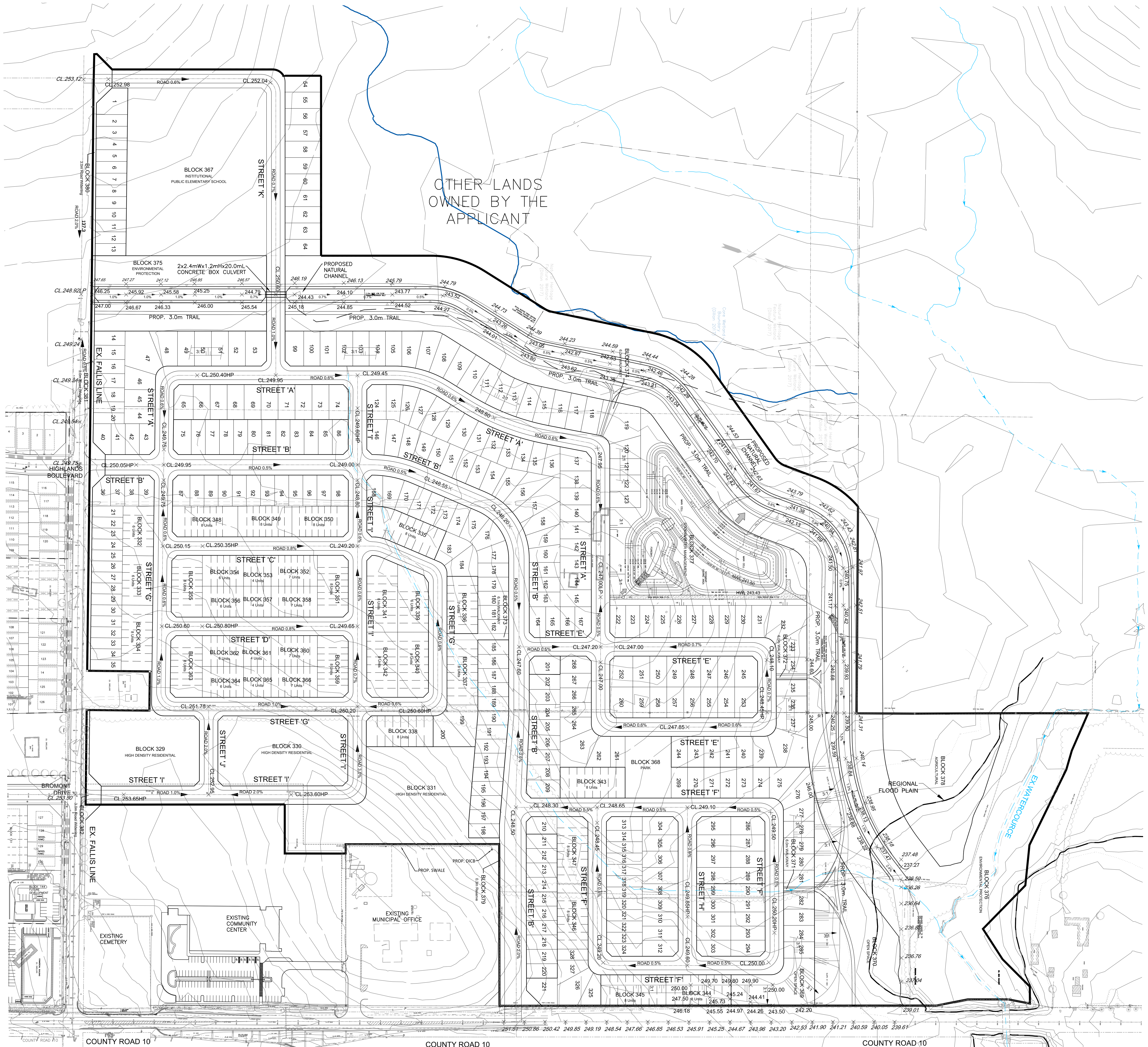
STRESSCRETE CATALOGUE NO.: KCH20-G-S11-DB C/W 140-30/40

MILLBROOK SUBDIVISION
PHASE 2
TOWERHILL DEVELOPMENT INC.

VALDOR ENGINEERING INC.
Consulting Engineers - Project Managers
741 ROWNTREE DAIRY ROAD, SUITE 2, WOODBRIDGE, ONTARIO, L4L 5T9
TEL (905)264-0054, FAX (905)264-0069
E-MAIL: info@valdor-engineering.com
www.valdor-engineering.com

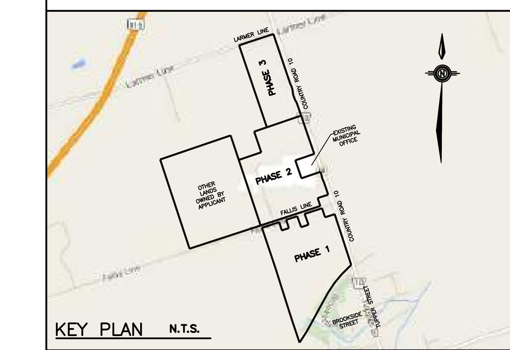
STREET LIGHT DETAIL

SCALE	N.T.S.	CKD. BY	D.G.	DWG.	J1
DATE	SEP 2018	DRAWN BY	J.K.	PROJECT	17125



METRIC

ALL DIMENSIONS AND ELEVATIONS ARE IN METRES UNLESS OTHERWISE SHOWN



KEY PLAN N.T.S.

NOTE:

Distances Shown On This Plan Are In Metres And Can Be Converted To Feet By Dividing By 0.3048

The Position of Pole Lines, Conduits, Watermains, Sewers and Other Underground and Overground Utilities and Structures is Not Necessarily Shown On The Contract Drawing, And Where Shown, The Accuracy Of The Position of Such Utilities and Structures is Not Guaranteed Before Starting Work, The Contractor Shall Inform Himself Of The Exact Location of All Such Utilities and Structures, and Shall Assume All Liability For Damage To Them.

LEGEND:

×240.14	EXISTING ELEVATION
188.5	EXISTING CONTOUR
	PROPOSED 3.0m TRAIL
ROAD 0.5%	SLOPE AND DRAINAGE FLOW DIRECTION
× CL.249.50	PROPOSED ELEVATION

NOTE

THIS PLAN HAS BEEN PREPARED TO DEMONSTRATE FEASIBILITY OF THE PROPOSED DEVELOPMENT WITH RESPECT TO GRADING IN CONJUNCTION WITH THE DRAFT PLAN APPLICATION. DETAILED GRADING DESIGN WILL BE PREPARED AT THE SUBDIVISION ENGINEERING STAGE.

No.	Revision	Date	By	Appr'd
5				
4				
3				
2				
1	AS PER REVISED DRAFT PLAN	APR.23, 2020	V.L.	D.G.

BENCHMARK:

No. 0011918U208G | Elevation: 212.436m | Description:

ELEVATIONS ARE GEODETIC AND ARE REFERRED TO A TOWNSHIP OF CAVAN—NORTH MONAGHAN BENCH MARK No.0011918U208G SET AT THE CPR BRIDGE ABUTMENT ON COUNTY ROAD 10 OVER MILLBROOK TO OMEMEE ROAD, 2,5km NORTH OF THE ROAD ALLOWANCE BETWEEN CONCESSION 6 AND 7, HAVING AN ELEVATION OF 212.436m ABOVE SEA LEVEL.

CONSULTANT:

MILLBROOK SUBDIVISION
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TOWNSHIP OF CAVAN MONAGHAN
COUNTY OF PETERBOROUGH

PRELIMINARY GRADING PLAN

Surveyed by:	Checked by: P.S.Z.	Project No. 17125
Drawn by: V.L.	Approved by: D.G.	
Designed by: V.L	Date: January 24, 2020	Drawing No. PGR—1
Scale: 1:1250		Sheet No.