Proposed Residential Development
147 Langstaff Drive
Carp, Ontario
Servicing and Stormwater Management Report

Prepared For:

Inverness Homes

Prepared By:

Robinson Land Development

Our Project No. 19008
December 2019

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LEGAL NOTIFICATION

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1.0 INTRODUCTION

Robinson Land Development (a division of Robinson Consultants Inc.) was retained by Inverness Homes to complete a servicing and stormwater management design for the development of the property at 147 Langstaff Drive, in the Village of Carp, Ontario. The proposed development is located between Carp Road and Langstaff Drive, to the north of Donald B. Munro Drive (refer to **Figure 1 – Key Plan** following page 1).

2.0 EXISTING CONDITIONS

The 8.1 hectare property is currently undeveloped, however, the grassed fields are cut and maintained seasonally. An existing tree covered ravine (which functions as a stormwater management facility) runs north-south through the middle of the site. The stormwater management (SWM) ravine conveys stormwater runoff from the existing land to the east via a 1200 mm diameter culvert crossing under Langstaff Drive to the existing 780 mm diameter culvert crossing under Donald B. Munro Drive before ultimately discharging into the Carp River. The SWM ravine was designed to provide quantity control and detention of stormwater runoff for the 51.8 hectare tributary drainage area. A second tree covered ravine is located along the western property boundary of the site and conveys stormwater runoff from the lands north-west of the site to the existing storm sewer system located on Carp Road. Refer to **Figure 2 – Existing Conditions** below.

Figure 2 – Existing Conditions

Existing municipal infrastructure is located within the vicinity of the subject property as follows:

- A 250 mm diameter sanitary sewer within the Langstaff Drive right-of-way conveys sewage flows south towards the Donald B. Munro Drive sanitary sewer.
- A 203 mm diameter PVC watermain is located within the Langstaff Drive right-of-way adjacent to the subject property.

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scale N.T.S.	147 LANGSTAFF DRIVE, CARP, ON	project no. 19008
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drawn by BLM	KEY PLAN	FIG 1.0

- A 250 mm diameter sanitary sewer within the Carp Road right-of-way conveys sewage flows south towards the Rivington Street sanitary sewer.
- A 305 mm diameter PVC watermain is located within the right-of-way of Carp Road and Donald B. Munro Drive.

3.0 DEVELOPMENT PROPOSAL

The Developer proposes to construct 23 townhouse blocks, ranging from 3 to 5 units each for a total of 75 townhouse units. In addition, the Developer proposes to construct a 3-storey, 36 unit apartment building, a 3-storey, 60 unit apartment building and a 3-storey, 18 unit apartment building, for a total of 114 apartment units. The apartment buildings and associated parking lots and access roads will be developed as part of a separate site plan application to the City of Ottawa. The ultimate development will also include a club house building and an open park space.

The subdivision will be split into two sections, separated by the existing SWM ravine which spans the middle of the site. The western section of the site will be accessed by a new road connection to Langstaff Drive, approximately 90 metres north of Frances Colbert Avenue. The eastern section of the site will be accessed by a new road connection to Langstaff Drive opposite to Cavanagh Drive and a second private connection approximately 50 metres further to the south. The on-site municipal roadways will be constructed with an 18 metre right-of-way in accordance with current City of Ottawa standards. Refer to the Plan of Subdivision, prepared by Fairhall Moffatt & Woodland Limited, in **Appendix A**.

4.0 GRADING DESIGN

The grading of the proposed development has been designed to tie into the existing elevations along the property boundaries. In areas where grading constraints occur, retaining walls or terracing (to a maximum slope of 3H:1V as per City standards) have been proposed. In accordance with the *Geotechnical Investigation*, prepared by Paterson Group (dated October 24, 2019), grade raises are not permitted within the Hazard Lands as identified on Drawing PG4918-2 of Paterson's report. The limits of the Hazard Lands are detailed in the *Geotechnical Investigation*, prepared by Paterson Group, and in the *Fluvial Geomorphological and Erosion Hazard Assessment*, prepared by GEO Morphix (dated October 23, 2019). Refer to the Grading Plans (DWG. 19008-GR1 and 19008-GR2) in **Appendix A**.

5.0 WATER SERVICING

5.1 Existing System

The existing watermain on Langstaff Drive is a 203 mm diameter PVC watermain constructed in 1995. The site also has access to a second watermain on Carp Road that consists of a 305 mm diameter PVC watermain that was constructed in 1996. The Village of Carp is provided with a domestic water supply and fire protection from the Carp communal well system. The communal well system consists of a groundwater well, reservoir and pumping station located on Salisbury Street, south of Donald B. Munro Drive.

5.2 Proposed System

For the proposed development, the western section of the site will be serviced with a 203 mm diameter watermain connected to both the 203 mm diameter watermain on Langstaff Drive and the 305 mm diameter watermain on Carp Road. The eastern section of the site will be serviced with a 152 mm diameter watermain connected to the 203 mm diameter watermain on Langstaff Drive. Fire hydrants will be provided with spacing based on City of Ottawa Water Distribution Design Guidelines.

5.3 Water Distribution Hydraulic Model

A water distribution hydraulic model was created using H2OMap Water with the proposed watermain layout and hydrant locations. Boundary conditions were obtained from the City of Ottawa and are as follows:

Table 1: Boundary Conditions

	Connection 1	Connection 2	Connection 3	Connection 4	Connection 5
Minimum HGL (m)	150.0	150.0	150.0	150.0	150.0
Maximum HGL (m)	160.0	160.0	160.0	160.0	160.0; the maximum pressure is estimated to be above 80 psi.
Available Flow @ 20psi (L/s)	155	155	160	160	160

These are for current conditions and are based on computer model simulation.

Disclaimer: The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation.

The hydraulic model utilized the provided boundary conditions, hydrant elevations from the proposed Grading Plan and typical c-values from the Water Distribution Design Guidelines. Pipe and junction tables are provided in **Appendix B**. A sketch of the hydraulic model is shown below.

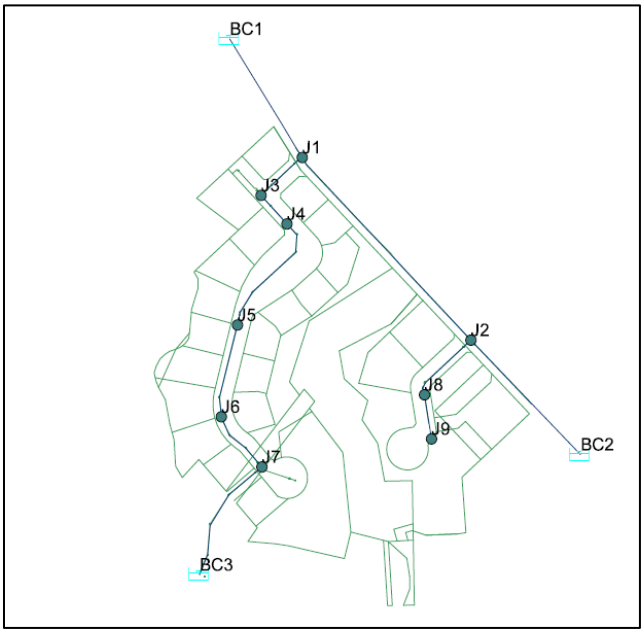


Figure 3: Water Distribution Hydraulic Model

5.3.1 Model Demands

Domestic water demands were calculated based on the type and number of units, as per the Water Distribution Design Guidelines. Domestic demands included average day, maximum daily and maximum hourly demands. The watermain design sheet is included in **Appendix B**.

Fireflow Demands were calculated using the revised City of Ottawa Water Design Guidelines Technical Bulletin ISTB-2018-02. Separate FUS Long Forms were calculated based on the different townhouse configurations, as well as the three different apartment types. The resulting required fireflow ranges from 9,000 – 11,000 LPM for the townhouses and 11,000 – 12,000 LPM for the apartments. The FUS Long Form spreadsheets are provided in **Appendix B**.

5.3.2 Model Results Domestic Demand

The resulting pressures from the model are as follows:

- Maximum Hour Demand – 59 to 65 psi
- Maximium Pressure – 73 to 80 psi

Based on the domestic demand results, the expected pressure range for maximum hour is above 40 psi and deemed acceptable. The maximum pressure is 80 psi at one location near the 36 unit apartment building. Pressure above 80 psi would require the installation of a pressure reducing valve (PRV), but considering the expected pressure is 80 psi at only one location, PRV's would not be necessary. Model output for maximum hour demand and maximum pressure can be found in **Appendix B**.

5.3.3 Model Results Fireflow

As indicated in the boundary conditions that were provided by the City, standard hydraulic gradeline (HGL) values were not provided, rather the actual available fireflow at 20 psi residual pressure was provided at two locations within the Carp distribution system. This is

based on the fact that the available fireflow within the Carp Communal Well system is based on the size of the fire pumps at the pumping station. This governing pumping rate ultimately determines that available fireflow within the Carp distribution system. The available fireflow provided with the boundary conditions is 155-160 L/s (9,300-9,600 Lpm). This available fireflow meets the requirements for most of the proposed townhouses, but falls short for the proposed apartment buildings. Although the calculated fireflow using the FUS for the apartments is higher than the available fireflow, the available fireflow is the maximum that the City has selected for the Village of Carp, based on the available pumping capacity at the Carp Pumping Station. The FUS Long forms for the various townhouses and apartments can be found in **Appendix B**.

6.0 SANITARY SERVICING

6.1 Existing System

The existing sanitary sewers on Langstaff Drive and Carp Road convey sewage flows to the Carp Pumping Station located on Salisbury Street, south of the subject property. The Carp Pumping Station pumps all flows to a forcemain terminating in the Hines Road truck sewer in North Kanata. The City of Ottawa was consulted to provide comment on the capacity of the existing sanitary sewer system and pumping station in regards to the proposed development. After providing estimated sewage flows for the proposed development, the City acknowledged that the existing sanitary sewer system in Carp would have sufficient capacity to receive flows from the site. The City further indicated that the Carp Pumping Station had a measured inflow of approximately 40 L/s in 2017 and has a pumping capacity of approximately 57 L/s. Refer to the email correspondence with the City in **Appendix C**.

6.2 Proposed System

For the proposed development, municipal sanitary servicing is also required. A new on-site sanitary sewer system will be installed to convey sewage flows from the proposed development to the existing municipal sanitary sewer system. Sewage flows from the western portion of the site will be conveyed by a 200 mm diameter sanitary sewer system to the existing 250 mm diameter sanitary sewer located on Carp Road. Sewage flows from the eastern portion of the site will be conveyed by a 200 mm diameter sanitary sewer system to the existing 250 mm diameter sanitary sewer located on Langstaff Drive. The peak sanitary design flows for the development have been calculated using the following parameters in accordance with the current City of Ottawa Sewer Design Guidelines (Technical Bulletin ISTB-2018-01):

Average residential flow:	280 L/cap/day
Extraneous flow allowance:	0.33 L/s/ha
Population density townhouse units:	2.7 persons/unit
Population density for apartments (2 bedroom):	2.1 persons/unit
Peaking factor for residential flow: (Harmon Equation, max. = 4.0, min. = 2.0, K = 0.8)	$1 + (14 / (4 + (P/1000)^{0.5}))K$

<u>To Carp Road Sanitary Sewer</u>

The estimated peak design flows to the existing 250 mm diameter sanitary sewer located on Carp Road have been calculated as follows:

Townhouse population = 60 units x 2.7 persons/unit = 162 persons

Apartment population = 36 units x 2.1 persons/unit = 75.6 persons

Residential peaking factor = 1 + (14/ (4 + (237.6/1000)$^{0.5}$)(0.8) = 3.50

Peak population flow = (280 L/cap/day) x (237.6 persons) x (3.50) / (86400 s/day)
Peak population flow = 2.69 L/s

Peak extraneous flow = (4.37 ha) x (0.33 L/s/ha) = 1.44 L/s

Peak design flow = (2.69 L/sec) + (1.44 L/sec) = 4.13 L/s

To Langstaff Drive Sanitary Sewer

The estimated peak design flows to the existing 250 mm diameter sanitary sewer located on Langstaff Drive have been calculated as follows:

Townhouse population = 15 units x 2.7 persons/unit = 40.5 persons

Apartment population = 78 units x 2.1 persons/unit = 163.8 persons

Residential peaking factor = 1 + (14/ (4 + (204.3/1000)$^{0.5}$)(0.8) = 3.52

Peak population flow = (280 L/cap/day) x (204.3 persons) x (3.52) / (86400 s/day)
Peak population flow = 2.33 L/s

Peak extraneous flow = (1.75 ha) x (0.33 L/s/ha) = 0.58 L/s

Peak design flow = (2.33 L/sec) + (0.58 L/sec) = 2.91 L/s

As calculated above, the estimated peak design flows from the proposed development to the existing Carp Road and Langstaff Drive sanitary sewers are 4.13 L/s and 2.91 L/s respectively. The total peak design flows from the proposed development to the Carp Road Pumping Station is 7.04 L/s. Based on the measured data provided by the City (refer to **Section 6.1**), the Carp Pumping Station would have capacity to receive the additional 7.04 L/s of sewage flows generated from the proposed site. The on-site sanitary sewer system has been designed to have capacity to convey the peak design flows and has been designed to meet the full flow velocity range of 0.60 m/s to 3.0 m/s in accordance with the current City of Ottawa Sewer Design Guidelines. Refer to the sanitary sewer design sheet and Sanitary Drainage Area Plan (DWG. 19008-SAN1) in **Appendix C.**

7.0 STORM & STORMWATER MANAGEMENT DESIGN

7.1 Minor System Design

For the proposed development, municipal storm servicing is required. A new storm sewer system (minor system) will be installed to collect and convey stormwater runoff from the site to the existing SWM ravine spanning the middle of the property before it ultimately outlets to the Carp River. The proposed storm sewer system will consist of catch basins, maintenance holes and sewers ranging from 250 mm to 600 mm in diameter. Four inline stormwater treatment units will also be installed to provide quality control of stormwater runoff prior to discharging into the SWM ravine (refer to **Section 7.4**). The proposed storm sewers have been designed, using the Rational Method and the City of Ottawa IDF curve equation, to have capacity to convey the 5 year peak design flow. In addition, the proposed storm sewers have been designed to meet the minimum flow velocity of 0.80 m/s for self-cleansing in

accordance with the current City of Ottawa Sewer Design Guidelines. Refer to the storm sewer design sheet and Storm Drainage Area Plan (DWG. 19008-STM1) in **Appendix D**.

7.2 Major System Design

For events exceeding the 5 year design storm, stormwater runoff from the proposed municipal roadways will be conveyed via the major overland flow route (major system) to the existing SWM ravine. The proposed major system has been designed to incorporate the following design components:

- Ponding within the roadway sags and within rear yard swales does not exceed the City of Ottawa maximum depth of 0.35 m.
- Rear yard flows, from Blocks 2 to 11 will be uncontrolled and directed (via surface grading) to the exiting ravine along the western property boundary.
- Rear yard flows, from Blocks 14 to 19 and from Blocks 21 and 22 will be uncontrolled and directed (via surface grading) to control structure G3 within the exiting SWM ravine.
- Rear yard flows, from Blocks 12, 13 and 20 will be uncontrolled and directed (via surface grading) to control structure G4 within the exiting SWM ravine.
- Overland flow from Street 1 will be conveyed to control structure G4.
- Overland flow from Street 2 will be conveyed to control structure G4.

7.3 Design Criteria

In accordance with the Village of Carp Master Drainage Plan (CMP, Robinson Consultants, May 1996) and pre-application consultation with the City of Ottawa and Mississippi Valley Conservation Authority (MVCA) the following stormwater management design criteria have been outlined for the proposed development:

- Provide normal level quality control (minimum 70% TSS removal)
- Control 100 year post-development flows to 2-year pre-development levels (3.5 m^3/s as per the CMP)
- Maintain rear yard drainage into the watercourse abutting the western boundary

Refer to the pre-application consultation notes with the City and MVCA in **Appendix D**.

7.4 Quality Control

In order to provide normal level (minimum 70% TSS removal) quality control of stormwater runoff four on-site stormwater treatment units will be provided. The stormwater treatment units will be installed inline within the on-site storm sewer system and will treat the site's stormwater runoff prior to discharging into the existing SWM ravine. Areas of the site which are considered clean (i.e. grassed areas and roofs) are not required to be treated prior to discharging off-site. The stormwater treatment units (denoted as OGS 1, OGS 2, OGS 3 and OGS 4 on the Servicing Plans in **Appendix A**) are proposed to be Stormceptors, designed by Imbrium Systems (or approved equivalent). The Stormceptor EF is a high performing oil-grit separator that effectively removes a wide variety of pollutants from stormwater and snowmelt runoff. The Stormceptor EF's treatment and scour prevention technology and internal bypass ensures sediment is retained during all rainfall events. The units are designed to provide enhanced level (minimum 80% TSS removal) quality control based on site specific parameters. Refer to the stormwater treatment unit correspondence provided in **Appendix D**.

7.5 Existing West Ravine

Under pre-development conditions, approximately 1.77 hectares of the site's drainage is conveyed uncontrolled via surface flow to the existing ravine located along the western property boundary before it outlets to the existing Carp Road storm sewer system. Following development of the property, approximately 1.03 hectares of rear year drainage from Blocks 2 to 11 will continue to be conveyed uncontrolled to the existing west ravine as recommended by the MVCA (refer to pre-application consultation notes in **Appendix D**). Since the runoff is considered "clean" (i.e. from grassed areas and roofs), quality control is not required prior to discharging off-site. The drainage area tributary to the existing west ravine will be reduced from 1.77 hectares to 1.03 hectares following the development, however, the runoff coefficient of the drainage area will be increased from a value of 0.20 to a value of 0.38. The greater runoff coefficient will result in an increased flow of approximately 10 percent for the 5 year and 100 year design storm events (using a time of concentration of 20 minutes). Refer to the Pre-Development Drainage Area Plan (DWG. 19008-PRE1) in **Appendix A** and free flow calculations in **Appendix D**.

7.6 Existing SWM Ravine

Quantity control of stormwater runoff for the proposed development will be provided by the ravine spanning the middle of the property which functions as a stormwater management facility. The SWM ravine conveys stormwater runoff from the existing land to the east via a 1200 mm diameter culvert crossing under Langstaff Drive to the existing 780 mm diameter culvert crossing under Donald B. Munro Drive before it ultimately outlets into the Carp River. The existing SWM ravine was designed to provide quantity control and detention of stormwater runoff for the 51.8 hectare tributary drainage area. The design of the existing SWM ravine is detailed in the report, *Glenncastle SWM Plan, Addendum Rev1, prepared by PSR Group Ltd. and David McManus Engineering Ltd., dated May 2003* (herein referred to as the PSR Report, provided in **Appendix D**). Key details of the PSR Report as it relates to the proposed development are as follows:

- The subject property is denoted as drainage area 1 and 1a within the PSR Report with areas of 3.60 hectares and 4.17 hectares respectively. Refer to *Figure 1 – Stormwater Management Drainage Area Plan* of the PSR Report (provided in **Appendix D**).
- Drainage areas 1 and 1a were assumed to have a percent impervious ratio of 0.45.
- Water control structures G3 and G4 (located within the SWM ravine abutting the property) will provide water quantity control to the Master Drainage Plan requirements for all future land use conditions in the upstream drainage areas.
- Drainage area 1 is to be conveyed to the SWM ravine upstream of control structure G3 and drainage area 1a is to be conveyed to the SWM ravine upstream of control structure G4.
- The 100 year water levels for control structures G3 and G4 are 102.75 metres and 100.00 metres respectively.
- Facilities G3 and G4 provide stormwater quantity storage and detention.

Facility G3 within the SWM ravine is located approximately 130 metres south of Langstaff Drive. The facility is classified as a dry pond having an approximate peak storage volume of 1,855 cubic metres. Stormwater is controlled by control structure G3, a 675 mm diameter outlet pipe and rip-rapped overflow weir. Facility G4 is located approximately 285 metres south of Langstaff Drive and is also classified as a dry pond having an approximate peak storage volume of 3,298 cubic metres. Stormwater is controlled by control structure G4, a 450 mm diameter outlet pipe and rip-rapped overflow weir. Facilities G3 and G4 along with facility G1 (located upstream of Langstaff Drive) received a Certificate of Approval (ECA) for

Municipal and Private Sewage Works (Number 8260-5LJQH5) from the Ministry of the Environment (Currently known as the Ministry of the Environment, Conservation and Parks), dated June 9th, 2003. A copy of the ECA for the existing SWM facilities has been provided in **Appendix D**.

7.7 Quantity Control

The proposed storm sewer system has been designed to convey stormwater runoff from the development to either facility G3 or G4 within the existing SWM ravine as prescribed in the PSR Report. The areas tributary to the existing control structures were in keeping with the defined drainage areas of the PSR Report where possible to do so based on grading constraints. A summary of the on-site drainage areas tributary to the existing SWM ravine control structures are provided in **Table 2** below:

Table 2 – Existing SWM Ravine Drainage Areas

Tributary Drainage Area	Total Area (ha)	Impervious Area (ha)	Percent Impervious (%)
Control Structure G3:			
STM1	0.12	0.07	56.9
STM2	0.06	0.02	37.4
STM3	0.21	0.12	57.4
STM4	0.36	0.19	53.0
STM5	0.16	0.11	65.4
STM10	0.95	0.14	15.2
STM13	0.31	0.19	59.9
STM17	0.52	0.06	10.9
G3 Total =	**2.70**	**0.90**	**33.2**
PSR Report =	**3.60**	**1.62**	**45.0**
Control Structure G4:			
STM6	0.44	0.26	59.0
STM7	0.39	0.22	56.7
STM8	0.33	0.17	53.3
STM9	0.72	0.27	38.1
STM11	0.65	0.05	7.3
STM14	0.25	0.14	57.4
STM15	0.14	0.04	30.4
STM16	0.73	0.34	46.4
STM18	0.48	0.02	5.0
G4 Total =	**4.12**	**1.52**	**37.0**
PSR Report =	**4.17**	**1.88**	**45.0**

As shown in **Table 2** above, the on-site drainage areas tributary to the control structures within the existing ravine are less than the design values detailed in the PSR Report. Further,

the percent imperious values of the drainage areas are lower than what was assumed in the PSR Report.

It should be noted that the values listed in **Table 2** assume that the drainage areas are fully captured by the on-site storm sewer system. Since the storm sewer system is designed to only have capacity to convey the peak 5 year flow, events exceeding the system capacity will be conveyed via the major overland flow route to control structure G4 within the existing SWM ravine.

7.8 Modeling Analysis

The minor and major on-site storm systems have been modelled using SWMHYMO. The goal of the modelling analysis was to:

- Determine the stormwater flows generated from the site for the 2 year, 5 year and 100 year design storm events.
- Analyse the impacts of the 2 year, 5 year and 100 year design storm events on the existing SWM ravine.
- Determine if the existing SWM ravine will have capacity for all events up to and including the 100 year design storm in accordance with the PSR Report.

The SWMHYMO model was developed to generate runoff rates from rainfall events. The rainfall events used for the generation of these hydrographs are the 6 hour 2, 5, and 100 year design storms. Rainfall hydrograph ordinates for the various events were calculated using data obtained from the Ottawa International Airport, Atmospheric Environment Service rain gauge. The SCS type II storm distribution and Chicago storm distribution were used. An average soil moisture condition was assumed for all flow simulations. Other parameters required for hydrograph generation are basin area, slope, fraction impervious, and soil curve number.

The catchments were modeled using the DESIGN STANDHYD and DESIGN SCSHYD routines that require three basic parameters, CN number, the impervious ratio, and time to peak (TP). The CN number or Composite Number is used by the model to transform rainfall inputs into runoff; therefore, the parameter reflects all runoff related phenomena such as infiltration, interception and depression storage. The time to peak was calculated using the Federal Aviation Agency (FAA) Airport Method.

The rainfall-runoff relationship was evaluated for proposed land use conditions. This provided flow estimates for the watershed under proposed conditions. The total instantaneous peak flows at key locations within the site are presented in **Table 3**. The flows are calculated at the downstream limit of the catchments, or the outlet of the site. Refer to modeling outputs and **Figure 4 – Hydrologic Model – SWM** in **Appendix D**.

Table 3 - Peak Flow Estimates

Location	Peak Flow (m^3/s)								
	Chicago 3 Hour			Chicago 6 Hour			SCS II 6 Hour		
	2 yr	5 yr	100 yr	2 yr	5 yr	100 yr	2 yr	5 yr	100 yr
Upstream of Langstaff Drive	0.341	0.556	2.509	0.355	0.695	2.753	0.390	1.034	3.624
G3[*1]	0.411	0.630	1.627	0.430	0.795	1.671	0.472	1.091	3.181
G4[*1]	0.295	0.456	1.688	0.302	0.623	1.745	0.315	0.951	2.353

Notes:
1. Attenuated flows outletting from the control structures.

The most conservative peak flows, the SCS II 6 hour storm, were taken and compared to the allowable 100 year flows as outlined in the Carp MDP (3.5 m^3/s) and the peak flows calculated in the PSR Report (2.9 m^3/s). The proposed condition peak flows are below the allowable flows as well as the previously calculated flows, therefore, the existing SWM ravine has adequate capacity to receive flows from the subject site for up to and including the 100 design event.

7.9 Inlet Control Devices

In order to not surcharge the proposed storm sewer system during larger storm events (i.e. event greater than the 5 year event), inlet control devices (ICD's) are proposed at all catch basin locations. The ICD's will be sized appropriately to restrict flows to the on-site storm sewer system to less than or equal to the 5 year design event.

8.0 RISK MANAGEMENT

The proposed development is located within the Wellhead Protection Area (WHPA) for the Carp Municipal Supply Well. Specifically, the property contains the following wellhead protection areas:

- WHPA-B, vulnerability score 10 – encompasses a small area at the south-east corner of the property.
- WHPA-C, vulnerability score 8 and 6 – encompasses the south and east halves of the property.
- WHPA-D, vulnerability score of 6 and 4 – encompasses the north and west halves of the property.

The proposed development is also located within the Mississippi-Rideau Source Protection Region and therefore is subject to the polices of the Mississippi-Rideau Source Protection Plan. There are no legally-binding prohibition polices in a WHPA-C that are applicable for solely residential developments and none that are applicable in a WHPA-D. For a WHPA-B (vulnerability score of 10), the following are polices of note related to residential developments:

Policy: SEW-4-LB – Mandatory Connection to Municipal Sewer Services.

Description: The policy indicates that if a connection (and capacity) is available to a municipal sewer, then the connection is mandatory (i.e. no on-site septic systems are permitted).

Response: All sewage flows from the proposed development will be conveyed to the existing municipal sanitary sewer on Langstaff Drive or the existing municipal sanitary sewer on Carp Road. No on-site septic systems are proposed.

Policy: SEW-7-LB-PI-MC – Future Sanitary Sewers and Related Pipes - Prescribed

Description: New sanitary sewers or related pipes in the WHPA will be required to be constructed of watermain quality pipe and pressure tested in place at a pressure of 350 kPA (50 psi) using testing methodology in the Ontario Provincial Standard Specification (OPSS) 412.

Response: All proposed sanitary sewers within the area with a vulnerability score of 10 will be specified to be installed in accordance with Policy SEW-7-LB-PI-MC and OPSS 412. The implementation of this policy will be reviewed under the sewer works Environmental Compliance Application (ECA), administered by the MECP.

Policy: SEW-10-LB-PI-MC – Future Stormwater Management Facility in WHPA "B" scored 10 – Prescribed Instrument

Description: A stormwater management facility is a significant drinking water threat in a WHPA scored 10 if the drainage area is greater than 100 hectares and the drainage area is rural, agricultural or residential use; or if the drainage area is greater than 10 hectares and the drainage areas is industrial or commercial use.

Response: Given that the drainage area of the subject property is less than 10 hectares and is of residential use, the development is in conformance with the conditions of Policy SEW-10-LB-PI-MC.

Policy: FUEL-1-LB-S58 – Fuel (Heating Oil) – Risk Management Plan

Description: If heating oil is used for home heating, then a risk management plan will be required to be negotiated with the Risk Management Official prior to approval of the Planning Act application.

Response: All units within the proposed development will utilize natural gas as the source of home heating, therefore, the above policy does not apply.

As detailed above, the proposed development will be in conformance with all polices of the Mississippi-Rideau Source Protection Plan relating to WHPAs and residential developments.

9.0 EROSION AND SEDIMENT CONTROL

Erosion and sediment control measures are required to mitigate the impacts on receiving watercourses and existing infrastructure. The following erosion and sediment control measures are proposed to be implemented during construction:

- Installation of silt sacks between frame and cover on all proposed and existing catch basins and storm manholes
- Silt fence to be installed at the locations shown on the Erosion and Sediment Control Plan (DWG. 19008-ESC1) in **Appendix A**.
- Visual inspections on sediment control barriers shall be completed regularly and after storm events and any damage shall be repaired immediately
- Sediment control devices will be cleaned of accumulated silt as required or replaced as necessary
- During the course of construction, if the Engineer believes that additional prevention methods are required to manage erosion and sedimentation, the Contractor shall install additional controls as required to the satisfaction of the Engineer
- Construction and maintenance requirements for erosion and sediment controls are to comply with Ontario Provincial Standard Specification (OPSS) 577 and current City of Ottawa specifications.

10.0 CONCLUSIONS/ RECOMMENDATIONS

This servicing and stormwater management report is being submitted to support the proposed development of 75 townhouse units and 114 apartment units within the Village of Carp. The report demonstrates that the development can be adequately serviced for water, sanitary, storm and also meet stormwater management requirements by implementing the following key design features:

- A proposed on-site watermain system with connections to the existing watermains on Langstaff Drive and Carp Road.
- A proposed on-site sanitary sewer system with connections to the existing sanitary sewers on Langstaff Drive and Carp Road.
- A proposed on-site storm sewer system which outlets to the existing SWM ravine.
- Utilization of the existing SWM ravine and control structures for stormwater quantity storage and detention for events up to and including the 100 year design storm.
- Four inline stormwater treatment units to provide enhanced level quality control of stormwater runoff prior to discharging into the existing SWM ravine.
- Major overland flow routes which convey excess runoff to the existing SWM ravine.
- Erosion and sediment control measures to mitigate impacts to the receiving watercourse and existing infrastructure.

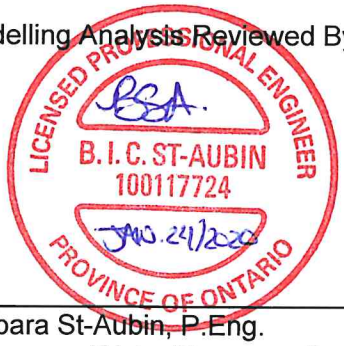
Report Prepared By:

Brandon MacKechnie, P.Eng.
Project Engineer

Report Reviewed By:

Sean Czaharynski, P.Eng.
Manager – Land Development

Modelling Analysis Reviewed By:



Barbara St-Aubin, P.Eng.
Manager – Water Resource Services

Appendix A

Plan of Subdivision

Servicing Plans
(DWG. 19008-S1,S2,S3)

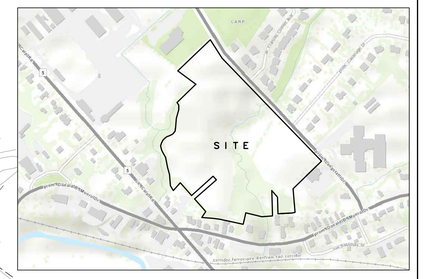
Grading Plans
(DWG. 19008-GR1,GR2)

Plan and Profiles
(DWG. 19008-P1-P4)

Pre-Development Drainage Area Plan (DWG. 19008-PRE1)

Erosion and Sediment Control Plan
(DWG. 19008-ESC1)

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



KEY PLAN
NOT TO SCALE

DRAFT PLAN OF SUBDIVISION OF
PART OF NELSON STREET IN FRONT OF LOTS 49 TO 54, (BOTH INCLUSIVE)
(CLOSED BY BY-LAW NO. 2007-295, INST. OC1751815)
AND
PART OF BLOCKS "A", "B" & "C"
AND
ALL OF LOTS 6 TO 21 (BOTH INCLUSIVE)
PART OF LOT 49,
ALL OF LOTS 50, 51, 52 & 53
PART OF LOTS 54, 55 & 56
REGISTERED PLAN 148
AND
PART OF LOT 18, CONCESSION 2
GEOGRAPHIC TOWNSHIP OF HUNTLEY
CITY OF OTTAWA

SCALE 1 : 500
0 10 20 50 metres

FAIRHALL, MOFFATT & WOODLAND LIMITED
ONTARIO LAND SURVEYORS

NOTES

1. BEARINGS ARE GRID AND ARE REFERRED TO THE SOUTHWESTERLY LIMIT OF LANGSTAFF DRIVE SHOWN ON PLAN 4R-24903 AS HAVING A BEARING OF N 43°10'30" W AND ARE REFERRED TO THE CENTRAL MERIDIAN, 76°30'W LONGITUDE MTM ZONE 9, NAD83 ORIGINAL.

2. DISTANCES ARE GROUND AND CAN BE CONVERTED TO GRID BY MULTIPLYING BY THE COMBINED SCALE FACTOR 0.999905.

3. LIMIT OF HAZARD LANDS DERIVED FROM DRAWING No. PG4918-1 BY PATERSON GROUP, CONSULTING ENGINEERS DATED AUGUST, 2019.

SECTION 51 – 17 OF THE PLANNING ACT.

a) SHOWN ON PLAN
b) SHOWN ON PLAN
c) SHOWN ON PLAN
d) – 75 UNITS ON-STREET TOWNHOUSES BLOCKS 1 TO 23 INCLUSIVE, 28 & 29
– 3 STOREY APARTMENT BUILDING (18 UNITS) ON PRIVATE STREET (BLOCK 24)
– 2, 3 STOREY APARTMENT BUILDINGS (96 UNITS) ON PUBLIC STREET (BLOCKS 25 & 26)
– WALKWAY (BLOCK 28)
e) SHOWN ON PLAN
f) SHOWN ON PLAN
g) SHOWN ON PLAN
h) PIPED MUNICIPAL WATER SUPPLY
i) SEE GEOTECHNICAL INVESTIGATION REPORT No. PG4918-1 BY PATERSON GROUP DATED OCTOBER 24, 2019.
j) SHOWN ON PLAN (REFERRED TO GEODETIC DATUM)
k) FULL MUNICIPAL SERVICES AVAILABLE
l) AS SHOWN ON PLAN

OWNER'S AUTHORIZATION

I (WE) _____ BEING THE REGISTERED OWNER OF THE SUBJECT LANDS HEREBY AUTHORIZE THE SUBMISSION OF THIS PLAN FOR APPROVAL.

DATE _____

SURVEYOR'S CERTIFICATE

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

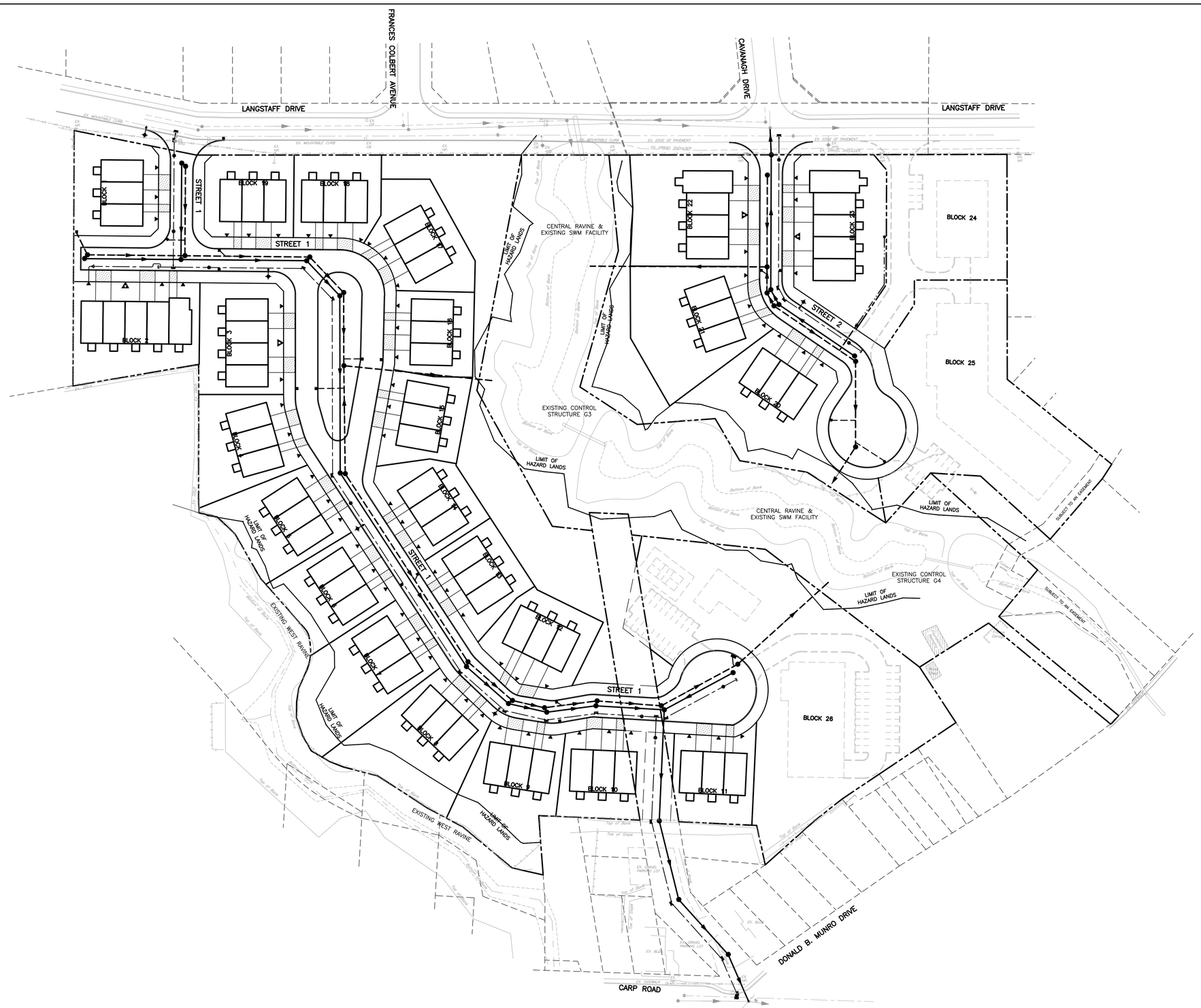
DATE _____ JOHN H. GUTRI
ONTARIO LAND SURVEYOR

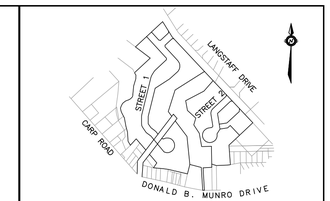
AREA

TOTAL AREA OF SITE = 7.9303 Ha.

Fairhall Moffatt & Woodland
LIMITED
ONTARIO LAND SURVEYORS
OTTAWA
Surveying and Land Information Services
100-600 TERRY FOX DRIVE, KANATA, ONTARIO K2L 4B6
TEL: (613) 591-2580 FAX: (613) 591-1455
www.fmw.on.ca

JOB No. Z 2 2 0 0 0
E 341276, N 5023039
REFERENCE No. 144 – 2 HUNTLEY 26 – 148 HUNTLEY
S:\JOBS\22000\DWL30\DWG\DRAFT PLAN\FMW.DP_JAN.16.20.DWG (dj)
JAN. 17, 2020





KEY PLAN

LEGEND

- SINGLE SERVICE: 135mmø SANITARY, 100mmø STORM, 19mmø WATER
- DOUBLE SERVICE: 2–135mmø SANITARY, 2–100mmø STORM, 2–19mmø WATER
- PROPERTY BOUNDARY
- SANITARY SEWER AND MANHOLE
- STORM SEWER AND MANHOLE
- WATERMAIN
- VALVE AND VALVE BOX
- HYDRANT WITH VALVE AND VALVE BOX
- ROADSIDE CATCH BASIN
- LANDSCAPE CATCH BASIN
- SWALE WITH 250mmø SUBDRAIN
- EXISTING SANITARY SEWER AND MANHOLE
- EXISTING STORM SEWER AND MANHOLE
- EXISTING WATERMAIN
- EXISTING CATCH BASIN
- EXISTING HYDRANT
- EXISTING DITCH

NOTES

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NO.	REVISION DESCRIPTION	DATE	BY
2	REVISED PER CITY COMMENTS	21/01/20	SMC
1	ISSUED FOR SUBDIVISION APPLICATION	05/12/19	SMC

SCALE

0 5m 10m 30m

HORIZONTAL 1:750

LICENSED PROFESSIONAL ENGINEER
S. M. CZAIRAPYNSKI
JAN 21 2020
PROVINCE OF ONTARIO

Robinson Land Development

CONSULTING ENGINEERS
350 PALLADIUM DRIVE
KANATA, ONTARIO K2V 1A8
TELEPHONE (613) 592-6060

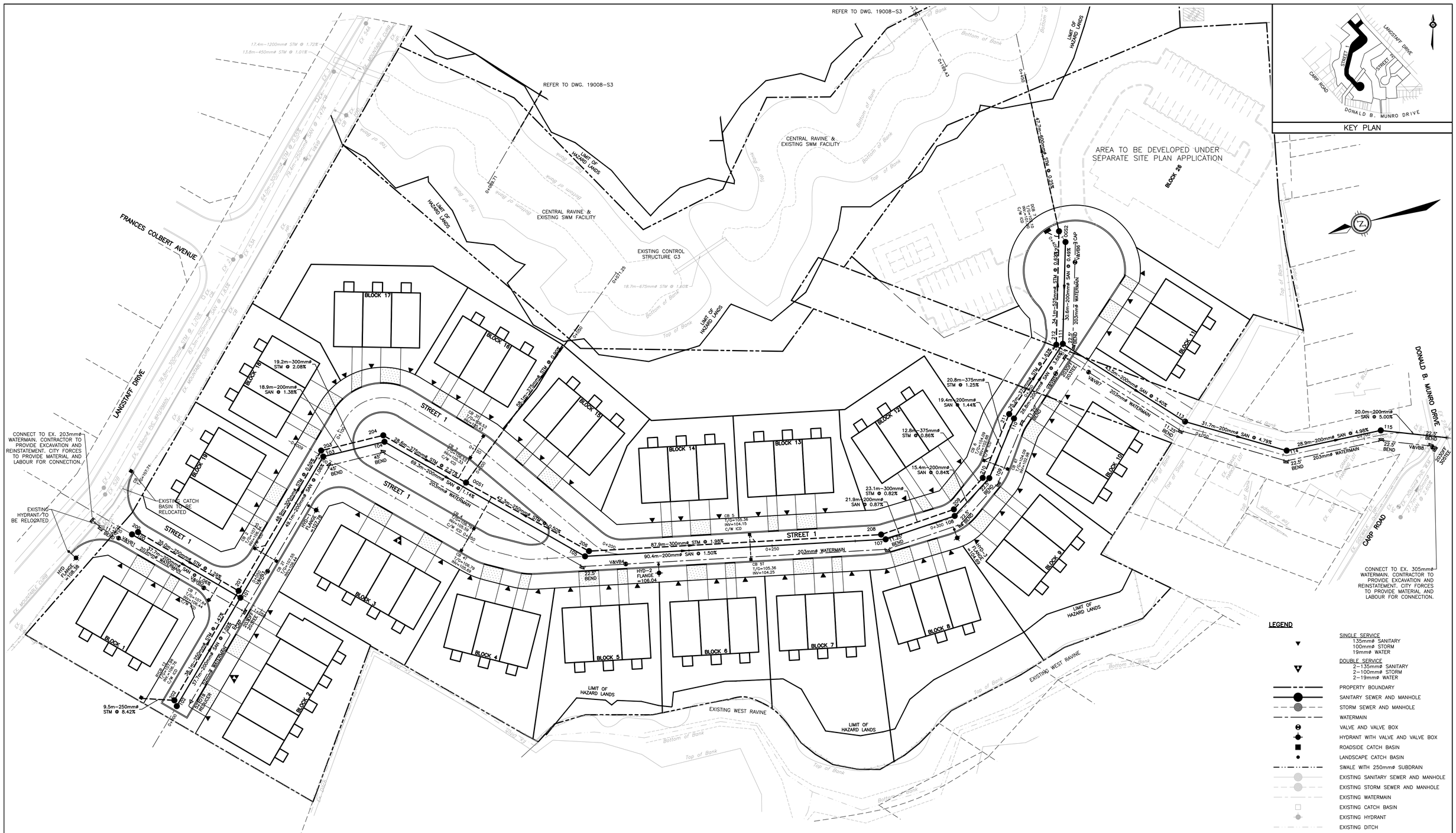
DESIGN	BLM
CHECKED	SMC
DRAWN	BLM
CHECKED	SMC
APPROVED	SMC

INVERNESS HOMES
38 AURIGA DRIVE, SUITE 200
OTTAWA, ON K2E 8A6

147 LANGSTAFF DRIVE
CARP, ON

GENERAL PLAN OF SERVICES

PROJECT No.	19008
SURVEY	RLD
DATED	JANUARY 2020
DWG. No:	19008-S1



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2	REVISED PER CITY COMMENTS	21/01/20	SMC
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SCALE
0 5m 10m 20m
HORIZONTAL 1:500

LICENSED PROFESSIONAL ENGINEER
S. M. CZABARYNSKI
JAN 21 2020
PROVINCE OF ONTARIO

Robinson Land Development

CONSULTING ENGINEERS
350 PALLADIUM DRIVE
KANATA, ONTARIO K2V 1A8
TELEPHONE (613) 592-6060

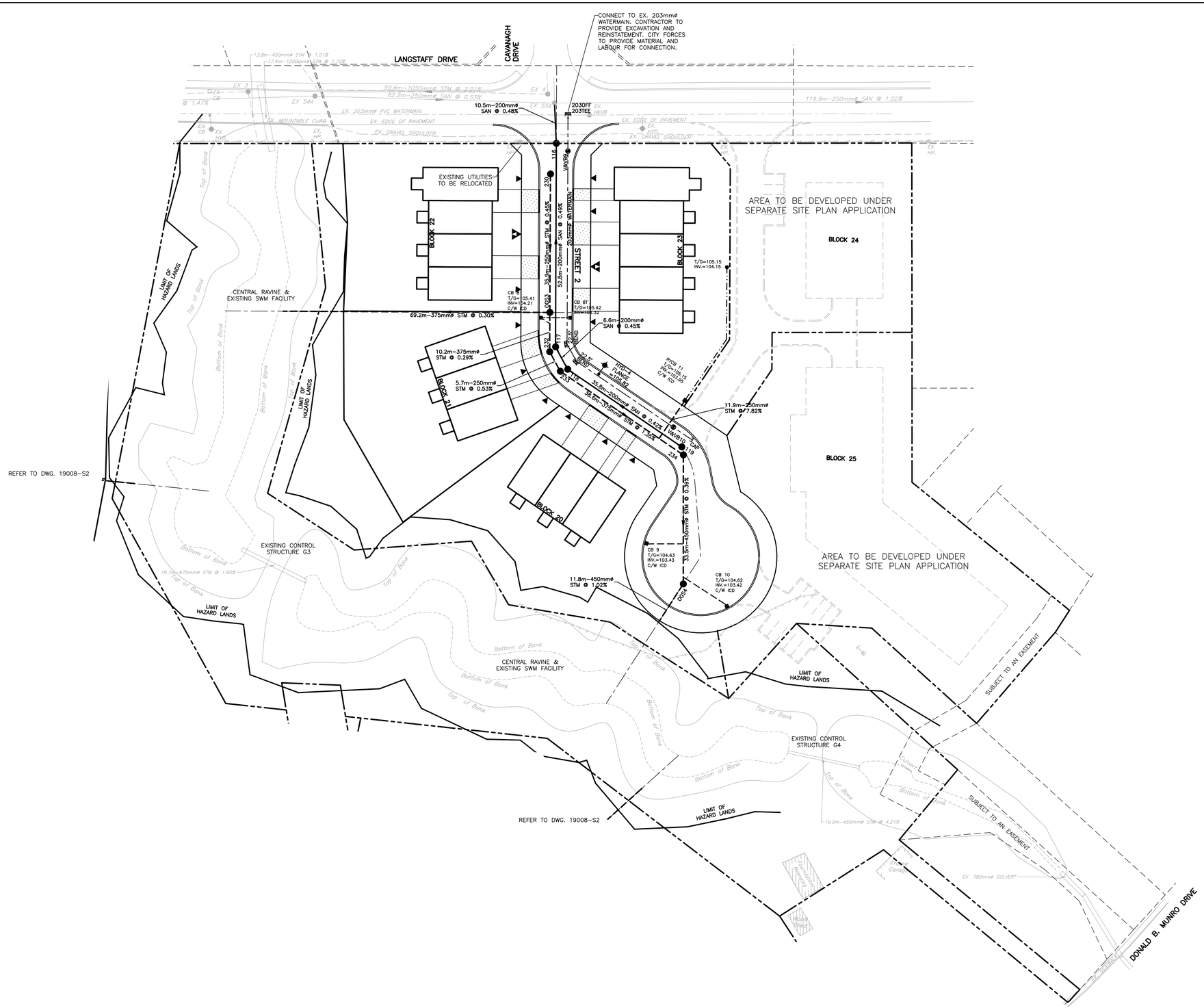
DESIGN	BLM
CHECKED	SMC
DRAWN	BLM
CHECKED	SMC
APPROVED	SMC

INVERNESS HOMES
38 AURIGA DRIVE, SUITE 200
OTTAWA, ON K2E 8A6

147 LANGSTAFF DRIVE
CARP, ON

SERVICING PLAN

PROJECT No.	19008
SURVEY	RLD
DATED	JANUARY 2020
DWG. No:	19008-S2



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2	REVISED PER CITY COMMENTS	21/01/20	SMC
1	ISSUED FOR SUBDIVISION APPLICATION	05/12/19	SMC

SCALE

HORIZONTAL 1:500

LICENSED PROFESSIONAL ENGINEER S. M. CZABARYNSKI JANUARY 20 2020 PROVINCE OF ONTARIO

Robinson Land Development

CONSULTING ENGINEERS

350 PALLADIUM DRIVE
KANATA, ONTARIO K2V 1A8
TELEPHONE (613) 592-6060

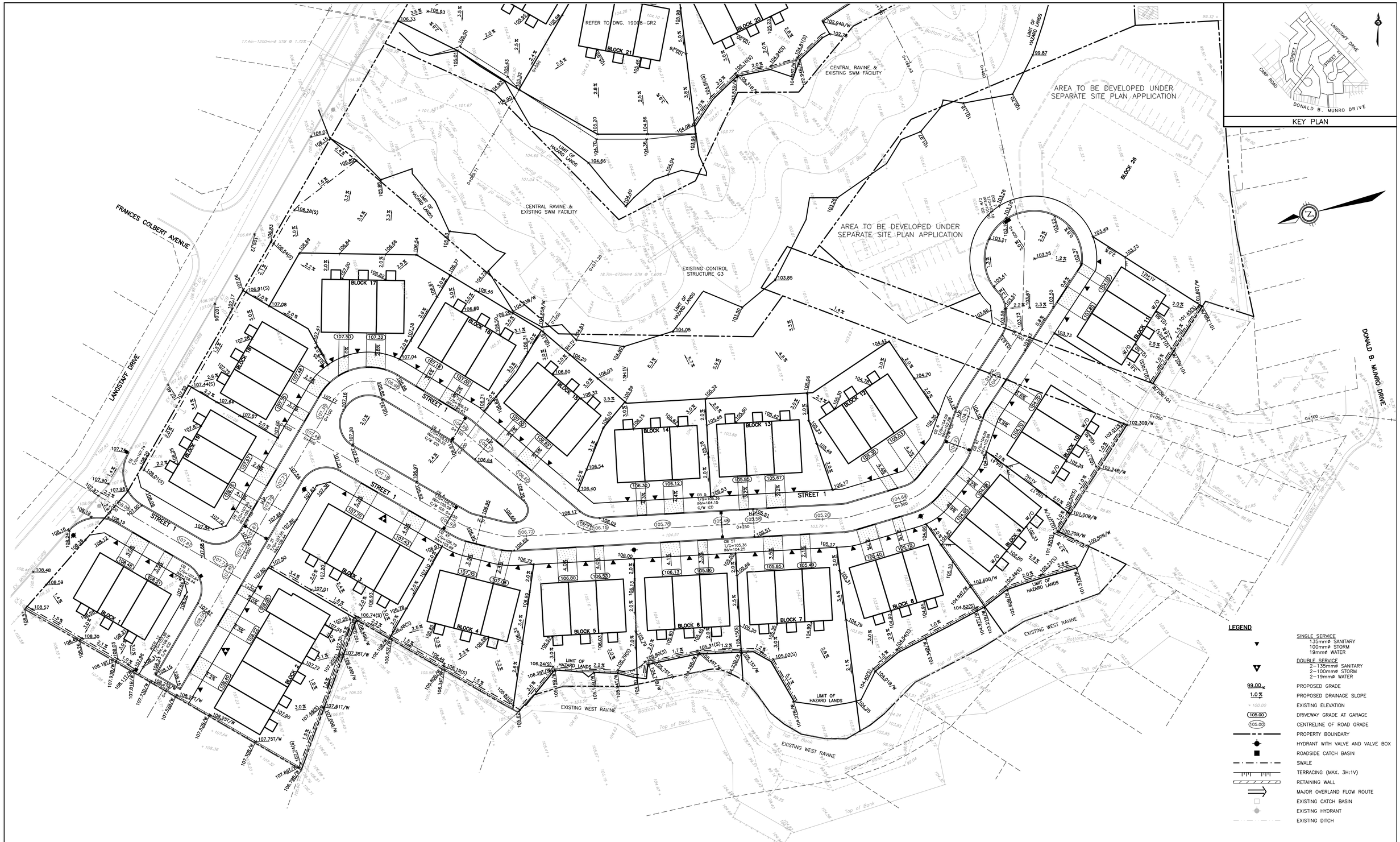
DESIGN	BLM
CHECKED	SMC
DRAWN	BLM
CHECKED	SMC
APPROVED	SMC

INVERNESS HOMES
38 AURIGA DRIVE, SUITE 200
OTTAWA, ON K2E 8A6

147 LANGSTAFF DRIVE
CARP, ON

SERVICING PLAN

PROJECT No.	19008
SURVEY	RLD
DATED	JANUARY 2020
DWG. No:	19008-S3



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SCALE

HORIZONTAL 1:500

LICENSED PROFESSIONAL ENGINEER
S. M. CZAHARYNSKI
JAN 21 2020
PROVINCE OF ONTARIO

Robinson Land Development

CONSULTING ENGINEERS
350 PALLADIUM DRIVE
KANATA, ONTARIO K2V 1A8
TELEPHONE (613) 592-6060

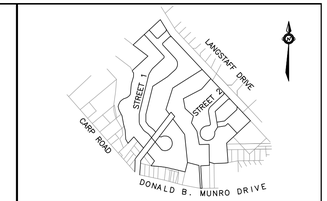
DESIGN	BLM
CHECKED	SMC
DRAWN	BLM
CHECKED	SMC
APPROVED	SMC

INVERNESS HOMES
38 AURIGA DRIVE, SUITE 200
OTTAWA, ON K2E 8A6

147 LANGSTAFF DRIVE
CARP, ON

GRADING PLAN

PROJECT No.	19008
SURVEY	RLD
DATED	JANUARY 2020
DWG. No:	19008-GR1



KEY PLAN

LEGEND

▼	SINGLE SERVICE 135mmø SANITARY 100mmø STORM 19mmø WATER
▼	DOUBLE SERVICE 2–135mmø SANITARY 2–100mmø STORM 2–19mmø WATER
99.00 x	PROPOSED GRADE
1.0 %	PROPOSED DRAINAGE SLOPE
+ 100.00	EXISTING ELEVATION
(105.00)	DRIVEWAY GRADE AT GARAGE
(105.00)	CENTRELINE OF ROAD GRADE
	PROPERTY BOUNDARY
	HYDRANT WITH VALVE AND VALVE BOX
	ROADSIDE CATCH BASIN
	SWALE
	TERRACING (MAX. 3H:1V)
	RETAINING WALL
	MAJOR OVERLAND FLOW ROUTE
	EXISTING CATCH BASIN
	EXISTING HYDRANT
	EXISTING DITCH

NOTES

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1	ISSUED FOR SUBDIVISION APPLICATION	05/12/19	SMC

SCALE

0 5m 10m 20m

HORIZONTAL 1:500

LICENSED PROFESSIONAL ENGINEER
S. M. CZARNYNSKI
JAN 21 2020
PROVINCE OF ONTARIO

Robinson Land Development

CONSULTING ENGINEERS
350 PALLADIUM DRIVE
KANATA, ONTARIO K2V 1A8
TELEPHONE (613) 592-6060

DESIGN	BLM
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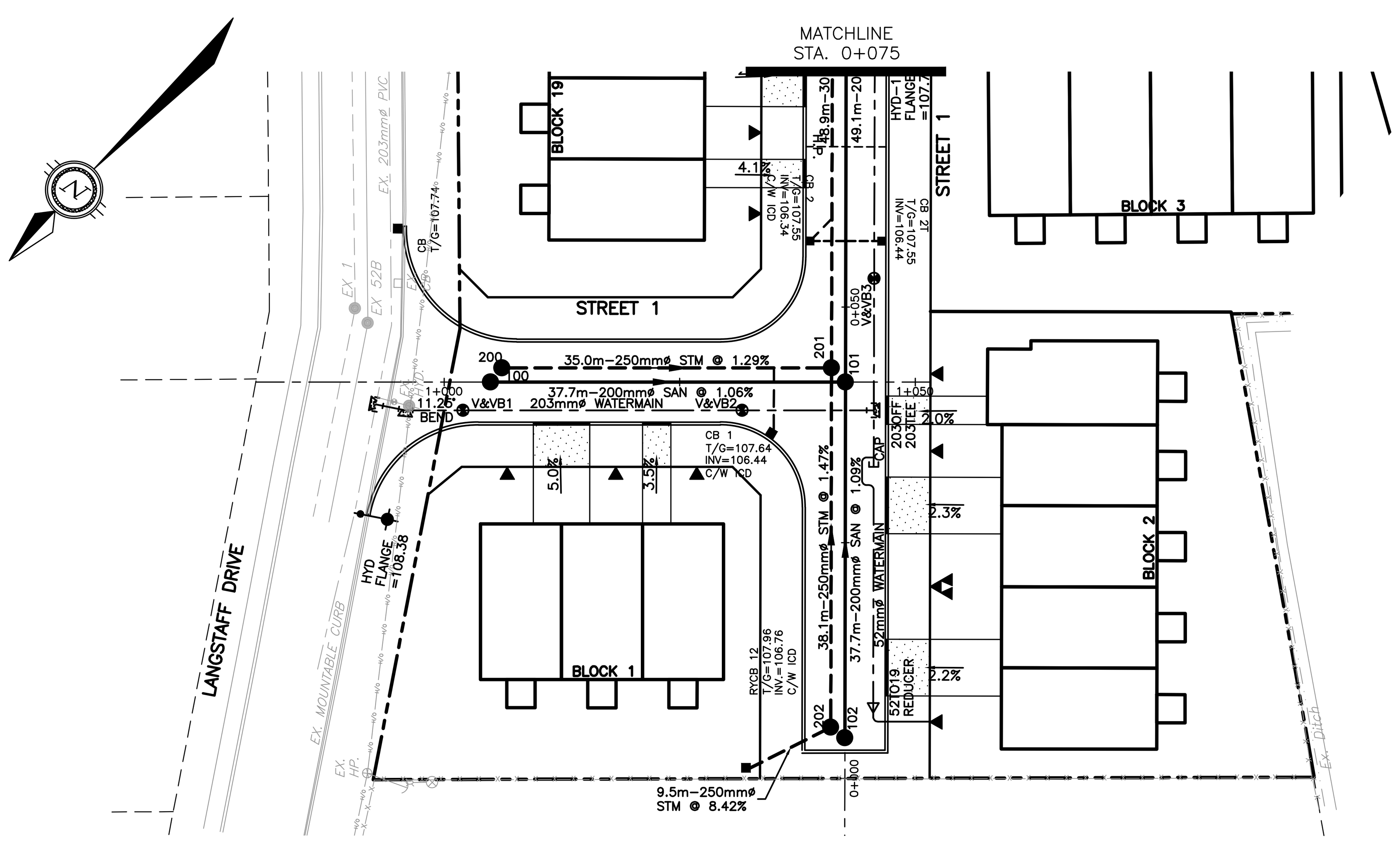
CHECKED	SMC
APPROVED	SMC

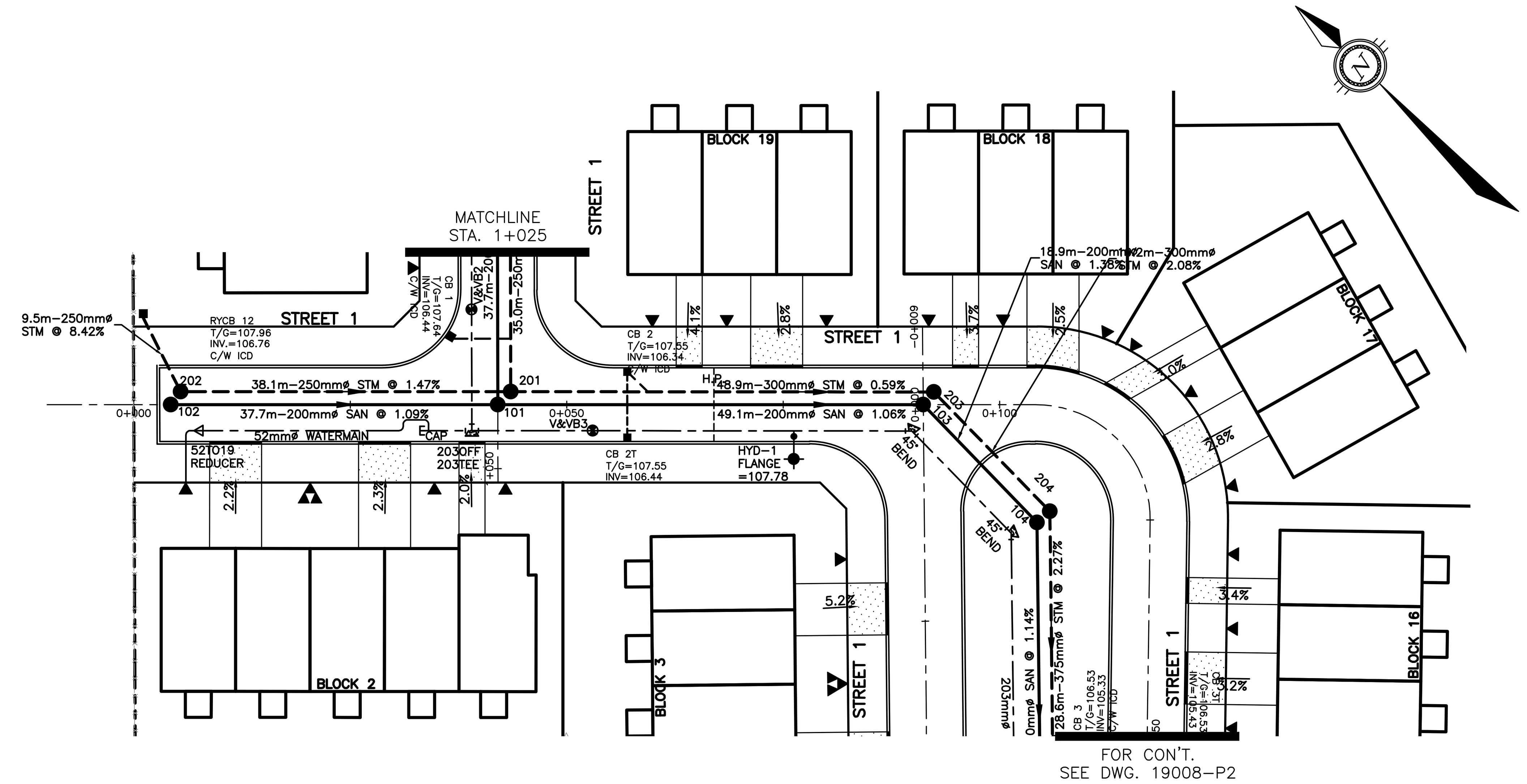
INVERNESS HOMES
38 AURIGA DRIVE, SUITE 200
OTTAWA, ON K2E 8A6

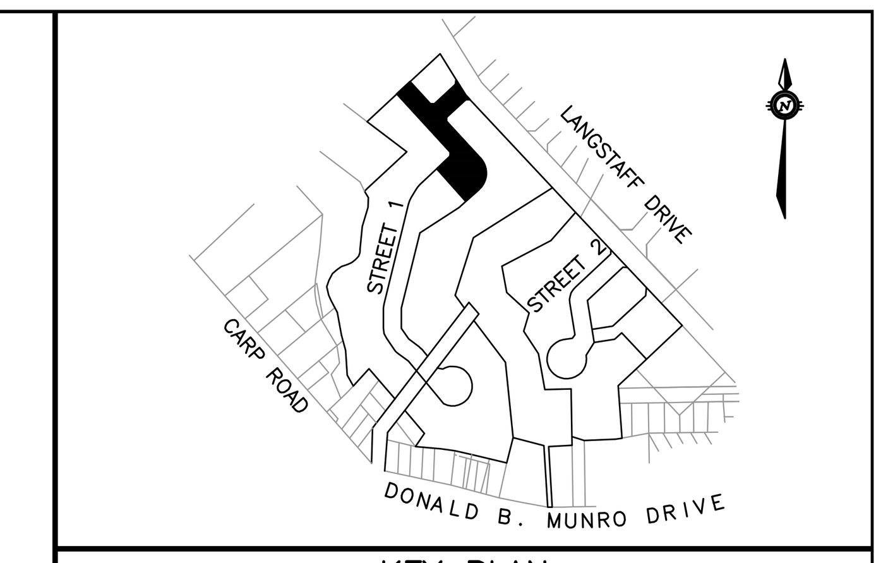
147 LANGSTAFF DRIVE
CARP, ON

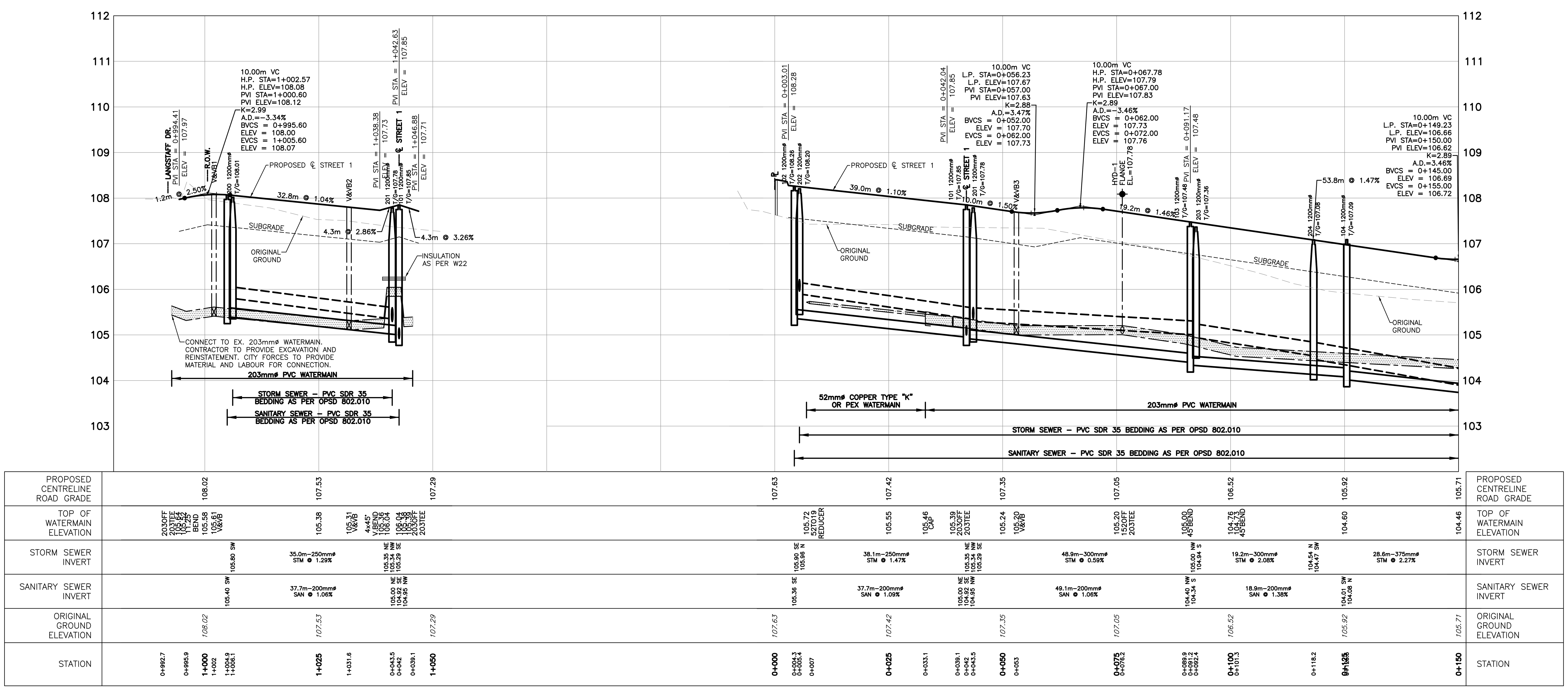
GRADING PLAN

PROJECT No.	19008
SURVEY	RLD
DATED	JANUARY 2020
DWG. No:	19008-GR2









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SCALE
HORIZONTAL 1:500
VERTICAL 1:50

LICENSED PROFESSIONAL ENGINEER
S. M. CZARABYNSKI
JAN 21 2020
PROVINCE OF ONTARIO

Robinson Land Development

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350 PALLADIUM DRIVE
KANATA, ONTARIO K2V 1A8
TELEPHONE (613) 592-6060

DESIGN	BLM
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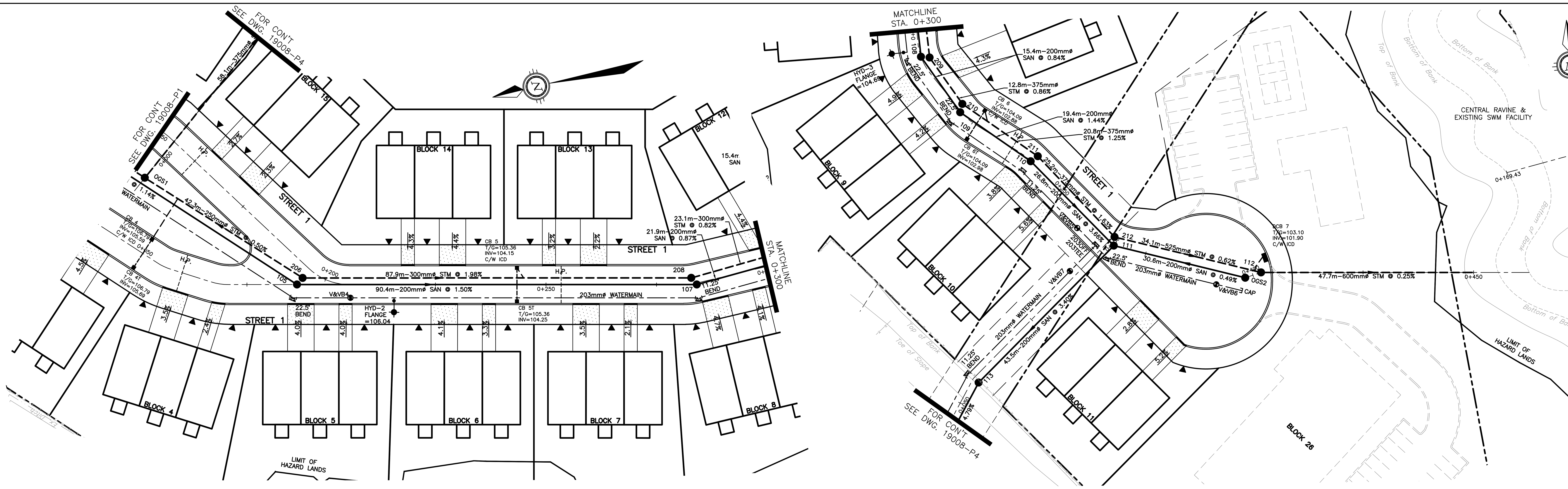
DRAWN	BLM
CHECKED	SMC
APPROVED	SMC

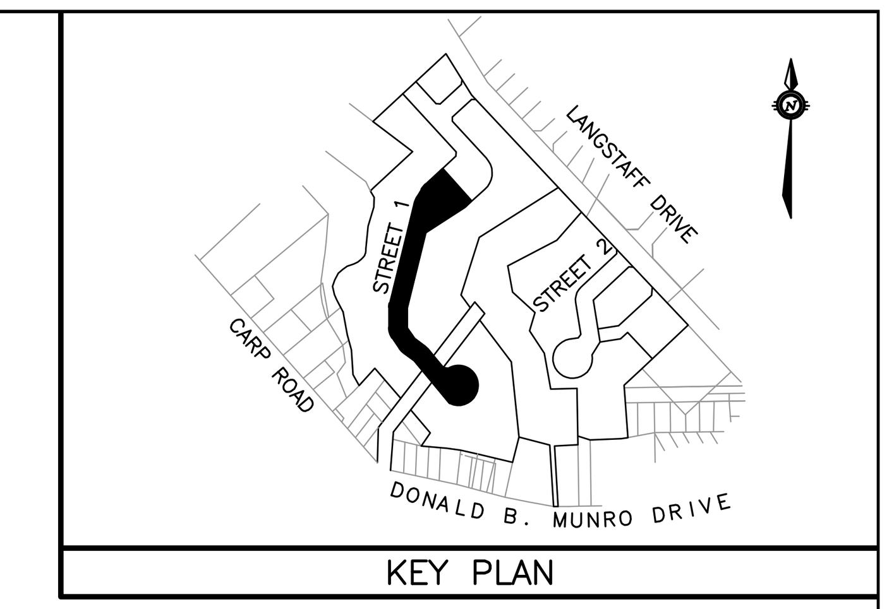
INVERNESS HOMES
38 AURIGA DRIVE, SUITE 200
OTTAWA, ON K2E 8A6

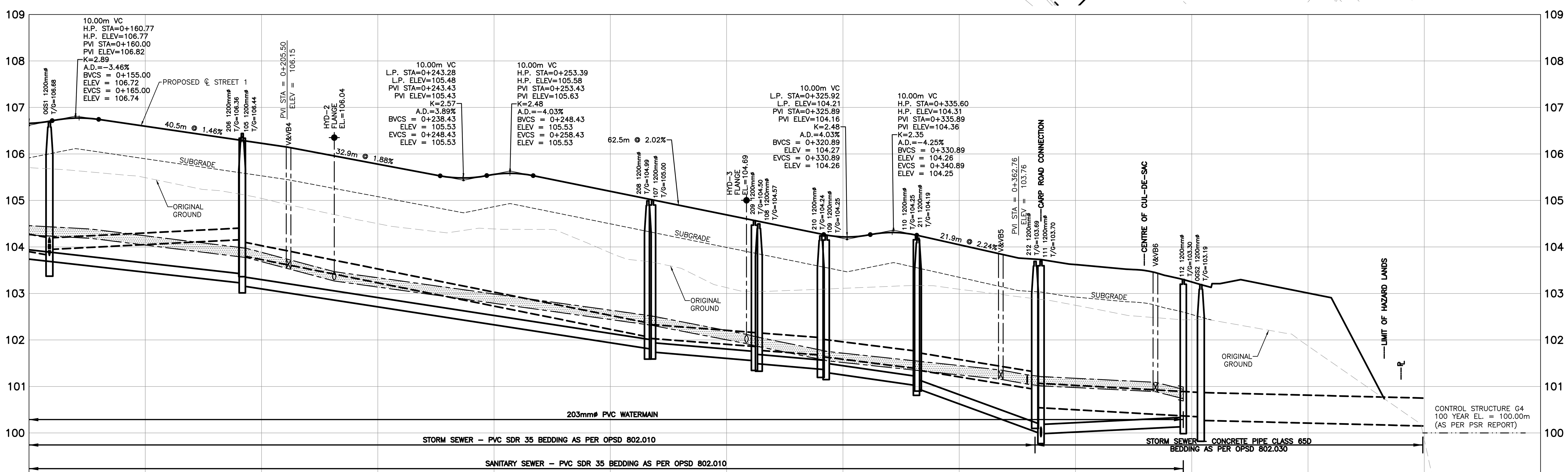
147 LANGSTAFF DRIVE
CARP, ON

PLAN AND PROFILE
STREET 1
STA. 1+000 TO STA. 1+050
STA. 0+000 TO STA. 0+150

PROJECT No. 19008
SURVEY RLD
DATED JANUARY 2020
DWG. No: 19008-P1







PROPOSED CENTRELINE ROAD GRADE	105.71 · 105.49 · 105.04 · 104.50 · 104.39 · 103.87 · 103.13 · 103.11 · 103.09 · 102.75 · 102.43 · 101.87 · 99.85
TOP OF WATERMAIN ELEVATION	104.46 · 104.38 · 104.24 · 103.97 22.5°BEND · 103.88 · 103.73 V&VB · 103.47 152OFF 203TEE · 103.34 · 102.99 · 102.64 · 102.52 11.25° BEND · 102.20 · 102.12 152OFF 203TEE 22.5° BEND · 101.75 22.5° BEND · 101.72 · 101.45 · 101.35 V&VB · 101.25 203OFF 203TEE 101.21 22.5 BEND · 101.18 · 101.09 V&VB · 100.94 CAP
STORM SEWER INVERT	103.82 NE 103.95 SW 103.82 SE · 42.3m–250mmø STM @ 0.50% · 104.16 NE 103.81 S · 87.9m–300mmø STM @ 1.98% · 102.07 N 102.04 S · 23.1m–300mmø STM @ 0.82% · 101.85 N 101.78 SE · 12.8m–375mmø STM @ 0.86% · 101.67 NW 101.64 SE · 20.8m–375mmø STM @ 1.25% · 101.38 NW 101.35 SE · 25.2m–375mmø STM @ 1.63% · 100.94 NW 100.55 E · 34.1m–525mmø STM @ 0.62% · 100.34 W 100.27 E · 47.7m–600mmø STM @ 0.25% · 100.15
SANITARY SEWER INVERT	69.3m–200mmø SAN @ 1.14% · 103.22 NE 103.16 S · 90.4m–200mmø SAN @ 1.50% · 101.80 N 101.74 S · 21.9m–200mmø SAN @ 0.87% · 101.55 N 101.49 SE · 15.4m–200mmø SAN @ 0.84% · 101.36 NW 101.30 SE · 19.4m–200mmø SAN @ 1.44% · 101.02 NW 100.96 SE · 26.8m–200mmø SAN @ 3.66% · 99.92 SW 99.98 NW 99.98 E · 30.6m–200mmø SAN @ 0.49% · 100.13 W
ORIGINAL GROUND ELEVATION	105.71 · 105.49 · 105.04 · 104.50 · 104.39 · 103.87 · 103.13 · 103.11 · 103.09 · 102.75 · 102.43 · 101.87 · 99.85
STATION	0+150 · 0+154.4 · 0+163.4 · 0+175 · 0+195.8 · 0+196.7 · 0+200 · 0+205.8 · 0+215.6 · 0+225 · 0+250 · 0+275 · 0+283.1 · 0+283.9 · 0+300 · 0+304.3 · 0+306 · 0+306.9 · 0+320.2 · 0+321.4 · 0+325 · 0+340.8 · 0+341.1 · 0+350 · 0+358.9 · 0+364.6 · 0+366.3 · 0+367.6 · 0+367.6 · 0+375 · 0+392.2 · 0+398.2 · 0+400 · 0+402 · 0+425 · 0+450 · 0+475

NOTES

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2	REVISED PER CITY COMMENTS	21/01/20	SMC
1	ISSUED FOR SUBDIVISION APPLICATION	05/12/19	SMC

SCALE: HORIZONTAL 1:500 · VERTICAL 1:50

LICENSED PROFESSIONAL ENGINEER · S. M. CZABARYNSKI · PROVINCE OF ONTARIO · JAN 21 2020

Robinson Land Development

CONSULTING ENGINEERS
350 PALLADIUM DRIVE
KANATA, ONTARIO K2V 1A8
TELEPHONE (613) 592-6060

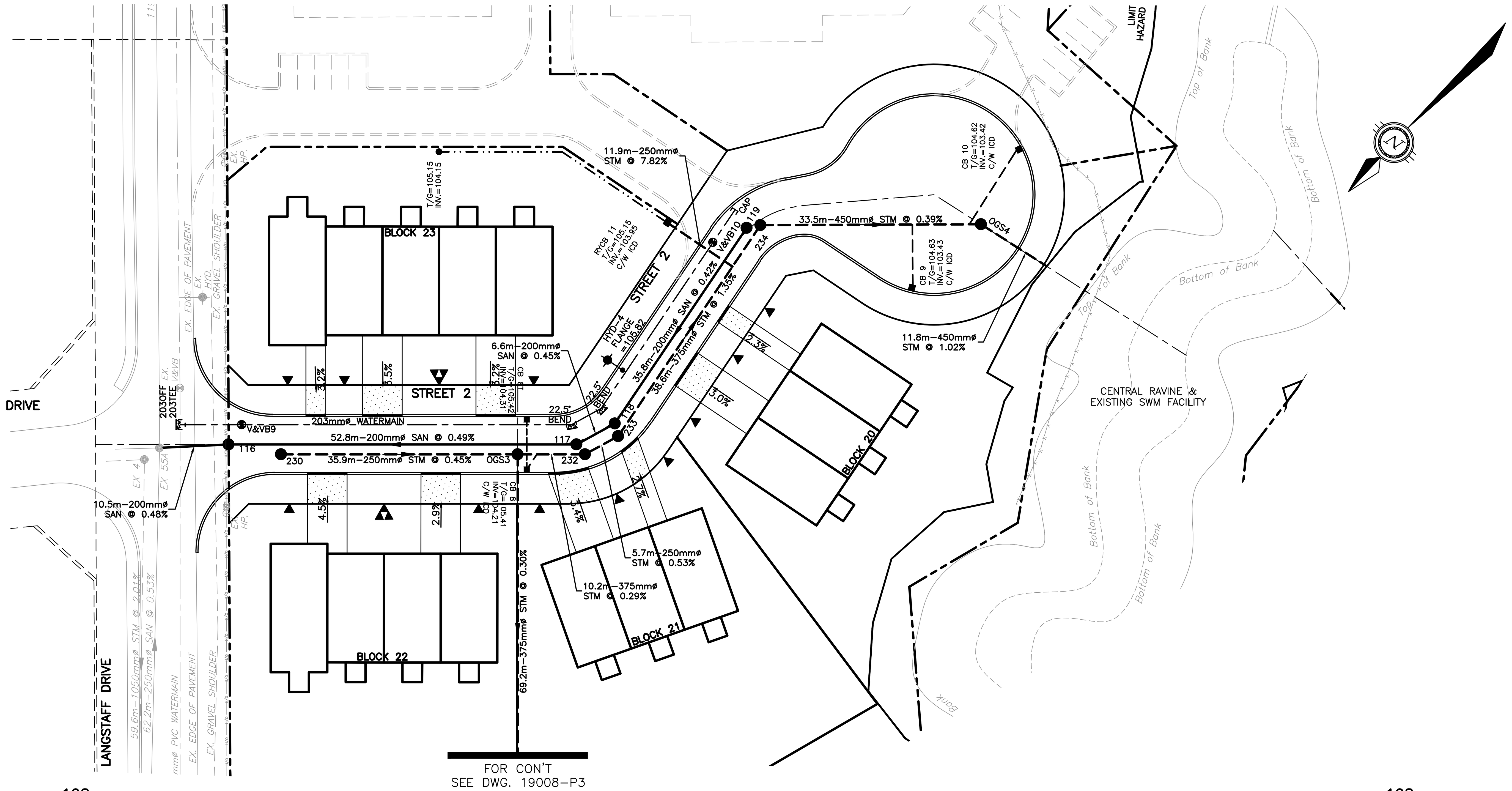
DESIGN BLM · CHECKED SMC · DRAWN BLM · CHECKED SMC · APPROVED SMC

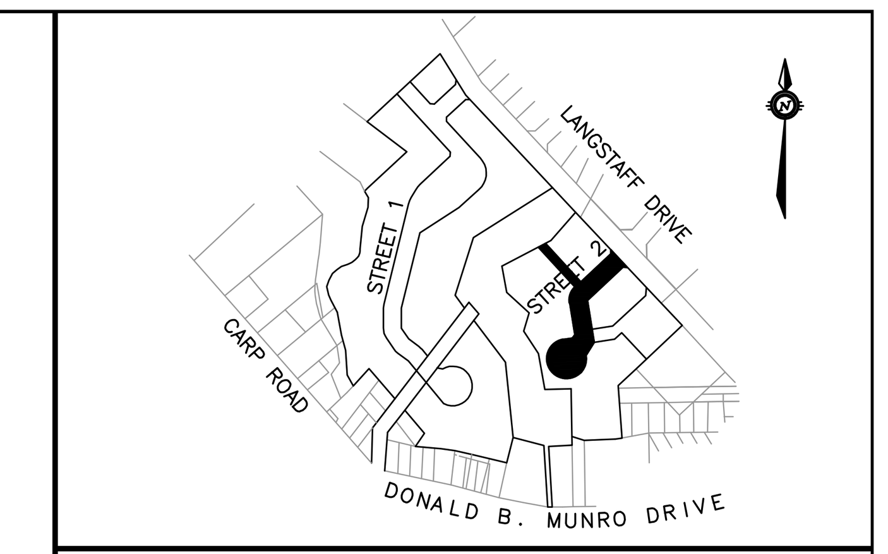
INVERNESS HOMES
38 AURIGA DRIVE, SUITE 200
OTTAWA, ON K2E 8A6

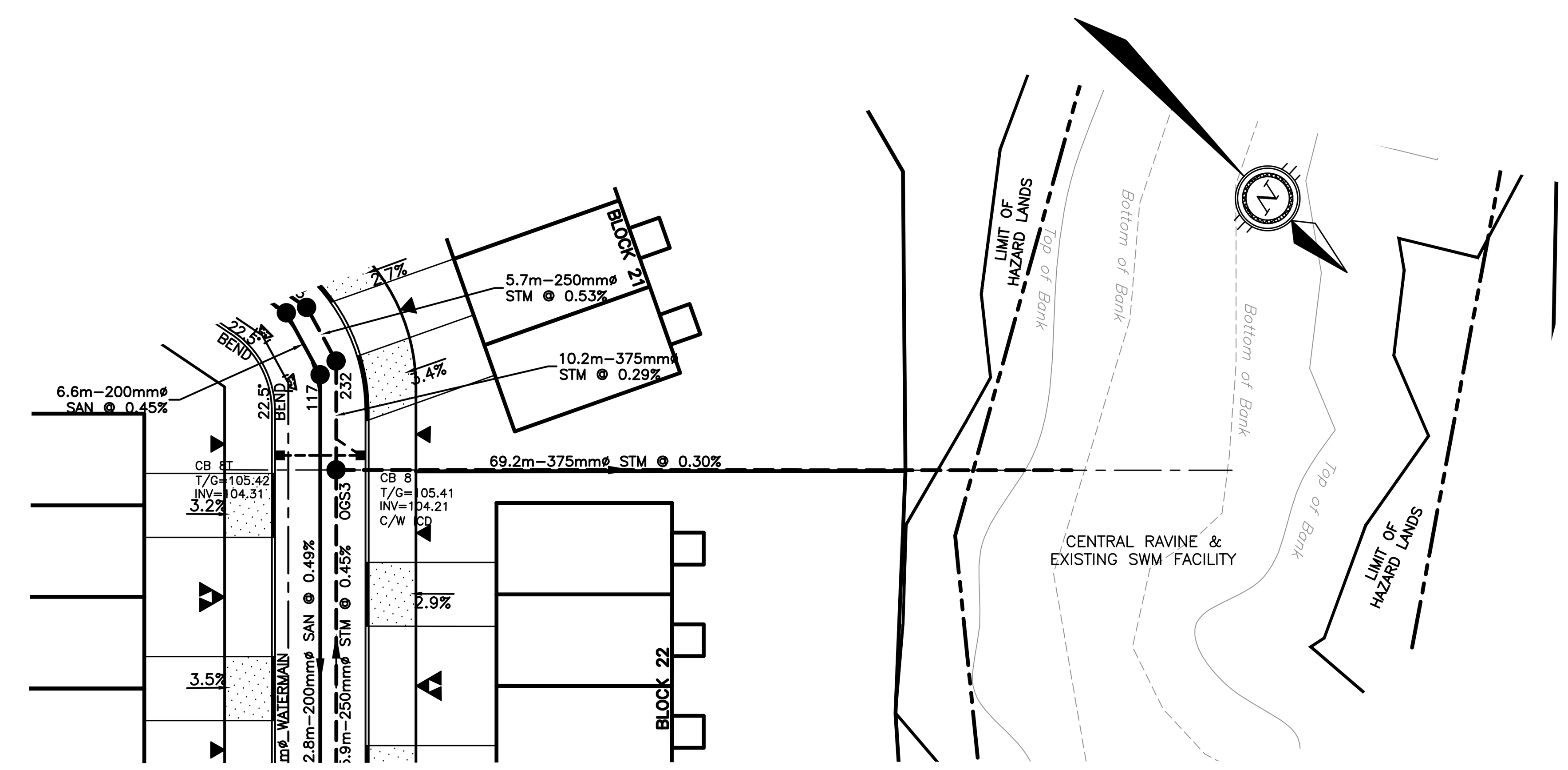
147 LANGSTAFF DRIVE
CARP, ON

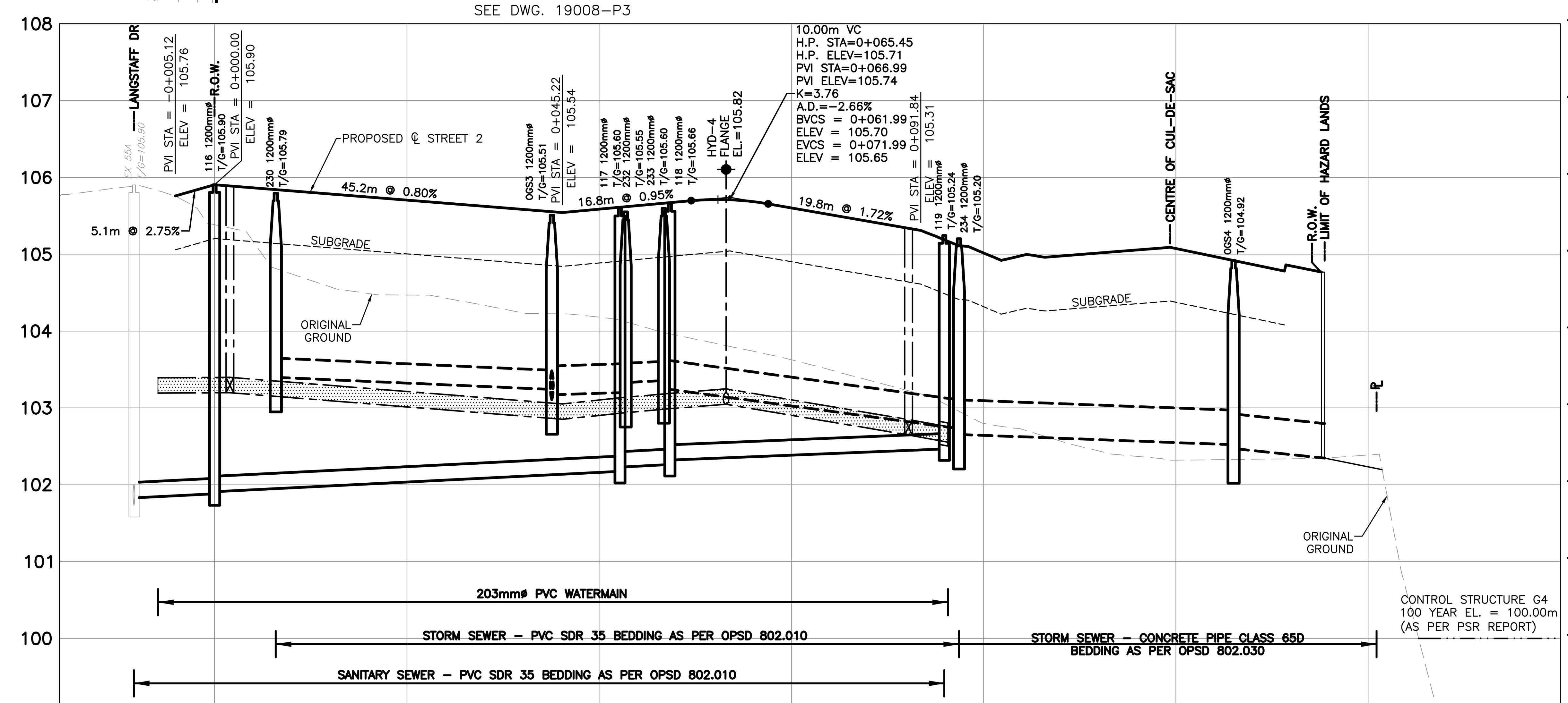
PLAN AND PROFILE
STREET 1
STA. 0+150 TO STA. 0+450

PROJECT No. 19008 · SURVEY RLD · DATED JANUARY 2020 · DWG. No: 19008-P2

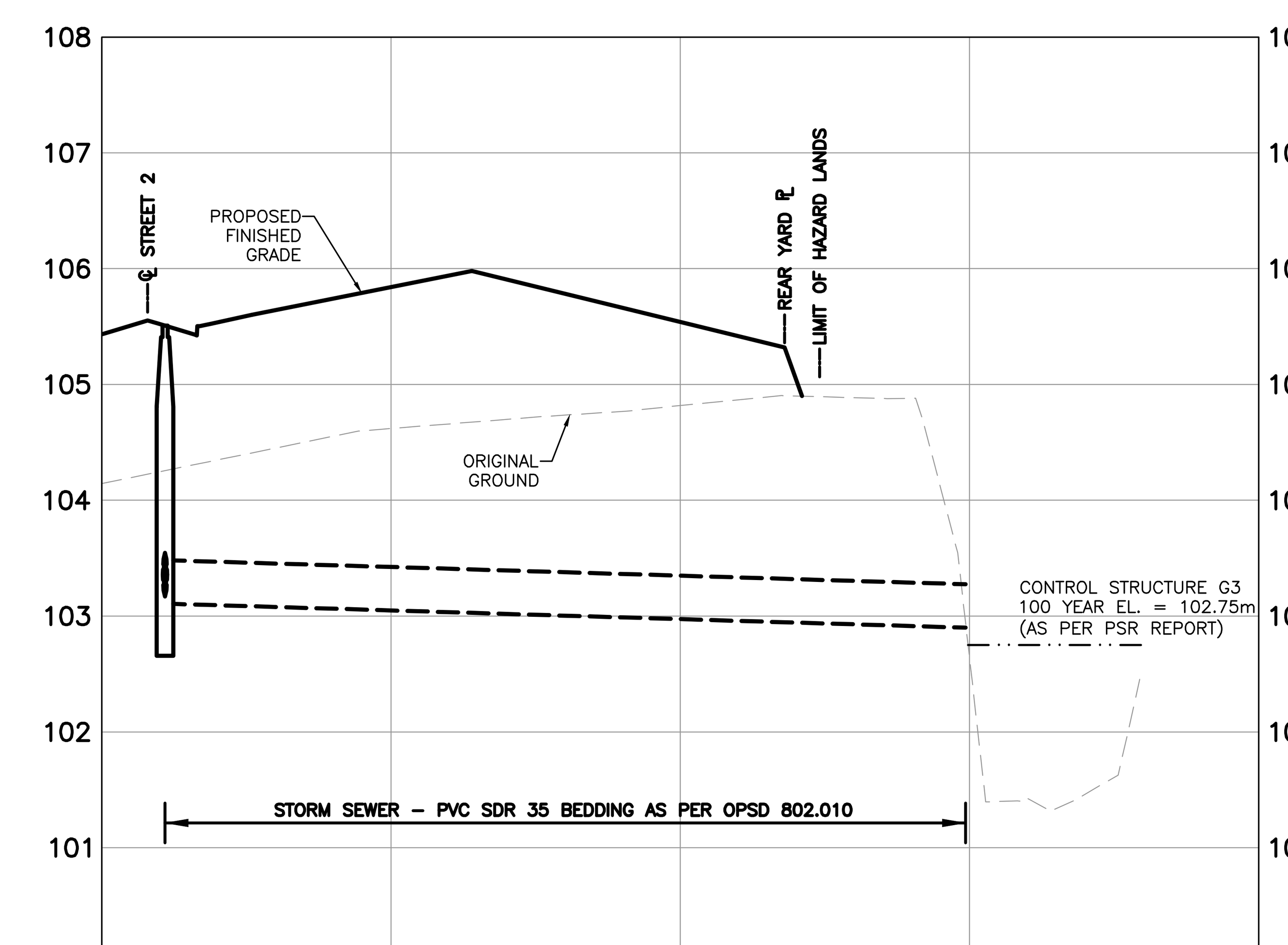








PROPOSED CENTRELINE ROAD GRADE	105.38, 104.47, 104.18, 103.63, 102.80, 102.32, 102.39
TOP OF WATERMAIN ELEVATION	103.39 203OFF 203TEE; 103.40; 103.40 V&VB; 103.21; 103.05; 103.10; 103.13 22.5° BEND; 103.19 22.5° BEND; 103.25 152OFF 203TEE; 103.10; 102.85 V&VB; 102.75 CAP
STORM SEWER INVERT	10.5m–200mmø SAN @ 0.48%; 103.40 SW; 35.9m–250mmø STM @ 0.45%; 103.24 NE 103.17 SW 103.11 NW; 103.33 S 103.20 NE; 103.25 S 103.36 N; 5.7m–250mmø STM @ 0.53%; 38.6m–375mmø STM @ 1.35%; 102.73 N 102.65 SW; 33.5m–450mmø STM @ 0.39%; 102.52 NE 102.47 W; 11.8m–450mmø STM @ 1.02%; 102.39
SANITARY SEWER INVERT	101.83 SW 101.76 NW 101.73 SE 101.76 NE; 101.91 SW 101.88 NE; 52.8m–200mmø SAN @ 0.49%; 10.2m–375mmø STM @ 0.29%; 102.23 S 102.17 NE; 102.32 S 102.26 N; 35.8m–200mmø SAN @ 0.42%; 102.47 N
ORIGINAL GROUND ELEVATION	105.38, 104.47, 104.18, 6.6m–200mmø SAN @ 0.45%, 103.63, 102.80, 102.32, 102.39
STATION	-0+010.5, -0+007.4, -0+000, 0+002, 0+008, 0+025, 0+043.9, 0+045.2, 0+050, 0+052.7, 0+053.5, 0+058.4, 0+059.2, 0+066.5, 0+075, 0+090.2, 0+094.9, 0+095.4, 0+096.8, 0+100, 0+125, 0+132.5, 0+150, 0+175



PROPOSED CENTRELINE ROAD GRADE	104.14, 104.62, 104.82, 102.64
TOP OF WATERMAIN ELEVATION	
STORM SEWER INVERT	103.24 NE 103.17 SW 103.11 NW; 69.2m–375mmø STM @ 0.30%; 102.90
SANITARY SEWER INVERT	
ORIGINAL GROUND ELEVATION	104.14, 104.62, 104.82, 102.64
STATION	0+000, 0+043.9, 0+025, 0+050, 0+075, 0+100

NOTES

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NO.	REVISION DESCRIPTION	DATE	BY
2	REVISED PER CITY COMMENTS	21/01/20	SMC
1	ISSUED FOR SUBDIVISION APPLICATION	05/12/19	SMC

SCALE
HORIZONTAL 1:500 (0, 5m, 10m, 20m)
VERTICAL 1:50 (0, 0.5m, 1m, 2m)

LICENSED PROFESSIONAL ENGINEER
S. M. CZAHARYNSKI
JAN 21 2020
PROVINCE OF ONTARIO

Robinson Land Development
CONSULTING ENGINEERS
350 PALLADIUM DRIVE
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TELEPHONE (613) 592-6060

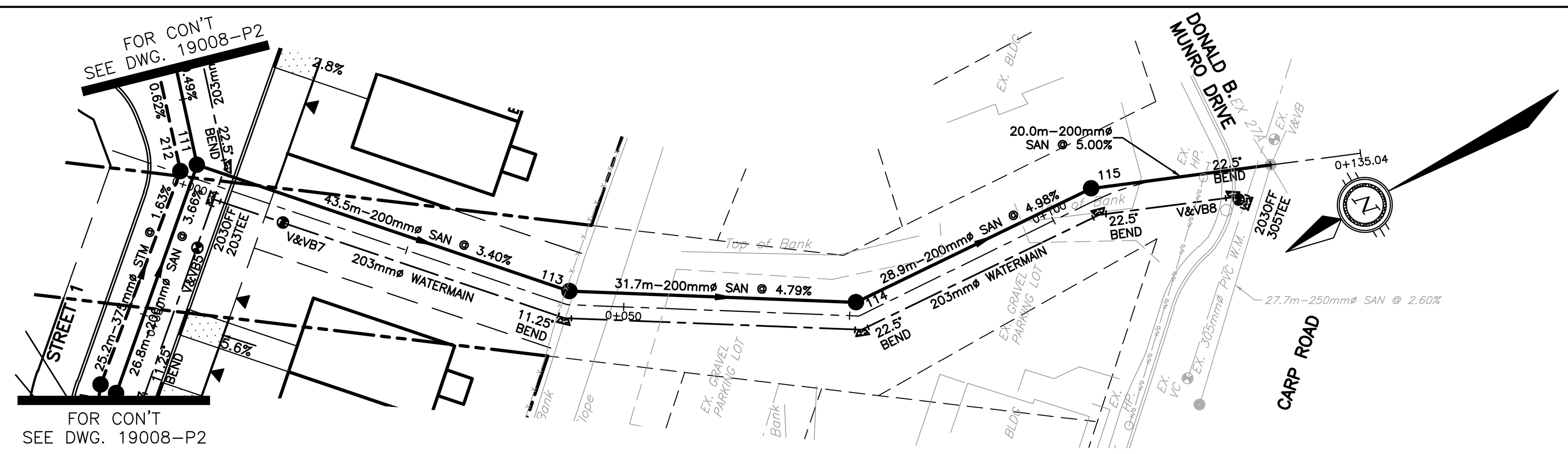
DESIGN BLM
CHECKED SMC
DRAWN BLM
CHECKED SMC
APPROVED SMC

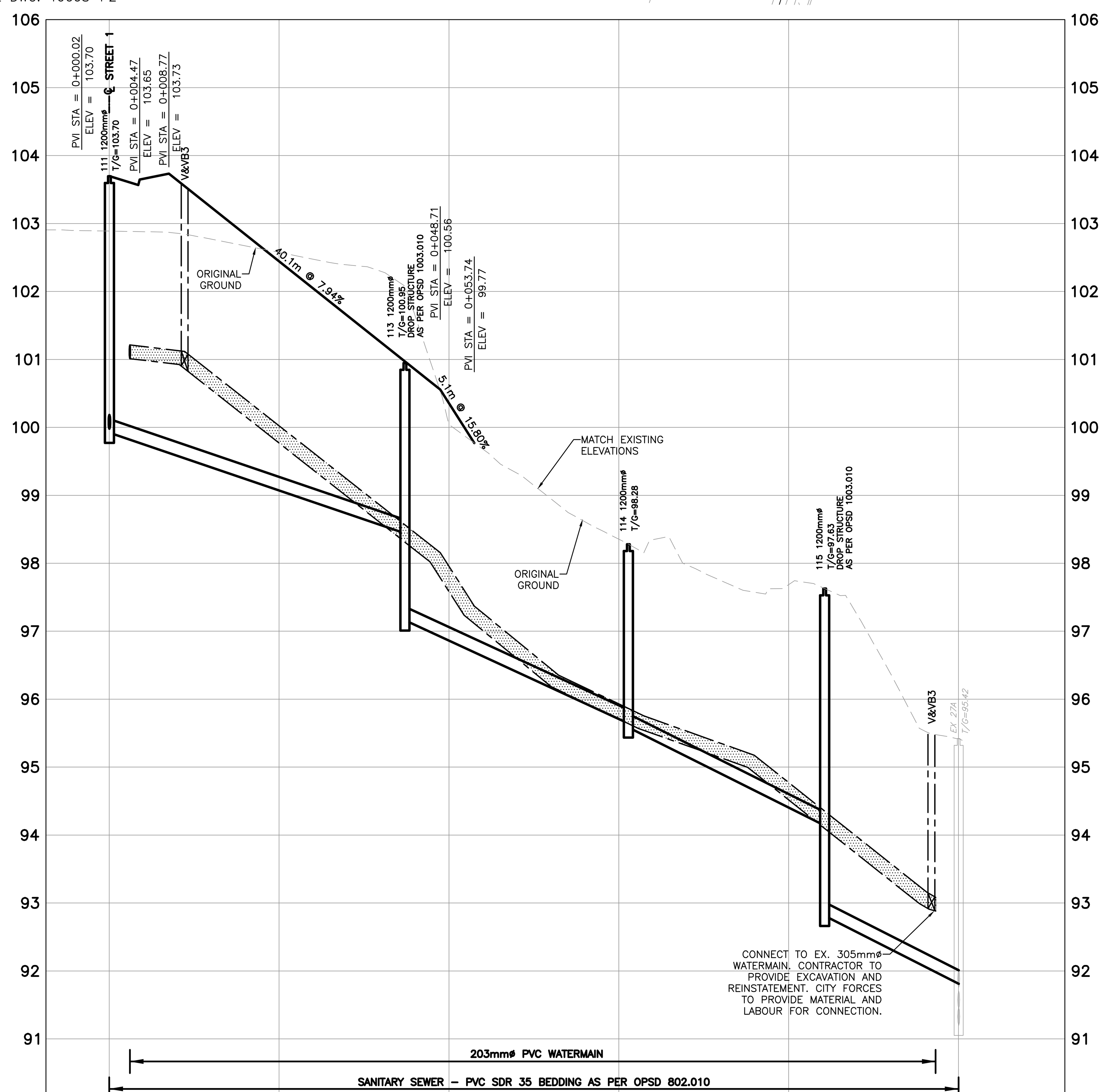
INVERNESS HOMES
38 AURIGA DRIVE, SUITE 200
OTTAWA, ON K2E 8A6

147 LANGSTAFF DRIVE
CARP, ON

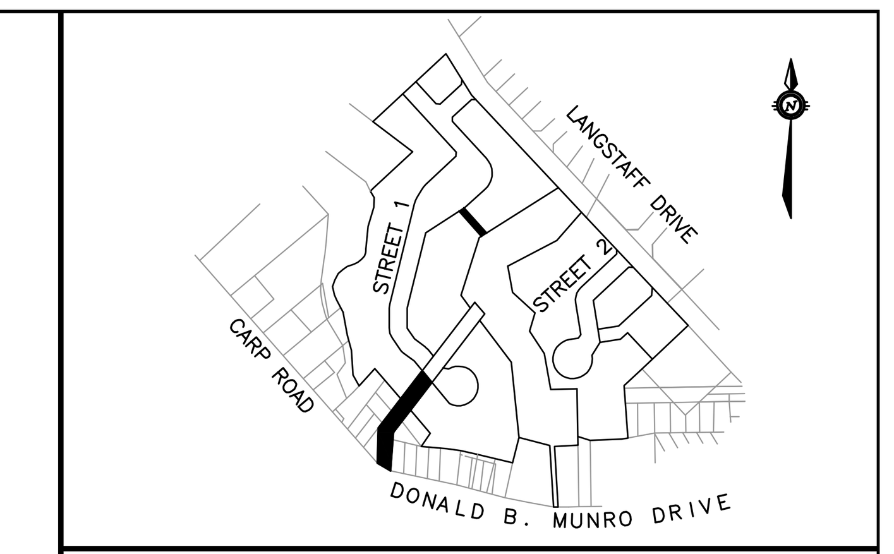
PLAN AND PROFILE
STREET 2; STREET 2 G3 OUTLET
STA. 0+000 TO STA. 0+175
STA. 0+000 TO STA. 0+100

PROJECT No. 19008
SURVEY RLD
DATED JANUARY 2020
DWG. No: 19008-P3

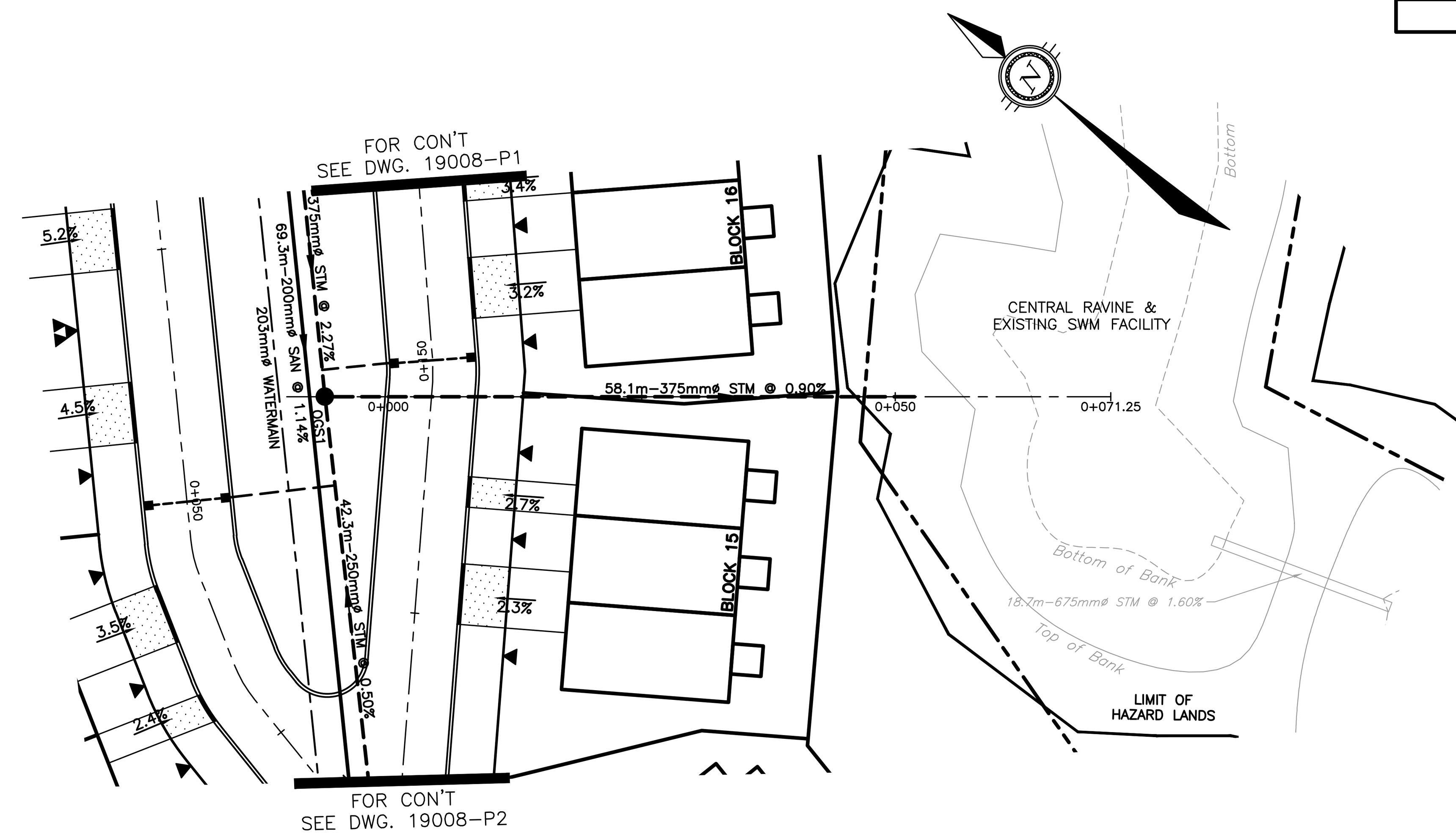


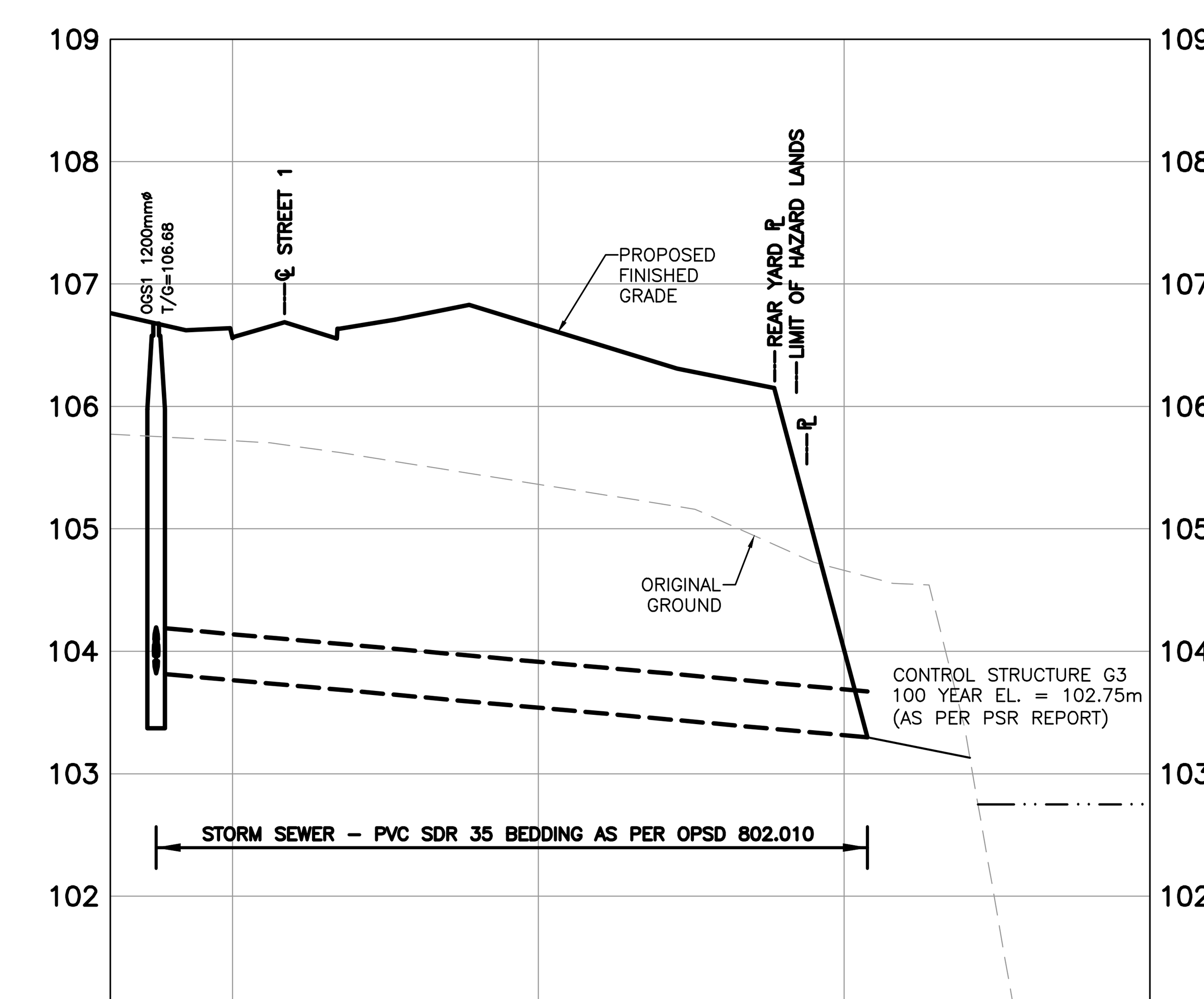


PROPOSED CENTRELINE ROAD GRADE	102.44; 100.36	PROPOSED CENTRELINE ROAD GRADE
TOP OF WATERMAIN ELEVATION	101.21 203OFF 203TEE; 101.12 V&VB; 100.02; 98.55 11.25° BEND; 97.95; 95.93 22.5°BEND; 94.77; 94.39 22.5°BEND; 93.79; 93.16 22.5° BEND 93.12 V&VB 93.08 203OFF 305TEE	TOP OF WATERMAIN ELEVATION
STORM SEWER INVERT		STORM SEWER INVERT
SANITARY SEWER INVERT	99.92 SW 99.98 NW 99.98 E; 43.5m-200mmø SAN @ 3.40%; 97.16 SW 98.44 NE; 31.7m-200mmø SAN @ 4.79%; 95.58 S 95.64 NE; 28.9m-200mmø SAN @ 4.98%; 92.81 SW 94.14 N; 20.0m-200mmø SAN @ 5.00%; 91.76 E 91.45 NW 91.20 SE 91.21 W	SANITARY SEWER INVERT
ORIGINAL GROUND ELEVATION	102.89; 102.58; 100.04; 98.35; 97.69; 95.42	ORIGINAL GROUND ELEVATION
STATION	0+367.6; 0+000; 0+011.1; 0+025; 0+043.5; 0+050; 0+075; 0+076.4; 0+100; 0+105.3; 0+120.4; 0+121; 0+125	STATION



KEY PLAN





PROPOSED CENTRELINE ROAD GRADE	105.72; 105.36; 104.66	PROPOSED CENTRELINE ROAD GRADE
TOP OF WATERMAIN ELEVATION		TOP OF WATERMAIN ELEVATION
STORM SEWER INVERT	103.82 NE 103.95 SW 103.82 SE; 58.1m-375mmø STM @ 0.90%; 103.30	STORM SEWER INVERT
SANITARY SEWER INVERT		SANITARY SEWER INVERT
ORIGINAL GROUND ELEVATION	105.72; 105.36; 104.66	ORIGINAL GROUND ELEVATION
STATION	0+154.4; 0+000; 0+025; 0+050; 0+075	STATION

NOTES

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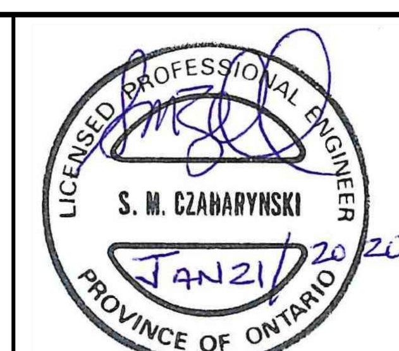
SCALE
HORIZONTAL 1:500
VERTICAL 1:50



Robinson Land Development

CONSULTING ENGINEERS
350 PALLADIUM DRIVE
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TELEPHONE (613) 592-6060

DESIGN BLM
CHECKED SMC
DRAWN BLM
CHECKED SMC
APPROVED SMC

INVERNESS HOMES
38 AURIGA DRIVE, SUITE 200
OTTAWA, ON K2E 8A6

147 LANGSTAFF DRIVE
CARP, ON

PLAN AND PROFILE
CARP ROAD CONNECTION;
STREET 1 G3 OUTLET
STA. 0+000 TO STA. 0+150
STA. 0+000 TO STA. 0+075

PROJECT No. 19008
SURVEY RLD
DATED JANUARY 2020
DWG. No: 19008-P4

N

LEGEND

- + 105.00 — EXISTING ELEVATION
- PROPERTY BOUNDARY
- PRE-DEVELOPMENT DRAINAGE BOUNDARY
- PRE-DEVELOPMENT DRAINAGE DIRECTION

RUNOFF COEFFICIENT
0.5Q1.25 — AREA (ha)
PRE1
DRAINAGE AREA ID

NOTES

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SCALE
0 10m 20m 40m
HORIZONTAL 1:1000

LICENSED PROFESSIONAL ENGINEER
S. M. CZARNYNSKI
PROVINCE OF ONTARIO
Jan 21 2020

Robinson Land Development
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TELEPHONE (613) 592-6060

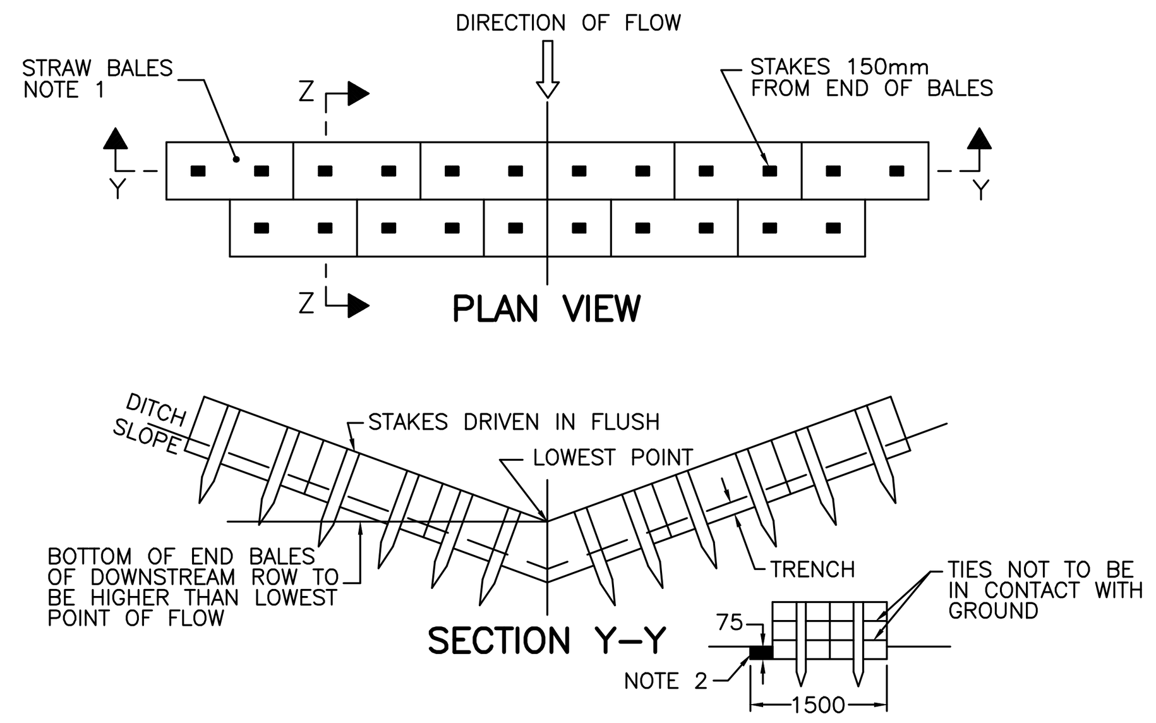
DESIGN	BLM
CHECKED	SMC
DRAWN	BLM
CHECKED	SMC
APPROVED	SMC

INVERNESS HOMES
38 AURIGA DRIVE, SUITE 200
OTTAWA, ON K2E 8A6

147 LANGSTAFF DRIVE
CARP, ON

PRE-DEVELOPMENT DRAINAGE AREA PLAN

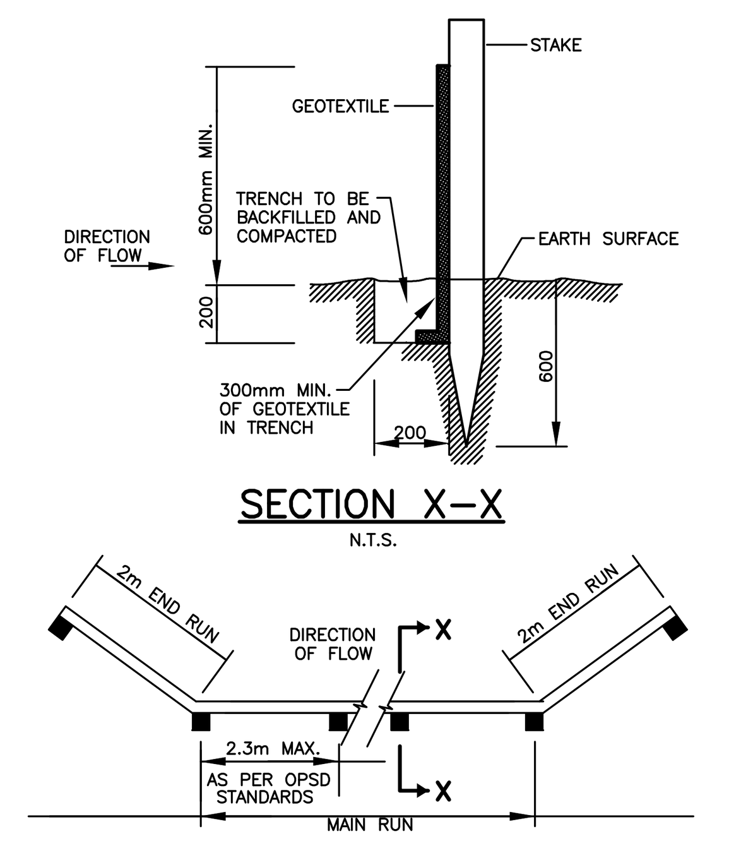
PROJECT No.	19008
SURVEY	RLD
DATED	JANUARY 2020
DWG. No:	19008-PRE1



NOTES:

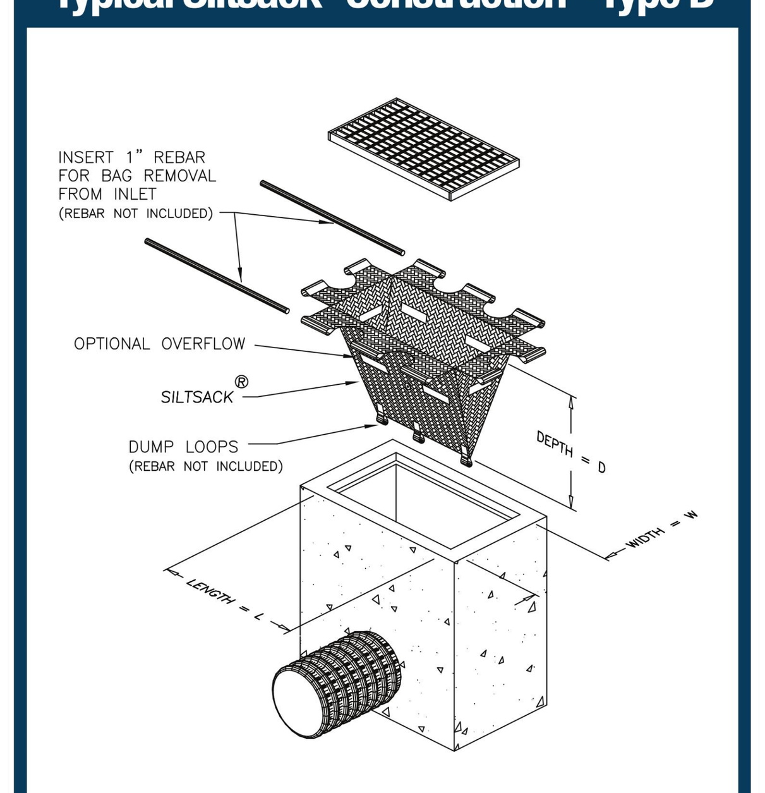
1. NUMBER OF BALES VARIABLE TO SUIT DITCH OR CHANNEL.
2. BALANCE OF EXCAVATED TRENCH TO BE BACKFILLED FOLLOWING BALE PLACEMENT.
3. ALL DIMENSIONS ARE IN MILLIMETERS OR METRES UNLESS OTHERWISE SHOWN.

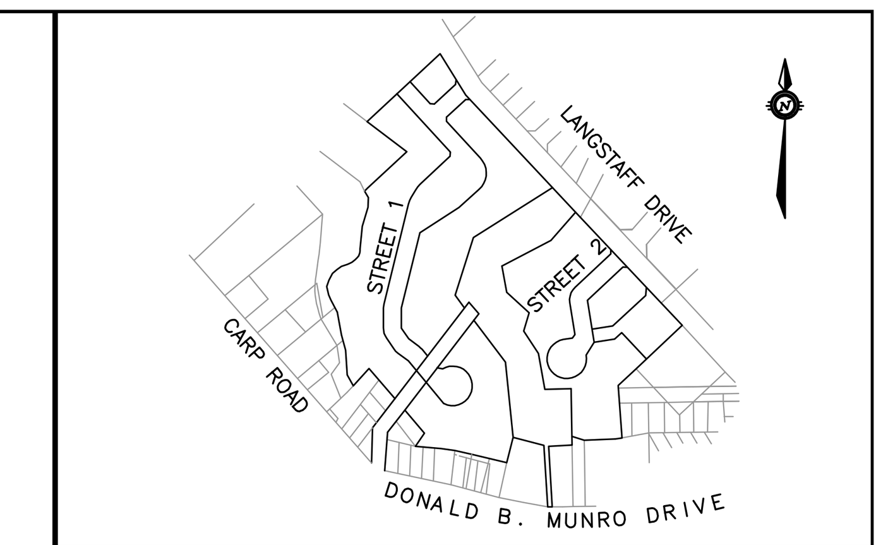
SEDIMENT CONTROL STRAW BALE DETAIL
N.T.S.



PLAN OF SILT FENCE BARRIER
N.T.S.

Typical Siltsack® Construction - Type B





KEY PLAN

LEGEND

—·—·—	PROPERTY BOUNDARY
— ● —	STORM SEWER AND MANHOLE
■	ROADSIDE CATCH BASIN
— ○ —	EXISTING STORM SEWER AND MANHOLE
□	EXISTING CATCH BASIN
—x—x—	SILT FENCE
▨	STRAW BALE CHECK DAM

EROSION & SEDIMENT CONTROL

1. SILT FENCE SHALL BE INSTALLED WHERE INDICATED AND MAINTAINED DURING CONSTRUCTION.
2. SILT SACKS SHALL BE INSTALLED UNDER THE FRAME AND COVER OF ALL PROPOSED AND EXISTING CATCH BASINS.
3. THE CONTRACTOR SHALL IMPLEMENT BEST MANAGEMENT PRACTICES, TO PROVIDE FOR PROTECTION OF THE AREA DRAINAGE SYSTEM DURING CONSTRUCTION ACTIVITIES. THE CONTRACTOR ACKNOWLEDGES THAT FAILURE TO IMPLEMENT APPROPRIATE EROSION AND SEDIMENT CONTROL MEASURES MAY BE SUBJECT TO PENALTIES IMPOSED BY ANY APPLICABLE REGULATORY AGENCY.

NOTES

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SCALE
0 10m 20m 40m
HORIZONTAL 1:1000

LICENSED PROFESSIONAL ENGINEER
S. M. CZARARYNSKI
JAN 21 2020
PROVINCE OF ONTARIO

Robinson
Land Development

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DESIGN	BLM
CHECKED	SMC
DRAWN	BLM
CHECKED	SMC
APPROVED	SMC

INVERNESS HOMES
38 AURIGA DRIVE, SUITE 200
OTTAWA, ON K2E 8A6

147 LANGSTAFF DRIVE
CARP, ON

EROSION AND SEDIMENT CONTROL PLAN

PROJECT No.	19008
SURVEY	RLD
DATED	JANUARY 2020
DWG. No:	19008-ESC1

Appendix B

Pipe Report

Junction Report

Watermain Design Sheet

Maximum Hour Pressure

Maximum Pressure

FUS Calculations

	PIPE: ID (Char)	PIPEHYD: LENGTH (Num)	PIPEHYD: DIAMETER (Num)	PIPEHYD: ROUGHNESS (Num)
1	87	131.99	203.00	110.00
2	89	236.23	203.00	110.00
3	93	150.42	203.00	110.00
4	95	53.32	203.00	110.00
5	97	36.61	203.00	110.00
6	99	121.35	203.00	110.00
7	101	89.31	203.00	110.00
8	103	62.54	203.00	110.00
9	105	123.64	203.00	110.00
10	107	71.77	152.00	100.00
11	109	42.39	152.00	100.00

	JUNCTION: ID (Char)	JUNCTION: ELEVATION (Num)
1	J1	107.97
2	J2	105.74
3	J3	107.85
4	J4	107.67
5	J5	106.00
6	J6	104.72
7	J7	103.70
8	J8	105.65
9	J9	104.97

WATERMAIN DESIGN SHEET

147 Langstaff Drive
Project No. 19008

TABLE

Junction Node Number	RESIDENTIAL POPULATION ACTUAL COUNT				NON-RES		AVG. DAILY DEMAND (l/s)				MAX. DAILY DEMAND (l/s)				MAX. HOURLY DEMAND (l/s)			
	Low Density	Medium Density	High Density	Total Population	COMM. (HA)	INST. (HA)	RES.	COMM.	INST.	TOTAL	RES.	COMM.	INST.	TOTAL	RES.	COMM.	INST.	TOTAL
J1		61	36	229.50			0.93			0.00	2.32			0.01	5.11			0.02
J2		5																
J3		21																
J4			72	129.60			0.53			0.00	1.31			0.01	2.89			0.01
J5																		
Total		87	108	234.90			0.95			0.95	2.38			2.38	5.23			5.23

Residential Densities

Low Density (SFH's) =	3.4	cap/unit
Medium Density (Townhouses) =	2.7	cap/unit
High Density (Apartments) =	1.8	cap/unit

Avg. Daily Demand:
Residential = 350 L/cap/day

Max. Daily Demand:
2.5 x Avg. Day

Max. Hourly Demand:
2.2 x Max. Day

		ID	Demand (Lpm)	Elevation (m)	Head (m)	Pressure (psi)
1		J1	0.00	107.97	149.95	59.68
2		J2	0.00	105.74	149.94	62.84
3		J3	0.00	107.85	149.94	59.83
4		J4	234.00	107.67	149.93	60.08
5		J5	146.40	106.00	149.93	62.45
6		J6	146.40	104.72	149.93	64.27
7		J7	214.20	103.70	149.94	65.74
8		J8	117.00	105.65	149.75	62.69
9		J9	367.20	104.97	149.68	63.56

		ID	Demand (Lpm)	Elevation (m)	Head (m)	Pressure (psi)
1		J1	0.00	107.97	160.00	73.96
2		J2	0.00	105.74	160.00	77.13
3		J3	0.00	107.85	160.00	74.13
4		J4	42.60	107.67	160.00	74.39
5		J5	26.40	106.00	160.00	76.76
6		J6	26.40	104.72	160.00	78.58
7		J7	39.00	103.70	160.00	80.03
8		J8	21.00	105.65	159.99	77.25
9		J9	66.60	104.97	159.99	78.21

FUS Fire Flow Calculations

Robinson Consultants

Project #: 19008
Project Name: 147 Langstaff Drive Carp
Date: 24-Apr-19

Calculations Based on 1999 Publication "Water Supply for Public Fire Protection" by Fire Underwriters' Survey (FUS)

Building Type/Description/Name: Bungalow Townhomes - 4 units

Table A: Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Unit	Total Fire Flow (L/min)
		Framing Material						
1	Choose Frame Used for Construction of Unit	Coefficient related to type of construction (C)	Wood Frame	1.5	Wood Frame	1.5	m	
			Ordinary Construction	1				
			Non-combustible construction	0.8				
			Fire resistive construction (< 2 hrs)	0.7				
			Fire resistive construction (> 2 hrs)	0.6				
		Floor Space Area						
2	Choose Type of Housing (if TH, Enter Number of Units per TH Block)	Type of Housing	Single Family	1	Townhouse - indicate # of units	4	Units	
			Townhouse - indicate # of units	6				
			Other (comm, ind, etc.)	1				
2.2	# of Storeys	Number of Floors/Storeys in the Unit (do not include basement):			1	1	Storeys	
2.3	Length-height factor	Length	North Side	32.0	Length-Height factor	32	m.Storeys	
			East Side	16.5	Length-Height factor	16.5	m.Storeys	
			South Side	32.0	Length-Height factor	32	m.Storeys	
			West Side	16.5	Length-Height factor	16.5	m.Storeys	
3	Enter Ground Floor Area of One Unit	Enter Ground Floor Area (A) of One Unit Only:			132	528	Area in Square Metres (m^2)	
		Measurement Units	Square Feet (ft^2)	0.09290304	Square Metres (m2)			
			Square Metres (m^2)	1				
			Hectares (ha)	10,000				
4	Obtain Required Fire Flow Without Reductions	Required Fire Flow (without reductions or increases per FUS) (F=220*C*√A), round to nearest 1000 L/min						8000
5	Apply Factors Affecting Burning	**Reductions/Increases Due to Factors Affecting Burning**						
5.1	Choose Combustibility of Building Contents	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Limited Combustible	-0.15	N/A	6800
			Limited Combustible	-0.15				
			Combustible	0				
			Free burning	0.15				
			Rapid Burning	0.25				
5.2	Choose Reduction Due to Presence of Sprinklers	Sprinkler reduction	Complete Automatic Sprinkler Protection	-0.3	None	0	N/A	0
			None	0				
5.3	Choose Separation Distance Between Units	Exposure Distance Between Units	North Side	50	5%	0.32	N/A	2560
			East Side	10	17%			
			South Side	48	5%			
			West Side	40	5%			
6	Obtain Required Fire Flow, Duration & Volume				***Total Required Fire Flow, rounded to nearest 1000 L/min:***			9000
					Total Required Fire Flow (above) in L/s:			150
					Required Duration of Fire Flow (hrs)			9.5
					Required Volume of Fire Flow (m^3)			5130

Note: The most current FUS document should be referenced before design to ensure that the above figures are consistent with the intent of the Guidelines

Legend	
	Drop down menu - choose option, or enter value
	No information, No input required

FUS Fire Flow Calculations

Robinson Consultants

Project #: 19008
Project Name: 147 Langstaff Drive Carp
Date: 24-Apr-19

Calculations Based on 1999 Publication "Water Supply for Public Fire Protection" by Fire Underwriters' Survey (FUS)

Building Type/Description/Name: Bungalow Townhomes - 5 units

Table A: Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Unit	Total Fire Flow (L/min)
		Framing Material						
1	**Choose Frame Used for Construction of Unit**	Coefficient related to type of construction (C)	Wood Frame	1.5	Wood Frame	1.5	m	
			Ordinary Construction	1				
			Non-combustible construction	0.8				
			Fire resistive construction (< 2 hrs)	0.7				
			Fire resistive construction (> 2 hrs)	0.6				
		Floor Space Area						
2	**Choose Type of Housing (if TH, Enter Number of Units per TH Block)**	Type of Housing	Single Family	1	Townhouse - indicate # of units	5	Units	
			Townhouse - indicate # of units	6				
			Other (comm, ind, etc.)	1				
2.2	**# of Storeys**	Number of Floors/Storeys in the Unit (do not include basement):			1	1	Storeys	
2.3	**Length-height factor**	Length	North Side	40.0	Length-Height factor	40	m.Storeys	
			East Side	16.5	Length-Height factor	16.5	m.Storeys	
			South Side	40.0	Length-Height factor	40	m.Storeys	
			West Side	16.5	Length-Height factor	16.5	m.Storeys	
3	**Enter Ground Floor Area of One Unit**	Enter Ground Floor Area (A) of One Unit Only:			132	660	Area in Square Metres (m^2)	
		Measurement Units	Square Feet (ft^2)	0.09290304	Square Metres (m2)			
			Square Metres (m^2)	1				
			Hectares (ha)	10,000				
4	**Obtain Required Fire Flow Without Reductions**	Required Fire Flow (without reductions or increases per FUS) (F=220*C*√A), round to nearest 1000 L/min						**8000**
5	**Apply Factors Affecting Burning**	**Reductions/Increases Due to Factors Affecting Burning**						
5.1	**Choose Combustibility of Building Contents**	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Limited Combustible	-0.15	N/A	**6800**
			Limited Combustible	-0.15				
			Combustible	0				
			Free burning	0.15				
			Rapid Burning	0.25				
5.2	**Choose Reduction Due to Presence of Sprinklers**	Sprinkler reduction	Complete Automatic Sprinkler Protection	-0.3	None	0	N/A	**0**
			None	0				
5.3	**Choose Separation Distance Between Units**	Exposure Distance Between Units	North Side	40	5%	0.23	N/A	**1840**
			East Side	35	5%			
			South Side	30	8%			
			West Side	40	5%			
6	**Obtain Required Fire Flow, Duration & Volume**	***Total Required Fire Flow, rounded to nearest 1000 L/min:***						**9000**
		Total Required Fire Flow (above) in L/s:						**150**
		Required Duration of Fire Flow (hrs)						**9.5**
		Required Volume of Fire Flow (m^3)						**5130**

Note: The most current FUS document should be referenced before design to ensure that the above figures are consistent with the intent of the Guidelines

Legend	
	Drop down menu - choose option, or enter value
	No information, No input required

FUS Fire Flow Calculations

Robinson Consultants

Project #: 19008
Project Name: 147 Langstaff Drive Carp
Date: 24-Apr-19

Calculations Based on 1999 Publication "Water Supply for Public Fire Protection" by Fire Underwriters' Survey (FUS)

Building Type/Description/Name: Bungalow Townhomes - 5 units Street #2

Table A: Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Unit	Total Fire Flow (L/min)
		Framing Material						
1	Choose Frame Used for Construction of Unit	Coefficient related to type of construction (C)	Wood Frame	1.5	Wood Frame	1.5	m	
			Ordinary Construction	1				
			Non-combustible construction	0.8				
			Fire resistive construction (< 2 hrs)	0.7				
			Fire resistive construction (> 2 hrs)	0.6				
		Floor Space Area						
2	Choose Type of Housing (if TH, Enter Number of Units per TH Block)	Type of Housing	Single Family	1	Townhouse - indicate # of units	5	Units	
			Townhouse - indicate # of units	6				
			Other (comm, ind, etc.)	1				
2.2	# of Storeys	Number of Floors/Storeys in the Unit (do not include basement):			1	1	Storeys	
2.3	Length-height factor	Length	North Side	40.0	Length-Height factor	40	m.Storeys	
			East Side	16.5	Length-Height factor	16.5	m.Storeys	
			South Side	40.0	Length-Height factor	40	m.Storeys	
			West Side	16.5	Length-Height factor	16.5	m.Storeys	
3	Enter Ground Floor Area of One Unit	Enter Ground Floor Area (A) of One Unit Only:			132	660	Area in Square Metres (m^2)	
		Measurement Units	Square Feet (ft^2)	0.09290304	Square Metres (m2)			
			Square Metres (m^2)	1				
			Hectares (ha)	10,000				
4	Obtain Required Fire Flow Without Reductions	Required Fire Flow (without reductions or increases per FUS) (F=220*C*√A), round to nearest 1000 L/min						8000
5	Apply Factors Affecting Burning	**Reductions/Increases Due to Factors Affecting Burning**						
5.1	Choose Combustibility of Building Contents	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Limited Combustible	-0.15	N/A	6800
			Limited Combustible	-0.15				
			Combustible	0				
			Free burning	0.15				
			Rapid Burning	0.25				
5.2	Choose Reduction Due to Presence of Sprinklers	Sprinkler reduction	Complete Automatic Sprinkler Protection	-0.3	None	0	N/A	0
			None	0				
5.3	Choose Separation Distance Between Units	Exposure Distance Between Units	North Side	6	18%	0.46	N/A	3680
			East Side	32	5%			
			South Side	6	18%			
			West Side	50	5%			
6	Obtain Required Fire Flow, Duration & Volume				***Total Required Fire Flow, rounded to nearest 1000 L/min:***			10000
					Total Required Fire Flow (above) in L/s:			166.667
					Required Duration of Fire Flow (hrs)			2
					Required Volume of Fire Flow (m^3)			1200

Note: The most current FUS document should be referenced before design to ensure that the above figures are consistent with the intent of the Guidelines

Legend	
	Drop down menu - choose option, or enter value
	No information, No input required

FUS Fire Flow Calculations

Robinson Consultants

Project #: 19008
Project Name: 147 Langstaff Drive Carp
Date: 24-Apr-19

Calculations Based on 1999 Publication "Water Supply for Public Fire Protection" by Fire Underwriters' Survey (FUS)

Building Type/Description/Name: Bungalow Townhomes - 6 units

Table A: Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Unit	Total Fire Flow (L/min)
		Framing Material						
1	Choose Frame Used for Construction of Unit	Coefficient related to type of construction (C)	Wood Frame	1.5	Wood Frame	1.5	m	
			Ordinary Construction	1				
			Non-combustible construction	0.8				
			Fire resistive construction (< 2 hrs)	0.7				
			Fire resistive construction (> 2 hrs)	0.6				
		Floor Space Area						
2	Choose Type of Housing (if TH, Enter Number of Units per TH Block)	Type of Housing	Single Family	1	Townhouse - indicate # of units	6	Units	
			Townhouse - indicate # of units	6				
			Other (comm, ind, etc.)	1				
2.2	# of Storeys	Number of Floors/Storeys in the Unit (do not include basement):			1	1	Storeys	
2.3	Length-height factor	Length	North Side	48.0	Length-Height factor	48	m.Storeys	
			East Side	16.5	Length-Height factor	16.5	m.Storeys	
			South Side	48.0	Length-Height factor	48	m.Storeys	
			West Side	16.5	Length-Height factor	16.5	m.Storeys	
3	Enter Ground Floor Area of One Unit	Enter Ground Floor Area (A) of One Unit Only:			132	792	Area in Square Metres (m^2)	
		Measurement Units	Square Feet (ft^2)	0.09290304	Square Metres (m2)			
			Square Metres (m^2)	1				
			Hectares (ha)	10,000				
4	Obtain Required Fire Flow Without Reductions	Required Fire Flow (without reductions or increases per FUS) (F=220*C*√A), round to nearest 1000 L/min						9000
5	Apply Factors Affecting Burning	**Reductions/Increases Due to Factors Affecting Burning**						
5.1	Choose Combustibility of Building Contents	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Limited Combustible	-0.15	N/A	7650
			Limited Combustible	-0.15				
			Combustible	0				
			Free burning	0.15				
			Rapid Burning	0.25				
5.2	Choose Reduction Due to Presence of Sprinklers	Sprinkler reduction	Complete Automatic Sprinkler Protection	-0.3	None	0	N/A	0
			None	0				
5.3	Choose Separation Distance Between Units	Exposure Distance Between Units	North Side	30	8%	0.35	N/A	3150
			East Side	38	5%			
			South Side	34	5%			
			West Side	6.5	17%			
6	Obtain Required Fire Flow, Duration & Volume							
							Total Required Fire Flow, rounded to nearest 1000 L/min:	**11000**
							Total Required Fire Flow (above) in L/s:	**183.333**
							Required Duration of Fire Flow (hrs)	**9.5**
							Required Volume of Fire Flow (m^3)	**6270**

Note: The most current FUS document should be referenced before design to ensure that the above figures are consistent with the intent of the Guidelines

Legend	
	Drop down menu - choose option, or enter value
	No information, No input required

FUS Fire Flow Calculations

Robinson Consultants

Project #: 19008
Project Name: 147 Langstaff Drive Carp
Date: 24-Apr-19

Calculations Based on 1999 Publication "Water Supply for Public Fire Protection" by Fire Underwriters' Survey (FUS)

Building Type/Description/Name: 36 Unit Apartment_1

Table A: Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Unit	Total Fire Flow (L/min)
		Framing Material						
1	**Choose Frame Used for Construction of Unit**	Coefficient related to type of construction (C)	Wood Frame	1.5	Wood Frame	1.5	m	
			Ordinary Construction	1				
			Non-combustible construction	0.8				
			Fire resistive construction (< 2 hrs)	0.7				
			Fire resistive construction (> 2 hrs)	0.6				
		Floor Space Area						
2	**Choose Type of Housing (if TH, Enter Number of Units per TH Block)**	Type of Housing	Single Family	1	Other (comm, ind, etc.)	1	Units	
			Townhouse - indicate # of units	1				
			Other (comm, ind, etc.)	1				
2.2	**# of Storeys**	Number of Floors/Storeys in the Unit (do not include basement):			3	3	Storeys	
2.3	**Length-height factor**	Length	North Side	45.0	Length-Height factor	135	m.Storeys	
			East Side	22.0	Length-Height factor	66	m.Storeys	
			South Side	45.0	Length-Height factor	135	m.Storeys	
			West Side	22.0	Length-Height factor	66	m.Storeys	
3	**Enter Ground Floor Area of One Unit**	Enter Ground Floor Area (A) of One Unit Only:			990	990	Area in Square Metres (m^2)	
		Measurement Units	Square Feet (ft^2)	0.09290304	Square Metres (m2)			
			Square Metres (m^2)	1				
			Hectares (ha)	10,000				
4	**Obtain Required Fire Flow Without Reductions**	Required Fire Flow (without reductions or increases per FUS) (F=220*C*√A), round to nearest 1000 L/min						**10000**
5	**Apply Factors Affecting Burning**	**Reductions/Increases Due to Factors Affecting Burning**						
5.1	**Choose Combustibility of Building Contents**	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Limited Combustible	-0.15	N/A	**8500**
			Limited Combustible	-0.15				
			Combustible	0				
			Free burning	0.15				
			Rapid Burning	0.25				
5.2	**Choose Reduction Due to Presence of Sprinklers**	Sprinkler reduction	Complete Automatic Sprinkler Protection	-0.3	None	0	N/A	**0**
			None	0				
5.3	**Choose Separation Distance Between Units**	Exposure Distance Between Units	North Side	34	5%	0.3	N/A	**3000**
			East Side	50	5%			
			South Side	13.5	15%			
			West Side	41	5%			
6	**Obtain Required Fire Flow, Duration & Volume**	***Total Required Fire Flow, rounded to nearest 1000 L/min:***						**12000**
		Total Required Fire Flow (above) in L/s:						**200**
		Required Duration of Fire Flow (hrs)						**2.5**
		Required Volume of Fire Flow (m^3)						**1800**

Note: The most current FUS document should be referenced before design to ensure that the above figures are consistent with the intent of the Guidelines

Legend	
	Drop down menu - choose option, or enter value
	No information, No input required

FUS Fire Flow Calculations

Robinson Consultants

Project #: 19008
Project Name: 147 Langstaff Drive Carp
Date: 24-Apr-19

Calculations Based on 1999 Publication "Water Supply for Public Fire Protection" by Fire Underwriters' Survey (FUS)

Building Type/Description/Name: 36 Unit Apartment_2

Table A: Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Unit	Total Fire Flow (L/min)
		Framing Material						
1	**Choose Frame Used for Construction of Unit**	Coefficient related to type of construction (C)	Wood Frame	1.5	Wood Frame	1.5	m	
			Ordinary Construction	1				
			Non-combustible construction	0.8				
			Fire resistive construction (< 2 hrs)	0.7				
			Fire resistive construction (> 2 hrs)	0.6				
		Floor Space Area						
2	**Choose Type of Housing (if TH, Enter Number of Units per TH Block)**	Type of Housing	Single Family	1	Other (comm, ind, etc.)	1	Units	
			Townhouse - indicate # of units	1				
			Other (comm, ind, etc.)	1				
2.2	**# of Storeys**	Number of Floors/Storeys in the Unit (do not include basement):			3	3	Storeys	
2.3	**Length-height factor**	Length	North Side	22.0	Length-Height factor	66	m.Storeys	
			East Side	45.0	Length-Height factor	135	m.Storeys	
			South Side	22.0	Length-Height factor	66	m.Storeys	
			West Side	45.0	Length-Height factor	135	m.Storeys	
3	**Enter Ground Floor Area of One Unit**	Enter Ground Floor Area (A) of One Unit Only:			990	990	Area in Square Metres (m^2)	
		Measurement Units	Square Feet (ft^2)	0.09290304	Square Metres (m2)			
			Square Metres (m^2)	1				
			Hectares (ha)	10,000				
4	**Obtain Required Fire Flow Without Reductions**	Required Fire Flow (without reductions or increases per FUS) (F=220*C*√A), round to nearest 1000 L/min						**10000**
5	**Apply Factors Affecting Burning**	**Reductions/Increases Due to Factors Affecting Burning**						
5.1	**Choose Combustibility of Building Contents**	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Limited Combustible	-0.15	N/A	**8500**
			Limited Combustible	-0.15				
			Combustible	0				
			Free burning	0.15				
			Rapid Burning	0.25				
5.2	**Choose Reduction Due to Presence of Sprinklers**	Sprinkler reduction	Complete Automatic Sprinkler Protection	-0.3	None	0	N/A	**0**
			None	0				
5.3	**Choose Separation Distance Between Units**	Exposure Distance Between Units	North Side	34	5%	0.29	N/A	**2900**
			East Side	50	5%			
			South Side	13.5	14%			
			West Side	41	5%			
6	**Obtain Required Fire Flow, Duration & Volume**	***Total Required Fire Flow, rounded to nearest 1000 L/min:***						**11000**
		Total Required Fire Flow (above) in L/s:						**183.333**
		Required Duration of Fire Flow (hrs)						**9.5**
		Required Volume of Fire Flow (m^3)						**6270**

Note: The most current FUS document should be referenced before design to ensure that the above figures are consistent with the intent of the Guidelines

Legend	
	Drop down menu - choose option, or enter value
	No information, No input required

FUS Fire Flow Calculations

Robinson Consultants

Project #: 19008
Project Name: 147 Langstaff Drive Carp
Date: 24-Apr-19

Calculations Based on 1999 Publication "Water Supply for Public Fire Protection" by Fire Underwriters' Survey (FUS)

Building Type/Description/Name: 36 Unit Apartment_2

Table A: Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Unit	Total Fire Flow (L/min)
		Framing Material						
1	**Choose Frame Used for Construction of Unit**	Coefficient related to type of construction (C)	Wood Frame	1.5	Wood Frame	1.5	m	
			Ordinary Construction	1				
			Non-combustible construction	0.8				
			Fire resistive construction (< 2 hrs)	0.7				
			Fire resistive construction (> 2 hrs)	0.6				
		Floor Space Area						
2	**Choose Type of Housing (if TH, Enter Number of Units per TH Block)**	Type of Housing	Single Family	1	Other (comm, ind, etc.)	1	Units	
			Townhouse - indicate # of units	1				
			Other (comm, ind, etc.)	1				
2.2	**# of Storeys**	Number of Floors/Storeys in the Unit (do not include basement):			3	3	Storeys	
2.3	**Length-height factor**	Length	North Side	22.0	Length-Height factor	66	m.Storeys	
			East Side	45.0	Length-Height factor	135	m.Storeys	
			South Side	22.0	Length-Height factor	66	m.Storeys	
			West Side	45.0	Length-Height factor	135	m.Storeys	
3	**Enter Ground Floor Area of One Unit**	Enter Ground Floor Area (A) of One Unit Only:			990	990	Area in Square Metres (m^2)	
		Measurement Units	Square Feet (ft^2)	0.09290304	Square Metres (m2)			
			Square Metres (m^2)	1				
			Hectares (ha)	10,000				
4	**Obtain Required Fire Flow Without Reductions**	Required Fire Flow (without reductions or increases per FUS) (F=220*C*√A), round to nearest 1000 L/min						**10000**
5	**Apply Factors Affecting Burning**	**Reductions/Increases Due to Factors Affecting Burning**						
5.1	**Choose Combustibility of Building Contents**	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Limited Combustible	-0.15	N/A	**8500**
			Limited Combustible	-0.15				
			Combustible	0				
			Free burning	0.15				
			Rapid Burning	0.25				
5.2	**Choose Reduction Due to Presence of Sprinklers**	Sprinkler reduction	Complete Automatic Sprinkler Protection	-0.3	None	0	N/A	**0**
			None	0				
5.3	**Choose Separation Distance Between Units**	Exposure Distance Between Units	North Side	30	9%	0.38	N/A	**3800**
			East Side	80	5%			
			South Side	30	9%			
			West Side	19	15%			
6	**Obtain Required Fire Flow, Duration & Volume**	***Total Required Fire Flow, rounded to nearest 1000 L/min:***						**12000**
		Total Required Fire Flow (above) in L/s:						**200**
		Required Duration of Fire Flow (hrs)						**2.5**
		Required Volume of Fire Flow (m^3)						**1800**

Note: The most current FUS document should be referenced before design to ensure that the above figures are consistent with the intent of the Guidelines

Legend	
	Drop down menu - choose option, or enter value
	No information, No input required

FUS Fire Flow Calculations

Robinson Consultants

Project #: 19008
Project Name: 147 Langstaff Drive Carp
Date: 24-Apr-19

Calculations Based on 1999 Publication "Water Supply for Public Fire Protection" by Fire Underwriters' Survey (FUS)

Building Type/Description/Name: 60 Unit Apartment

Table A: Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Unit	Total Fire Flow (L/min)
		Framing Material						
1	**Choose Frame Used for Construction of Unit**	Coefficient related to type of construction (C)	Wood Frame	1.5	Wood Frame	1.5	m	
			Ordinary Construction	1				
			Non-combustible construction	0.8				
			Fire resistive construction (< 2 hrs)	0.7				
			Fire resistive construction (> 2 hrs)	0.6				
		Floor Space Area						
2	**Choose Type of Housing (if TH, Enter Number of Units per TH Block)**	Type of Housing	Single Family	1	Other (comm, ind, etc.)	1	Units	
			Townhouse - indicate # of units	1				
			Other (comm, ind, etc.)	1				
2.2	**# of Storeys**	Number of Floors/Storeys in the Unit (do not include basement):			3	3	Storeys	
2.3	**Length-height factor**	Length	North Side	26.0	Length-Height factor	78	m.Storeys	
			East Side	74.0	Length-Height factor	222	m.Storeys	
			South Side	22.0	Length-Height factor	66	m.Storeys	
			West Side	94.0	Length-Height factor	282	m.Storeys	
3	**Enter Ground Floor Area of One Unit**	Enter Ground Floor Area (A) of One Unit Only:			990	990	Area in Square Metres (m^2)	
		Measurement Units	Square Feet (ft^2)	0.09290304	Square Metres (m2)			
			Square Metres (m^2)	1				
			Hectares (ha)	10,000				
4	**Obtain Required Fire Flow Without Reductions**	Required Fire Flow (without reductions or increases per FUS) (F=220*C*√A), round to nearest 1000 L/min						**10000**
5	**Apply Factors Affecting Burning**	**Reductions/Increases Due to Factors Affecting Burning**						
5.1	**Choose Combustibility of Building Contents**	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Limited Combustible	-0.15	N/A	**8500**
			Limited Combustible	-0.15				
			Combustible	0				
			Free burning	0.15				
			Rapid Burning	0.25				
5.2	**Choose Reduction Due to Presence of Sprinklers**	Sprinkler reduction	Complete Automatic Sprinkler Protection	-0.3	None	0	N/A	**0**
			None	0				
5.3	**Choose Separation Distance Between Units**	Exposure Distance Between Units	North Side	30	9%	0.38	N/A	**3800**
			East Side	80	5%			
			South Side	30	9%			
			West Side	19	15%			
6	**Obtain Required Fire Flow, Duration & Volume**				***Total Required Fire Flow, rounded to nearest 1000 L/min:***			**12000**
					Total Required Fire Flow (above) in L/s:			**200**
					Required Duration of Fire Flow (hrs)			**2.5**
					Required Volume of Fire Flow (m^3)			**1800**

Note: The most current FUS document should be referenced before design to ensure that the above figures are consistent with the intent of the Guidelines

Legend	
	Drop down menu - choose option, or enter value
	No information, No input required

Appendix C

Correspondence with City

Sanitary Sewer Design Sheet

Sanitary Drainage Area Plan
(DWG. 19008-SAN1)

From: Alvey, Harry <Harry.Alvey@ottawa.ca>
Sent: May 22, 2019 3:32 PM
To: Sean Czaharynski <sczaharynski@rcii.com>
Cc: McCormick, Sarah <sarah.mccormick@ottawa.ca>
Subject: RE: 147 Langstaff Drive, Carp - Design Sanitary Flow

Good Afternoon Sean,

Yes, I did and tentatively I have a response from our Infrastructure Planning group, but have not heard back from our Operations group. Infrastructure Planning states that will capacity is tight there should be capacity in the system for our proposed development with these caveats:

- *The peak inflow in 2017 at the station approached 40 l/s. The pumping capacity of the facility is +/- 57 l/s.*
- *The developer/engineer should review the capacity of the receiving sewer.*
- *In addition, a sanitary overflow within the development may be required to protect homes from a failure at the pump station (refer to Technical Bulletin ISTB-2018-01 for details on the sanitary overflow analysis criteria).*

However, I'll caution that we have not yet received a response from Operations regarding any issues they might have with the additional capacity. Once I receive a response from them, I'll forward that to you as well.

Harry

Harry R. Alvey, P.E., P.Eng.
Note: I'll be on Vacation starting Monday, July 15th, 2019 and returning Monday July 29th, 2019.
Project Manager
Planning, Infrastructure and Economic Development Department
Development Review Rural Branch
Services de la planification, de l'infrastructure et du développement économique
City of Ottawa | Ville d'Ottawa
613.580.2424 ext./poste 28103
ottawa.ca/planning / ottawa.ca/urbanisme

From: Sean Czaharynski <sczaharynski@rcii.com>
Sent: May 22, 2019 14:40
To: Alvey, Harry <Harry.Alvey@ottawa.ca>
Subject: FW: 147 Langstaff Drive, Carp - Design Sanitary Flow

Good Afternoon Harry

Just touching base to confirm you received my email last Thursday and if you need any additional information from me to regarding sanitary capacity in the City's network.

Regards,

Sean Czaharynski, P.Eng. | Manager - Land Development

Robinson Land Development
350 Palladium Drive, Suite 210, Ottawa ON, K2V 1A8
T.(613) 592-6060 ext. 152 | rcii.com

From: Sean Czaharynski
Sent: May 16, 2019 3:10 PM
To: Alvey, Harry <Harry.Alvey@ottawa.ca>
Cc: McCormick, Sarah (sarah.mccormick@ottawa.ca) <sarah.mccormick@ottawa.ca>; 'Kyle MacHutchon' <kyle@invernesshomes.ca>; 'Jack Stirling (jack@thestirlinggroup.ca)' <jack@thestirlinggroup.ca>; Alison Stirling (alison@thestirlinggroup.ca) <alison@thestirlinggroup.ca>; Peter Hume <peter.hume@hpurban.ca>
Subject: 147 Langstaff Drive, Carp - Design Sanitary Flow

Harry

We've completed our preliminary calculations for the design sanitary flows based on the most current development plan.

Attached is a sanitary drainage area plan that outlines the overall sanitary drainage area's and summarizes the unit counts for each contributing area. Also attached is the sanitary design sheet.

The larger development area (5.24 Ha) will outlet to the existing sanitary system at the intersection of Donald B Munro Drive and Carp Road with a peak flow of 4.84 L/sec. The smaller development area (2.82 Ha) will outlet to Langstaff Drive at two locations with a total peak flow of 3.47 L/sec.

Can you confirm that the existing municipal sanitary sewer system has capacity for these flows?

Please let me know if you have any questions.

Regards,

Sean Czaharynski, P.Eng. | Manager - Land Development

Robinson Land Development
350 Palladium Drive, Suite 210, Ottawa ON, K2V 1A8
T.(613) 592-6060 ext. 152 | rcii.com

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SANITARY SEWER DESIGN SHEET
for
147 LANGSTAFF DRIVE, CARP

LOCATION				RESIDENTIAL AREA AND POPULATION				FLOW				PIPE						
				INDIVIDUAL		CUMULATIVE												
STREET	DRAINAGE AREA	FROM MH	TO MH	POP.	AREA (ha)	POP.	AREA (ha)	PEAK FACTOR	PEAK POP. FLOW (L/s)	EXTRAN. FLOW (L/s)	PEAK DESIGN FLOW (L/s)	LENGTH (m)	DIAMETER (mm)	SLOPE (%)	CAPACITY (L/s)	VELOCITY (m/s)	EXCESS CAPACITY (L/s)	PERCENT FULL
TO CARP ROAD SEWER																		
STREET 1		100	101	8.1	0.19	8.1	0.19	3.74	0.10	0.06	0.16	37.7	201.16	1.06	34.33	1.08	34.17	0.47
STREET 1		102	101	10.8	0.21	10.8	0.21	3.73	0.13	0.07	0.20	37.7	201.16	1.09	34.81	1.10	34.61	0.57
STREET 1		101	103	13.5	0.27	32.4	0.67	3.68	0.39	0.22	0.61	49.1	201.16	1.06	34.33	1.08	33.72	1.77
STREET 1		103	104	10.8	0.20	43.2	0.87	3.66	0.51	0.29	0.80	18.9	201.16	1.38	39.17	1.23	38.37	2.04
STREET 1		104	105	40.5	0.90	83.7	1.77	3.61	0.98	0.58	1.56	69.3	201.16	1.14	35.60	1.12	34.04	4.39
STREET 1		105	107	40.5	0.83	124.2	2.60	3.57	1.44	0.86	2.30	90.4	201.16	1.50	40.84	1.28	38.54	5.62
STREET 1		107	108	10.8	0.22	135.0	2.82	3.56	1.56	0.93	2.49	21.9	201.16	0.87	31.10	0.98	28.61	8.01
STREET 1		108	109	8.1	0.17	143.1	2.99	3.56	1.65	0.99	2.64	15.4	201.16	0.84	30.56	0.96	27.92	8.63
STREET 1		109	110	5.4	0.15	148.5	3.14	3.55	1.71	1.04	2.75	19.4	201.16	1.44	40.01	1.26	37.26	6.86
STREET 1		110	111	5.4	0.11	153.9	3.25	3.55	1.77	1.07	2.84	26.8	201.16	3.66	63.79	2.01	60.94	4.46
PRIVATE		BLK 26	112	75.6	0.72	75.6	0.72	3.62	0.89	0.24	1.12	4.0	201.16	2.00	47.15	1.48	46.03	2.38
STREET 1		112	111	8.1	0.24	83.7	0.96	3.61	0.98	0.32	1.30	30.6	201.16	0.49	23.34	0.73	22.04	5.55
EASEMENT		111	113	0.0	0.04	237.6	4.25	3.50	2.69	1.40	4.09	43.5	201.16	3.40	61.48	1.93	57.38	6.66
EASEMENT		113	114	0.0	0.05	237.6	4.30	3.50	2.69	1.42	4.11	31.7	201.16	4.79	72.97	2.30	68.86	5.63
EASEMENT		114	115	0.0	0.05	237.6	4.35	3.50	2.69	1.44	4.13	28.9	201.16	4.98	74.41	2.34	70.28	5.55
EASEMENT		115	EX 27A	0.0	0.02	237.6	4.37	3.50	2.69	1.44	4.13	20.0	201.16	5.00	74.55	2.35	70.42	5.54
TO LANGSTAFF DRIVE SEWER																		
PRIVATE		BLK 24/25	119	163.8	0.78	163.8	0.78	3.54	1.88	0.26	2.14	4.0	201.16	0.50	23.58	0.74	21.44	9.07
STREET 2		119	118	10.8	0.31	174.6	1.09	3.54	2.00	0.36	2.36	35.8	201.16	0.42	21.61	0.68	19.25	10.92
STREET 2		118	117	2.7	0.05	177.3	1.14	3.53	2.03	0.38	2.41	6.6	201.16	0.45	22.37	0.70	19.96	10.76
STREET 2		117	116	27.0	0.60	204.3	1.74	3.52	2.33	0.57	2.90	52.8	201.16	0.49	23.34	0.73	20.44	12.43
STREET 2		116	EX 55A	0.0	0.01	204.3	1.75	3.52	2.33	0.58	2.91	10.5	201.16	0.48	23.10	0.73	20.19	12.58

DESIGN PARAMETERS

Average Daily Flow =	280	L/person/day
Comm./Inst. Flow =		
Industrial Flow =		
Maximum Residential Peak Factor =	4.0	
Harmon - Correction Factor (K) =	0.8	
Comm./Inst. Peak Factor =		
Extraneous Flow =	0.33	L/s/ha

Per Unit Populations:	
Single Family	3.4 persons/unit
Semi-detached	2.7 persons/unit
Duplex	2.3 persons/unit
Townhouse (ro	2.7 persons/unit
Apartments:	
Bachelor	1.4 persons/unit
1 Bedroom	1.4 persons/unit
2 Bedroom	2.1 persons/unit
3 Bedroom	3.1 persons/unit
Average Apt.	1.8 persons/unit

NOTES

THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

NO.	REVISION DESCRIPTION	DATE	BY
2	REVISED PER CITY COMMENTS	21/01/20	SMC
1	ISSUED FOR SUBDIVISION APPLICATION	05/12/19	SMC

SCALE
0 10m 20m 40m
HORIZONTAL 1:1000

LICENSED PROFESSIONAL ENGINEER
S. M. CZAHARYNSKI
JAN 21 2020
PROVINCE OF ONTARIO

Robinson Land Development
CONSULTING ENGINEERS
350 PALLADIUM DRIVE
KANATA, ONTARIO K2V 1A8
TELEPHONE (613) 592-6060

DESIGN	BLM
CHECKED	SMC
DRAWN	BLM
CHECKED	SMC
APPROVED	SMC

INVERNESS HOMES
38 AURIGA DRIVE, SUITE 200
OTTAWA, ON K2E 8A6

147 LANGSTAFF DRIVE
CARP, ON

SANITARY DRAINAGE AREA PLAN

PROJECT No. 19008
SURVEY RLD
DATED JANUARY 2020
DWG. No: 19008-SAN1

Appendix D

Storm Sewer Design Sheet

Storm Drainage Area Plan
(DWG. 19008-STM1)

Pre-Application Consultation Notes

Stormwater Treatment Unit
Correspondence

Free Flow Calculations

ECA for Existing SWM Facilities

PSR Report

Modelling Outputs

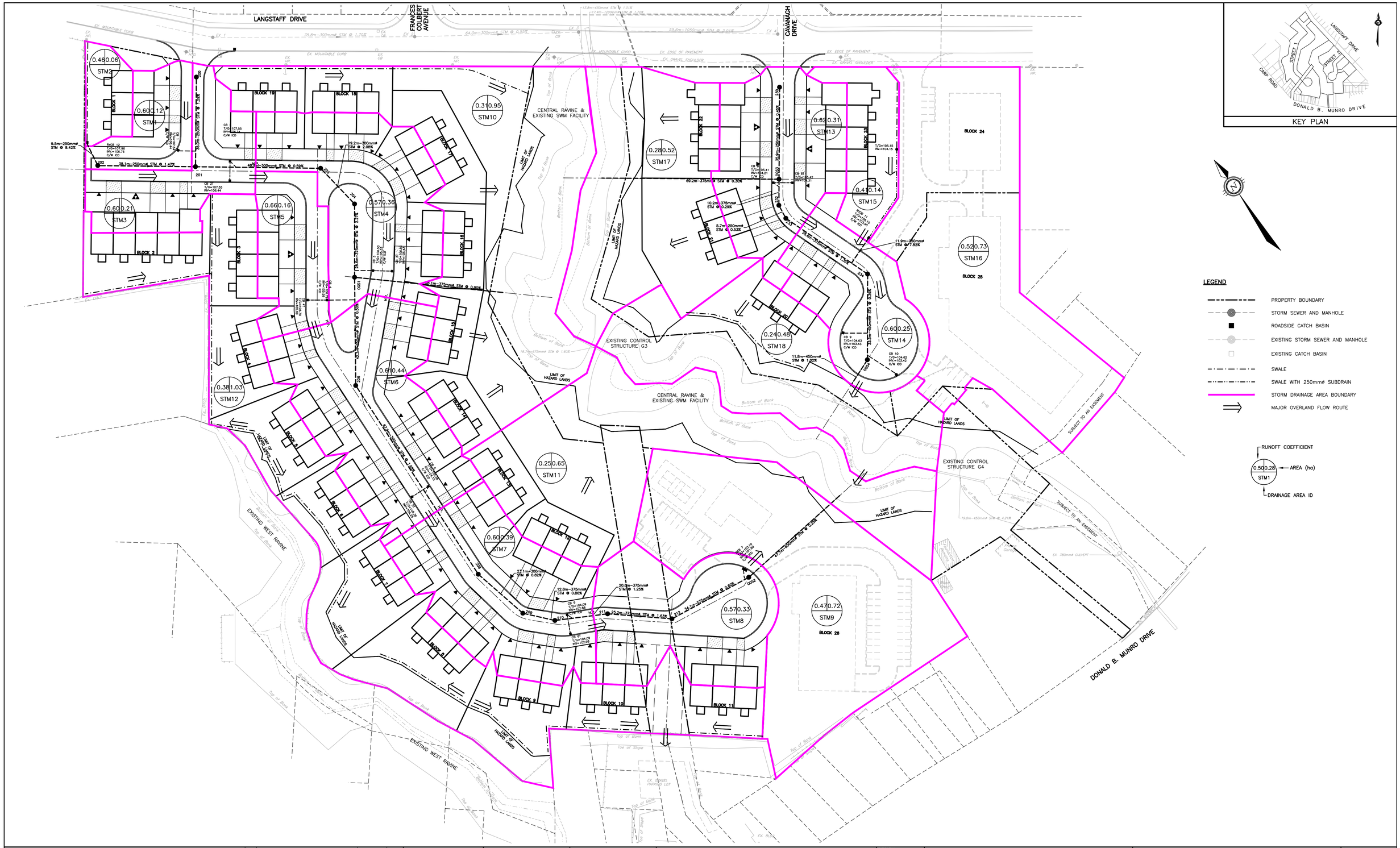
Figure 4 – Hydrologic Model - SWM

Runoff Coefficient Calculations

STORM SEWER DESIGN SHEET
for
147 LANGSTAFF DRIVE, CARP

LOCATION				AREA (ha)		INDIV. 2.78AR	ACCUM. 2.78AR	TIME OF CONC. (min)	5 YR RAINFALL INTENSITY (mm/hr)	5 YR PEAK FLOW (L/s)	PROPOSED SEWER						
DRAINAGE AREA	STREET NAME	FROM MH	TO MH	TOTAL AREA	C						PIPE DIA. (mm)	GRADE (%)	LENGTH (m)	CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)	TIME OF FLOW (min)	PERCENT FULL
STM1	STREET 1	200	201	0.12	0.60	0.19	0.19	10.00	104.19	20.00	251.5	1.29	35.0	68.67	1.38	0.42	29%
STM2	STREET 1	RYCB 12	202	0.06	0.46	0.08	0.08	10.00	104.19	8.57	251.5	8.42	9.5	175.44	3.53	0.04	5%
	STREET 1	202	201	0.00	0.00	0.00	0.08	10.04	103.96	8.55	251.5	1.47	38.1	73.30	1.48	0.43	12%
STM3	STREET 1	201	203	0.21	0.60	0.35	0.62	10.48	101.75	63.55	299.4	0.59	48.9	73.93	1.05	0.78	86%
	STREET 1	203	204	0.00	0.00	0.00	0.62	11.25	98.02	61.22	299.4	2.08	19.2	138.81	1.97	0.16	44%
STM4	STREET 1	204	OGS1	0.36	0.57	0.57	1.20	11.41	97.28	116.62	366.4	2.27	28.6	248.60	2.36	0.20	47%
STM5	STREET 1	206	205	0.16	0.66	0.30	0.30	10.00	104.19	31.22	251.5	0.50	42.3	42.75	0.86	0.82	73%
	EASEMENT	OGS1	G3 OUTLET	0.00	0.00	0.00	1.50	11.62	96.37	144.42	366.4	0.90	58.1	156.53	1.48	0.65	92%
STM6	STREET 1	206	208	0.44	0.61	0.75	0.75	10.00	104.19	78.51	299.4	1.98	87.9	135.43	1.92	0.76	58%
	STREET 1	208	209	0.00	0.00	0.00	0.75	10.76	100.34	75.60	299.4	0.82	23.1	87.16	1.24	0.31	87%
	STREET 1	209	210	0.00	0.00	0.00	0.75	11.07	98.85	74.48	366.4	0.86	12.8	153.02	1.45	0.15	49%
STM7	STREET 1	210	211	0.39	0.60	0.64	1.39	11.22	98.17	136.87	366.4	1.25	20.8	184.48	1.75	0.20	74%
	STREET 1	211	212	0.00	0.00	0.00	1.39	11.42	97.26	135.61	366.4	1.63	25.2	210.66	2.00	0.21	64%
STM8/9	STREET 1	212	OGS2	1.05	0.50	1.45	2.85	11.63	96.32	274.23	533.0	0.62	34.1	352.92	1.58	0.36	78%
	EASEMENT	OGS2	G4 OUTLET	0.00	0.00	0.00	2.85	11.99	94.75	269.77	610.0	0.25	47.7	321.16	1.10	0.72	84%
	STREET 2	230	OGS3	0.00	0.00	0.00	0.00	10.00	104.19	0.00	251.5	0.45	35.9	40.56	0.82	0.73	0%
	STREET 2	233	232	0.00	0.00	0.00	0.00	10.00	104.19	0.00	251.5	0.53	5.7	44.01	0.89	0.11	0%
STM13	STREET 2	232	231	0.31	0.62	0.54	0.54	10.11	103.63	55.76	366.4	0.29	10.2	88.86	0.84	0.20	63%
	EASEMENT	OGS3	G3 OUTLET	0.00	0.00	0.00	0.54	10.73	100.48	54.07	366.4	0.30	69.2	90.36	0.86	1.35	60%
STM15	STREET 2	RYCB 11	MAIN	0.14	0.41	0.16	0.16	10.00	104.19	16.24	251.5	7.82	11.9	169.14	3.40	0.06	10%
STM16	STREET 2	233	234	0.73	0.52	1.06	1.22	10.06	103.89	126.64	366.4	1.35	38.6	191.69	1.82	0.35	66%
STM14	STREET 2	234	OGS4	0.25	0.60	0.42	1.64	10.41	102.07	167.47	457.0	0.39	33.5	185.72	1.13	0.49	90%
	STREET 2	OGS4	G4 OUTLET	0.00	0.00	0.00	1.64	10.91	99.64	163.49	457.0	1.02	11.8	300.35	1.83	0.11	54%

Rainfall Intensity = 998.071 / (T + 6.053)$^{0.814}$ T= time in minutes
Peak Flow = Accummulated 2.78AR x Rainfall Intensity



KEY PLAN

LEGEND

- PROPERTY BOUNDARY
- STORM SEWER AND MANHOLE
- ROADSIDE CATCH BASIN
- EXISTING STORM SEWER AND MANHOLE
- EXISTING CATCH BASIN
- SWALE
- SWALE WITH 250mmø SUBDRAIN
- STORM DRAINAGE AREA BOUNDARY
- MAJOR OVERLAND FLOW ROUTE

RUNOFF COEFFICIENT
0.500.28 STM1 — AREA (ha)
DRAINAGE AREA ID

NOTES

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HORIZONTAL

LICENSED PROFESSIONAL ENGINEER
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JANUARY 21 2020
PROVINCE OF ONTARIO

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350 PALLADIUM DRIVE
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TELEPHONE (613) 592-6060

DESIGN	BLM
CHECKED	SMC
DRAWN	BLM
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INVERNESS HOMES
38 AURIGA DRIVE, SUITE 200
OTTAWA, ON K2E 8A6

147 LANGSTAFF DRIVE
CARP, ON

STORM DRAINAGE AREA PLAN

PROJECT No.	19008
SURVEY	RLD
DATED	JANUARY 2020
DWG. No:	19008-STM1

Pre-Application Consultation Notes

Date:	December 12th, 2018
Subject Address:	147 Langstaff Road
City Staff Attendees:	Sarah McCormick, Planner II (File lead) Harry Alvey, Project Manager Matthew Hayley, Planner II (Environmental) Amira Shehata, Project Manager (Transportation) Mark Young, Planner II (Urban Design) Niall Oddie, Planner - Mississippi Valley Conservation Authority
Existing Use:	Vacant greenfield with watercourse and ravine bisecting the property. Tree cover is located adjacent to the watercourse and ravine.
Existing Policies:	
Zoning:	V1O, V3B, V1N,
Official Plan:	Village
CDP:	Residential – Multi-Unit, Potential Fairground Expansion, Open Space
Proposed Use:	Residential subdivision of approximately 100 residential units (mix of singles and townhomes)
Comments:	
Planning Sarah.McCormick@ottawa.ca **(613) 580-2424 ext. 24487** **Urban Design** Mark.Young@ottawa.ca **(613) 580-2424 ext. 41396**	The Subject property is located within the Village designation of the Official Plan which permits the development of residential subdivisions. Please ensure to reference the Carp Road Community Design Plan (CDP) when designing the subdivision. The property is identified as Residential – multi unit, Potential Fairground Expansion and Open Space. A planning rationale must include a discussion on how the plan of subdivision complies with the CDP, with a specific discussion focused on the Potential Fairground Expansion Area. As per Schedule C of the CDP, pedestrian linkages connecting Carp Road and Langstaff Drive are required. Staff will be looking to ensure that these pedestrian linkages are achieved. For those lots that are bound by both Langstaff Drive and local roads, staff's preference would be to have the new homes front onto Langstaff versus the local road. Setbacks from the ravine will be determined through the findings of the Geotechnical and Slope Stability Study, and discussions with the Conservation Authority, while having consideration to the minimum water setback requirements of Section 69 of the City of Ottawa's Zoning By-law.

	Staff strongly recommends that you pre-consult with Councillor El-Chantiry, as there was significant public interest in maintaining the Potential Fairground Expansion Area.
Infrastructure **Harry.Alvey@ottawa.ca** **(613)580-2424 ext. 28103**	There is sanitary sewer and watermain located along Langstaff Dr. that the proposed development might be able to connect to if there is capacity in the existing utilities. To determine this the applicant should provide the City with their anticipated utility design flows so the boundary conditions for these utilities can be check to see there is capacity. There is a ravine, which appears to be 3 to 4 metres deep and is a designated water coarse, and bisects the proposed development. The presence of the ravine will require the submission of the following reports ○ Fluvial Geomorphology Report ○ Geotechnical Report with a Slope Stability analysis at key locations. ○ There is an easement, which was established along this ravine in the past, which might need modification based on the information provided in the Fluvial Geomorphology Report. Currently GeoOttawa indicates there are two (2) dry Stormwater ponds located in the ravine that predate the application. These SWM ponds need to be identified and a determination of their current service area and in use status. Stormwater Management and the proposed SWM pond located at the north end of the ravine will need to be reviewed by the Mississippi Conservation Authority as well as the City Municipal Drain Group prior to approval. There appears to be a hazard lands easement placed in the rear of the lots, which back up to the ravine. The development of lot parcels is not generally allowed with in these setback areas per the Official Plan of Ottawa, Section 4.7.3. The development shows that it will consist of two Cul-De-Sac. The northwesterly one has 61 single family units located along it. Unless the watermain is looped into another watermain, they are not allowed to have more than 49 single-family units on a dead-end watermain per Section 4.3.1 of the City Water Distribution Guidelines. The entire development is within the Wellhead Protection of the Carp Water Treatment Facility. The site falls in the source water protection zones from 6 to 10.

	Please note that the Village of Carp Master Drainage Plan, Robinson Consultants, May 1996, advised against wet ponds with concerns of destabilizing valley slopes. The report continues to recommend a facility with a minimum detention time of 12 hours, a minimum length-to-width ratio of 3:1, a sediment forebay, and a perforated riser outlet. The report suggested that the culvert under Langstaff Avenue be modelled carefully due to its impact on flows. The proposed the stormwater management quantity criteria for the proposed development is 100-year post-development to match 2-year pre-development. If the subdivision application discharges directly to a watercourse the MECP approval would be of the direct type of submission and a transfer-of-review for the sewers and possibly an additional, third, application depending on the type of SWM proposed- the type of SWM would determine which ECA type it would be. Legal access to the existing on-line SWM pond will be required to be dedicated in due course. There are two (2) existing unused road allowances, which run through the proposed development, which will need to be abandoned. This will need to be coordinated with City R.O.W. Staff recommend discussion with the Mississippi Valley Conservation Authority regarding the use of the ravine for SWM pond and setback requirements. There is the possibility that there are requirements for cooling the stormwater runoff prior to entering the ravine. A MECP ECA for the stormwater management pond will be required in addition to Conservation Authority approval for SWM within the ravine area.
Environment **Sami.Rehman@ottawa.ca** **(613)580-2424 ext. 13364**	The meeting was attending by Kerry Reed who provided the following comments. Any follow up questions can be directed to Sami Rehman. Natural Heritage Features: There are surface water features on and adjacent to the subject property- within MVCA's jurisdiction. The woodland on site has been identified as significant woodlands by the MNRF. The ravine and associated woodland provide a linkage function and are part of the natural heritage system. Species at Risk: Eastern meadowlark, barn swallow, and bobolink have been

	identified on site and chimney swift, bank swallow, Blanding's turtle, eastern silvery minnow, snapping turtle observations in proximity to the site. There is potential for butternut trees. Consistent with the Official Plan an Environmental Impact Statement is required for any development within or adjacent to land determined to be a component of the Natural Heritage System and a Tree Conservation Report is required for all Plans of Subdivision where there is a tree of 10 cm in diameter or greater on the site. An Integrated Environmental Review will need to be included in the Planning Rationale One of the key recommendations of the Carp River Watershed/Subwatershed Plan is for channel improvements and enhancements of the riparian vegetation along the Carp River and its tributaries to contribute to the overall health of the Carp River system. The Environmental Management Plan: – protect ravine lands by rezoning to EP/hazard lands - Existing ravine lands should be protected as wildlife corridors and for significant specimen trees. A vegetated buffer strip should be maintained along the top of bank of all ravines - A 15 m setback from top-of-bank - Vegetated cover using native species will be established and enhanced in the setback/buffer area through conditions of development approval and encouraged through stewardship programs in existing developed areas - Tribs no. 1 & 2 and their associated corridors should be dedicated into public ownership Refer to Section 2.3 Environmental Protection and its policies of the Village of Carp CDP, the Village of Carp Environmental Management Plan and the watershed/subwater plan for further information
Risk Management **Tessa.Dilorio@ottawa.ca** **(613)580-2424 . 17658**	<u>Requirement for Source Protection Policy Screening</u> The information below is provided as part of a development pre-consultation; a complete source protection policy screening <u>will be required from the City's Risk Management Official</u> once the development plan is finalized. Note that Mississippi-Rideau Source Protection Plan Policies ADMIN-1-LB and ADMIN-2-LB identify that: • A Notice from the Risk Management Official in accordance to Section 59 of the *Clean Water Act* is required prior to approval of any *Planning Act* application • Alternatively, a Notice may not be required if the applicant can demonstrate to the satisfaction of the planning authority

that a significant drinking water threat (SDWT) activity designated under Section 57 or Section 58 of the *Clean Water Act* will not be engaged in

Overview of Site Location in the Drinking Water Protection Zone

The proposed subdivision lies within the Mississippi-Rideau Source Protection Region and is subject to the policies of the Mississippi-Rideau Source Protection Plan. The plan can be referenced at: https://www.mrsourcewater.ca/en/library/reports/17-mississippi-rideau-source-protection-plan

The proposed subdivision is located within the Wellhead Protection Area (WHPA) for the Carp Municipal Supply Well, specifically, the proposed subdivision includes the following areas:

- WHPA-B, vulnerability score 10 – which include a small portion on the east portion of the site
- WHPA-C, vulnerability score 8 and 6 – approximately the east half of the site
- WHPA-D, vulnerability score 6 and 4 – approximately the west half of the site

Source Protection Policies that may be applicable (dependent on specific activities/circumstances)

Notes:

- There are no legally-binding prohibition polices that are applicable for solely residential developments
- There are no legally-binding policies applicable in WHPA-D

WHPA-B, vulnerability score 10

- There are 10 prohibition policies and 34 risk management policies applicable for this vulnerable area, most are not related to residential developments.
- Of note are the following policies (**please refer to the Policy in the Source Protection Plan for exact wording of each policy, below is a summary only**):

Policy	General description
SEW-4-LB: Mandatory Connection to Municipal Sewer Services.	If the connection (and capacity) is available, then connection to municipal sewer is mandatory (i.e. no on-site septic system permitted).
SEW-7-LB-PI-MC: **Future Sanitary Sewers and Related Pipes – Prescribed**	New sanitary sewers or related pipes in the WHPA (score 10) will be required to be constructed of

	Instrument	watermain quality pipe and pressure tested in place at a pressure of 350 kPa (50 psi) using testing methodology in the Ontario Provincial Strandard Specification 412 (OPSS 412). The implementation of this policy will be overseen/reviewed under the ECA related to the sewer infrastructure, administered by the MECP.
	SEW-10-LB-PI-MC – Future Stormwater Management Facility in WHPA "B" scored 10 – Prescribed Instrument.	A stormwater management facility (which includes stormwater ponds, stormwater pipes and their discharges) is a significant drinking water threat in a WHPA with a vulnerability score of 10 if: • The drainage area is >100 ha and the drainage area is rural, agricultural, or residential • The drainage area is >10 ha and the drainage are is industrial/commercial If considered a significant drinking water threat, then the ECA will include terms and conditions to manage the threat. Which will be reviewed by the MECP.
	FUEL-1-LB-S58 – Fuel (Heating Oil) – Risk Management Plan	If heating oil is used for home heating, then a risk management plan will be required to be negotiated with the Risk Management Official prior to

		approval of the Planning Act application. An alternate source of home heating is recommended (i.e. natural gas).

NOTE – there are many applicable legally-binding policies related to non-residential developments (i.e. commercial, industrial, etc). If any non-residential development is planned, then please contact the City's Risk Management Official to discuss the location and type of proposed activities to determine if any restrictions or requirements apply.

WHPA-C, vulnerability score 8 and 6

- There are no applicable legally-binding policies for solely residential development.
- **NOTE –** there are a few applicable legally-binding policies related to non-residential developments (i.e. commercial, industrial, etc); policies are related to the storage/management of certain chemicals (at any quantity), sewer works and waste disposal sites. If any non-residential development is planned, then please contact the City's Risk Management Official to discuss the location and type of proposed activities and any restrictions or requirements that may apply.

WHPA-D, vulnerability score 8 and 6

- There are no applicable legally-binding policies within WHPA-D.

Other

Education and Outreach:

Due to the proximity to the municipal well and the location of the development within the Wellhead Protection Area, it is recommended that all new residents be provided with an information package related to Source Water Protection prior to occupancy.

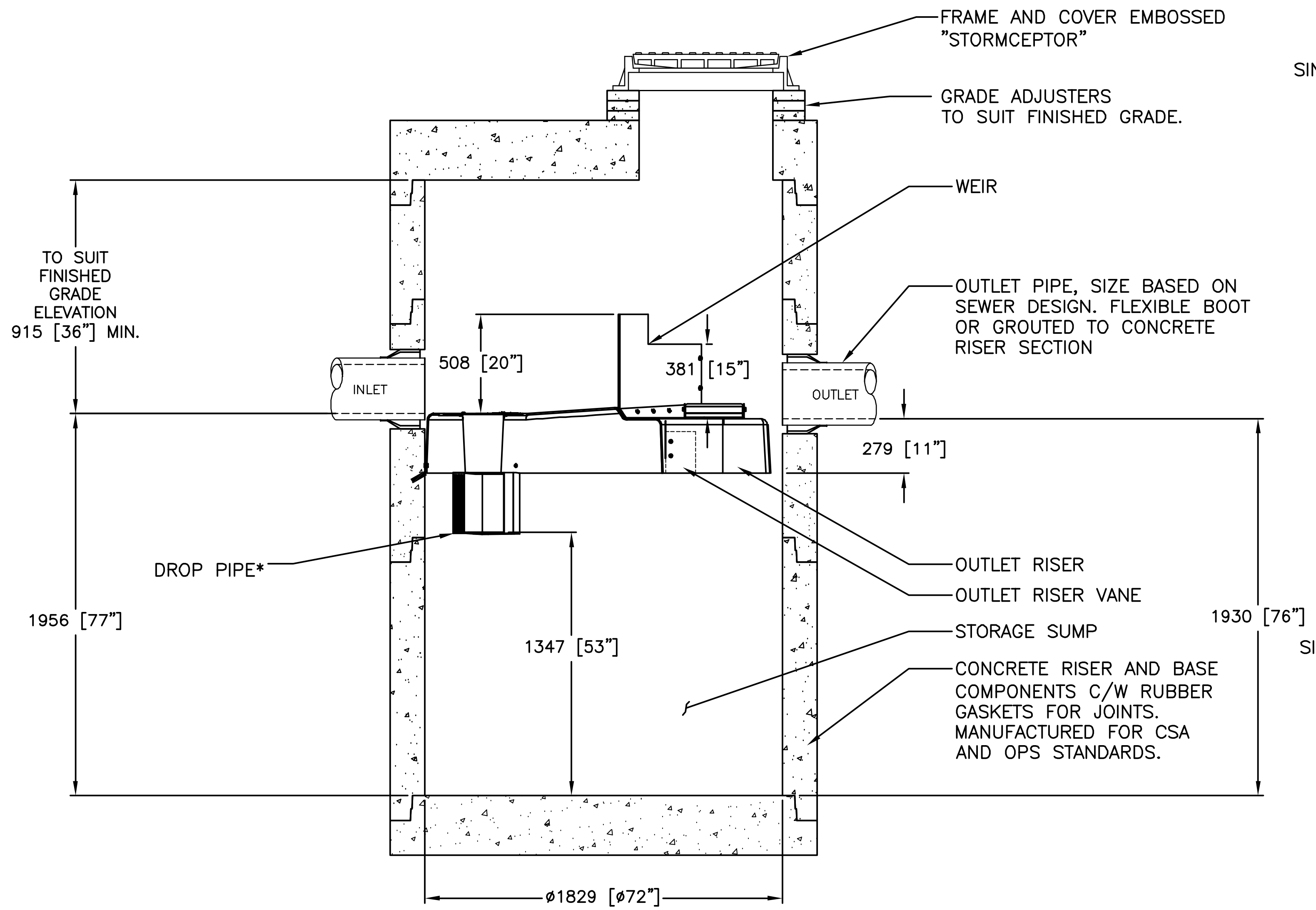
The City of Ottawa has developed and maintains Factsheets related to Source Water Protection, which can be downloaded from: www.Ottawa.ca/SourceProtection.
Specific factsheets to be provided can be discussed with the Risk Management Official; at a minimum, the following are recommended:

	• Drinking Water Source Protection in Carp • Living in the Zone: A guide for people living in drinking water protection zones
Transportation **Amira.Shehata@ottawa.ca** **(613)580-2424 ext. 27737**	A Transportation Impact Study is required as part of the subdivision application. The Carp Road corridor CDP identifies Langstaff Drive as a collector road and that sidewalks are required on the south side of Langstaff to ensure connectivity with all public facilities. As Langstaff Drive is an existing collector road, a noise study is also required. Protected right-of-way widths are as follows: • Langstaff Drive – 26 metres • Proposed local streets – 18 metres
Parks **Lise.Guevremont@ottawa.ca** **(613)580-2424 ext. 27784**	1. Parkland Dedication: The concept plan for the plan of subdivision at 147 Langstaff Drive proposes 72 townhomes and 27 single detached houses. The concept plan does not include parkland dedication. Schedule A of the Community Design Plan designates the land as potential expansion of fairgrounds, residential multi-unit and open space. The Community Design Plan identifies that "In newly developing areas, there will be a need for additional park facilities" (s3.8) In addition, s.7.3: "Adequate dedication for parks and open space will be provided through the subdivision and site plan processes". The full amount of parkland dedication is owing as land and must be dedicated in this phase of development. The park would be an active recreation park and would need to be large enough to accommodate a variety of amenities. Woodlot and open space blocks are not accepted as parkland dedication. Please request the estimated number of units for this subdivision and the density of units per net hectare so that a parkland dedication requirement can be calculated (in hectares) as per the City of Ottawa Parkland Dedication By-law No. 2009-95. Please note: These areas should be considered as 'approximate' until the final version of the proposed 4M-plan for the subdivision is developed at time of registration, and block areas are confirmed to 3-decimal places. In the event that block sizes and/or proposed uses change, parkland dedication requirements will be re-calculated to

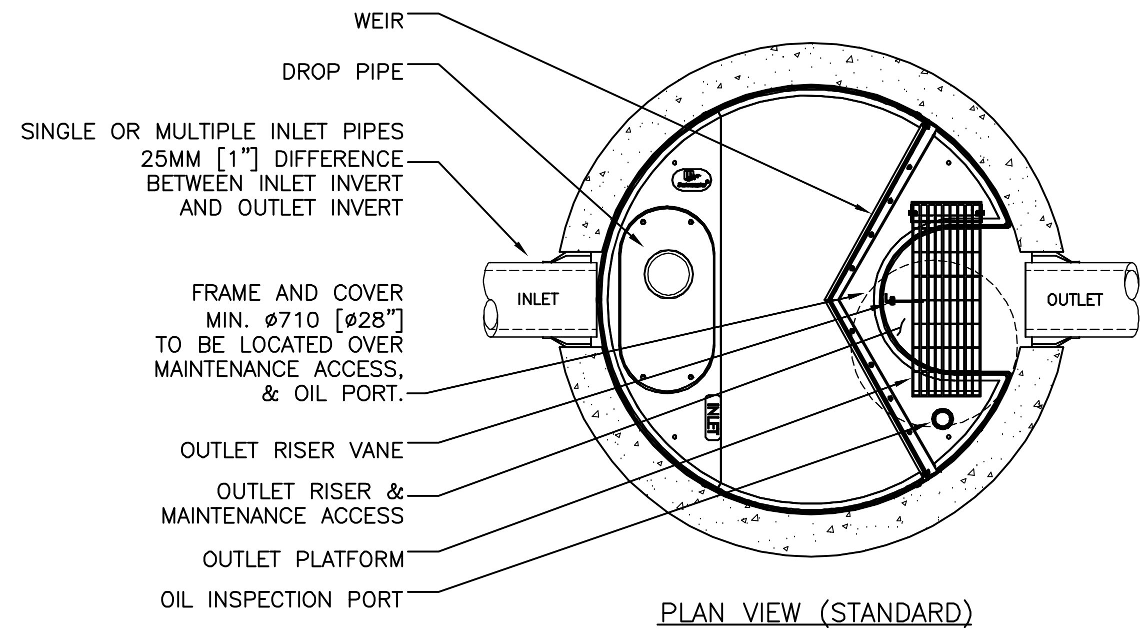
	reflect this change. 2. <u>Proposed Park Block Location:</u> The proposed park block location should be in a central location close to the recreational path and closer to higher density, townhouses. 3. <u>Connections to pathways:</u> Connections between the proposed Park Block and pathways will be determined at a future date as the application progresses. 4. <u>Design of the Proposed Park Block:</u> To be noted: Consistent with the Park Development Manual, 2nd edition, the park will follow the City Developer-Built scenario, where a developer conveys parkland to the City as part of a subdivision agreement, and undertakes the design and construction of the park on behalf of the City. A Project Charter is prepared for each Park development project. The Charter is prepared by the City, and its preparation is initiated upon Draft Plan Approval, and completed and signed by all stakeholders after Registration. A Park Facility Fit Plan will be required for the proposed park block before Registration of the Subdivision can proceed. Public consultation will be required on proposed park amenities and park concept plans. Particularly because of the lands for an expansion to the fairgrounds were protected in the original CDP and numerous community groups and residents will be interested. 5. <u>Park Development Funding:</u> Park development funding will be based on the current Park Development Rate at time of Subdivision Registration. 6. <u>Vegetation:</u> The preservation of existing vegetation on the proposed Park Block, if any, will be determined at a later date. The tree canopy target is 30% within the park, please include existing vegetation as well as vegetation to be removed or newly planted on the facility fit plan. 7. <u>Encumbrances:</u> No encumbrances on the proposed Park Block will be allowed. 8. <u>Service Locations within the proposed Park Block:</u> Parks & Facilities Planning requires the following park services to the Park Block: *Please note: The exact location of the servicing will be determined as*

	the Composite Utility Plan is being developed; this plan is to be submitted to Parks & Facilities Planning at draft stage for comment. • A 300mm diameter storm sewer and CB/MH at 2m inside the park property line. • A 50mm diameter water line complete with standpost at 2m inside the park property line. 150mm diameter sanitary sewer and MH at 2m inside the park property line. • A 120/240 volt, 200 amperes single phase hydro service at 2m inside the park property line. The Owner is responsible for making all arrangements and coordinating the connection of the new hydro (electrical) service, including costs and inspections, with the respective hydro (electricity) agencies. The Owner is also responsible to ensure the park electricity service(s) is included on the approved CUP drawings. 9. <u>Fill and Grading of the Park Block:</u> Please forward preliminary grading plan for the subdivision, and the park block, to my attention for comment. Reviewing the subdivision grading will aid in determining where to place the proposed service drops for the park (water, storm, electrical). Please note, that grading of the park block, to subdivision levels (ensuring positive drainage), is a requirement of the subdivision construction, and not of the park construction. Any desired grading above subdivision level (ex: berms, etc) will be funded from the park development budget (to within 10% of this budget).
Mississippi Valley Conservation **Niall Oddie** **noddie@mvc.on.ca** **(613)253-0006**	-normal quality treatment for SWM at 70% TSS removal; -recommended that slope stability be considered for the ravine that bisects the subject lands and as well for the slope that abuts the western boundary of the site; -recommended maintaining rear yard drainage into the watercourse abutting the western boundary; - The Village of Carp Environmental Management Plan indicates that the soils surrounding the village have low recharge potential and that 'infiltration SWMPs should therefore only be considered where soil conditions and water table elevations are confirmed to be suitable'. With this in mind, MVCA recommends that the applicant further investigate the soils on site through their geotechnical investigation and design the stormwater management accordingly, implementing infiltration where possible.

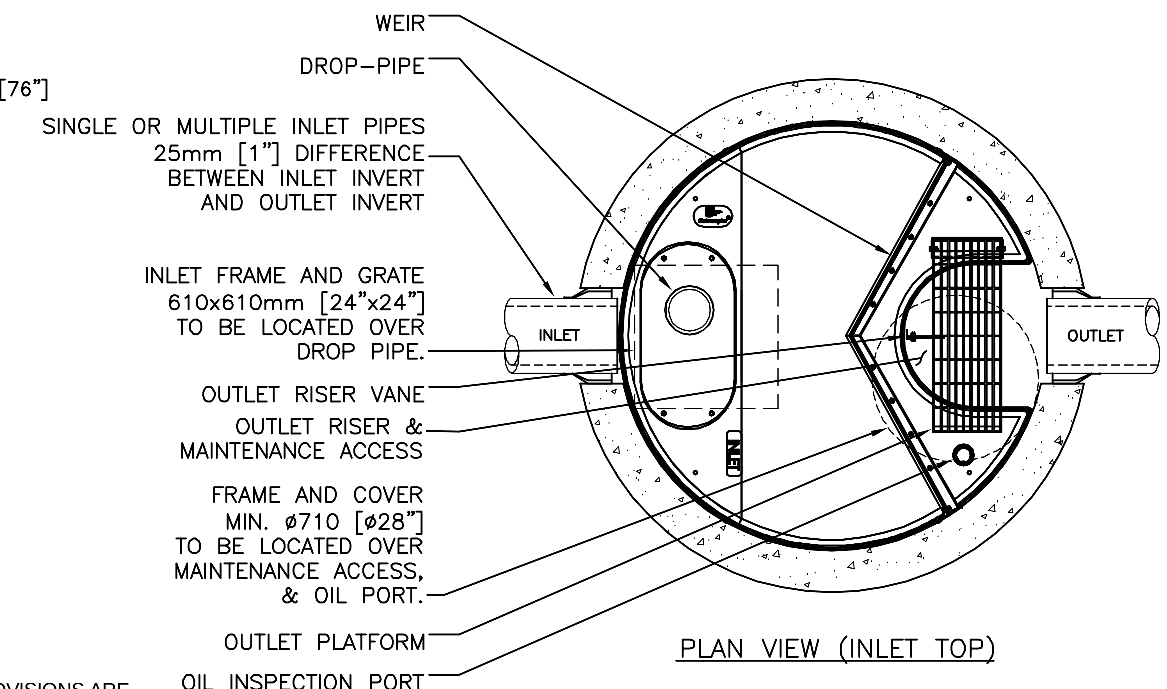
DRAWING NOT TO BE USED FOR CONSTRUCTION



SECTION VIEW



PLAN VIEW (STANDARD)



PLAN VIEW (INLET TOP)

GENERAL NOTES:

* MAXIMUM SURFACE LOADING RATE (SLR) INTO LOWER CHAMBER THROUGH DROP PIPE IS 1135 L/min/m^2 (27.9 gpm/ft^2) FOR STORMCEPTOR EF6 AND 535 L/min/m^2 (13.1 gpm/ft^2) FOR STORMCEPTOR EFO6 (OIL CAPTURE CONFIGURATION).

1. ALL DIMENSIONS INDICATED ARE IN MILLIMETERS (INCHES) UNLESS OTHERWISE SPECIFIED.
2. STORMCEPTOR STRUCTURE INLET AND OUTLET PIPE SIZE AND ORIENTATION SHOWN FOR INFORMATIONAL PURPOSES ONLY.
3. UNLESS OTHERWISE NOTED, BYPASS INFRASTRUCTURE, SUCH AS ALL UPSTREAM DIVERSION STRUCTURES, CONNECTING STRUCTURES, OR PIPE CONDUITS CONNECTING TO COMPLETE THE STORMCEPTOR SYSTEM SHALL BE PROVIDED AND ADDRESSED SEPARATELY.
4. DRAWING FOR INFORMATION PURPOSES ONLY. REFER TO ENGINEER'S SITE/UTILITY PLAN FOR STRUCTURE ORIENTATION.
5. NO PRODUCT SUBSTITUTIONS SHALL BE ACCEPTED UNLESS SUBMITTED 10 DAYS PRIOR TO PROJECT BID DATE, OR AS DIRECTED BY THE ENGINEER OF RECORD.

INSTALLATION NOTES

A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STRUCTURE (LIFTING CLUTCHES PROVIDED)
C. CONTRACTOR WILL INSTALL AND LEVEL THE STRUCTURE, SEALING THE JOINTS, LINE ENTRY AND EXIT POINTS (NON-SHRINK GROUT WITH APPROVED WATERSTOP OR FLEXIBLE BOOT)
D. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT THE DEVICE FROM CONSTRUCTION-RELATED EROSION RUNOFF.
E. DEVICE ACTIVATION, BY CONTRACTOR, SHALL OCCUR ONLY AFTER SITE HAS BEEN STABILIZED AND THE STORMCEPTOR UNIT IS CLEAN AND FREE OF DEBRIS.

FOR SITE SPECIFIC DRAWINGS PLEASE CONTACT YOUR LOCAL STORMCEPTOR REPRESENTATIVE. SITE SPECIFIC DRAWINGS ARE BASED ON THE BEST AVAILABLE INFORMATION AT THE TIME. SOME FIELD REVISIONS TO THE SYSTEM LOCATION OR CONNECTION PIPING MAY BE NECESSARY BASED ON AVAILABLE SPACE OR SITE CONFIGURATION REVISIONS. ELEVATIONS SHOULD BE MAINTAINED EXCEPT WHERE NOTED ON BYPASS STRUCTURE (IF REQUIRED).

STANDARD DETAIL
NOT FOR CONSTRUCTION

SITE SPECIFIC DATA REQUIREMENTS

STORMCEPTOR MODEL	EF6				
STRUCTURE ID					*
WATER QUALITY FLOW RATE (L/s)					*
PEAK FLOW RATE (L/s)					*
RETURN PERIOD OF PEAK FLOW (yrs)					*
DRAINAGE AREA (HA)					*
DRAINAGE AREA IMPERVIOUSNESS (%)					*
PIPE DATA:	I.E.	MAT'L	DIA	SLOPE %	HGL
INLET #1	*	*	*	*	*
INLET #2	*	*	*	*	*
OUTLET	*	*	*	*	*

* PER ENGINEER OF RECORD

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If discrepancies between the supplied information upon which the drawing is based and actual field conditions are encountered as site work progresses, these discrepancies must be reported to Imbrium immediately for re-evaluation of the design. Imbrium accepts no liability for designs based on missing, incomplete or inaccurate information supplied by others.

MARK	DATE	REVISION DESCRIPTION	BY
####	####	####	####
####	####	####	####
####	####	####	####
1	6/8/18	OUTLET PLATFORM	JSK
0	05/26/17	INITIAL RELEASE	JSK

Stormceptor® EF

SCALE = NTS

imbrium®

407 FAIRVIEW DRIVE, WHITBY, ON L1N 3A9

DATE: 5/26/2017	
DESIGNED: JSK	DRAWN: JSK
CHECKED: BSF	APPROVED: SP
PROJECT No.: EF6	SEQUENCE No.: *
SHEET: 1 OF 1	

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STANDARD SPECIFICATION FOR
"OIL GRIT SEPARATOR" (OGS) STORMWATER QUALITY TREAMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, designing, maintaining, and constructing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, with third-party testing results and a Statement of Verification in accordance with ISO 14034 Environmental Management – Environmental Technology Verification (ETV). Work includes supply and installation of concrete bases, precast sections, and the appropriate precast section with OGS internal components correctly installed within the system, watertight sealed to the precast concrete prior to arrival to the project site.

1.2 REFERENCE STANDARDS

1.2.1 For Canadian projects only, the following reference standards apply:

CAN/CSA-A257.4-14: Joints for Circular Concrete Sewer and Culvert Pipe, Manhole Sections, and Fittings Using Rubber Gaskets
CAN/CSA-A257.4-14: Precast Reinforced Circular Concrete Manhole Sections, Catch Basins, and Fittings
CAN/CSA-S6-00: Canadian Highway Bridge Design Code

1.2.2 For ALL projects, the following reference standards apply:

ASTM D-4097: Contact Molded Glass Fiber Reinforced Chemical Resistant Tanks
ASTM C 478: Specification for Precast Reinforced Concrete Manhole Sections
ASTM C 443: Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C 891: Standard Practice for Installation of Underground Precast Concrete Utility Structures
ASTM D2563: Standard Practice for Classification of Visual Defects in Reinforced Plastics

1.3 SHOP DRAWINGS

1.3.1 Shop drawings shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail the precast concrete components and OGS internal components prior to shipment, including the sequence for installation.

1.3.2 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record. Any and all changes to project cost estimates, bonding amounts, plan check fees for revision of approved documents, or design impacts due to regulatory requirements as a result of a product substitution shall be coordinated by the Contractor with the Engineer of Record.

1.4 HANDLING AND STORAGE

Prevent damage to materials during storage and handling.

1.4.1 OGS internal components supplied by the Manufacturer for attachment to the precast concrete vessel shall be pre-fabricated, bolted to the precast and watertight sealed to the precast vessel surface prior to site delivery to ensure Manufacturer's internal assembly process and quality control processes are fully adhered to, and to prevent materials damage on site.

1.4.2 Follow all instructions including the sequence for installation in the shop drawings during installation.

PART 2 – PRODUCTS

2.1 GENERAL

2.1.1 The OGS vessel shall be cylindrical and constructed from precast concrete riser and slab components.

2.1.2 The precast concrete OGS internal components shall include a fiberglass insert bolted and watertight sealed inside the precast concrete vessel, prior to site delivery. Primary internal components that are to be anchored and watertight sealed to the precast concrete vessel shall be done so only by the Manufacturer prior to arrival at the job site to ensure product quality.

2.1.3 The OGS shall be allowed to be specified and have the ability to function as a 240-degree bend structure in the stormwater drainage system, or as a junction structure.

2.1.4 The OGS to be specified shall have the capability to accept influent flow from an inlet grate and an inlet pipe.

2.2 PRECAST CONCRETE SECTIONS

All precast concrete components shall be designed and manufactured to meet highway loading conditions per State/Provincial or local requirements.

2.3 GASKETS

Only profile neoprene or nitrile rubber gaskets that are oil resistant shall be accepted. For Canadian projects only, gaskets shall be in accordance to CSA A257.4-14. Mastic sealants, butyl tape/rope or Conseal CS-101 alone are not acceptable gasket materials.

2.4 JOINTS

The concrete joints shall be watertight and meet the design criteria according to ASTM C-990. For projects where joints require gaskets, the concrete joints shall be watertight and oil resistant and meet the design criteria according to ASTM C-443. Mastic sealants or butyl tape/rope alone are not an acceptable alternative.

2.5 FRAMES AND COVERS

Frames and covers shall be manufactured in accordance with State/Provincial or local requirements for inspection and maintenance access purposes. A minimum of one cover, at least 22-inch (560 mm) in diameter, shall be clearly embossed with the OGS manufacturer's product name to properly identify this asset's purpose is for stormwater quality treatment.

2.6 PRECAST CONCRETE

All precast concrete components shall conform to the appropriate CSA or ASTM specifications.

2.7 FIBERGLASS

The fiberglass portion of the OGS device shall be constructed in accordance with ASTM D2563, and in accordance with the PS15-69 manufacturing standard, and shall only be installed, bolted and watertight sealed to the precast concrete by the Manufacturer prior to arrival at the project site to ensure product quality.

2.8 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a fiberglass insert for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The total sediment storage capacity shall be a minimum 40 ft^3 (1.1 m^3). The total petroleum hydrocarbon storage capacity shall be a minimum 50 gallons (189 liters). The access opening to the sump of the OGS device for periodic inspection and maintenance purposes shall be a minimum 16 inches (406 mm) in diameter.

2.9 LADDERS

Ladder rungs shall be provided upon request or to comply with State/Provincial or local requirements.

2.10 INSPECTION

All precast concrete sections shall be level and inspected to ensure dimensions, appearance, integrity of internal components, and quality of the product meets State/Provincial or local specifications and associated standards.

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 HYDROLOGY AND RUNOFF VOLUME

The OGS device shall be engineered, designed and sized to treat a minimum of 90 percent of the average annual runoff volume, unless otherwise stated by the Engineer of Record, using historical rainfall data. Rainfall data sets should be comprised of a minimum 15-years of rainfall data or a longer continuous period if available for a given location, but in all cases a minimum 5-year period of rainfall data.

3.3 ANNUAL (TSS) SEDIMIMENT LOAD AND STORAGE CAPACITY

The OGS device shall be capable of removing and have sufficient storage capacity for the calculated annual total suspended solids (TSS) mass load and volume without scouring previously captured pollutants prior to maintenance being required. The annual (TSS) sediment load and volume transported from the drainage area should be calculated and compared to the OGS device's available storage capacity by the specifying Engineer to ensure adequate capacity between maintenance cycles. Sediment loadings shall be determined by land use and defined as a minimum of 450 kg (992 lb) of sediment (TSS) per impervious hectare of drainage area per year, or greater based on land use, as noted in Table 1 below.

Annual sediment volume calculations shall be performed using the projected average annual treated runoff volume, a typical sediment bulk density of 1602 kg/m^3 (100 lbs/ft^3) and an assumed Event Mean Concentration (EMC) of 125 mg/L TSS in the runoff, or as otherwise determined by the Engineer of Record.

Example calculation for a 1.3-hectares parking lot site:

- 1.28 meters of rainfall depth, per year

- 1.3 hectares of 100% impervious drainage area
- EMC of 125 mg/L TSS in runoff
- Treatment of 90% of the average annual runoff volume
- Target average annual TSS removal rate of 60% by OGS

Annual Runoff Volume:

- 1.28 m rain depth x 1.3 ha x 10,000 m^2/ha= 16,640 m^3 of runoff volume
- 16,640 m^3 x 1000 L/m^3 = 16,640,000 L of runoff volume
- 16,640,000 L x 0.90 = 14,976,000 L to be treated by OGS unit

Annual Sediment Mass and Sediment Volume Load Calculation:

- 14,976,000 L x 125 mg/L x kg/1,000,000 mg = 1,872 kg annual sediment mass
- 1,872 kg x m^3/1602 kg = 1.17 m^3 annual sediment volume
- 1.17 m^3 x 60% TSS removal rate by OGS = 0.70 m^3 minimum expected annual storage requirement in OGS

As a guideline, the U.S. EPA has determined typical annual sediment loads per drainage area for various sites by land use (see Table 1). Certain States, Provinces and local jurisdictions have also established such guidelines.

Table 1 – Annual Mass Sediment Loading by Land Use

	Commercial	Parking Lot	Residential			Highways	Industrial	Shopping Center
			High	Med.	Low			
(lbs/acre/yr)	1,000	400	420	250	10	880	500	440
(kg/hectare/yr)	1,124	450	472	281	11	989	562	494

Source: U.S. EPA Stormwater Best Management Practice Design Guide Volume 1, Appendix D, Table D-1, Burton and Pitt 2002

3.4 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in Table 2, Section 3.5, and based on third-party performance testing conducted in accordance with the Canadian Environmental Technology Verification (ETV) Program's **Procedure for Laboratory Testing of Oil-Grit Separators**. Sizing shall be determined using historical rainfall data (as specified in Section 3.2) and a sediment removal performance curve derived from the actual third-party verified laboratory testing data. The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 3.3.

3.4.1 The Peclet Number is not an approved method or model for calculating TSS removal, sizing, or scaling OGS devices.

3.4.2 If an alternate OGS device is proposed, supporting documentation shall be submitted that demonstrates:

- Canadian ETV or ISO 14034 ETV Verification Statement which verifies third-party performance testing conducted in accordance with the **Procedure for Laboratory Testing of Oil-Grit Separators**
- Equal or better sediment (TSS) removal of the PSD specified in Table 2 at equivalent surface loading rates, as compared to the OGS device specified herein.
- Equal or greater sediment storage capacity, as compared to the OGS device specified herein.
- Supporting documentation shall be signed and sealed by a local registered Professional Engineer. All costs associated with preparing and certifying this documentation shall be born solely by the Contractor.

3.5 PARTICLE SIZE DISTRIBUTION (PSD) FOR SIZING

The OGS device shall be sized to achieve the Engineer-specified average annual percent sediment (TSS) removal based solely on the test sediment used in the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.** This test sediment is comprised of inorganic ground silica with a specific gravity of 2.65, uniformly mixed, and containing a broad range of particle sizes as specified in Table 2. No alternative PSDs or deviations from Table 2 shall be accepted.

Table 2
Canadian ETV Program Procedure for Laboratory Testing of Oil-Grit Separators
Particle Size Distribution (PSD) of Test Sediment

Particle Diameter (Microns)	% by Mass of All Particles	Specific Gravity
1000	5%	2.65
500	5%	2.65
250	15%	2.65
150	15%	2.65
100	10%	2.65
75	5%	2.65
50	10%	2.65
20	15%	2.65
8	10%	2.65
5	5%	2.65
2	5%	2.65

3.6 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators**. This scour testing is conducted with the device pre-loaded with test sediment comprised of the particle size distribution (PSD) illustrated in Table 2.

3.6.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m^2.

Data generated from laboratory scour testing performed with an OGS device pre-loaded with a coarser PSD than in Table 2 (i.e. the coarser PSD has no particles in the 1-micron to 50-micron size range, or the D_{50} of the test sediment exceeds 75 microns) shall not be acceptable for the determination of the device's suitability for on-line installation.

3.7 DESIGN ACCOUNTING FOR BYPASS

3.7.1 The OGS device shall be specified to achieve the TSS removal performance and water quality objectives without washout of previously captured pollutants. The OGS device shall also have sufficient hydraulic conveyance capacity to convey the peak storm event, in accordance with hydraulic conditions per the Engineer of Record. To ensure this is achieved, there are two design options with associated requirements:

3.7.1.1 The OGS device shall be placed **off-line** with an upstream diversion structure (typically in an upstream manhole) that only allows the water quality volume to be diverted to the OGS device, and excessive flows diverted downstream around the OGS device to prevent high flow washout of pollutants previously captured. This design typically incorporates a triangular layout including an upstream bypass manhole with an appropriately engineered weir wall, the OGS device, and a downstream junction manhole, which is connected to both the OGS device and bypass structure. In this case with an external bypass required, the OGS device manufacturer must provide calculations and designs for all structures, piping and any other required material applicable to the proper functioning of the system, stamped by a Professional Engineer.

3.7.1.2 Alternatively, OGS devices in compliance with Section 3.6 shall be acceptable for an **on-line** design configuration, thereby eliminating the requirement for an upstream bypass manhole and downstream junction manhole.

3.7.2 The OGS device shall also have sufficient hydraulic conveyance capacity to convey the peak storm event, in accordance with hydraulic conditions per the Engineer of Record. If an alternate OGS device is proposed, supporting documentation shall be submitted that demonstrates equal or better hydraulic conveyance capacity as compared to the OGS device specified herein. This documentation shall be signed and sealed by a local registered Professional Engineer. All costs associated with preparing and certifying this documentation shall be born solely by the Contractor.

3.8 PETROLEUM HYDROCARBONS AND FLOATABLES STORAGE CAPACITY

Petroleum hydrocarbons and floatables storage capacity in the OGS device shall be a minimum 50 gallons (189 Liters), or more as specified.

3.8.1 The OGS device shall have gasketed precast concrete joints that are watertight, and oil resistant and meet the design criteria according to ASTM C-443 to provide safe oil and other hydrocarbon materials storage and ground water protection. Mastic sealants or butyl tape/rope alone are not an acceptable alternative.

3.9 SURFACE LOADING RATE SCALING OF DIFFERENT MODEL SIZES

The reference device for scaling shall be an OGS device that has been third-party tested in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators**. Other model sizes of the tested device shall only be scaled such that the claimed TSS removal efficiency of the scaled device shall be no greater than the TSS removal efficiency of the tested device at identical **surface loading rates** (flow rate divided by settling surface area). The depth of other model sizes of the tested device shall be scaled in accordance with the depth scaling provisions within Section 6.0 of the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators**.

3.9.1 The Peclet Number and volumetric scaling are not approved methods for scaling OGS devices.

PART 4 – INSPECTION & MAINTENANCE

The OGS manufacturer shall provide an Owner's Manual upon request.

4.1 A Quality Assurance Plan that provides inspection and maintenance for a minimum of 5 years shall be included with the OGS stormwater quality device, and written into the Environmental Compliance Approval (ECA) or the appropriate State/Provincial or local approval document.

4.2 OGS device inspection shall include determination of sediment depth and presence of petroleum hydrocarbons and floatables below the insert. Inspection shall be easily conducted from finished grade through a Frame and Cover of at least 22 inch (560 mm) in diameter.

4.3 Inspection and pollutant removal from below the OGS's insert shall be conducted as a periodic maintenance practice using a standard maintenance truck and vacuum apparatus, and shall be easily conducted from finished grade through a Frame and Cover of at least 22-inches (560 mm) in diameter, and through an access opening to the OGS device's sump with a minimum 16-inches diameter (406 mm).

4.4 No confined space for sediment removal or inspection of internal components shall be required for normal operation, annual inspection or maintenance activity.

PART 5 – EXECUTION

5.1 PRECAST CONCRETE INSTALLATION

The installation of the precast concrete OGS stormwater quality treatment device shall conform to ASTM C 891, ASTM C 478, ASTM C 443, CAN/CSA-A257.4-14, CAN/CSA-A257.4-14, CAN/CSA-S6-00 and all highway, State/Provincial, or local specifications for the construction of manholes. Selected sections of a general specification that are applicable are summarized below. The Contractor shall furnish all labor, equipment and materials necessary to offload, assemble as needed the OGS internal components as specified in the Shop Drawings.

5.2 EXCAVATION

5.2.1 Excavation for the installation of the OGS stormwater quality treatment device shall conform to highway, State/Provincial or local specifications. Topsoil that is removed during the excavation for the OGS stormwater quality treatment device shall be stockpiled in designated areas and not be mixed with subsoil or other materials. Topsoil stockpiles and the general site preparation for the installation of the OGS stormwater quality device shall conform to highway, State/Provincial or local specifications.

5.2.2 The OGS device shall not be installed on frozen ground. Excavation shall extend a minimum of 12 inch (300 mm) from the precast concrete surfaces plus an allowance for shoring and bracing where required. If the bottom of the excavation provides an unsuitable foundation additional excavation may be required.

5.2.3 In areas with a high water table, continuous dewatering shall be provided to ensure that the excavation is stable and free of water.

5.3 BACKFILLING

Backfill material shall conform to highway, State/Provincial or local specifications. Backfill material shall be placed in uniform layers not exceeding 12 inches (300 mm) in depth and compacted to highway, State/Provincial or local specifications.

5.4 OGS WATER QUALITY DEVICE CONSTRUCTION SEQUENCE

5.4.1 The precast concrete OGS stormwater quality treatment device is installed and leveled in sections in the following sequence:

- aggregate base
- base slab, or base
- riser section(s) (if required)
- riser section w/ pre-installed fiberglass insert
- upper riser section(s)
- internal OGS device components
- connect inlet and outlet pipes
- riser section, top slab and/or transition (if required)
- frame and access cover

5.4.2 The precast concrete base shall be placed level at the specified grade. The entire base shall be in contact with the underlying compacted granular material. Subsequent sections, complete with oil resistant, watertight joint seals, shall be installed in accordance with the precast concrete manufacturer’s recommendations.

5.4.3 Adjustment of the OGS stormwater quality treatment device can be performed by lifting the upper sections free of the excavated area, re-leveling the base, and re-installing the sections.

Damaged sections and gaskets shall be repaired or replaced as necessary. Once the OGS stormwater quality treatment device has been constructed, any lift holes must be plugged with mortar.

5.5 DROP PIPE AND OIL INSPECTION PIPE

Once the upper precast concrete riser has been attached to the lower precast concrete riser section, the OGS device Drop Pipe and Oil Inspection Pipe must be attached, and watertight sealed to the fiberglass insert using Sikaflex 1a. Installation instructions and required materials shall be provided by the OGS manufacturer.

5.6 INLET AND OUTLET PIPES

Inlet and outlet pipes shall be securely set using grout or approved pipe seals (flexible boot connections, where applicable) so that the structure is watertight. Non-secure inlets and outlets will result in improper performance.

5.7 FRAME AND COVER OR FRAME AND GRATE INSTALLATION

Precast concrete adjustment units shall be installed to set the frame and cover/grate at the required elevation. The adjustment units shall be laid in a full bed of mortar with successive units being joined using sealant recommended by the manufacturer. Frames for the cover/grate should be set in a full bed of mortar at the elevation specified.

5.7.1 A minimum of one cover, at least 22-inch (560 mm) in diameter, shall be clearly embossed with the OGS device brand or product name to properly identify this asset's purpose is for stormwater quality treatment.

Free Flow Calculations to Existing West Ravine
Pre-Development Area PRE1

Given:

Area (ha) = 1.77

C = 0.20

C (100 YR) = 0.25

Return Period	Time (min)	Intensity (mm/hr)	* Flow (L/s)
5 Year	5.0	141.2	138.9
	10.0	104.2	102.5
	15.0	83.6	82.2
	20.0	**70.3**	**69.1**
	25.0	60.9	59.9
	30.0	53.9	53.1
100 Year	5.0	242.7	298.6
	10.0	178.6	219.7
	15.0	142.9	175.8
	20.0	**120.0**	**147.6**
	25.0	103.8	127.7
	30.0	91.9	113.0

*Q = 2.78 CiA

Free Flow Calculations to Existing West Ravine
Post-Development Area STM12

Given:

Area (ha) = 1.03

C = 0.38

C (100 YR) = 0.48

Return Period	Time (min)	Intensity (mm/hr)	* Flow (L/s)
5 Year	5.0	141.2	153.8
	10.0	104.2	113.5
	15.0	83.6	91.0
	20.0	**70.3**	**76.5**
	25.0	60.9	66.3
	30.0	53.9	58.8
100 Year	5.0	242.7	330.5
	10.0	178.6	243.2
	15.0	142.9	194.6
	20.0	**120.0**	**163.3**
	25.0	103.8	141.4
	30.0	91.9	125.1

*Q = 2.78 CiA

Ontario

Ministry of the Environment **Ministère de l'Environnement**

CERTIFICATE OF APPROVAL
MUNICIPAL AND PRIVATE SEWAGE WORKS
NUMBER 8260-5LJQH5

D & H Rivington Enterprises Incorporated
P.O. Box 190, Carp
West Carleton, Ontario
K0A 1L0

Site Location: Glencastle Subdivision Phase 2
Lot Pt of 18, Concession 2
West Carleton Township,
Regional Municipality Of Ottawa-Carleton

You have applied in accordance with Section 53 of the Ontario Water Resources Act for approval of:

Stormwater Management Facilities for approximately 15.9ha. development of Glencastle Subdivision Phase 2 in the City of Ottawa consisting of:

Facility G1:

- a wet pond with a forebay located in the ravine block with an approximately 30m wide outlet structure on the north east side of Langstaff Drive having approximate permanent volume of 930cu.m., extended detention volume of 640cu.m. and a maximum storage volume of 1,940cu.m.,

- one (1) 450mm diameter outlet conveyance pipe with a 600mm by 600mm grated ditch inlet catchbasin outlet structure fitted with a 90mm diameter horizontal orifice plate,

- a 10.0m wide by 450mm deep rip-rapped emergency overflow weir on the berm;

Facility G3:

- a dry pond located approximately 130m south of Langstaff Drive having approximate peak storage volume of 1,855cu.m.,

- one (1) 675mm diameter outlet conveyance pipe,

- a 20.0m wide berm with 4m topwidth and 3m height,

- a 5.0m wide rip-rapped overflow weir on the berm;

Facility G4:

- a dry pond located approximately 285m south of Langstaff Drive culvert having approximate peak storage volume of 3,298cu.m.,

- one (1) 675mm diameter outlet conveyance pipe,

- a 17.0m wide berm with 4m topwidth and 3m height,

- a 7.5m wide rip-rapped overflow weir on the berm;

all finally discharging to the existing 780mm diameter culvert under Donald B. Munro Drive.

The simulated storm drainage pattern of the site and results of the estimated simulation at the Donald B. Munro Drive are

as follows:

Events (4 hr. peak) 25mm 2-year 5-year 100-year

Pre-development (cu.m./s.) 0.23 0.39 0.94 2.40

Post development (cu.m./s.) 0.69 1.16 2.82 5.80

Post-development attenuated (cu.m./s.) 0.23 0.30 0.95 2.92

including permanent and temporary erosion / sedimentation control measures for all phases of construction to minimize the effects on external lands and to reduce the amount of silt carried to the pond, the ravine, the Creek and the Carp River;

all in accordance with the Application for the Approval of the Municipal and Private Sewage Works dated April 19, 2001, design report, final drawings and addendum documents prepared and submitted by David McManus Engineering Ltd. and PSR Group Ltd., Consulting Engineers.

For the purpose of this Certificate of Approval and the terms and conditions specified below, the following definitions apply:

(1) "Certificate" means this entire Certificate of Approval document, issued in accordance with Section 53 of the *Ontario Water Resources Act*, and includes any schedules;

(2) "Director" means any Ministry employee appointed by the Minister pursuant to Section 53 of the *Ontario Water Resources Act*;

(3) "Ministry" means the Ontario Ministry of Environment;

(4) "Regional Director" means the Regional Director of the Eastern Region of the Ministry;

(5) "District Manager" means the District Manager of the Ottawa District Office of the Ministry.;

(6) "Owner" means D & H Rivington Enterprise Inc.;

(7) "Municipality" means the City of Ottawa; and,

(8) "Works" means the sewage works described in the Owner's application, this Certificate and in the supporting documentation referred to herein, to the extent approved by this Certificate.

You are hereby notified that this approval is issued to you subject to the terms and conditions outlined below:

TERMS AND CONDITIONS

1. The Owner shall make all necessary investigations, take all necessary steps and obtain all necessary approvals so as to ensure that the physical structure, siting and operations of the stormwater works do not constitute a safety or health hazard to the general public.

2. The Owner shall ensure that sediment and excessive decaying vegetation are removed from the above noted stormwater management system at such a frequency as to prevent the excessive buildup and potential overflow of sediment and/or decaying vegetation into the receiving watercourse.

3.1 Except as otherwise provided by these Conditions, the Owner shall design, build, install, operate and maintain the works in accordance with the description given in this Certificate, the application for approval of the works and the submitted supporting documents and plans and specifications as listed in this Certificate.

3.2 Where there is a conflict between a provision of any submitted document referred to in this Certificate and the Conditions of this Certificate, the Conditions in this Certificate shall take precedence, and where there is a conflict between the listed submitted documents, the document bearing the most recent date shall prevail.

The reasons for the imposition of these terms and conditions are as follows:

1. Condition 1 is imposed because it is not in the public interest for the Director to approve facilities which, by reason of potential health and safety hazards do not generally comply with legal standards or approval requirements falling outside the purview of this Ministry.

2. Condition 2 is included as regular removal of sediment and excessive decaying vegetation from this approved stormwater management system are required to mitigate the impact of sediment and/or decaying vegetation on the downstream receiving watercourse. It is also required to ensure that adequate storage is maintained in the stormwater management facilities at all times as required by the design.

3. Condition 3 is imposed to ensure that the works are built and operated in the manner in which they were described for review and upon which approval was granted. This condition is also included to emphasize the precedence of Conditions in the Certificate and the practice that the Approval is based on the most current document, if several conflicting documents are submitted for review.

In accordance with Section 100 of the Ontario Water Resources Act, R.S.O. 1990, Chapter 0.40, as amended, you may by written notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 101 of the Ontario Water Resources Act, R.S.O. 1990, Chapter 0.40, provides that the Notice requiring the hearing shall state:

1. The portions of the approval or each term or condition in the approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The Certificate of Approval number;
6. The date of the Certificate of Approval;
7. The name of the Director;
8. The municipality within which the works are located;

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary*
Environmental Review Tribunal
2300 Yonge St., 12th Floor
P.O. Box 2382
Toronto, Ontario
M4P 1E4

AND

The Director
Section 53, *Ontario Water Resources Act*
Ministry of the Environment
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario
M4V 1L5

*** Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 314-4600, Fax: (416) 314-4506 or www.ert.gov.on.ca**

The above noted sewage works are approved under Section 53 of the Ontario Water Resources Act.

DATED AT TORONTO this 9th day of June, 2003

Aziz Ahmed, P.Eng.
Director
Section 53, *Ontario Water Resources Act*

MN/

c: District Manager, MOE Ottawa
Clerk, the City of Ottawa
Paul Frigon, PSR Group Limited

Glenncastle
SWM Plan

ADDENDUM
Rev1

Prepared for: D & H Enterprises Inc.

by PSR Group Ltd.
David McManus Engineering Ltd.

May 2003

PSR Group Ltd., 100 Craig Henry Dr., Suite 101, Nepean, Ontario, K2G 5W3
Telephone (613) 820-6019 Fax (613) 820-7281
e-mail: pfrigon@psrgroup.on.ca

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SUMMARY

D & H Enterprises Inc. propose to develop a 15.3 hectare parcel of land, as medium density residential, in the Carp Planning Area, City of Ottawa. The development drains to the Carp River via local ditches and outlets at the Donald B Munro Drive culvert. As well, adjacent lands totaling 35.9 ha drain to this outlet.

The proposed development may impact surface water and fish habitat and mitigative measures have been identified, in the **Glenncastle SWM Plan – June 2001**, to address these issues.

As part of the final review of the abovementioned SWM plan, MOE Approvals Branch has requested that mitigative measures be provided, during the current development phase, to meet Provincial and Federal fisheries requirements; rather than wait until the lands south of Langstaff are developed.

As a result, water **quality** impacts from the Glenncastle Phase 2 development will be mitigated by a SWM pond at location G-1. This will be created by modifiying the previously proposed control structure upstream of Langstaff and by excavation of the ditch upstream of G-1 to provide the necessary permanent pool, extended detention and erosion control storage volumes. This proposed facility will reduce suspended solids concentrations to a level that can be discharged to a type 2 fish habitat (MOEE Level 2 treatment).

Drainage areas 1 and 1A may require additional treatment for level 2 **quality** control, depending on the type of development that eventually occurs on these sites: drainage areas 6 and 7 are already developed and drainage area 8 is not zoned for development

The water control structures at G3 and G4 will remain as proposed and they will continue to provide water **quantity** control to Master Drainage Plan requirements, not only for the proposed development but for all future landuse conditions in the upstream drainage areas .

An "Operations, Maintenance and Monitoring Plan" has been developed in accordance with Regulatory Agency guidelines.

1.0 HYDROLOGY - FUTURE

As in the previous SWM Plan, the flows from the development area are based upon the hydrologic parameters identified in Table 1 and the resulting flows are summarized in Table 2. The SWMHYMO flow simulation model (version 4.0/1998) was used; rainfall (2 year = 35.8 mm, 5 year = 54 mm, 10 year = 63.9, 100 year = 95.2 mm) was distributed using the 6 hour SCS Type II Storm from the Carp MDP. Details of the hydrologic modelling are provided in Appendix A and include typical input data, summary output data, storage–discharge rating curves in Table A1 and a schematic of the hydrologic model in Figure A2 .

It is important to note that drainage from Drainage Area 8 is limited to minor flows by the DICB at Glenncastle Drive and that contributing flows from Drainage Areas 6, 7 and 8 are limited by the stormsewer capacity along Cavanagh to 1.0m³/s: the major flows from Drainage Areas 6, 7 and 8 enter the Carp River by outlets other than the Donald B. Munro Drive culvert. This is illustrated in drainage area plan - Figure 1.

Table 1: Hydrologic Parameters – Future

Drainage Area	Area (ha)	% Impervious
1	3.60	46
1a	4.17	49
2	5.63	45
2a	0.82	CN=65
3	1.73	45
4	4.26	45
5	3.45	45
6	7.35	30
7	5.66	30
8	15.15	CN=70

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e-mail: pfrigon@psrgroup.on.ca

Table 2: - Proposed Flows/Storage Volumes - Glenncastle Subdivision

Location	PP	ED	25mm EC	2YR	5YR	100YR
G-1						
Total Phase 2 flow 15.9 ha						
SWM Volume(m3)	930	640	910	1476	1611	1941
Flows (m3/s)						
pre dev flow	n/a	n/a	0.00	0.01	0.14	1.00
post dev flow	n/a	n/a	0.30	0.52	1.2	3.0
post dev flow (attenuated)	n/a	n/a	0.02	0.06	0.58	2.7
G-2						
At Langstaff (G2) 44.1 ha						
SWM Volume(m3)	n/a	n/a	34	57	160	600
Flows (m3/s)						
pre dev flow	n/a	n/a	0.23	0.38	0.92	1.91
post dev flow	n/a	n/a	0.52	0.89	2.1	4.0
post dev flow (attenuated)	n/a	n/a	0.21	0.36	1.00	3.7
G-3						
D/SLangstaff (G3) 47.6 ha						
SWM Volume(m3)	n/a	n/a	74	128	334	1855
Flows (m3/s)						
pre dev flow	n/a	n/a	0.23	0.38	0.93	2.1
post dev flow	n/a	n/a	0.60	1.0	2.4	4.8
post dev flow (attenuated)	n/a	n/a	0.26	0.44	1.1	3.7
G-4						
U/S DB Munro (G4) 51.8 ha						
SWM Volume(m3)	n/a	n/a	256	640	1969	3298
Flows (m3/s)						
pre dev flow	n/a	n/a	0.23	0.34	0.94**[1.3]**	2.4**[3.5]**
post dev flow	n/a	n/a	0.69	1.2	2.8	5.8
post dev flow (attenuated)	n/a	n/a	0.23	0.30	0.95	2.9

Note: numbers in [ ] refer to design criteria from Carp MDP

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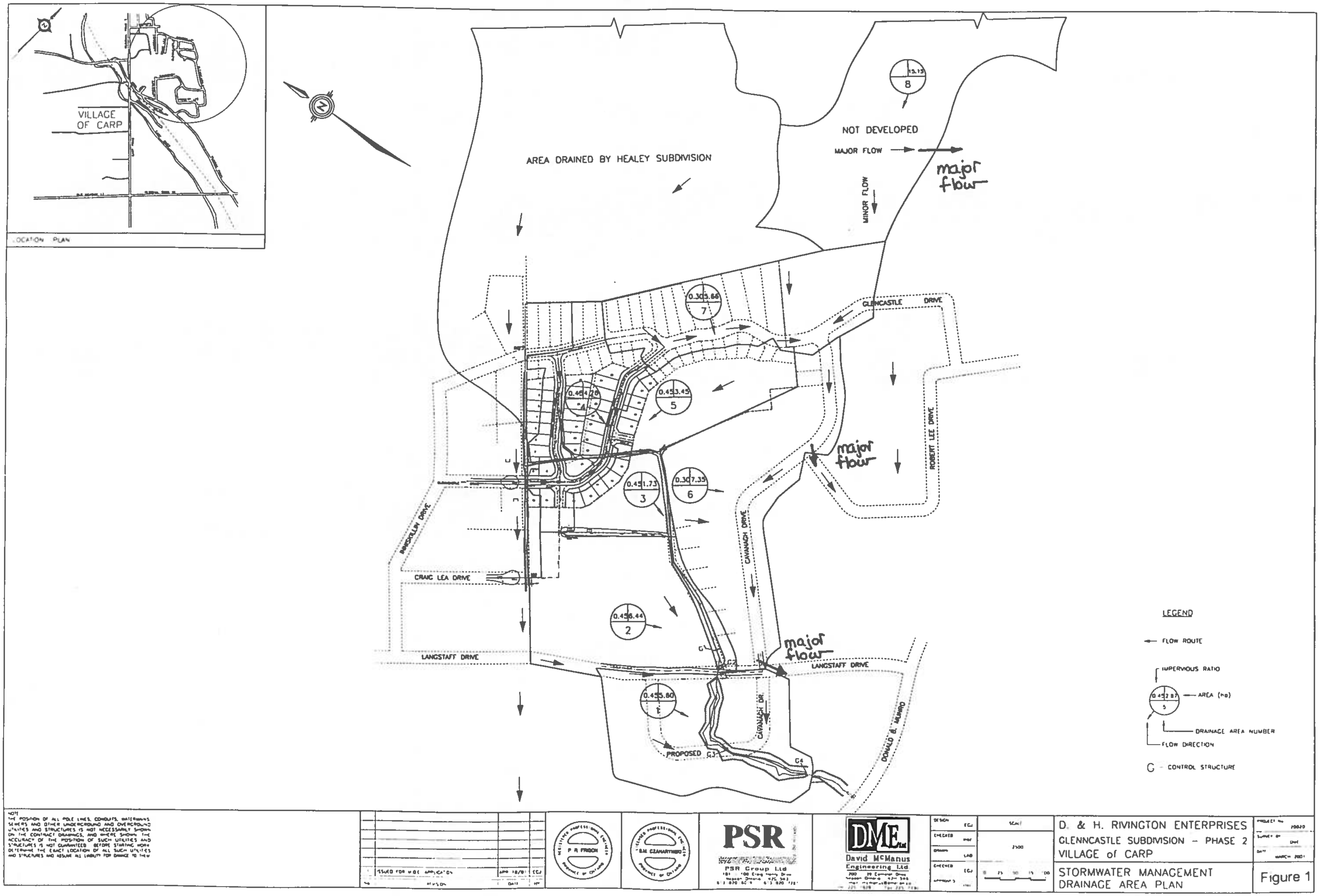

VILLAGE OF CARP
LOCATION PLAN
AREA DRAINED BY HEALEY SUBDIVISION
NOT DEVELOPED
MAJOR FLOW
MINOR FLOW
major flow
GLENCASTLE DRIVE
ROBERT LEE DRIVE
CAVANAGH DRIVE
CRAIG LEA DRIVE
LANGSTAFF DRIVE
CAVANAGH DR.
DONALD B. MUNRO
PROPOSED
0.30 5.66
7
0.45 4.26
4
0.45 3.45
5
0.45 1.73
3
0.30 7.35
6
0.45 6.44
2
0.45 5.80
1
15.15
8
LEGEND
FLOW ROUTE
IMPERVIOUS RATIO
AREA (ha)
DRAINAGE AREA NUMBER
FLOW DIRECTION
C - CONTROL STRUCTURE
PSR
PSR Group Ltd
DME
David McManus Engineering Ltd
D. & H. RIVINGTON ENTERPRISES
GLENNCASTLE SUBDIVISION - PHASE 2
VILLAGE of CARP
STORMWATER MANAGEMENT
DRAINAGE AREA PLAN
Figure 1

4.0 STORMWATER MANAGEMENT FOR PROPOSED DEVELOPMENT

Runoff from the proposed development is directed by existing ditch to a SWM Pond located upstream of Langstaff. The SWM Pond (G-1) has an outlet control structure and forebay, permanent pool, extended detention and erosion control features that achieve Level 2 water quality thereby addressing fisheries and erosion concerns.

The SWM Pond characteristics are illustrated in Dwg No. 20020-01, Dwg No. 20020-02, Dwg No. 20020-03 and Dwg No. 20020-04 and summarised in Table 4. Detailed calculations for the SWM Pond are provided in Appendix B. The existing ditch/ravine is capable of withstanding rapid drawdowns and is stable with a factor of safety between 1.8 and 2.0 at the most critical cross sections (see original SWM Plan). As noted in DWG No. 20020-01, existing storm drains servicing lots on Cavanaugh Drive must be rerouted to the Cavanaugh Drive stormsewer.

A summary of design elements and assumptions for G-1 are provided below:

- The outlet berm will be 1.75m. high with a 4m. top width and 3:1 side slopes.
- The structure will feature a 0.6mx0.6m DICB with a 450mm ø concrete outlet pipe and a 90 mm ø orifice plate (horizontal), set at 104.0m. This will allow for a controlled drawdown over 24 hours and retention of sediment upstream.
- The DICB will be covered with a "honey-comb" grate to prevent child access and to minimise the amount of debris reaching the orifice.
- The top of the structure will be a 10m. wide weir capable of passing the 100 year flow of 3.0m³/s at a depth of 0.35m.
- The existing ditch will be excavated, 90m. upstream of the structure, to a depth of 103.0m with a 7.5 m bottom width and a 4:1 sideslope. This will create a 1.0m deep permanent pool with a volume of 930m3 and provide for 0.5m of extended detention with a volume of 640m3 and 0.75m of erosion control with a volume of 910m3.
- A forebay berm will be constructed 60 m upstream of the outlet control structure
- The storage/discharge for the structure is provided in Table A1 in Appendix A.
- The forebay cleanout frequency is 10 years
- The pond inlet will have a 2.5 m drop provided by a cascading gabion weir structure

Drainage areas 1 and 1A may require additional treatment for level 2 **quality** control, depending on the type of development that eventually occurs on these sites: drainage areas 6 and 7 are already developed and drainage area 8 is not zoned for development

The reduction of peak flows to meet Carp MDP constraints will still be achieved as identified in the Glenncastle SWM Plan. Control structures G2, G3 and G4 have not changed. However, the additional storage upstream of G1 has increased the overall mitigative impact of the control structures on the peak flows at DB Munro Drive: the 100 year peak flow has been reduced to 2.9 m3/s which is below the identified design flow of 3.5m3/s

Table 4 Existing and Proposed Control Structures – Technical Summary (revised 2003)

ID	Location	Berm		Outlet					Pond*				
		H (m)	W (m)	Weir	Pipe				Max d (m)	Volume (m^3)			
				W (m)	d (mm)	L (m)	u/s invert (m)	Slope (m/100m)		5 yr	100 yr	Permanent Pool (PP)	Extended Detention (ED)
G1	u/s Langstaff	1.75 2.75	20	10	90 450	n/a 9.8	104.0 103.4	n/a 2.0	3.0	1611	1941	930	640
G2	@ Langstaff	3.25	n/a	n/a	675 1200	n/a 17.5	102.8 102.8	n/a 1.5	2.5	160	600	na	na
G3	d/s Langstaff	3.0	20	15	675	17.5	99.7	1.2	3.25	334	1855	na	na
G4	u/s DB Munro	3.0	17	7.5	450	19.0	97.0	4.2	3.25	1969	3298	na	na

*note:
- all ponding will be temporary and is for flood control, except for G1 which has a permanent pool and is for both water quality and quantity control
- ponding will occur in the modified ditch u/s of Langstaff and the existing ravine d/ s of Langstaff
- a geotechnical study confirming sideslope stability under rapid drawdown conditions for the ravine is provided in Appendix C

5. SEDIMENT & EROSION CONTROL

1.Construction
see previous SWM Plan

2.Outlets and Channels
see previous SWM Plan

The impact of the new control structure on the 25mm rainfall is provided as Figure 2 and illustrates, using hydrographs, a significant mitigative impact on erosion flows.

6.0 WATER QUALITY MONITORING

In order to confirm the effectiveness of the SWM Pond, the following monitoring program is being proposed to the MOEE District Office in Ottawa.

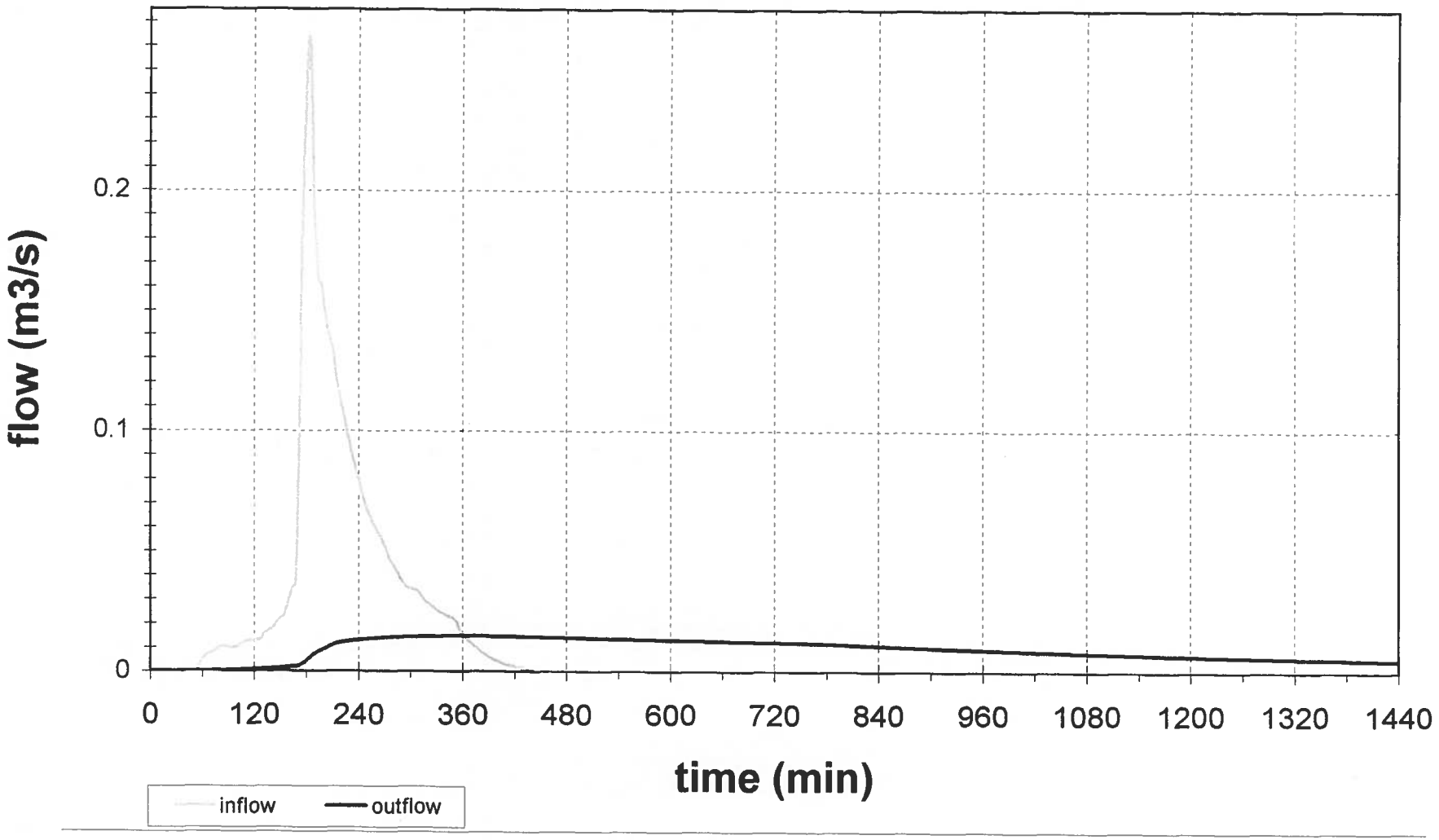
1. Sample runoff from the forebay for a total of 5 rainfall events per year (May to September inclusive) over four years.
2. Composite sample for each event over a 2 hour runoff period – 3 grab samples: one at the beginning; one at hour one; one at hour two: combined to one composite sample for analysis. Sampling process can be automated or manual.
3. Analyse the composite sample from each event for the following parameters:
   Total Suspended Solids; Lead (GFAAS); Zinc (GFAAS), Oil & grease (total)
   Total Phosphorus , Ammonia and Ammonium
4. In addition, for one event in July and one event in August, record Dissolved Oxygen level in pond and in composite sample at completion of composite sample collection.
5. Begin full monitoring program when residential is 90% completed.
6. Implement the monitoring program for at least one drainage ditch in area 1 in order to establish background conditions over a three year period.

Results to be forwarded to MOEE and City of Ottawa.

7.0 MAINTENANCE & OPERATION

The operation of the ponds are essentially self-regulating. As determined in Appendix B, the SWM Pond forebay will have to be maintained every 10 years by removal of less than 0.2 metres of sediment that is anticipated over that time period. The forebay should be inspected annually and if sediment deposition occurs at a faster rate than anticipated removal should occur more frequently.
The catchbasins in the commercial and residential area should be cleaned annually and street cleaning should be undertaken in the spring and after long periods of no rain (10 days minimum).

Figure 2: 25mm Runoff
SWM Pond inflow/outflow hydrographs



8.0 CONCLUSIONS

Based on the previous sections, it is concluded that:

1. Provincial and Federal water quality requirements can be achieved with a SWM Pond upstream of Langstaff. An increased assurance can be gained by providing appropriate source controls including lot grading and eavestrough/splash pad commitments.

2. This Addendum, in conjunction with the previous SWM Plan dated June 2001, will meet the requirements of the Carp MDP, the City of Ottawa, MOE and the MVC

9.0 RECOMMENDATIONS

Based on the conclusions, it is recommended that:

1. A SWM Pond, instead of the previously recommended forebay, be constructed to achieve fisheries requirements.

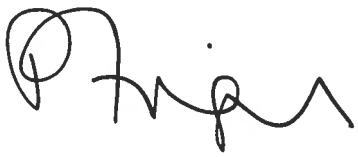
2. All storm drains outletting to the stormwater management system upstream of Langstaff Drive are to be rerouted to the stormsewer on Cavanaugh Drive via sump pump systems.

3. As previously recommended, two water quantity ponds be constructed to meet water quantity criteria.

4. All construction areas for the control structures are to be laid out by the contractor and then approved by Daniel Brunton Consulting Services prior to construction.

5. The proposed Operations, Maintenance and Monitoring plan be implemented.

All of which is respectfully submitted.



Paul Frigon, P.Eng.
PSR Group Ltd

APPENDIX A - Hydrology & SWM – Water Quantity

TABLE A1 (revised 2003)
RATING CURVES – GLENNCASTLE SWM STRUCTURES in ravine

SWM Pond (G-1)

10 m wide weir at 105.15 m 90mm orifice, 450mm pipe			Storage (m^3)				
Elev. (m)	H(m)			Orifice Q(m^3)	Weir Q(m^3)	Total Q(m^3)	comment
	Orifice	Weir					
103.0	0	0	0	0	0	0	
104.0	0	0	930	0	0	0	Permanent Pool
104.5	0.455	0	640	.012	0	.012	Extended Detention
104.75	0.75	0	913	.015	0	.015	Erosion Control
105.0	1.0	0	1235	.018	0	.018	
105.15	1.15	0	1468	.019	0	.019	Weir
105.30	1.3	0.15	1701	.020	.900	.920	
105.5	1.5	0.35	2011	.022	3.209	3.231	
106.0	2.0	0.85	2787	.025	12.1	12.125	

LANGSTAFF (EXISTING) (G-2)

3.8 m weir at 105.0 m 675 mm orifice; 1200 mm pipe			Storage (m^3)			
Elev. (m)	H(m)			Orifice Q(m^3)	Weir Q(m^3)	Total Q(m^3)
	Orifice	Weir				
102.8			0	0	0	0
104.000	0.863		158	1.000	0	1.000
105.00	1.863		478	1.470	0	1.470
105.50	2.363	0.5	603	1.655	2.082	3.737
105.9	2.5	0.9	900	5.381	0	5.381

DOWNSTREAM LANGSTAFF (G-3)

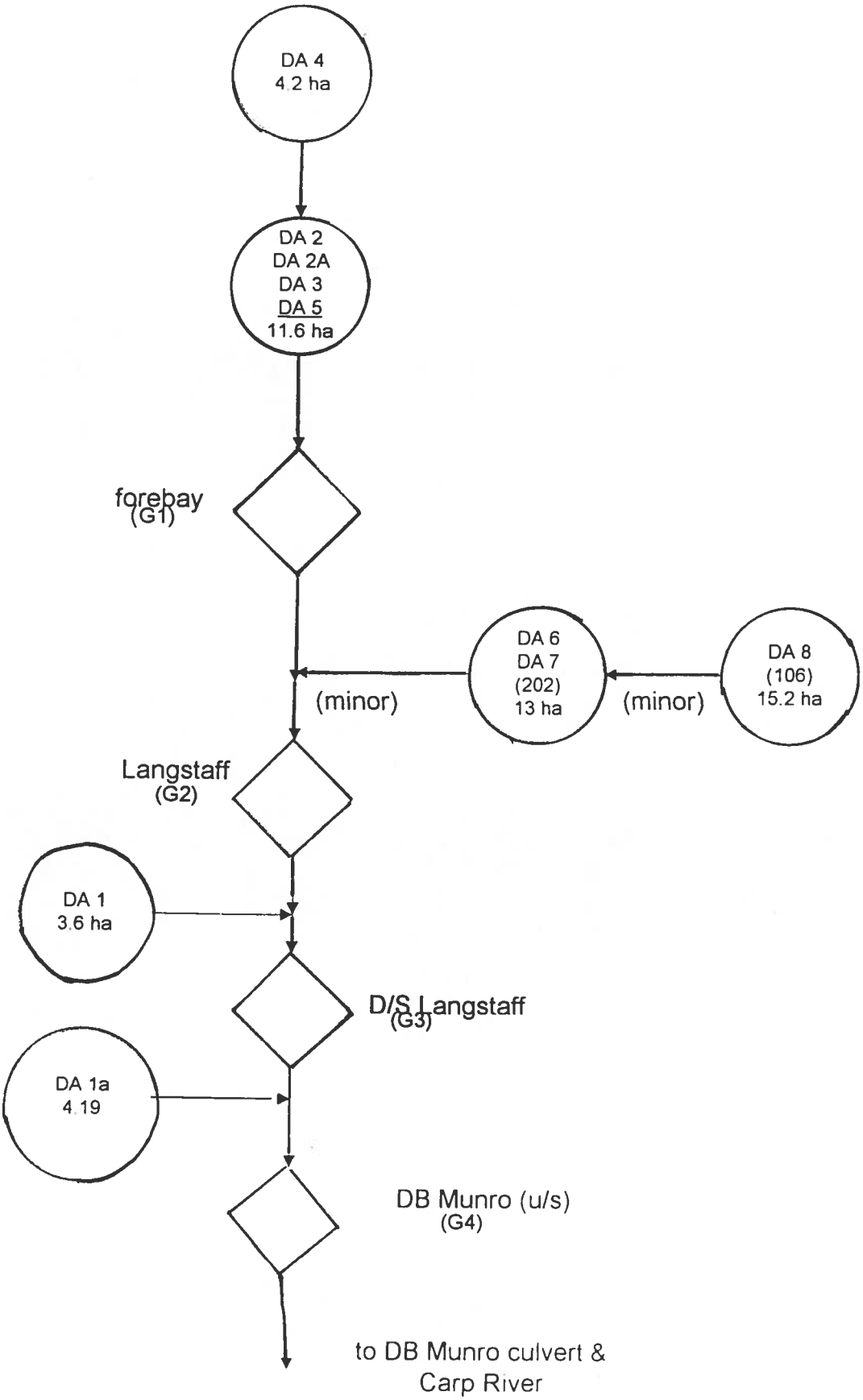
15 m weir at 102.4 m 675 mm pipe at 1.2%			Storage (m^3)			
Elev. (m)	H(m)			Inlet Q(m^3)	Weir Q(m^3)	Total Q(m^3)
	Inlet	Weir				
99. 5			0	0	0	0
101.00	.913		321	1.1	0	1.1
102.00	1.913		1160	1.6	0	1.6
102.4	2.313		1773	1.7	0	1.7
102.75	2.663	0.35	1900	1.9	2.906	4.8

UPSTREAM DB Munro (G-4)

7.5m weir at 99.7 m 450 mm pipe at 4.2%			Storage (m^3)			
Elev. (m)	H(m)			Inlet Q(m^3)	Weir Q(m^3)	Total Q(m^3)
	Inlet	Weir				
97.0			0	0	0	0
98.0	0.9		285	.260	0	.260
99.0	1.9		1482	.400	0	.400
100.0	2.9	.30	3253	.500	1.910	2.410
100.25	3.15	.55	3500	.520	4.742	5.262

Note: Storage based on cross section surveyed in winter/spring 2001

Figure A2
Glenncastle Subdivision
Hydrologic Model - SWM



SWMHYMO INPUT

```
2
*       REVISED APRIL 2003
*       SWM Pond u/s of Langstaff
*       Glenncastle
*       Carp River - POST-DEVELOPMENT MODEL -
*       6 hour SCS storm distribution
*       revised storage u/s langstaff - spring 2001 survey
*       100 year EVENT for water quantity
*
***
START                RAINFALL BEGINNING @ 0.0 HRS
*
MASS STORM           PTOT=95 dt=15min
                     "c:\water\swmhymo\storms\scs6II.mst"
*
*
*# rivington phase A (s/c 4)
DESIGN STANDHYD      1 105A 0.2hr 4.26 ximp.15 timp.45
                     0 2 60 1% -1
**SAVE HYD             ID1      pcycles1 icase-1 "postdev.hyd" "post development"
*#rivington phase B (s/c 2, 3, 5)
DESIGN STANDHYD      2 105AA 0.2hr 10.80 .15 .45
                     0 2 60 1% -1
*#playing field
*#rivington phase B (s/c 2a)
DESIGN SCSHYD        6    "playing field"    dt0.2hrs  0.82ha 0   CN65   Tp0.5hr -1
ADD HYD              3 201 1 2 6
*#route thru G-1 structure: 450 cp with 90mm orifice; 10m weir@105.15m
**SAVE HYD             ID3      pcycles1 icase-1 "for100i.hyd" "G-1 inflow - post
development"
ROUTE RESERVOIR      idout=4 nhyd="G-1 pond" idin=3  dt=2min
                      flow (cms)    storage (ha-m)   0               0
                         .012            .0640
                         .018            .1235
                         .019            .1465
                         0.920           .1701
                         3.231           .2011
                        12.125           .2787
*SAVE HYD             ID4 pcycles1 icase-1 "for25mmo.hyd" "post development outflow forebay
routing"
*#cavanagh et al developed
DESIGN STANDHYD      1 202 0.2hr 13.01ha .15 .30
                     0 2 60 1% -1
*#u/s wetlands - minor to cavanagh; major diverted elsewhere
DESIGN SCSHYD        2    "rural 106 SCS"    dt0.2hrs  15.15ha  0   CN70   Tp1.5hr -1
COMPUTE DUHYD        2 1060 inlet=.25 ninlet=1  maid 10 miid 9
*#cavanagh plus wetland
ADD HYD              8 202 9 1
*#only minor to ravine - controlled by 1060mm sewer at 0.47%  and 675mm@1.4%+/- Q=1.0m3/s
COMPUTE DUHYD        8 1061 inlet=1.000 ninlet=1  maid 10 miid 9
ADD HYD              7 203 9 4
*#route existing langstaff structure - 675mm orifice ; 1200mm cp@2.2%; no weir
*SAVE HYD             ID7 pcycles1 icase-1 "lan100i.hyd" " langstaff inflow - post
development"
ROUTE RESERVOIR      idout=4 nhyd="langstaff pond" idin=7  dt=2min
                      flow (cms)    storage (ha-m)
                         0               0
                         1.0           .0158
                         1.47          .0478
                         3.737         .0603
                         5.381         .0900
                        -1              -1
*SAVE HYD             ID4 pcycles1 icase-1 "lan25mmo.hyd" " langstaff outflow - post
development"
*#lands d/s langstaff (s/c 1)
DESIGN STANDHYD      1 105C 0.2hr 3.6ha .15 .45
```

```
                    0 2 70 .5% -1
ADD HYD             10 203 1 4
*#route proposed G3 structure d/s of Langstaff - 675mm outlet@1.2%,invert@99.75m; 15m
weir@102.5m
*SAVE HYD            ID10 pcycles1 icase-1 "G3100i.hyd" " cavanagh inflow - post
development"
ADD HYD             10 203 1 4
ROUTE RESERVOIR     idout=4 nhyd="G3 pond" idin=10  dt=1min
                     flow (cms)    storage (ha-m)
                        0              0
                        1.1           .0321
                        1.6           .1160
                        1.7           .1773
                        4.800         .1900
                       -1             -1
*SAVE HYD            ID4 pcycles1 icase-1 "G325mmo.hyd" " G3 outflow/dbmuninflow  - post
development"
*#lands d/s langstaff (s/c 1a)
DESIGN STANDHYD     1 105C 0.2hr 4.19ha .15 .45
                    0 2 70 .5% -1
ADD HYD             5 204 4 1
*#route structure u/s dbmunro - 450mm outlet @4.2%invert@97.0m;7.5m weir@99.7.0m
ROUTE RESERVOIR     idout=8 nhyd="dbmunro pond" idin=5  dt=2min
                     flow (cms)    storage (ha-m)
                        0              0
                        .26           .0285
                        .40           .1482
                        2.410         .3253
                        5.262         .3500
                       -1             -1
*SAVE HYD            ID8 pcycles1 icase-1 "G425mmo.hyd" " dbmunro outflow - post
development"
FINISH
```

25mm rainfall
run April, 2003

```
 RUN:COMMAND#
 001:0001----------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   0 ]
      [NRUN  =   1 ]
 001:0002----------------------------------------------------------------------
     MASS STORM
      Filename = c:\water\swmhymo\storms\scs6II.mst
      Comment  =  SCS 6 HOUR TYPE II STORM DISTRIBUTION
      [SDT=15.00:SDUR=   6.25:PTOT=  25.00]
# rivington phase A (s/c 4)
 001:0003--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  DESIGN STANDHYD    01:000105     4.26      .086 No_date    3:15    7.30 .292
      [XIMP=.15:TIMP=.45]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 60.0]
#rivington phase B (s/c 2, 3, 5)
 001:0004--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  DESIGN STANDHYD    02:000105    10.80      .209 No_date    3:15    7.30 .292
      [XIMP=.15:TIMP=.45]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 60.0]
#playing field
#rivington phase B (s/c 2a)
 001:0005--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     DESIGN SCSHYD      06:playin      .82      .000 No_date    0:00     .00 .000
      [CN= 65.0: N= 5.00]
      [Tp=  .50:DT=15.00]
 001:0006--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:000105     4.26      .086 No_date    3:15    7.30  n/a
                    +   02:000105    10.80      .209 No_date    3:15    7.30  n/a
                    +   06:playin      .82      .000 No_date    0:00     .00  n/a
      [DT=15.00]  SUM=  03:000201    15.88      .295 No_date    3:15    6.93  n/a
#route thru forebay structure: 450 cp with 250mm orifice; 10m weir@105.15m
 001:0007--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 03:000201    15.88      .295 No_date    3:15    6.93  n/a
      [RDT= 1.88] out<- 04:foreba    15.88      .015 No_date    6:24    6.93  n/a
     {MxStoUsed=.9131E-01}
#cavanagh et al developed
 001:0008--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  DESIGN STANDHYD    01:000202    13.01      .226 No_date    3:15    6.57 .263
      [XIMP=.15:TIMP=.30]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 60.0]
#u/s wetlands - minor to cavanagh; major diverted elsewhere
 001:0009--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     DESIGN SCSHYD      02:rural      15.15      .002 No_date    7:00     .09 .004
      [CN= 70.0: N= 5.00]
      [Tp= 1.50:DT=15.00]
 001:0010--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  COMPUTE DUHYD      02:rural      15.15      .002 No_date    7:00     .09  n/a
       Major System /   10:001060      .00      .000 No_date    0:00     .00  n/a
       Minor System \   09:101060    15.15      .002 No_date    7:00     .09  n/a
#cavanagh plus wetland
 001:0011--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            09:101060    15.15      .002 No_date    7:00     .09  n/a
                    +   01:000202    13.01      .226 No_date    3:15    6.57  n/a
      [DT=15.00]  SUM=  08:000202    28.16      .226 No_date    3:15    3.09  n/a
#only minor to ravine - controlled by 1060mm sewer at 0.47%  and 675mm@1.4%+/-
 001:0012--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  COMPUTE DUHYD      08:000202    28.16      .226 No_date    3:15    3.09  n/a
       Major System /   10:001061      .00      .000 No_date    0:00     .00  n/a
       Minor System \   09:101061    28.16      .226 No_date    3:15    3.09  n/a
 001:0013--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            09:101061    28.16      .226 No_date    3:15    3.09  n/a
                    +   04:foreba    15.88      .015 No_date    6:24    6.93  n/a
      [DT= 1.88]  SUM=  07:000203    44.04      .231 No_date    3:15    4.47  n/a
#route existing langstaff structure - 675mm orifice ; 1200mm cp@2.2%; no weir
 001:0014--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 07:000203    44.04      .231 No_date    3:15    4.47  n/a
      [RDT= 1.88] out<- 04:langst    44.04      .210 No_date    3:17    4.47  n/a
     {MxStoUsed=.3362E-02}
#lands d/s langstaff (s/c 1)
 001:0015--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  DESIGN STANDHYD    01:000105     3.60      .076 No_date    3:15    8.83 .353
      [XIMP=.15:TIMP=.45]
      [SLP= .50:DT=15.00]
```

```
     [LOSS= 2 :CN= 70.0]
 001:0016---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             01:000105     3.60     .076 No_date    3:15    8.83  n/a
                       + 04:langst    44.04     .210 No_date    3:17    4.47  n/a
      [DT= 1.88]  SUM=   10:000203    47.64     .284 No_date    3:17    4.80  n/a
#route proposed G3 structure d/s of Langstaff - 675mm outlet@1.2%,invert@99.75m
 001:0017---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             01:000105     3.60     .076 No_date    3:15    8.83  n/a
                       + 04:langst    44.04     .210 No_date    3:17    4.47  n/a
      [DT= 1.88]  SUM=   10:000203    47.64     .284 No_date    3:17    4.80  n/a
 001:0018---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 10:000203    47.64     .284 No_date    3:17    4.80  n/a
      [RDT=  .94] out<- 04:G3 pon    47.64     .255 No_date    3:23    4.80  n/a
     {MxStoUsed=.7449E-02}
#lands d/s langstaff (s/c 1a)
 001:0019---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
   * DESIGN STANDHYD     01:000105     4.19     .088 No_date    3:15    8.83 .353
      [XIMP=.15:TIMP=.45]
      [SLP= .50:DT=15.00]
      [LOSS= 2 :CN= 70.0]
 001:0020---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             04:G3 pon     47.64     .255 No_date    3:23    4.80  n/a
                       + 01:000105      4.19     .088 No_date    3:15    8.83  n/a
      [DT=  .94]  SUM=   05:000204     51.83     .330 No_date    3:22    5.13  n/a
#route structure u/s dbmunro - 450mm outlet @4.2%invert@97.0m;7.5m weir@99.7.0m
 001:0021---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 05:000204     51.83     .330 No_date    3:22    5.13  n/a
      [RDT=  .94] out<- 08:dbmunr     51.83     .234 No_date    3:38    5.13  n/a
     {MxStoUsed=.2564E-01}
 001:0022---------------------------------------------------------------------------
      FINISH
```

2 year event
run April 2003

```
 RUN:COMMAND#
 001:0001--------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on         0]
      [METOUT=    2     (1=imperial, 2=metric output)]
      [NSTORM=    0 ]
      [NRUN  =    1 ]
 001:0002--------------------------------------------------------------------------
     MASS STORM
      Filename = c:\water\swmhymo\storms\scs6II.mst
      Comment  =  SCS 6 HOUR TYPE II STORM DISTRIBUTION
      [SDT=15.00:SDUR=   6.25:PTOT=  35.80]
# rivington phase A (s/c 4)
 001:0003---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  DESIGN STANDHYD     01:000105      4.26      .181 No_date     3:15    12.39 .346
      [XIMP=.15:TIMP=.45]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 60.0]
#rivington phase B (s/c 2, 3, 5)
 001:0004---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  DESIGN STANDHYD     02:000105     10.80      .336 No_date     3:15    12.39 .346
      [XIMP=.15:TIMP=.45]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 60.0]
#playing field
#rivington phase B (s/c 2a)
 001:0005---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     DESIGN SCSHYD       06:playin       .82      .000 No_date     5:00     .49 .014
      [CN= 65.0: N= 5.00]
      [Tp=  .50:DT=15.00]
 001:0006---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             01:000105      4.26      .181 No_date     3:15    12.39  n/a
                       + 02:000105     10.80      .336 No_date     3:15    12.39  n/a
                       + 06:playin       .82      .000 No_date     5:00     .49  n/a
      [DT=15.00]  SUM=  03:000201     15.88      .517 No_date     3:15    11.78  n/a
#route thru forebay structure: 450 cp with 250mm orifice; 10m weir@105.15m
 001:0007---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 03:000201     15.88      .517 No_date     3:15    11.78  n/a
      [RDT= 1.88] out<- 04:foreba     15.88      .062 No_date     5:02    11.78  n/a
     {MxStoUsed=.1476E+00}
#cavanagh et al developed
 001:0008---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  DESIGN STANDHYD     01:000202     13.01      .377 No_date     3:15    11.09 .310
      [XIMP=.15:TIMP=.30]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 60.0]
#u/s wetlands - minor to cavanagh; major diverted elsewhere
 001:0009---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     DESIGN SCSHYD       02:rural      15.15      .021 No_date     5:45     1.60 .045
      [CN= 70.0: N= 5.00]
      [Tp= 1.50:DT=15.00]
 001:0010---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  COMPUTE DUHYD       02:rural      15.15      .021 No_date     5:45     1.60  n/a
        Major System /   10:001060       .00      .000 No_date     0:00      .00  n/a
        Minor System \   09:101060     15.15      .021 No_date     5:45     1.60  n/a
#cavanagh plus wetland
 001:0011---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             09:101060     15.15      .021 No_date     5:45     1.60  n/a
                       + 01:000202     13.01      .377 No_date     3:15    11.09  n/a
      [DT=15.00]  SUM=  08:000202     28.16      .377 No_date     3:15     5.98  n/a
#only minor to ravine - controlled by 1060mm sewer at 0.47%  and 675mm@1.4%+/-
 001:0012---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  COMPUTE DUHYD       08:000202     28.16      .377 No_date     3:15     5.98  n/a
        Major System /   10:001061       .00      .000 No_date     0:00      .00  n/a
        Minor System \   09:101061     28.16      .377 No_date     3:15     5.98  n/a
 001:0013---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             09:101061     28.16      .377 No_date     3:15     5.98  n/a
                       + 04:foreba     15.88      .062 No_date     5:02    11.78  n/a
      [DT= 1.88]  SUM=  07:000203     44.04      .385 No_date     3:15     8.07  n/a
#route existing langstaff structure - 675mm orifice ; 1200mm cp@2.2%; no weir
 001:0014---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 07:000203     44.04      .385 No_date     3:15     8.07  n/a
      [RDT= 1.88] out<- 04:langst     44.04      .358 No_date     3:19     8.07  n/a
     {MxStoUsed=.5680E-02}
#lands d/s langstaff (s/c 1)
 001:0015---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  DESIGN STANDHYD     01:000105      3.60      .124 No_date     3:15    15.05 .420
```

```
     [XIMP=.15:TIMP=.45]
     [SLP= .50:DT=15.00]
     [LOSS= 2 :CN= 70.0]
 001:0016---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD             01:000105     3.60      .124 No_date    3:15   15.05  n/a
                    +   04:langst    44.04      .358 No_date    3:19    8.07  n/a
     [DT= 1.88]  SUM=   10:000203    47.64      .476 No_date    3:19    8.60  n/a
#route proposed G3 structure d/s of Langstaff - 675mm outlet@1.2%,invert@99.75m
 001:0017---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD             01:000105     3.60      .124 No_date    3:15   15.05  n/a
                    +   04:langst    44.04      .358 No_date    3:19    8.07  n/a
     [DT= 1.88]  SUM=   10:000203    47.64      .476 No_date    3:19    8.60  n/a
 001:0018---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 10:000203    47.64      .476 No_date    3:19    8.60  n/a
     [RDT=  .94] out<- 04:G3 pon    47.64      .439 No_date    3:24    8.60  n/a
    {MxStoUsed=.1280E-01}
#lands d/s langstaff (s/c 1a)
 001:0019---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  DESIGN STANDHYD     01:000105     4.19      .143 No_date    3:15   15.05 .420
     [XIMP=.15:TIMP=.45]
     [SLP= .50:DT=15.00]
     [LOSS= 2 :CN= 70.0]
 001:0020---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD             04:G3 pon     47.64      .439 No_date    3:24    8.60  n/a
                    +   01:000105     4.19      .143 No_date    3:15   15.05  n/a
     [DT=  .94]  SUM=   05:000204    51.83      .567 No_date    3:23    9.12  n/a
#route structure u/s dbmunro - 450mm outlet @4.2%invert@97.0m;7.5m weir@99.7.0m
 001:0021---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 05:000204    51.83      .567 No_date    3:23    9.12  n/a
     [RDT=  .94] out<- 08:dbmunr    51.83      .302 No_date    3:58    9.12  n/a
    {MxStoUsed=.6400E-01}
 001:0022---------------------------------------------------------------------------
     FINISH
```

5 year event
run april, 2003

```
 RUN:COMMAND#
 001:0001----------------------------------------------------------------------
      START
       [TZERO =    .00 hrs on        0]
       [METOUT=   2     (1=imperial, 2=metric output)]
       [NSTORM=   0 ]
       [NRUN  =   1 ]
 001:0002----------------------------------------------------------------------
      MASS STORM
       Filename = c:\water\swmhymo\storms\scs6II.mst
       Comment  =  SCS 6 HOUR TYPE II STORM DISTRIBUTION
       [SDT=15.00:SDUR=   6.25:PTOT=  53.90]
# rivington phase A (s/c 4)
 001:0003---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *   DESIGN STANDHYD    01:000105     4.26      .347 No_date    3:15   22.62 .420
       [XIMP=.15:TIMP=.45]
       [SLP=1.00:DT=15.00]
       [LOSS= 2 :CN= 60.0]
#rivington phase B (s/c 2, 3, 5)
 001:0004---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *   DESIGN STANDHYD    02:000105    10.80      .852 No_date    3:15   22.62 .420
       [XIMP=.15:TIMP=.45]
       [SLP=1.00:DT=15.00]
       [LOSS= 2 :CN= 60.0]
#playing field
#rivington phase B (s/c 2a)
 001:0005---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
      DESIGN SCSHYD      06:playin      .82      .005 No_date    3:45    4.31 .080
       [CN= 65.0: N= 5.00]
       [Tp=  .50:DT=15.00]
 001:0006---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
      ADD HYD            01:000105     4.26      .347 No_date    3:15   22.62  n/a
                       + 02:000105    10.80      .852 No_date    3:15   22.62  n/a
                       + 06:playin      .82      .005 No_date    3:45    4.31  n/a
       [DT=15.00]  SUM=  03:000201    15.88     1.200 No_date    3:15   21.67  n/a
#route thru forebay structure: 450 cp with 250mm orifice; 10m weir@105.15m
 001:0007---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
      ROUTE RESERVOIR -> 03:000201    15.88     1.200 No_date    3:15   21.67  n/a
       [RDT= 1.88] out<- 04:foreba    15.88      .575 No_date    3:34   21.67  n/a
      {MxStoUsed=.1611E+00}
#cavanagh et al developed
 001:0008---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *   DESIGN STANDHYD    01:000202    13.01      .890 No_date    3:15   20.24 .375
       [XIMP=.15:TIMP=.30]
       [SLP=1.00:DT=15.00]
       [LOSS= 2 :CN= 60.0]
#u/s wetlands - minor to cavanagh; major diverted elsewhere
 001:0009---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
      DESIGN SCSHYD      02:rural      15.15      .103 No_date    5:00    7.32 .136
       [CN= 70.0: N= 5.00]
       [Tp= 1.50:DT=15.00]
 001:0010---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *   COMPUTE DUHYD      02:rural      15.15      .103 No_date    5:00    7.32  n/a
        Major System /   10:001060       .00      .000 No_date    0:00     .00  n/a
        Minor System \   09:101060     15.15      .103 No_date    5:00    7.32  n/a
#cavanagh plus wetland
 001:0011---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
      ADD HYD            09:101060     15.15      .103 No_date    5:00    7.32  n/a
                       + 01:000202     13.01      .890 No_date    3:15   20.24  n/a
       [DT=15.00]  SUM=  08:000202     28.16      .891 No_date    3:15   13.29  n/a
#only minor to ravine - controlled by 1060mm sewer at 0.47%  and 675mm@1.4%+/-
 001:0012---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *   COMPUTE DUHYD      08:000202     28.16      .891 No_date    3:15   13.29  n/a
        Major System /   10:001061       .00      .000 No_date    0:00     .00  n/a
        Minor System \   09:101061     28.16      .891 No_date    3:15   13.29  n/a
 001:0013---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
      ADD HYD            09:101061     28.16      .891 No_date    3:15   13.29  n/a
                       + 04:foreba     15.88      .575 No_date    3:34   21.67  n/a
       [DT= 1.88]  SUM=  07:000203     44.04     1.031 No_date    3:32   16.31  n/a
#route existing langstaff structure - 675mm orifice ; 1200mm cp@2.2%; no weir
 001:0014---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
      ROUTE RESERVOIR -> 07:000203     44.04     1.031 No_date    3:32   16.31  n/a
       [RDT= 1.88] out<- 04:langst     44.04     1.001 No_date    3:36   16.31  n/a
      {MxStoUsed=.1596E-01}
#lands d/s langstaff (s/c 1)
 001:0015---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *   DESIGN STANDHYD    01:000105      3.60      .336 No_date    3:15   27.27 .506
       [XIMP=.15:TIMP=.45]
```

```
     [SLP= .50:DT=15.00]
     [LOSS= 2 :CN= 70.0]
 001:0016---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             01:000105     3.60      .336 No_date    3:15   27.27  n/a
                       + 04:langst    44.04     1.001 No_date    3:36   16.31  n/a
     [DT= 1.88]  SUM=  10:000203    47.64     1.170 No_date    3:34   17.14  n/a
#route proposed G3 structure d/s of Langstaff - 675mm outlet@1.2%,invert@99.75m
 001:0017---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             01:000105     3.60      .336 No_date    3:15   27.27  n/a
                       + 04:langst    44.04     1.001 No_date    3:36   16.31  n/a
     [DT= 1.88]  SUM=  10:000203    47.64     1.170 No_date    3:34   17.14  n/a
 001:0018---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 10:000203    47.64     1.170 No_date    3:34   17.14  n/a
      [RDT=  .94] out<- 04:G3 pon    47.64     1.108 No_date    3:39   17.14  n/a
     {MxStoUsed=.3340E-01}
#lands d/s langstaff (s/c 1a)
 001:0019---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  DESIGN STANDHYD     01:000105     4.19      .389 No_date    3:15   27.27 .506
      [XIMP=.15:TIMP=.45]
      [SLP= .50:DT=15.00]
      [LOSS= 2 :CN= 70.0]
 001:0020---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             04:G3 pon     47.64     1.108 No_date    3:39   17.14  n/a
                       + 01:000105     4.19      .389 No_date    3:15   27.27  n/a
      [DT=  .94]  SUM=  05:000204    51.83     1.336 No_date    3:22   17.96  n/a
#route structure u/s dbmunro - 450mm outlet @4.2%invert@97.0m;7.5m weir@99.7.0m
 001:0021---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 05:000204    51.83     1.336 No_date    3:22   17.96  n/a
      [RDT=  .94] out<- 08:dbmunr    51.83      .953 No_date    3:53   17.96  n/a
     {MxStoUsed=.1969E+00}
 001:0022---------------------------------------------------------------------------
      FINISH
```

10 year event
run April 2003

```
 RUN:COMMAND#
 001:0001----------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2     (1=imperial, 2=metric output)]
      [NSTORM=   0 ]
      [NRUN  =   1 ]
 001:0002----------------------------------------------------------------------
     MASS STORM
      Filename = c:\water\swmhymo\storms\scs6II.mst
      Comment  =  SCS 6 HOUR TYPE II STORM DISTRIBUTION
      [SDT=15.00:SDUR=   6.25:PTOT=  63.90]
# rivington phase A (s/c 4)
 001:0003---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  DESIGN STANDHYD    01:000105     4.26     .457 No_date    3:15   28.98 .454
      [XIMP=.15:TIMP=.45]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 60.0]
#rivington phase B (s/c 2, 3, 5)
 001:0004---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  DESIGN STANDHYD    02:000105    10.80    1.124 No_date    3:15   28.98 .454
      [XIMP=.15:TIMP=.45]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 60.0]
#playing field
#rivington phase B (s/c 2a)
 001:0005---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     DESIGN SCSHYD      06:playin      .82     .011 No_date    3:45    7.71 .121
      [CN= 65.0: N= 5.00]
      [Tp=  .50:DT=15.00]
 001:0006---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:000105     4.26     .457 No_date    3:15   28.98  n/a
                      +  02:000105    10.80    1.124 No_date    3:15   28.98  n/a
                      +  06:playin      .82     .011 No_date    3:45    7.71  n/a
      [DT=15.00]  SUM=  03:000201    15.88    1.584 No_date    3:15   27.88  n/a
#route thru forebay structure: 450 cp with 250mm orifice; 10m weir@105.15m
 001:0007---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 03:000201    15.88    1.584 No_date    3:15   27.88  n/a
      [RDT= 1.88] out<- 04:foreba    15.88    1.017 No_date    3:26   27.88  n/a
     {MxStoUsed=.1715E+00}
#cavanagh et al developed
 001:0008---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  DESIGN STANDHYD    01:000202    13.01    1.171 No_date    3:15   25.98 .407
      [XIMP=.15:TIMP=.30]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 60.0]
#u/s wetlands - minor to cavanagh; major diverted elsewhere
 001:0009---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     DESIGN SCSHYD      02:rural      15.15     .171 No_date    5:00   11.75 .184
      [CN= 70.0: N= 5.00]
      [Tp= 1.50:DT=15.00]
 001:0010---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  COMPUTE DUHYD      02:rural      15.15     .171 No_date    5:00   11.75  n/a
       Major System /   10:001060      .00     .000 No_date    0:00     .00  n/a
       Minor System \   09:101060    15.15     .171 No_date    5:00   11.75  n/a
#cavanagh plus wetland
 001:0011---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            09:101060    15.15     .171 No_date    5:00   11.75  n/a
                      +  01:000202    13.01    1.171 No_date    3:15   25.98  n/a
      [DT=15.00]  SUM=  08:000202    28.16    1.172 No_date    3:15   18.33  n/a
#only minor to ravine - controlled by 1060mm sewer at 0.47%  and 675mm@1.4%+/-
 001:0012---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  COMPUTE DUHYD      08:000202    28.16    1.172 No_date    3:15   18.33  n/a
       Major System /   10:001061      .85     .172 No_date    3:15   18.33  n/a
       Minor System \   09:101061    27.31    1.000 No_date    3:15   18.33  n/a
 001:0013---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            09:101061    27.31    1.000 No_date    3:15   18.33  n/a
                      +  04:foreba    15.88    1.017 No_date    3:26   27.88  n/a
      [DT= 1.88]  SUM=  07:000203    43.19    1.751 No_date    3:26   21.84  n/a
#route existing langstaff structure - 675mm orifice ; 1200mm cp@2.2%; no weir
 001:0014---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 07:000203    43.19    1.751 No_date    3:26   21.84  n/a
      [RDT= 1.88] out<- 04:langst    43.19    1.418 No_date    3:34   21.84  n/a
     {MxStoUsed=.4434E-01}
#lands d/s langstaff (s/c 1)
 001:0015---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  DESIGN STANDHYD    01:000105     3.60     .443 No_date    3:15   34.70 .543
      [XIMP=.15:TIMP=.45]
      [SLP= .50:DT=15.00]
```

```
     [LOSS= 2 :CN= 70.0]
 001:0016---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             01:000105     3.60      .443 No_date    3:15   34.70  n/a
                       + 04:langst     43.19    1.418 No_date    3:34   21.84  n/a
      [DT= 1.88]  SUM=  10:000203     46.79    1.640 No_date    3:32   22.83  n/a
#route proposed G3 structure d/s of Langstaff - 675mm outlet@1.2%,invert@99.75m
 001:0017---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             01:000105     3.60      .443 No_date    3:15   34.70  n/a
                       + 04:langst     43.19    1.418 No_date    3:34   21.84  n/a
      [DT= 1.88]  SUM=  10:000203     46.79    1.640 No_date    3:32   22.83  n/a
 001:0018---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 10:000203     46.79    1.640 No_date    3:32   22.83  n/a
      [RDT=  .94] out<- 04:G3 pon     46.79    1.373 No_date    3:46   22.83  n/a
     {MxStoUsed=.7799E-01}
#lands d/s langstaff (s/c 1a)
 001:0019---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  DESIGN STANDHYD     01:000105     4.19      .513 No_date    3:15   34.70 .543
      [XIMP=.15:TIMP=.45]
      [SLP= .50:DT=15.00]
      [LOSS= 2 :CN= 70.0]
 001:0020---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             04:G3 pon     46.79    1.373 No_date    3:46   22.83  n/a
                       + 01:000105     4.19      .513 No_date    3:15   34.70  n/a
      [DT=  .94]  SUM=  05:000204     50.98    1.571 No_date    3:18   23.80  n/a
#route structure u/s dbmunro - 450mm outlet @4.2%invert@97.0m;7.5m weir@99.7.0m
 001:0021---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 05:000204     50.98    1.571 No_date    3:18   23.80  n/a
      [RDT=  .94] out<- 08:dbmunr     50.98    1.369 No_date    4:01   23.80  n/a
     {MxStoUsed=.2336E+00}
 001:0022---------------------------------------------------------------------
      FINISH
```

100 year event
run April, 2003

```
 RUN:COMMAND#
 001:0001----------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2     (1=imperial, 2=metric output)]
      [NSTORM=   0 ]
      [NRUN  =   1 ]
 001:0002----------------------------------------------------------------------
     MASS STORM
      Filename = c:\water\swmhymo\storms\scs6II.mst
      Comment  =  SCS 6 HOUR TYPE II STORM DISTRIBUTION
      [SDT=15.00:SDUR=   6.25:PTOT=  95.00]
# rivington phase A (s/c 4)
 001:0003---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  DESIGN STANDHYD     01:000105     4.26     .866 No_date     3:15   51.04 .537
      [XIMP=.15:TIMP=.45]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 60.0]
#rivington phase B (s/c 2, 3, 5)
 001:0004---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  DESIGN STANDHYD     02:000105    10.80    2.134 No_date     3:15   51.04 .537
      [XIMP=.15:TIMP=.45]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 60.0]
#playing field
#rivington phase B (s/c 2a)
 001:0005---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     DESIGN SCSHYD       06:playin      .82     .036 No_date     3:45   22.39 .236
      [CN= 65.0: N= 5.00]
      [Tp=  .50:DT=15.00]
 001:0006---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             01:000105     4.26     .866 No_date     3:15   51.04  n/a
                       + 02:000105    10.80    2.134 No_date     3:15   51.04  n/a
                       + 06:playin      .82     .036 No_date     3:45   22.39  n/a
      [DT=15.00]  SUM=   03:000201    15.88    3.011 No_date     3:15   49.56  n/a
#route thru forebay structure: 450 cp with 250mm orifice; 10m weir@105.15m
 001:0007---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 03:000201    15.88    3.011 No_date     3:15   49.56  n/a
      [RDT= 1.88] out<- 04:foreba    15.88    2.686 No_date     3:19   49.56  n/a
     [MxStoUsed=.1941E+00]
#cavanagh et al developed
 001:0008---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  DESIGN STANDHYD     01:000202    13.01    2.230 No_date     3:15   46.17 .486
      [XIMP=.15:TIMP=.30]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 60.0]
#u/s wetlands - minor to cavanagh; major diverted elsewhere
 001:0009---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     DESIGN SCSHYD       02:rural      15.15     .453 No_date     4:45   29.45 .310
      [CN= 70.0: N= 5.00]
      [Tp= 1.50:DT=15.00]
 001:0010---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  COMPUTE DUHYD       02:rural      15.15     .453 No_date     4:45   29.45  n/a
        Major System /   10:001060      3.53     .203 No_date     4:45   29.45  n/a
        Minor System \   09:101060     11.62     .250 No_date     4:00   29.45  n/a
#cavanagh plus wetland
 001:0011---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             09:101060     11.62     .250 No_date     4:00   29.45  n/a
                       + 01:000202     13.01    2.230 No_date     3:15   46.17  n/a
      [DT=15.00]  SUM=   08:000202     24.63    2.235 No_date     3:15   38.28  n/a
#only minor to ravine - controlled by 1060mm sewer at 0.47%  and 675mm@1.4%+/-
 001:0012---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  COMPUTE DUHYD       08:000202     24.63    2.235 No_date     3:15   38.28  n/a
        Major System /   10:001061      3.38    1.235 No_date     3:15   38.28  n/a
        Minor System \   09:101061     21.25    1.000 No_date     3:15   38.28  n/a
 001:0013---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             09:101061     21.25    1.000 No_date     3:15   38.28  n/a
                       + 04:foreba     15.88    2.686 No_date     3:19   49.56  n/a
      [DT= 1.88]  SUM=   07:000203     37.13    3.686 No_date     3:19   43.11  n/a
#route existing langstaff structure - 675mm orifice ; 1200mm cp@2.2%; no weir
 001:0014---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 07:000203     37.13    3.686 No_date     3:19   43.11  n/a
      [RDT= 1.88] out<- 04:langst     37.13    3.665 No_date     3:19   43.11  n/a
     [MxStoUsed=.6002E-01]
#lands d/s langstaff (s/c 1)
 001:0015---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  DESIGN STANDHYD     01:000105      3.60     .830 No_date     3:15   59.82 .630
      [XIMP=.15:TIMP=.45]
```

```
     [SLP= .50:DT=15.00]
     [LOSS= 2 :CN= 70.0]
 001:0016---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             01:000105     3.60     .830 No_date    3:15   59.82  n/a
                       + 04:langst    37.13    3.665 No_date    3:19   43.11  n/a
     [DT= 1.88]  SUM=  10:000203    40.73    4.393 No_date    3:19   44.58  n/a
#route proposed G3 structure d/s of Langstaff - 675mm outlet@1.2%,invert@99.75m
 001:0017---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             01:000105     3.60     .830 No_date    3:15   59.82  n/a
                       + 04:langst    37.13    3.665 No_date    3:19   43.11  n/a
     [DT= 1.88]  SUM=  10:000203    40.73    4.393 No_date    3:19   44.58  n/a
 001:0018---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 10:000203    40.73    4.393 No_date    3:19   44.58  n/a
      [RDT=  .94] out<- 04:G3 pon    40.73    3.698 No_date    3:26   44.58  n/a
     {MxStoUsed=.1855E+00}
#lands d/s langstaff (s/c 1a)
 001:0019---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  DESIGN STANDHYD     01:000105     4.19     .961 No_date    3:15   59.83 .630
     [XIMP=.15:TIMP=.45]
     [SLP= .50:DT=15.00]
     [LOSS= 2 :CN= 70.0]
 001:0020---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             04:G3 pon     40.73    3.698 No_date    3:26   44.58  n/a
                       + 01:000105     4.19     .961 No_date    3:15   59.83  n/a
     [DT=  .94]  SUM=  05:000204    44.92    4.308 No_date    3:26   46.00  n/a
#route structure u/s dbmunro - 450mm outlet @4.2%invert@97.0m;7.5m weir@99.7.0m
 001:0021---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 05:000204    44.92    4.308 No_date    3:26   46.00  n/a
      [RDT=  .94] out<- 08:dbmunr    44.92    2.918 No_date    3:38   46.00  n/a
     {MxStoUsed=.3298E+00}
 001:0022---------------------------------------------------------------------------
     FINISH
```

APPENDIX B – Stormwater Management – Water Quality

SWM Pond Volumes to meet MOE Level 2 Fisheries requirements

Pond Volumes:

Drainage Area to water quality pond (upstream G1) – 15.3 hectares
% imperviousness – 45%
interpolated storage requirements for level 2 control – 100m3/ha

- 40m3/ha – extended detention
- 60m3/ha – permanent pool

volume requirements:

- extended detention – 40x15.3= 612 m3
- permanent pool – 60x15.3= 918 m3

volumes achieved - OK

- extended detention (104.5m) `= 640 m3
- permanent pool (104.0m) = 930 m3

Attached Figure B1 provides 24 hour drawdown confirmation with 90mm orifice for extended detention.

Forebay Criteria:

forebay is 30m long and 10m wide

1. settling length = (3*.012/.0003)**1/2 = 11m < 30m OK
2. dispersion length = (8*.295/1.0/.15) = 16m < 30m OK
3. L:W ratio = 3.0 > 2.0 OK

Cleanout Frequency

Loading – 1.25m3/ha * 15.3 ha = 19m3/year
Efficiency – 70%
Amount remaining in forebay = 0.7*19= 13m3/year
Over 10 years = 130m3
Elevation = 103.15m

PSR Group Ltd., 100 Craig Henry Dr., Suite 101, Nepean, Ontario, K2G 5W3
Telephone (613) 820-6019 Fax (613) 820-7281
e-mail: pfrigon@psrgroup.on.ca

Figure B1: Extended Detention Drawdown Calculations

DRAWDOWN WITH AREA VS DEPTH KNOWN

C2	C3	orifice area	h-orifice head	pond depth
270	1080	0.006	**0.455**	0.500
calc'd drawdown=	86408	seconds		
drawdown=	***24***	hours		
orifice coefficient	g(m/s)	orifice diam(m)	pi	
0.630	9.810	*0.09*	3.1416	
orifice flow=	0.012	m3/s		

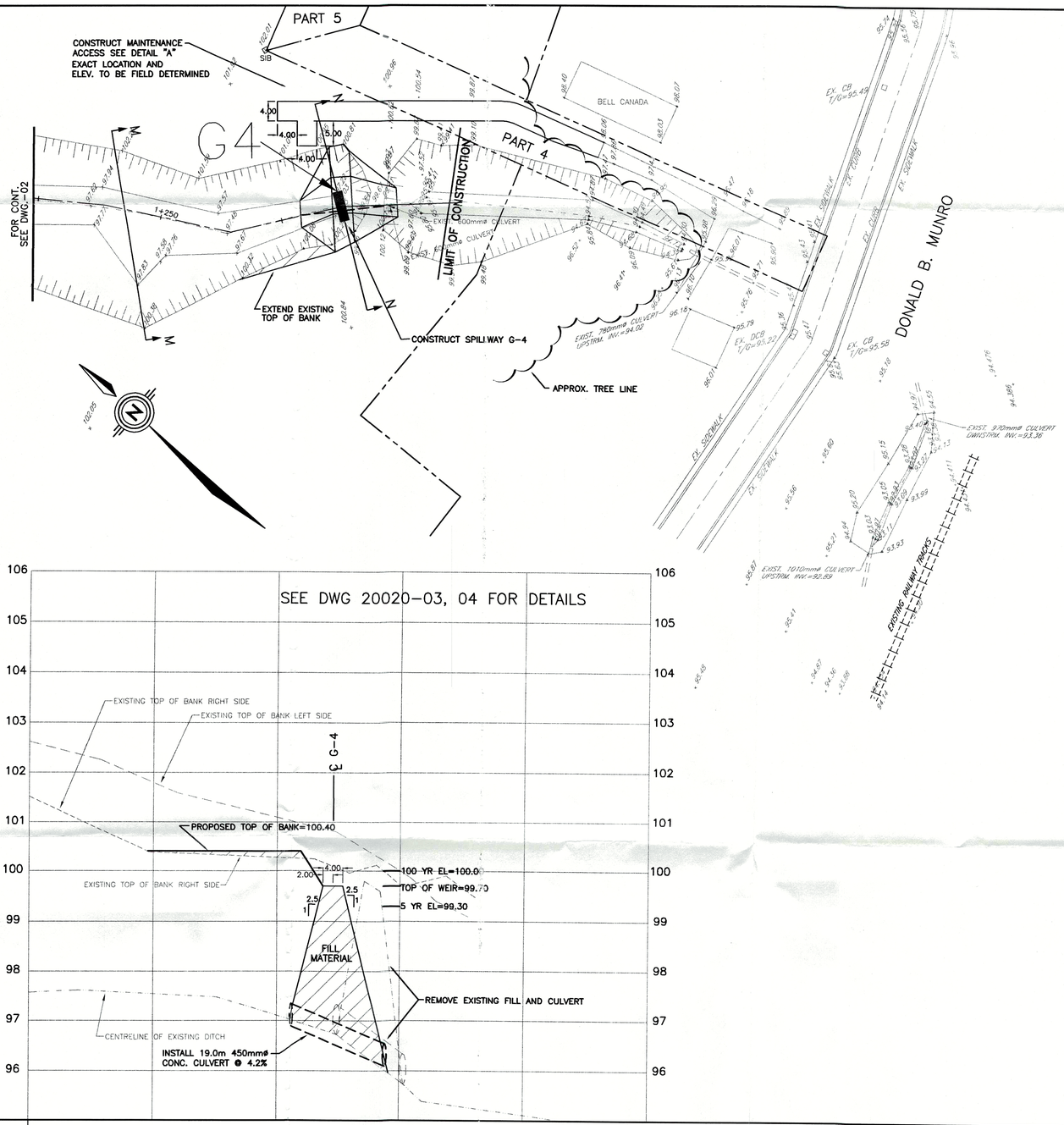
linear regression a=C2h+C3

1080 C3 calculated

270 C2 calculated

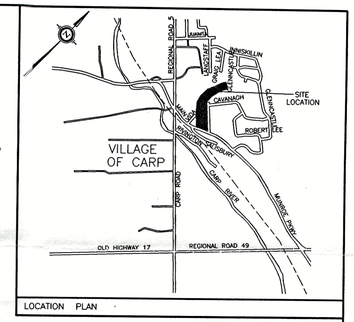
AREA VS DEPTH

pond depth(m) - h	pond area(m2) - a
0	1080
0.5	1215



LEGEND

- x112.00 EXISTING ELEVATION
- x106.38 PROPOSED ELEVATION
- DIRECTION OF FLOW ARROW
- FILL MATERIAL



LOCATION PLAN

NOTES

1. STRIP TOPSOIL PRIOR TO CONSTRUCTION AND STOCKPILE ON SITE AS DIRECTED BY ENGINEER.
2. SALVAGED EXISTING TOPSOIL TO BE SPREAD IN DISTURBED AREAS.
3. DISTURBED AREAS TO BE REINSTATED WITH SEED AND MULCH IMMEDIATELY UPON COMPLETION.
4. ALL FILL MATERIAL TO BE SUBMITTED TO ENGINEER FOR GRAIN SIZE ANALYSIS PRIOR TO CONSTRUCTION.
5. PROTECT ALL SURVEY S.I.B.
6. PROVIDE CLOSE CUT CLEARING FOR ACCESS AND G-3 AND G-4 SPILLWAY CONSTRUCTION.
7. REMOVE UNWANTED MATERIAL (TRASH) FROM RAVINE WITHIN LIMITS OF CONTRACT AT CONTRACTORS EXPENSE.
8. FOR GEOTECHNICAL INFORMATION REFER TO REPORT No. G8134-01.LET BY JOHN D. PATERSON cnd ASSOC. LTD.
9. CONCRETE PIPE SHALL BE 100 D WITH CLASS B BEDDING USING 150mm GRANULAR A.
10. RECONSTRUCT SIDE SLOPES ONLY AT SPILLWAYS.

EXISTING TOP OF SLOPE RIGHT	101.51		102.88		102.27						
EXISTING TOP OF SLOPE LEFT	102.62		101.80		101.10						
EXISTING & PROPOSED ℄ DITCH ELEVATION	97.59		97.54		97.25	96.73		96.10	95.74		
CHAINAGE	1+225.0		1+250.0		1+275.0 1+278.1	1+286.5		1+297.1 1+300.0			
					INV. 450mmø CULVERT	INV. Ex. 600mmø CULVERT		INV. 450mmø CULVERT	INV. Ex. 600mmø CULVERT		

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Nepean Ontario, K2G 5W3
613-820-6019 613-820-7281

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E-mail: mcmanus@dmel.on.ca
Ph. 225-1929 JDMFax 225-7330

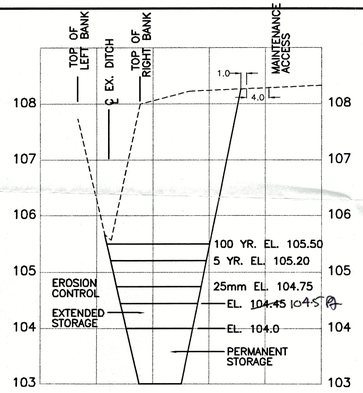
BASEPLAN	DME
DESIGN	ECJ
CHECKED	PRF
CAD	GSC
CHECKED	ECJ
APPROVED	SMC/PRF

SCALE
1:500
0 5 10 15 20
HORIZONTAL
1:50
0 0.5 1.0 1.5 2.0
VERTICAL

D. & H. ENTERPRISES LIMITED
GLENNCASTLE SUBDIVISION - PH 2
VILLAGE of CARP

STORMWATER MANAGEMENT STRUCTURES
STA. 0+875 TO 1+300

PROJECT No. 20020
SURVEY BY DME FALL/WINTER 00/01
DATE MARCH 2001
DRAWING No. 20020-02



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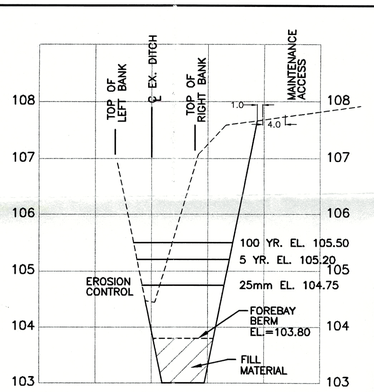

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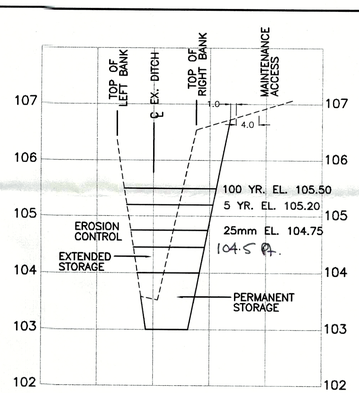

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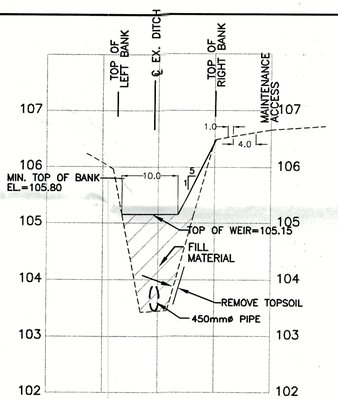
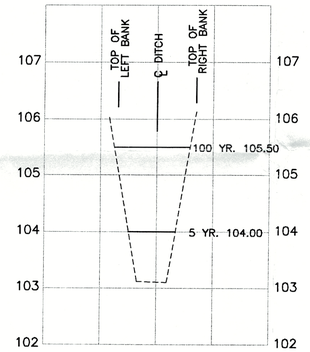


SPILLWAY G–1
SECTION C–C
STA 0+970



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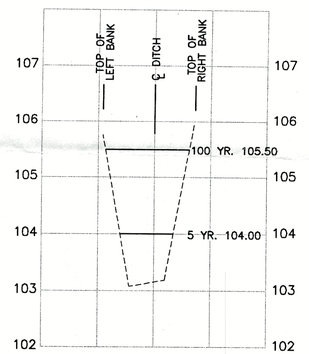

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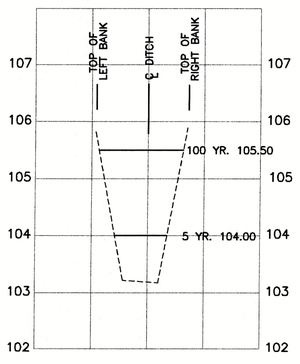

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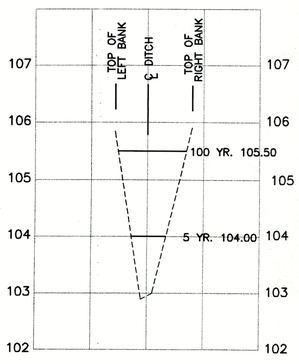

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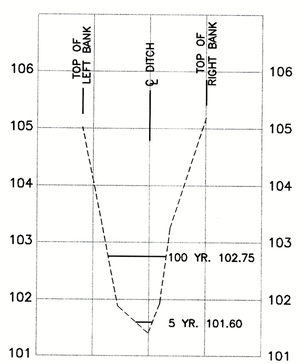

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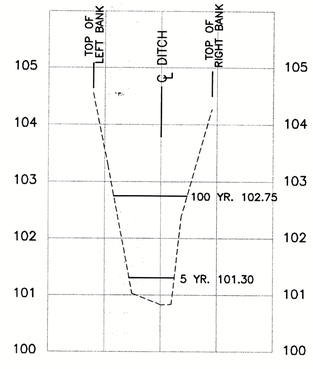

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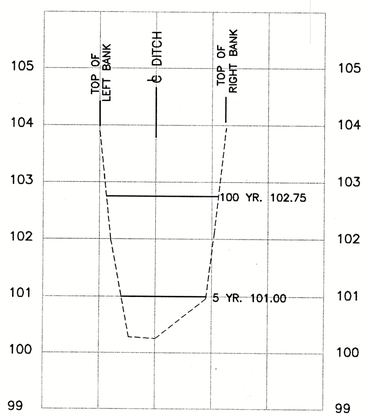

SECTION J–J
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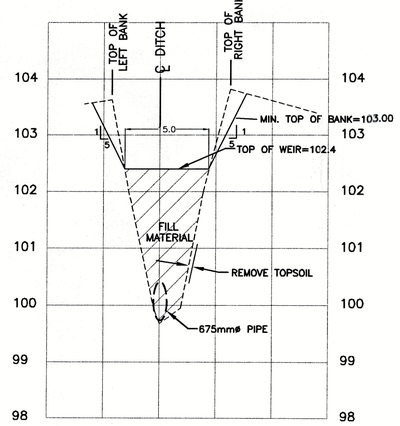
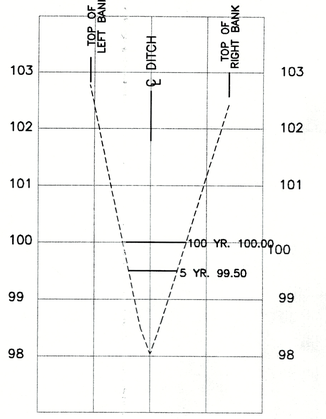


SPILLWAY G–3
SECTION K–K
STA 1+135.9



SECTION L–L
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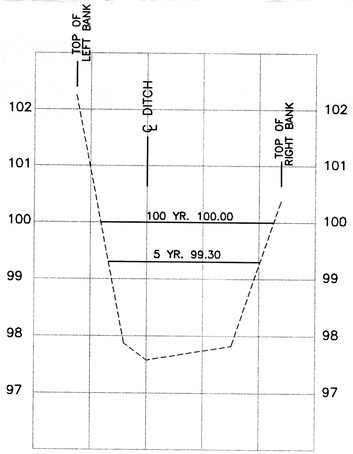

SECTION M–M
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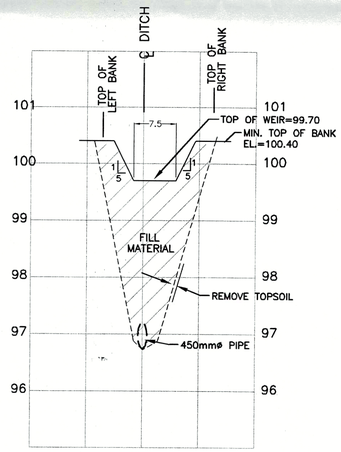

SPILLWAY G–4
SECTION N–N
STA 1+286.5

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Ph. 225-1929 Fax 225-7330

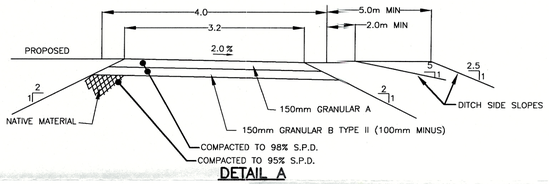
DESIGN	ECJ
CHECKED	PRF
CAD	GSC
CHECKED	ECJ
APPROVED	SMC/PRF

SCALE
1:500
0 5 10 15 20
HORIZONTAL
1:50
0 0.5 1.0 1.5 2.0
VERTICAL

D. & H. ENTERPRISES LIMITED
GLENNCASTLE SUBDIVISION – PH 2
VILLAGE of CARP

DITCH CROSS SECTIONS

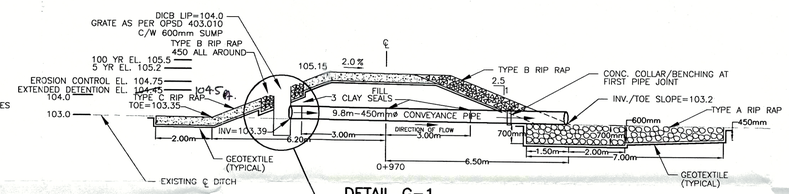
PROJECT No.	20020
SURVEY BY	DME
	FALL/WINTER 00/01
DATE	MARCH 2001
DRAWING No.	20020–03



DETAIL A

TYPICAL MAINTENANCE ACCESS

1:50



DETAIL G-1

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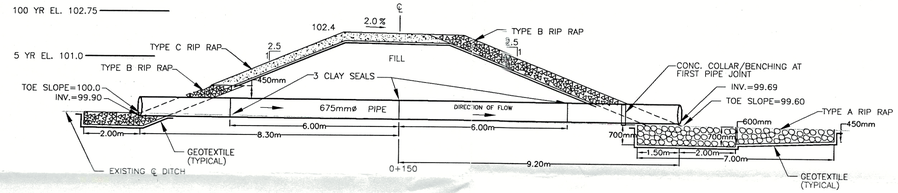

DETAIL G-3

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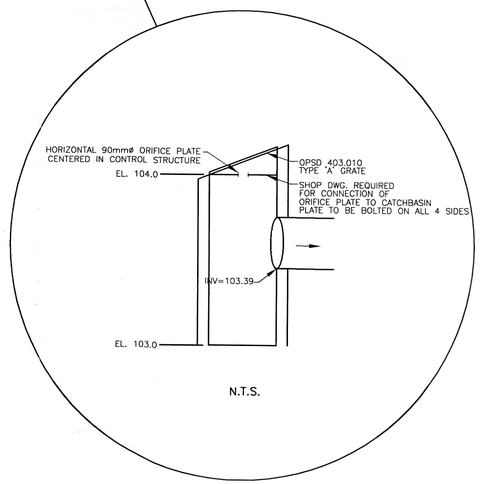
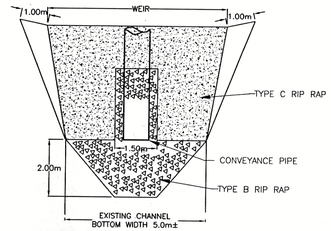


DETAIL B

EXISTING STRUCTURE G-2

1:100

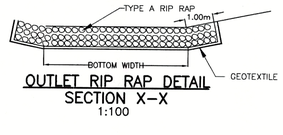
N.T.S.



INLET PIPE RIP RAP DETAIL

PLAN

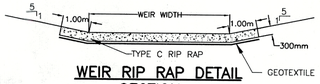
N.T.S.



OUTLET RIP RAP DETAIL

SECTION X-X

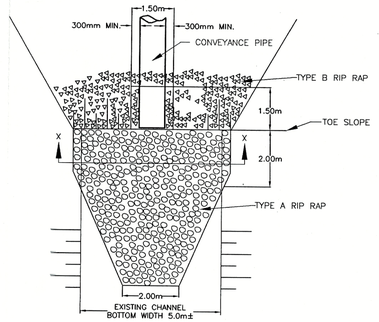
1:100



WEIR RIP RAP DETAIL

SECTION

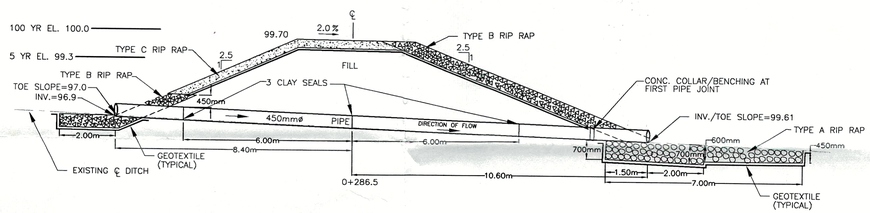
1:100



OUTLET RIP RAP DETAIL G-1,G-3,G-4

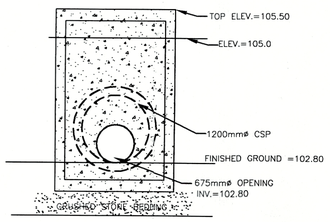
PLAN

1:100



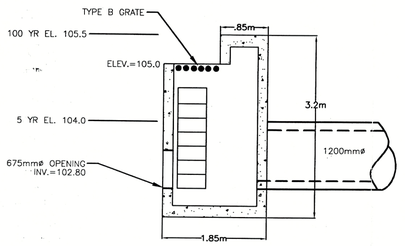
DETAIL G-4

1:100



ELEVATION

EXISTING STRUCTURE FROM NOVATECH DWG 8313-D1 ROCKWOOD HILLS APRIL 1983

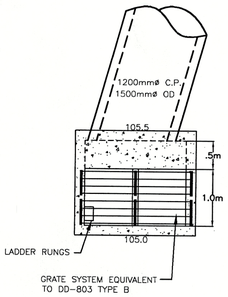


SIDE VIEW

DETAIL B

LANGSTAFF INLET CHAMBER (EXISTING)

1:50



PLAN VIEW

FILL MATERIAL CHART

TYPE	MAXIMUM LIFT THICKNESS	MINIMUM COMPACTION	MOISTURE CONTENT
WELL GRADED GRANULAR FILL MATERIAL 75mm (100% PASSING)	300mm	95% OF THE MATERIALS STANDARD PROCTOR MAXIMUM DRY DENSITY	OPTIMUM WATER CONTENT
MOIST (NOT WET) BROWN SILTY CLAY CLAY SEAL BROWN MOIST (NOT WET) COMPACTIBLE SILTLY CLAY	300mm 1.5m LONG x WIDTH TRENCH	95% OF THE MATERIALS STANDARD PROCTOR MAXIMUM DRY DENSITY	WHEN NATURAL WATER CONTENT IS SLIGHTLY ABOVE OPTIMUM WATER CONTENT

EROSION PROTECTION CHART

TYPE	EROSION PROTECTION	STONE SIZE (mm)	THICKNESS (mm)	GEOTEXTILE	GEOTEXTILE PLACEMENT
A	DURABLE STONE, NO SHALE PARTINGS MAXIMUM LENGTH = 3 / WIDTH = 5	200mm (80% LARGER) TO 450mm (100% SMALLER) AVG.-300mm	VARIES 450mm TO 700mm	AMOCO 4553 TERRAFIX 600R	TOP to BOTTOM (NOT HORIZONTAL) OVERLAP 1.0m EXTEND 300mm BEYOND ARMOR AND KEY IN
B	DURABLE STONE, NO SHALE PARTINGS MAXIMUM LENGTH = 3 / WIDTH = 5	100mm (80% LARGER) TO 200mm (100% SMALLER) AVG.-150mm	450mm	AMOCO 4553 TERRAFIX 600R	TOP to BOTTOM (NOT HORIZONTAL) OVERLAP 1.0m EXTEND 300mm BEYOND ARMOR AND KEY IN
C	DURABLE STONE, NO SHALE PARTINGS MAXIMUM LENGTH = 3 / WIDTH = 5	50mm (80% LARGER) TO 150mm (100% SMALLER) AVG.-100mm	300mm	AMOCO 4546 TERRAFIX 270R	TOP to BOTTOM (NOT HORIZONTAL) OVERLAP 500mm EXTEND 300mm BEYOND ARMOR AND KEY IN

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3.	REVISED AS PER CITY COMMENTS	JUNE 12/01	ECJ
2.	ISSUED FOR APPROVAL	MAY 31/01	ECJ
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400 - 30 Camelot Drive
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E-mail: mcmanus@dmel.on.ca
Ph. 225-1929 Fax 225-7330

DESIGN	ECJ
CHECKED	PRF
CAD	GSC
CHECKED	ECJ
APPROVED	SMC/PRF

SCALE: AS SHOWN

D. & H. ENTERPRISES LIMITED
GLENNCASTLE SUBDIVISION - PH 2
VILLAGE of CARP

DETAILS

PROJECT No.	20020
SURVEY BY	DME
DATE	MARCH 2001
DRAWING No.	20020-04

					450mmø CONVEYANCE PIPE		450mmø CONVEYANCE PIPE							675mmø CULVERT		675mmø CULVERT				
EXISTING TOP OF SLOPE RIGHT	108.00	107.48	106.69	106.24		106.15		105.99	105.11	105.22	104.47	104.52	103.87				103.65	102.89	102.13	101.51
EXISTING TOP OF SLOPE LEFT	107.62	107.03	106.76	106.43		106.17		105.94	105.26	105.07	104.76	104.48	103.80				103.00	102.76	102.81	102.62
EXISTING & PROPOSED ℄ DITCH ELEVATION	105.51	104.64	104.15	103.53	INV. 103.39	103.22	INV. 103.20	103.10	102.22	101.45	101.22	100.37	100.11	INV. 99.90		INV. 99.69	99.48	98.53	97.78	97.58
CHAINAGE	0+875.0	0+900.0	0+925.0	0+950.0	0+966.7	0+975.0	0+976.5	1+000.0	1+025.0	1+050.0	1+075.0	1+100.0	1+125.0	1+128.0	1+135.9	1+145.5	1+150.0	1+175.0	1+200.0	1+225.0

NOTE
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

No.	REVISION	DATE	BY
5.	REVISED PER M.O.E. COMMENTS	MAY 6/03	PRF
4.	REVISED PER M.O.E. APPROVALS COMMENTS	APR. 4/03	PRF
3.	REVISED AS PER CITY COMMENTS	JUNE 12/01	ECJ
2.	ISSUED FOR APPROVAL	MAY 31/01	ECJ
1.	ISSUED FOR M.O.E. APPLICATION	APR 18/01	ECJ

PSR
PSR Group Ltd.
101 - 100 Craig Henry Drive
Nepean Ontario, K2G 5W3
613-820-6019 613-820-7281

LICENSED PROFESSIONAL ENGINEER S.M. CZAHARYNSKI PROVINCE OF ONTARIO

REGISTERED PROFESSIONAL ENGINEER P. R. FRIGON PROVINCE OF ONTARIO

DME Ltd.
David McManus Engineering Ltd.
400 - 30 Camelot Drive
Nepean Ontario, K2H 5X8
E-mail: mcmanus@dmel.on.ca
Ph. 225-1929 Fax 225-7330

BASEPLAN	DME
DESIGN	ECJ
CHECKED	PRF
CAD	GSC
CHECKED	ECJ
APPROVED	SMC/PRF

SCALE
HORIZONTAL 1:500 (0 5 10 15 20)
VERTICAL 1:50 (0 0.5 1.0 1.5 2.0)

D. & H. ENTERPRISES LIMITED
GLENNCASTLE SUBDIVISION - PH 2
VILLAGE of CARP
STORMWATER MANAGEMENT STRUCTURES
STA. 0+875 TO 1+300

PROJECT No. 20020
SURVEY BY DME FALL/WINTER 00/01
DATE MARCH 2001
DRAWING No. 20020-01

```
  SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
  S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
  SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
      S   W W   M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
  SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9   =========
                                                       9   9  9   9   # 3772465
       StormWater Management HYdrologic Model           999    999    =========

*****************************************************************************
***************************** SWMHYMO Ver/4.05  *****************************
*********  A single event and continuous hydrologic simulation model  *********
*********     based on the principles of HYMO and its successors      *********
*********                  OTTHYMO-83 and OTTHYMO-89.                 *********
*****************************************************************************
********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
*********                  Ottawa,  Ontario: (613) 836-3884           *********
*********                  Gatineau, Quebec: (819) 243-6858           *********
*********                  E-Mail: swmhymo@jfsa.Com                   *********
*****************************************************************************

+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++++++++ Licensed user: Robinson Consultants Inc.                    +++++++++
+++++++++               Kanata                SERIAL#:3772465        +++++++++
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

*****************************************************************************
*********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++            *********
*********           Maximum value for ID numbers  :     10           *********
*********           Max. number of rainfall points: 105408           *********
*********           Max. number of flow points    : 105408           *********
*****************************************************************************

***** DESCRIPTION SUMMARY TABLE HEADERS (units depend on METOUT in START) *****
*****-------------------------------------------------------------------*****
*****    ID:  Hydrograph IDentification numbers, (1-10).                 *****
*****  NHYD:  Hydrograph reference numbers, (6 digits or characters).    *****
*****  AREA:  Drainage area associated with hydrograph, (ac.) or (ha.).  *****
***** QPEAK:  Peak flow of simulated hydrograph, (ft^3/s) or (m^3/s).    *****
***** TpeakDate_hh:mm is the date and time of the peak flow.             *****
*****  R.V.:  Runoff Volume of simulated hydrograph, (in) or (mm).       *****
*****  R.C.:  Runoff Coefficient of simulated hydrograph, (ratio).       *****
*****     *:  see WARNING or NOTE message printed at end of run.         *****
*****    **:  see  ERROR  message printed at end of run.                 *****
*****************************************************************************
*****************************************************************************
```

```
::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::

 ********************************************************************************

 **********************   S U M M A R Y   O U T P U T   **********************
 ********************************************************************************
 *         DATE: 2019-11-26     TIME: 09:34:24     RUN COUNTER: 001157         *
 ********************************************************************************
 * Input   filename: U:\SWMHYMO\CHISTM.dat                                      *
 * Output  filename: U:\SWMHYMO\CHISTM.out                                      *
 * Summary filename: U:\SWMHYMO\CHISTM.sum                                      *
 * User comments:                                                               *
 * 1:_____________________________________________________________________________*
 * 2:_____________________________________________________________________________*
 * 3:_____________________________________________________________________________*
 ********************************************************************************


#*******************************************************************************
#  Project Name: [19008]    Project Number: [Carp Subdivision-Langstaff Drive]
#  Date        : 07-08-2019
#  Modeller    : [CN]
#  Company     : Robinson Consultants Inc.
#  License #   :  3772465
#*******************************************************************************
 RUN:COMMAND#

001:0001-------------------------------------------------------------------------
--
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   1 ]

001:0002-------------------------------------------------------------------------
--
     READ STORM
      Filename = STORM.001
      Comment  =
      [SDT=15.00:SDUR=   3.00:PTOT=  31.84]
#===============================================================================
#Rivington Phase A (S/C 4)
#===============================================================================

001:0003--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    01:105A           4.26     .130 No_date    1:00   10.42
```

```
.327
      [XIMP=.15:TIMP=.45]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 60.0]
#=============================================================================
#Rivington Phase B (S/C 2,3,5)
#=============================================================================

001:0004--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    02:105AA         10.80     .320 No_date    1:00   10.42
.327
      [XIMP=.15:TIMP=.45]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 60.0]
#=============================================================================
#Rivington Phase B Playing Field (S/C 2a)
#=============================================================================

001:0005--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     DESIGN SCSHYD      06:Field           .82     .000 No_date    3:00     .14
.004
      [CN= 65.0: N= 5.00]
      [Tp=  .50:DT=15.00]

001:0006--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            01:105A           4.26     .130 No_date    1:00   10.42
n/a
                     +  02:105AA         10.80     .320 No_date    1:00   10.42
n/a
                     +  06:Field           .82     .000 No_date    3:00     .14
n/a
      [DT=15.00]  SUM=  03:201           15.88     .450 No_date    1:00    9.89
n/a
#=============================================================================
#Route through G-1 structure: 450 CONC w 90mm orifice; 10m weir @105.15m
#=============================================================================

001:0007--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ROUTE RESERVOIR -> 03:201          15.88     .450 No_date    1:00    9.89
n/a
      [RDT= 1.88] out<- 04:G-1          15.88     .019 No_date    3:30    9.89
n/a
     {MxStoUsed=.1394E+00}
#=============================================================================
```

```
#Cavanagh developed (S/C 6,7)
#===============================================================================

001:0008--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    01:202           13.01     .362 No_date    1:00    9.34
.293
      [XIMP=.15:TIMP=.30]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 60.0]
#===============================================================================
#u/s Wetlands (S/C 8)- minor to Cavanagh, major diverted elsewhere
#===============================================================================

001:0009--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     DESIGN SCSHYD      02:Rural 106     15.15     .020 No_date    2:15     .85
.027
      [CN= 70.0: N= 5.00]
      [Tp=  .50:DT=15.00]

001:0010--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     COMPUTE DUALHYD    02:Rural 106     15.15     .020 No_date    2:15     .85
n/a
        Major System /  10:MAJ106          .00     .000 No_date    0:00     .00
n/a
        Minor System \  09:MIN106        15.15     .020 No_date    2:15     .85
n/a

001:0011--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            01:202           13.01     .362 No_date    1:00    9.34
n/a
                     +  09:MIN106        15.15     .020 No_date    2:15     .85
n/a
      [DT=15.00]  SUM=  08:202           28.16     .362 No_date    1:00    4.77
n/a
#===============================================================================
#Minor to ravine - controlled by 1060mm sewer at 0.47% and 675mm @1.4% Q=1.0m3/
#===============================================================================

001:0012--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     COMPUTE DUALHYD    08:202           28.16     .362 No_date    1:00    4.77
n/a
        Major System /  10:MAJ202          .00     .000 No_date    0:00     .00
n/a
```

```
                                        CHISTM
        Minor System \  09:MIN202        28.16     .362 No_date    1:00    4.77
n/a

001:0013--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            04:G-1           15.88     .019 No_date    3:30    9.89
n/a
                     +  09:MIN202        28.16     .362 No_date    1:00    4.77
n/a
      [DT= 1.88]  SUM=  07:203           44.04     .368 No_date    1:00    6.62
n/a
#=============================================================================
#Route through G-2: 675mm orifice; 1200mm CONC @2.2%, no weir
#=============================================================================

001:0014--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ROUTE RESERVOIR -> 07:203          44.04     .368 No_date    1:00    6.62
n/a
      [RDT= 1.88] out<- 04:G-2          44.04     .341 No_date    1:03    6.62
n/a
     {MxStoUsed=.5418E-02}
#=============================================================================
#d/s Langstaff (S/C 1)
#=============================================================================

001:0015--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    01:WESTG3          .91     .093 No_date    1:00   21.73
.683
      [XIMP=.45:TIMP=.56]
      [SLP=1.25:DT=15.00]
      [LOSS= 2 :CN= 85.0]

001:0016--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     COMPUTE DUALHYD    01:WESTG3          .91     .093 No_date    1:00   21.73
n/a
        Major System /  06:MAJG3W          .00     .000 No_date    0:00     .00
n/a
        Minor System \  07:MING3W          .91     .093 No_date    1:00   21.73
n/a

001:0017--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN SCSHYD      02:STM10           .95     .002 No_date    1:30    1.07
.034
      [CN= 71.0: N= 5.00]
```

```
      [Tp=  .19:DT=15.00]

001:0018--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    03:EASTG3          .31     .036 No_date    1:00   23.56
.740
      [XIMP=.50:TIMP=.60]
      [SLP=1.50:DT=15.00]
      [LOSS= 2 :CN= 88.0]

001:0019--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     COMPUTE DUALHYD    03:EASTG3          .31     .036 No_date    1:00   23.56
n/a
        Major System /  08:MAJG3E          .00     .000 No_date    0:00     .00
n/a
        Minor System \  09:MING3E          .31     .036 No_date    1:00   23.56
n/a

001:0020--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN SCSHYD      05:STM17           .52     .001 No_date    1:30    1.32
.041
      [CN= 72.0: N= 5.00]
      [Tp=  .13:DT=15.00]

001:0021--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            02:STM10           .95     .002 No_date    1:30    1.07
n/a
                     +  04:G-2           44.04     .341 No_date    1:03    6.62
n/a
                     +  05:STM17           .52     .001 No_date    1:30    1.32
n/a
                     +  07:MING3W          .91     .093 No_date    1:00   21.73
n/a
                     +  09:MING3E          .31     .036 No_date    1:00   23.56
n/a
      [DT= 1.88]  SUM=  10:G3IN          46.73     .457 No_date    1:01    6.85
n/a
#===============================================================================
#Route through G-3: 675mm outlet @1.2% invert @99.75m; 15m weir @102.5m
#===============================================================================

001:0022--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ROUTE RESERVOIR -> 10:G3IN          46.73     .457 No_date    1:01    6.85
n/a
```

```
      [RDT=  .94] out<- 05:G-3           46.73     .411 No_date    1:07    6.85
n/a
     {MxStoUsed=.1200E-01}
#===============================================================================
#d/s Langstaff (S/C 1a)
#===============================================================================

001:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    01:WESTG4          1.87     .161 No_date    1:00   19.31
.607
      [XIMP=.34:TIMP=.49]
      [SLP=1.50:DT=15.00]
      [LOSS= 2 :CN= 83.0]

001:0024---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    02:EASTG4          1.12     .092 No_date    1:00   18.57
.583
      [XIMP=.36:TIMP=.46]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 81.0]

001:0025---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN SCSHYD      03:STM11            .65     .001 No_date    1:30     .85
.027
      [CN= 70.0: N= 5.00]
      [Tp=  .13:DT=15.00]

001:0026---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN SCSHYD      04:STM18            .48     .000 No_date    2:15     .35
.011
      [CN= 67.0: N= 5.00]
      [Tp=  .13:DT=15.00]

001:0027---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            01:WESTG4          1.87     .161 No_date    1:00   19.31
n/a
                    +   02:EASTG4          1.12     .092 No_date    1:00   18.57
n/a
                    +   03:STM11            .65     .001 No_date    1:30     .85
n/a
                    +   04:STM18            .48     .000 No_date    2:15     .35
n/a
                    +   05:G-3            46.73     .411 No_date    1:07    6.85
```

```
n/a
                    +  06:MAJG3W          .00     .000 No_date    0:00     .00
n/a
                    +  08:MAJG3E          .00     .000 No_date    0:00     .00
n/a
      [DT=  .94]  SUM=  10:G4IN          50.85     .607 No_date    1:04    7.43
n/a
#===============================================================================
#Route through G-4: 450mm outlet @4.2% invert @97.0m; 7.5m weir @99.70m
#===============================================================================

001:0028--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ROUTE RESERVOIR -> 10:G4IN          50.85     .607 No_date    1:04    7.43
n/a
      [RDT=  .94] out<- 08:G-4           50.85     .295 No_date    1:32    7.43
n/a
     {MxStoUsed=.5813E-01}
  ** END OF RUN :   1

*******************************************************************************




 RUN:COMMAND#

002:0001--------------------------------------------------------------------------
--
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   2 ]
#*******************************************************************************
#  Project Name: [19008]    Project Number: [Carp Subdivision-Langstaff Drive]
#  Date        : 07-08-2019
#  Modeller    : [CN]
#  Company     : Robinson Consultants Inc.
#  License #   :  3772465
#*******************************************************************************

002:0002--------------------------------------------------------------------------
--
     READ STORM
      Filename = STORM.001
      Comment  =
```

```
      [SDT=15.00:SDUR=   3.00:PTOT=  42.48]
#===============================================================================
#Rivington Phase A (S/C 4)
#===============================================================================

002:0003--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    01:105A           4.26     .261 No_date    1:00   15.95
.375
      [XIMP=.15:TIMP=.45]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 60.0]
#===============================================================================
#Rivington Phase B (S/C 2,3,5)
#===============================================================================

002:0004--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    02:105AA         10.80     .642 No_date    1:00   15.95
.375
      [XIMP=.15:TIMP=.45]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 60.0]
#===============================================================================
#Rivington Phase B Playing Field (S/C 2a)
#===============================================================================

002:0005--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     DESIGN SCSHYD      06:Field           .82     .002 No_date    2:00    1.51
.035
      [CN= 65.0: N= 5.00]
      [Tp=  .50:DT=15.00]

002:0006--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            01:105A           4.26     .261 No_date    1:00   15.95
n/a
                     +  02:105AA         10.80     .642 No_date    1:00   15.95
n/a
                     +  06:Field           .82     .002 No_date    2:00    1.51
n/a
      [DT=15.00]  SUM=  03:201           15.88     .903 No_date    1:00   15.20
n/a
#===============================================================================
#Route through G-1 structure: 450 CONC w 90mm orifice; 10m weir @105.15m
#===============================================================================
```

```
002:0007--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ROUTE RESERVOIR -> 03:201           15.88     .903 No_date    1:00   15.20
n/a
      [RDT= 1.88] out<- 04:G-1           15.88     .255 No_date    1:39   15.20
n/a
     {MxStoUsed=.1527E+00}
#==============================================================================
#Cavanagh developed (S/C 6,7)
#==============================================================================

002:0008--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    01:202           13.01     .532 No_date    1:00   14.26
.336
      [XIMP=.15:TIMP=.30]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 60.0]
#==============================================================================
#u/s Wetlands (S/C 8)- minor to Cavanagh, major diverted elsewhere
#==============================================================================

002:0009--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     DESIGN SCSHYD      02:Rural 106     15.15     .086 No_date    1:45    3.31
.078
      [CN= 70.0: N= 5.00]
      [Tp=  .50:DT=15.00]

002:0010--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     COMPUTE DUALHYD    02:Rural 106     15.15     .086 No_date    1:45    3.31
n/a
        Major System /  10:MAJ106          .00     .000 No_date    0:00     .00
n/a
        Minor System \  09:MIN106        15.15     .086 No_date    1:45    3.31
n/a

002:0011--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            01:202           13.01     .532 No_date    1:00   14.26
n/a
                     +  09:MIN106        15.15     .086 No_date    1:45    3.31
n/a
      [DT=15.00]  SUM=  08:202           28.16     .541 No_date    1:00    8.37
n/a
#==============================================================================
#Minor to ravine - controlled by 1060mm sewer at 0.47% and 675mm @1.4% Q=1.0m3/
```

```
#=============================================================================

002:0012--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     COMPUTE DUALHYD    08:202           28.16     .541 No_date    1:00    8.37
n/a
        Major System /  10:MAJ202          .00     .000 No_date    0:00     .00
n/a
        Minor System \  09:MIN202        28.16     .541 No_date    1:00    8.37
n/a

002:0013--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            04:G-1           15.88     .255 No_date    1:39   15.20
n/a
                     +  09:MIN202        28.16     .541 No_date    1:00    8.37
n/a
      [DT= 1.88]  SUM=  07:203           44.04     .565 No_date    1:37   10.83
n/a
#=============================================================================
#Route through G-2: 675mm orifice; 1200mm CONC @2.2%, no weir
#=============================================================================

002:0014--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ROUTE RESERVOIR -> 07:203          44.04     .565 No_date    1:37   10.83
n/a
      [RDT= 1.88] out<- 04:G-2          44.04     .556 No_date    1:39   10.83
n/a
     {MxStoUsed=.8794E-02}
#=============================================================================
#d/s Langstaff (S/C 1)
#=============================================================================

002:0015--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    01:WESTG3          .91     .136 No_date    1:00   30.91
.728
      [XIMP=.45:TIMP=.56]
      [SLP=1.25:DT=15.00]
      [LOSS= 2 :CN= 85.0]

002:0016--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     COMPUTE DUALHYD    01:WESTG3          .91     .136 No_date    1:00   30.91
n/a
        Major System /  06:MAJG3W          .00     .000 No_date    0:00     .00
n/a
```

```
       Minor System \  07:MING3W          .91     .136 No_date    1:00   30.91
n/a

002:0017--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN SCSHYD      02:STM10          .95     .009 No_date    1:15    3.76
.089
      [CN= 71.0: N= 5.00]
      [Tp=  .19:DT=15.00]

002:0018--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    03:EASTG3         .31     .052 No_date    1:00   33.19
.781
      [XIMP=.50:TIMP=.60]
      [SLP=1.50:DT=15.00]
      [LOSS= 2 :CN= 88.0]

002:0019--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     COMPUTE DUALHYD    03:EASTG3         .31     .052 No_date    1:00   33.19
n/a
       Major System /  08:MAJG3E         .00     .000 No_date    0:00     .00
n/a
       Minor System \  09:MING3E         .31     .052 No_date    1:00   33.19
n/a

002:0020--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN SCSHYD      05:STM17          .52     .006 No_date    1:15    4.25
.100
      [CN= 72.0: N= 5.00]
      [Tp=  .13:DT=15.00]

002:0021--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            02:STM10          .95     .009 No_date    1:15    3.76
n/a
                    +  04:G-2           44.04     .556 No_date    1:39   10.83
n/a
                    +  05:STM17          .52     .006 No_date    1:15    4.25
n/a
                    +  07:MING3W         .91     .136 No_date    1:00   30.91
n/a
                    +  09:MING3E         .31     .052 No_date    1:00   33.19
n/a
      [DT= 1.88]  SUM=  10:G3IN          46.73     .689 No_date    1:01   11.15
n/a
```

```
#==============================================================================
#Route through G-3: 675mm outlet @1.2% invert @99.75m; 15m weir @102.5m
#==============================================================================

002:0022--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ROUTE RESERVOIR -> 10:G3IN          46.73     .689 No_date    1:01   11.15
n/a
      [RDT=  .94] out<- 05:G-3           46.73     .630 No_date    1:08   11.15
n/a
     {MxStoUsed=.1838E-01}
#==============================================================================
#d/s Langstaff (S/C 1a)
#==============================================================================

002:0023--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    01:WESTG4         1.87     .242 No_date    1:00   28.00
.659
      [XIMP=.34:TIMP=.49]
      [SLP=1.50:DT=15.00]
      [LOSS= 2 :CN= 83.0]

002:0024--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    02:EASTG4         1.12     .137 No_date    1:00   26.89
.633
      [XIMP=.36:TIMP=.46]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 81.0]

002:0025--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN SCSHYD      03:STM11           .65     .005 No_date    1:15    3.31
.078
      [CN= 70.0: N= 5.00]
      [Tp=  .13:DT=15.00]

002:0026--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN SCSHYD      04:STM18           .48     .002 No_date    1:15    2.14
.050
      [CN= 67.0: N= 5.00]
      [Tp=  .13:DT=15.00]

002:0027--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            01:WESTG4         1.87     .242 No_date    1:00   28.00
```

```
n/a
                    +  02:EASTG4          1.12     .137 No_date    1:00   26.89
n/a
                    +  03:STM11            .65     .005 No_date    1:15    3.31
n/a
                    +  04:STM18            .48     .002 No_date    1:15    2.14
n/a
                    +  05:G-3            46.73     .630 No_date    1:08   11.15
n/a
                    +  06:MAJG3W           .00     .000 No_date    0:00     .00
n/a
                    +  08:MAJG3E           .00     .000 No_date    0:00     .00
n/a
      [DT=  .94]  SUM=  10:G4IN           50.85     .918 No_date    1:04   11.93
n/a
#===============================================================================
#Route through G-4: 450mm outlet @4.2% invert @97.0m; 7.5m weir @99.70m
#===============================================================================

002:0028---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ROUTE RESERVOIR -> 10:G4IN           50.85     .918 No_date    1:04   11.93
n/a
      [RDT=  .94] out<- 08:G-4            50.85     .456 No_date    2:09   11.93
n/a
     {MxStoUsed=.1532E+00}
  ** END OF RUN :   2

*******************************************************************************




 RUN:COMMAND#

003:0001---------------------------------------------------------------------
--
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   3 ]
#*******************************************************************************
#  Project Name: [19008]    Project Number: [Carp Subdivision-Langstaff Drive]
#  Date        : 07-08-2019
#  Modeller    : [CN]
#  Company     : Robinson Consultants Inc.
```

```
#  License #   :  3772465
#*****************************************************************************

003:0002-----------------------------------------------------------------------
--
     READ STORM
      Filename = STORM.001
      Comment  =
      [SDT=15.00:SDUR=   3.00:PTOT=  71.61]
#=============================================================================
#Rivington Phase A (S/C 4)
#=============================================================================

003:0003--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    01:105A           4.26     .613 No_date    1:00   34.16
.477
      [XIMP=.15:TIMP=.45]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 60.0]
#=============================================================================
#Rivington Phase B (S/C 2,3,5)
#=============================================================================

003:0004--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    02:105AA         10.80    1.512 No_date    1:00   34.16
.477
      [XIMP=.15:TIMP=.45]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 60.0]
#=============================================================================
#Rivington Phase B Playing Field (S/C 2a)
#=============================================================================

003:0005--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     DESIGN SCSHYD      06:Field           .82     .017 No_date    1:30   10.82
.151
      [CN= 65.0: N= 5.00]
      [Tp=  .50:DT=15.00]

003:0006--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            01:105A           4.26     .613 No_date    1:00   34.16
n/a
                     +  02:105AA         10.80    1.512 No_date    1:00   34.16
n/a
```

```
                                        CHISTM
                     +  06:Field           .82     .017 No_date    1:30   10.82
n/a
      [DT=15.00]  SUM=  03:201           15.88    2.130 No_date    1:00   32.95
n/a
#===============================================================================
#Route through G-1 structure: 450 CONC w 90mm orifice; 10m weir @105.15m
#===============================================================================

003:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ROUTE RESERVOIR -> 03:201           15.88    2.130 No_date    1:00   32.95
n/a
      [RDT= 1.88] out<- 04:G-1           15.88    1.535 No_date    1:09   32.95
n/a
     {MxStoUsed=.1786E+00}
#===============================================================================
#Cavanagh developed (S/C 6,7)
#===============================================================================

003:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    01:202           13.01    1.578 No_date    1:00   30.68
.428
      [XIMP=.15:TIMP=.30]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 60.0]
#===============================================================================
#u/s Wetlands (S/C 8)- minor to Cavanagh, major diverted elsewhere
#===============================================================================

003:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     DESIGN SCSHYD      02:Rural 106     15.15     .494 No_date    1:30   15.65
.219
      [CN= 70.0: N= 5.00]
      [Tp=  .50:DT=15.00]

003:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     COMPUTE DUALHYD    02:Rural 106     15.15     .494 No_date    1:30   15.65
n/a
        Major System /  10:MAJ106         3.62     .244 No_date    1:30   15.65
n/a
        Minor System \  09:MIN106        11.53     .250 No_date    1:15   15.65
n/a

003:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
```

```
                                        CHISTM
     ADD HYD            01:202           13.01    1.578 No_date    1:00   30.68
n/a
                     +  09:MIN106        11.53     .250 No_date    1:15   15.65
n/a
      [DT=15.00]  SUM=  08:202           24.54    1.720 No_date    1:00   23.62
n/a
#===============================================================================
#Minor to ravine - controlled by 1060mm sewer at 0.47% and 675mm @1.4% Q=1.0m3/
#===============================================================================

003:0012--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     COMPUTE DUALHYD    08:202           24.54    1.720 No_date    1:00   23.62
n/a
        Major System /  10:MAJ202         3.07     .720 No_date    1:00   23.62
n/a
        Minor System \  09:MIN202        21.47    1.000 No_date    1:00   23.62
n/a

003:0013--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            04:G-1           15.88    1.535 No_date    1:09   32.95
n/a
                     +  09:MIN202        21.47    1.000 No_date    1:00   23.62
n/a
      [DT= 1.88]  SUM=  07:203           37.35    2.535 No_date    1:09   27.59
n/a
#===============================================================================
#Route through G-2: 675mm orifice; 1200mm CONC @2.2%, no weir
#===============================================================================

003:0014--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ROUTE RESERVOIR -> 07:203           37.35    2.535 No_date    1:09   27.59
n/a
      [RDT= 1.88] out<- 04:G-2           37.35    2.509 No_date    1:11   27.59
n/a
     {MxStoUsed=.5372E-01}
#===============================================================================
#d/s Langstaff (S/C 1)
#===============================================================================

003:0015--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    01:WESTG3          .91     .268 No_date    1:00   57.52
.803
      [XIMP=.45:TIMP=.56]
      [SLP=1.25:DT=15.00]
```

```
      [LOSS= 2 :CN= 85.0]

003:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     COMPUTE DUALHYD    01:WESTG3          .91     .268 No_date    1:00   57.52
n/a
        Major System /  06:MAJG3W          .17     .108 No_date    1:00   57.52
n/a
        Minor System \  07:MING3W          .74     .160 No_date    1:00   57.52
n/a

003:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN SCSHYD      02:STM10           .95     .051 No_date    1:00   16.73
.234
      [CN= 71.0: N= 5.00]
      [Tp=  .19:DT=15.00]

003:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    03:EASTG3          .31     .099 No_date    1:00   60.67
.847
      [XIMP=.50:TIMP=.60]
      [SLP=1.50:DT=15.00]
      [LOSS= 2 :CN= 88.0]

003:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     COMPUTE DUALHYD    03:EASTG3          .31     .099 No_date    1:00   60.67
n/a
        Major System /  08:MAJG3E          .01     .009 No_date    1:00   60.67
n/a
        Minor System \  09:MING3E          .30     .090 No_date    1:00   60.67
n/a

003:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN SCSHYD      05:STM17           .52     .033 No_date    1:00   17.85
.249
      [CN= 72.0: N= 5.00]
      [Tp=  .13:DT=15.00]

003:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            02:STM10           .95     .051 No_date    1:00   16.73
n/a
                     +  04:G-2           37.35    2.509 No_date    1:11   27.59
n/a
```

```
                                        CHISTM
                     +  05:STM17           .52     .033 No_date    1:00   17.85
n/a
                     +  07:MING3W          .74     .160 No_date    1:00   57.52
n/a
                     +  09:MING3E          .30     .090 No_date    1:00   60.67
n/a
      [DT= 1.88]  SUM=  10:G3IN          39.85    2.734 No_date    1:11   28.01
n/a
#===============================================================================
#Route through G-3: 675mm outlet @1.2% invert @99.75m; 15m weir @102.5m
#===============================================================================

003:0022--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ROUTE RESERVOIR -> 10:G3IN          39.85    2.734 No_date    1:11   28.01
n/a
      [RDT=  .94] out<- 05:G-3           39.85    1.627 No_date    1:30   28.01
n/a
     {MxStoUsed=.1325E+00}
#===============================================================================
#d/s Langstaff (S/C 1a)
#===============================================================================

003:0023--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    01:WESTG4          1.87     .500 No_date    1:00   53.68
.750
      [XIMP=.34:TIMP=.49]
      [SLP=1.50:DT=15.00]
      [LOSS= 2 :CN= 83.0]

003:0024--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    02:EASTG4          1.12     .282 No_date    1:00   51.75
.723
      [XIMP=.36:TIMP=.46]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 81.0]

003:0025--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN SCSHYD      03:STM11           .65     .034 No_date    1:00   15.65
.219
      [CN= 70.0: N= 5.00]
      [Tp=  .13:DT=15.00]

003:0026--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
```

```
                                        CHISTM
  *  DESIGN SCSHYD      04:STM18           .48     .017 No_date    1:00   12.64
.177
      [CN= 67.0: N= 5.00]
      [Tp=  .13:DT=15.00]

003:0027--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            01:WESTG4         1.87     .500 No_date    1:00   53.68
n/a
                    +  02:EASTG4         1.12     .282 No_date    1:00   51.75
n/a
                    +  03:STM11           .65     .034 No_date    1:00   15.65
n/a
                    +  04:STM18           .48     .017 No_date    1:00   12.64
n/a
                    +  05:G-3           39.85    1.627 No_date    1:30   28.01
n/a
                    +  06:MAJG3W          .17     .108 No_date    1:00   57.52
n/a
                    +  08:MAJG3E          .01     .009 No_date    1:00   60.67
n/a
      [DT=  .94]  SUM=  10:G4IN          44.16    1.896 No_date    1:03   29.47
n/a
#==============================================================================
#Route through G-4: 450mm outlet @4.2% invert @97.0m; 7.5m weir @99.70m
#==============================================================================

003:0028--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ROUTE RESERVOIR -> 10:G4IN          44.16    1.896 No_date    1:03   29.47
n/a
      [RDT=  .94] out<- 08:G-4           44.16    1.688 No_date    1:50   29.47
n/a
     {MxStoUsed=.2617E+00}
  ** END OF RUN :   3

*******************************************************************************




 RUN:COMMAND#

004:0001--------------------------------------------------------------------------
--
     START
      [TZERO =    .00 hrs on        0]
```

```
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   4 ]
#*******************************************************************************
#  Project Name: [19008]    Project Number: [Carp Subdivision-Langstaff Drive]
#  Date        : 07-08-2019
#  Modeller    : [CN]
#  Company     : Robinson Consultants Inc.
#  License #   :  3772465
#*******************************************************************************

004:0002-------------------------------------------------------------------------
--
     READ STORM
      Filename = STORM.001
      Comment  =
      [SDT=15.00:SDUR=   6.00:PTOT=  36.85]
#================================================================================
#Rivington Phase A (S/C 4)
#================================================================================

004:0003--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    01:105A           4.26     .175 No_date    2:00   12.93
.351
      [XIMP=.15:TIMP=.45]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 60.0]
#================================================================================
#Rivington Phase B (S/C 2,3,5)
#================================================================================

004:0004--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    02:105AA         10.80     .333 No_date    2:00   12.93
.351
      [XIMP=.15:TIMP=.45]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 60.0]
#================================================================================
#Rivington Phase B Playing Field (S/C 2a)
#================================================================================

004:0005--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     DESIGN SCSHYD      06:Field           .82     .000 No_date    4:00     .62
.017
      [CN= 65.0: N= 5.00]
```

```
      [Tp=  .50:DT=15.00]

004:0006--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            01:105A          4.26     .175 No_date    2:00   12.93
n/a
                     +  02:105AA        10.80     .333 No_date    2:00   12.93
n/a
                     +  06:Field          .82     .000 No_date    4:00     .62
n/a
      [DT=15.00]  SUM=  03:201          15.88     .508 No_date    2:00   12.30
n/a
#==============================================================================
#Route through G-1 structure: 450 CONC w 90mm orifice; 10m weir @105.15m
#==============================================================================

004:0007--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ROUTE RESERVOIR -> 03:201          15.88     .508 No_date    2:00   12.30
n/a
      [RDT= 1.88] out<- 04:G-1          15.88     .058 No_date    4:00   12.30
n/a
     {MxStoUsed=.1475E+00}
#==============================================================================
#Cavanagh developed (S/C 6,7)
#==============================================================================

004:0008--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    01:202          13.01     .374 No_date    2:00   11.57
.314
      [XIMP=.15:TIMP=.30]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 60.0]
#==============================================================================
#u/s Wetlands (S/C 8)- minor to Cavanagh, major diverted elsewhere
#==============================================================================

004:0009--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     DESIGN SCSHYD      02:Rural 106     15.15     .028 No_date    3:00    1.84
.050
      [CN= 70.0: N= 5.00]
      [Tp=  .50:DT=15.00]

004:0010--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     COMPUTE DUALHYD    02:Rural 106     15.15     .028 No_date    3:00    1.84
```

```
n/a
        Major System /  10:MAJ106          .00     .000 No_date    0:00     .00
n/a
        Minor System \  09:MIN106        15.15     .028 No_date    3:00    1.84
n/a

004:0011--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            01:202           13.01     .374 No_date    2:00   11.57
n/a
                     +  09:MIN106        15.15     .028 No_date    3:00    1.84
n/a
      [DT=15.00]  SUM=  08:202           28.16     .374 No_date    2:00    6.33
n/a
#==============================================================================
#Minor to ravine - controlled by 1060mm sewer at 0.47% and 675mm @1.4% Q=1.0m3/
#==============================================================================

004:0012--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     COMPUTE DUALHYD    08:202           28.16     .374 No_date    2:00    6.33
n/a
        Major System /  10:MAJ202          .00     .000 No_date    0:00     .00
n/a
        Minor System \  09:MIN202        28.16     .374 No_date    2:00    6.33
n/a

004:0013--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            04:G-1           15.88     .058 No_date    4:00   12.30
n/a
                     +  09:MIN202        28.16     .374 No_date    2:00    6.33
n/a
      [DT= 1.88]  SUM=  07:203           44.04     .381 No_date    2:00    8.48
n/a
#==============================================================================
#Route through G-2: 675mm orifice; 1200mm CONC @2.2%, no weir
#==============================================================================

004:0014--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ROUTE RESERVOIR -> 07:203           44.04     .381 No_date    2:00    8.48
n/a
      [RDT= 1.88] out<- 04:G-2           44.04     .355 No_date    2:03    8.48
n/a
     {MxStoUsed=.5634E-02}
#==============================================================================
#d/s Langstaff (S/C 1)
```

```
#=============================================================================

004:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    01:WESTG3          .91     .096 No_date    2:00   26.00
.706
      [XIMP=.45:TIMP=.56]
      [SLP=1.25:DT=15.00]
      [LOSS= 2 :CN= 85.0]

004:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     COMPUTE DUALHYD    01:WESTG3          .91     .096 No_date    2:00   26.00
n/a
        Major System /  06:MAJG3W          .00     .000 No_date    0:00     .00
n/a
        Minor System \  07:MING3W          .91     .096 No_date    2:00   26.00
n/a

004:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN SCSHYD      02:STM10           .95     .003 No_date    2:15    2.16
.059
      [CN= 71.0: N= 5.00]
      [Tp=  .19:DT=15.00]

004:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    03:EASTG3          .31     .037 No_date    2:00   28.06
.761
      [XIMP=.50:TIMP=.60]
      [SLP=1.50:DT=15.00]
      [LOSS= 2 :CN= 88.0]

004:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     COMPUTE DUALHYD    03:EASTG3          .31     .037 No_date    2:00   28.06
n/a
        Major System /  08:MAJG3E          .00     .000 No_date    0:00     .00
n/a
        Minor System \  09:MING3E          .31     .037 No_date    2:00   28.06
n/a

004:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN SCSHYD      05:STM17           .52     .002 No_date    2:15    2.52
.068
      [CN= 72.0: N= 5.00]
```

```
      [Tp=  .13:DT=15.00]

004:0021--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            02:STM10           .95     .003 No_date    2:15    2.16
n/a
                     +  04:G-2           44.04     .355 No_date    2:03    8.48
n/a
                     +  05:STM17           .52     .002 No_date    2:15    2.52
n/a
                     +  07:MING3W          .91     .096 No_date    2:00   26.00
n/a
                     +  09:MING3E          .31     .037 No_date    2:00   28.06
n/a
      [DT= 1.88]  SUM=  10:G3IN          46.73     .475 No_date    2:01    8.76
n/a
#==============================================================================
#Route through G-3: 675mm outlet @1.2% invert @99.75m; 15m weir @102.5m
#==============================================================================

004:0022--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ROUTE RESERVOIR -> 10:G3IN          46.73     .475 No_date    2:01    8.76
n/a
      [RDT=  .94] out<- 05:G-3           46.73     .430 No_date    2:07    8.76
n/a
     {MxStoUsed=.1254E-01}
#==============================================================================
#d/s Langstaff (S/C 1a)
#==============================================================================

004:0023--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    01:WESTG4          1.87     .168 No_date    2:00   23.34
.633
      [XIMP=.34:TIMP=.49]
      [SLP=1.50:DT=15.00]
      [LOSS= 2 :CN= 83.0]

004:0024--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    02:EASTG4          1.12     .096 No_date    2:00   22.42
.608
      [XIMP=.36:TIMP=.46]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 81.0]

004:0025--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
```

```
.-
  *  DESIGN SCSHYD      03:STM11           .65     .001 No_date    2:30    1.83
.050
      [CN= 70.0: N= 5.00]
      [Tp=  .13:DT=15.00]

004:0026--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN SCSHYD      04:STM18           .48     .000 No_date    2:45    1.02
.028
      [CN= 67.0: N= 5.00]
      [Tp=  .13:DT=15.00]

004:0027--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            01:WESTG4         1.87     .168 No_date    2:00   23.34
n/a
                    +  02:EASTG4         1.12     .096 No_date    2:00   22.42
n/a
                    +  03:STM11           .65     .001 No_date    2:30    1.83
n/a
                    +  04:STM18           .48     .000 No_date    2:45    1.02
n/a
                    +  05:G-3           46.73     .430 No_date    2:07    8.76
n/a
                    +  06:MAJG3W          .00     .000 No_date    0:00     .00
n/a
                    +  08:MAJG3E          .00     .000 No_date    0:00     .00
n/a
      [DT=  .94]  SUM=  10:G4IN          50.85     .633 No_date    2:04    9.43
n/a
#================================================================================
#Route through G-4: 450mm outlet @4.2% invert @97.0m; 7.5m weir @99.70m
#================================================================================

004:0028--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ROUTE RESERVOIR -> 10:G4IN          50.85     .633 No_date    2:04    9.43
n/a
      [RDT=  .94] out<- 08:G-4           50.85     .302 No_date    2:36    9.43
n/a
     {MxStoUsed=.6471E-01}
  ** END OF RUN :   4

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

```
 RUN:COMMAND#

005:0001-----------------------------------------------------------------------
--
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   5 ]
#******************************************************************************
#  Project Name: [19008]    Project Number: [Carp Subdivision-Langstaff Drive]
#  Date        : 07-08-2019
#  Modeller    : [CN]
#  Company     : Robinson Consultants Inc.
#  License #   :  3772465
#******************************************************************************

005:0002-----------------------------------------------------------------------
--
     READ STORM
      Filename = STORM.001
      Comment  =
      [SDT=15.00:SDUR=   6.00:PTOT=  49.03]
#==============================================================================
#Rivington Phase A (S/C 4)
#==============================================================================

005:0003---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    01:105A           4.26     .280 No_date    2:00   19.69
.402
      [XIMP=.15:TIMP=.45]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 60.0]
#==============================================================================
#Rivington Phase B (S/C 2,3,5)
#==============================================================================

005:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    02:105AA         10.80     .687 No_date    2:00   19.69
.402
      [XIMP=.15:TIMP=.45]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 60.0]
#==============================================================================
```

```
#Rivington Phase B Playing Field (S/C 2a)
#===============================================================================

005:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     DESIGN SCSHYD      06:Field           .82     .003 No_date    2:45    2.96
.060
      [CN= 65.0: N= 5.00]
      [Tp=  .50:DT=15.00]

005:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            01:105A           4.26     .280 No_date    2:00   19.69
n/a
                     +  02:105AA         10.80     .687 No_date    2:00   19.69
n/a
                     +  06:Field           .82     .003 No_date    2:45    2.96
n/a
      [DT=15.00]  SUM=  03:201           15.88     .967 No_date    2:00   18.83
n/a
#===============================================================================
#Route through G-1 structure: 450 CONC w 90mm orifice; 10m weir @105.15m
#===============================================================================

005:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ROUTE RESERVOIR -> 03:201           15.88     .967 No_date    2:00   18.83
n/a
      [RDT= 1.88] out<- 04:G-1           15.88     .330 No_date    2:30   18.83
n/a
     {MxStoUsed=.1547E+00}
#===============================================================================
#Cavanagh developed (S/C 6,7)
#===============================================================================

005:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    01:202           13.01     .723 No_date    2:00   17.61
.359
      [XIMP=.15:TIMP=.30]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 60.0]
#===============================================================================
#u/s Wetlands (S/C 8)- minor to Cavanagh, major diverted elsewhere
#===============================================================================

005:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
```

```
                                        CHISTM
     DESIGN SCSHYD      02:Rural 106     15.15     .107 No_date    2:45    5.46
.111
      [CN= 70.0: N= 5.00]
      [Tp=  .50:DT=15.00]

005:0010--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     COMPUTE DUALHYD    02:Rural 106     15.15     .107 No_date    2:45    5.46
n/a
        Major System /  10:MAJ106          .00     .000 No_date    0:00     .00
n/a
        Minor System \  09:MIN106        15.15     .107 No_date    2:45    5.46
n/a

005:0011--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            01:202           13.01     .723 No_date    2:00   17.61
n/a
                     +  09:MIN106        15.15     .107 No_date    2:45    5.46
n/a
      [DT=15.00]  SUM=  08:202           28.16     .740 No_date    2:00   11.07
n/a
#==============================================================================
#Minor to ravine - controlled by 1060mm sewer at 0.47% and 675mm @1.4% Q=1.0m3/
#==============================================================================

005:0012--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     COMPUTE DUALHYD    08:202           28.16     .740 No_date    2:00   11.07
n/a
        Major System /  10:MAJ202          .00     .000 No_date    0:00     .00
n/a
        Minor System \  09:MIN202        28.16     .740 No_date    2:00   11.07
n/a

005:0013--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            04:G-1           15.88     .330 No_date    2:30   18.83
n/a
                     +  09:MIN202        28.16     .740 No_date    2:00   11.07
n/a
      [DT= 1.88]  SUM=  07:203           44.04     .752 No_date    2:00   13.87
n/a
#==============================================================================
#Route through G-2: 675mm orifice; 1200mm CONC @2.2%, no weir
#==============================================================================

005:0014--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
```

```
.-
     ROUTE RESERVOIR -> 07:203           44.04     .752 No_date    2:00   13.87
n/a
      [RDT= 1.88] out<- 04:G-2           44.04     .695 No_date    2:03   13.87
n/a
     {MxStoUsed=.1105E-01}
#===============================================================================
#d/s Langstaff (S/C 1)
#===============================================================================

005:0015--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    01:WESTG3          .91     .141 No_date    2:00   36.74
.749
      [XIMP=.45:TIMP=.56]
      [SLP=1.25:DT=15.00]
      [LOSS= 2 :CN= 85.0]

005:0016--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     COMPUTE DUALHYD    01:WESTG3          .91     .141 No_date    2:00   36.74
n/a
        Major System /  06:MAJG3W          .00     .000 No_date    0:00     .00
n/a
        Minor System \  07:MING3W          .91     .141 No_date    2:00   36.74
n/a

005:0017--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN SCSHYD      02:STM10           .95     .011 No_date    2:15    6.06
.124
      [CN= 71.0: N= 5.00]
      [Tp=  .19:DT=15.00]

005:0018--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    03:EASTG3          .31     .053 No_date    2:00   39.26
.801
      [XIMP=.50:TIMP=.60]
      [SLP=1.50:DT=15.00]
      [LOSS= 2 :CN= 88.0]

005:0019--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     COMPUTE DUALHYD    03:EASTG3          .31     .053 No_date    2:00   39.26
n/a
        Major System /  08:MAJG3E          .00     .000 No_date    0:00     .00
n/a
```

```
                                        CHISTM
        Minor System \  09:MING3E          .31     .053 No_date    2:00   39.26
n/a

005:0020--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN SCSHYD      05:STM17           .52     .007 No_date    2:15    6.69
.136
      [CN= 72.0: N= 5.00]
      [Tp=  .13:DT=15.00]

005:0021--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            02:STM10           .95     .011 No_date    2:15    6.06
n/a
                     +  04:G-2           44.04     .695 No_date    2:03   13.87
n/a
                     +  05:STM17           .52     .007 No_date    2:15    6.69
n/a
                     +  07:MING3W          .91     .141 No_date    2:00   36.74
n/a
                     +  09:MING3E          .31     .053 No_date    2:00   39.26
n/a
      [DT= 1.88]  SUM=  10:G3IN          46.73     .882 No_date    2:01   14.24
n/a
#===============================================================================
#Route through G-3: 675mm outlet @1.2% invert @99.75m; 15m weir @102.5m
#===============================================================================

005:0022--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ROUTE RESERVOIR -> 10:G3IN         46.73     .882 No_date    2:01   14.24
n/a
      [RDT=  .94] out<- 05:G-3          46.73     .795 No_date    2:07   14.24
n/a
     {MxStoUsed=.2321E-01}
#===============================================================================
#d/s Langstaff (S/C 1a)
#===============================================================================

005:0023--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    01:WESTG4          1.87     .254 No_date    2:00   33.57
.685
      [XIMP=.34:TIMP=.49]
      [SLP=1.50:DT=15.00]
      [LOSS= 2 :CN= 83.0]

005:0024--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
```

```
.-
  *  DESIGN STANDHYD    02:EASTG4         1.12     .143 No_date    2:00   32.26
.658
      [XIMP=.36:TIMP=.46]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 81.0]

005:0025--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN SCSHYD      03:STM11           .65     .007 No_date    2:15    5.46
.111
      [CN= 70.0: N= 5.00]
      [Tp=  .13:DT=15.00]

005:0026--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN SCSHYD      04:STM18           .48     .003 No_date    2:15    3.87
.079
      [CN= 67.0: N= 5.00]
      [Tp=  .13:DT=15.00]

005:0027--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            01:WESTG4         1.87     .254 No_date    2:00   33.57
n/a
                    +  02:EASTG4         1.12     .143 No_date    2:00   32.26
n/a
                    +  03:STM11           .65     .007 No_date    2:15    5.46
n/a
                    +  04:STM18           .48     .003 No_date    2:15    3.87
n/a
                    +  05:G-3           46.73     .795 No_date    2:07   14.24
n/a
                    +  06:MAJG3W          .00     .000 No_date    0:00     .00
n/a
                    +  08:MAJG3E          .00     .000 No_date    0:00     .00
n/a
      [DT=  .94]  SUM=  10:G4IN          50.85    1.098 No_date    2:05   15.14
n/a
#==============================================================================
#Route through G-4: 450mm outlet @4.2% invert @97.0m; 7.5m weir @99.70m
#==============================================================================

005:0028--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ROUTE RESERVOIR -> 10:G4IN          50.85    1.098 No_date    2:05   15.14
n/a
      [RDT=  .94] out<- 08:G-4           50.85     .623 No_date    2:52   15.14
```

```
n/a
     {MxStoUsed=.1678E+00}
  ** END OF RUN :   5

************************************************************************




 RUN:COMMAND#

006:0001-------------------------------------------------------------------
--
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   6 ]
#************************************************************************
#  Project Name: [19008]    Project Number: [Carp Subdivision-Langstaff Drive]
#  Date        : 07-08-2019
#  Modeller    : [CN]
#  Company     : Robinson Consultants Inc.
#  License #   :  3772465
#************************************************************************

006:0002-------------------------------------------------------------------
--
     READ STORM
      Filename = STORM.001
      Comment  =
      [SDT=15.00:SDUR=   6.00:PTOT=  82.30]
#=======================================================================
#Rivington Phase A (S/C 4)
#=======================================================================

006:0003--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    01:105A           4.26     .659 No_date    2:00   41.68
.506
      [XIMP=.15:TIMP=.45]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 60.0]
#=======================================================================
#Rivington Phase B (S/C 2,3,5)
#=======================================================================
```

```
006:0004--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    02:105AA         10.80    1.625 No_date    2:00   41.68
.506
      [XIMP=.15:TIMP=.45]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 60.0]
#==============================================================================
#Rivington Phase B Playing Field (S/C 2a)
#==============================================================================

006:0005--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     DESIGN SCSHYD      06:Field           .82     .021 No_date    2:30   15.75
.191
      [CN= 65.0: N= 5.00]
      [Tp=  .50:DT=15.00]

006:0006--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            01:105A           4.26     .659 No_date    2:00   41.68
n/a
                     +  02:105AA         10.80    1.625 No_date    2:00   41.68
n/a
                     +  06:Field           .82     .021 No_date    2:30   15.75
n/a
      [DT=15.00]  SUM=  03:201           15.88    2.290 No_date    2:00   40.34
n/a
#==============================================================================
#Route through G-1 structure: 450 CONC w 90mm orifice; 10m weir @105.15m
#==============================================================================

006:0007--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ROUTE RESERVOIR -> 03:201          15.88    2.290 No_date    2:00   40.34
n/a
      [RDT= 1.88] out<- 04:G-1          15.88    1.789 No_date    2:07   40.34
n/a
     {MxStoUsed=.1821E+00}
#==============================================================================
#Cavanagh developed (S/C 6,7)
#==============================================================================

006:0008--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    01:202           13.01    1.693 No_date    2:00   37.56
.456
      [XIMP=.15:TIMP=.30]
```

```
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 60.0]
#===============================================================================
#u/s Wetlands (S/C 8)- minor to Cavanagh, major diverted elsewhere
#===============================================================================

006:0009--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     DESIGN SCSHYD      02:Rural 106     15.15     .582 No_date    2:30   21.63
.263
      [CN= 70.0: N= 5.00]
      [Tp=  .50:DT=15.00]

006:0010--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     COMPUTE DUALHYD    02:Rural 106     15.15     .582 No_date    2:30   21.63
n/a
        Major System /  10:MAJ106         3.75     .332 No_date    2:30   21.63
n/a
        Minor System \  09:MIN106        11.40     .250 No_date    2:15   21.63
n/a

006:0011--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            01:202           13.01    1.693 No_date    2:00   37.56
n/a
                     +  09:MIN106        11.40     .250 No_date    2:15   21.63
n/a
      [DT=15.00]  SUM=  08:202           24.41    1.878 No_date    2:00   30.12
n/a
#===============================================================================
#Minor to ravine - controlled by 1060mm sewer at 0.47% and 675mm @1.4% Q=1.0m3/
#===============================================================================

006:0012--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     COMPUTE DUALHYD    08:202           24.41    1.878 No_date    2:00   30.12
n/a
        Major System /  10:MAJ202         3.04     .878 No_date    2:00   30.12
n/a
        Minor System \  09:MIN202        21.37    1.000 No_date    2:00   30.12
n/a

006:0013--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            04:G-1           15.88    1.789 No_date    2:07   40.34
n/a
                     +  09:MIN202        21.37    1.000 No_date    2:00   30.12
```

```
n/a
      [DT= 1.88]  SUM=  07:203           37.25    2.789 No_date    2:07   34.47
n/a
#==============================================================================
#Route through G-2: 675mm orifice; 1200mm CONC @2.2%, no weir
#==============================================================================

006:0014--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ROUTE RESERVOIR -> 07:203           37.25    2.789 No_date    2:07   34.47
n/a
      [RDT= 1.88] out<- 04:G-2           37.25    2.753 No_date    2:09   34.47
n/a
     {MxStoUsed=.5508E-01}
#==============================================================================
#d/s Langstaff (S/C 1)
#==============================================================================

006:0015--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    01:WESTG3          .91     .276 No_date    2:00   67.60
.821
      [XIMP=.45:TIMP=.56]
      [SLP=1.25:DT=15.00]
      [LOSS= 2 :CN= 85.0]

006:0016--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     COMPUTE DUALHYD    01:WESTG3          .91     .276 No_date    2:00   67.60
n/a
        Major System /  06:MAJG3W          .15     .116 No_date    2:00   67.60
n/a
        Minor System \  07:MING3W          .76     .160 No_date    2:00   67.60
n/a

006:0017--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN SCSHYD      02:STM10           .95     .066 No_date    2:00   22.92
.278
      [CN= 71.0: N= 5.00]
      [Tp=  .19:DT=15.00]

006:0018--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    03:EASTG3          .31     .102 No_date    2:00   70.97
.862
      [XIMP=.50:TIMP=.60]
      [SLP=1.50:DT=15.00]
```

```
      [LOSS= 2 :CN= 88.0]

006:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     COMPUTE DUALHYD    03:EASTG3          .31     .102 No_date    2:00   70.97
n/a
        Major System /  08:MAJG3E          .02     .012 No_date    2:00   70.97
n/a
        Minor System \  09:MING3E          .29     .090 No_date    2:00   70.97
n/a

006:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN SCSHYD      05:STM17           .52     .043 No_date    2:00   24.25
.295
      [CN= 72.0: N= 5.00]
      [Tp=  .13:DT=15.00]

006:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            02:STM10           .95     .066 No_date    2:00   22.92
n/a
                     +  04:G-2           37.25    2.753 No_date    2:09   34.47
n/a
                     +  05:STM17           .52     .043 No_date    2:00   24.25
n/a
                     +  07:MING3W          .76     .160 No_date    2:00   67.60
n/a
                     +  09:MING3E          .29     .090 No_date    2:00   70.97
n/a
      [DT= 1.88]  SUM=  10:G3IN          39.77    3.011 No_date    2:09   34.96
n/a
#==============================================================================
#Route through G-3: 675mm outlet @1.2% invert @99.75m; 15m weir @102.5m
#==============================================================================

006:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ROUTE RESERVOIR -> 10:G3IN          39.77    3.011 No_date    2:09   34.96
n/a
      [RDT=  .94] out<- 05:G-3           39.77    1.671 No_date    2:30   34.96
n/a
     {MxStoUsed=.1597E+00}
#==============================================================================
#d/s Langstaff (S/C 1a)
#==============================================================================

006:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
```

```
.-
  *  DESIGN STANDHYD    01:WESTG4         1.87     .521 No_date    2:00   63.52
.772
      [XIMP=.34:TIMP=.49]
      [SLP=1.50:DT=15.00]
      [LOSS= 2 :CN= 83.0]

006:0024--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    02:EASTG4         1.12     .293 No_date    2:00   61.35
.745
      [XIMP=.36:TIMP=.46]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 81.0]

006:0025--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN SCSHYD      03:STM11           .65     .044 No_date    2:00   21.63
.263
      [CN= 70.0: N= 5.00]
      [Tp=  .13:DT=15.00]

006:0026--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN SCSHYD      04:STM18           .48     .023 No_date    2:00   17.99
.219
      [CN= 67.0: N= 5.00]
      [Tp=  .13:DT=15.00]

006:0027--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            01:WESTG4         1.87     .521 No_date    2:00   63.52
n/a
                    +  02:EASTG4         1.12     .293 No_date    2:00   61.35
n/a
                    +  03:STM11           .65     .044 No_date    2:00   21.63
n/a
                    +  04:STM18           .48     .023 No_date    2:00   17.99
n/a
                    +  05:G-3           39.77    1.671 No_date    2:30   34.96
n/a
                    +  06:MAJG3W          .15     .116 No_date    2:00   67.60
n/a
                    +  08:MAJG3E          .02     .012 No_date    2:00   70.97
n/a
      [DT=  .94]  SUM=  10:G4IN          44.06    1.989 No_date    2:02   36.59
n/a
#===============================================================================
```

```
#Route through G-4: 450mm outlet @4.2% invert @97.0m; 7.5m weir @99.70m
#================================================================================

006:0028---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ROUTE RESERVOIR -> 10:G4IN          44.06    1.989 No_date    2:02   36.59
n/a
      [RDT=  .94] out<- 08:G-4           44.06    1.745 No_date    2:50   36.59
n/a
     {MxStoUsed=.2667E+00}

006:0002---------------------------------------------------------------------------
--
      FINISH
-------------------------------------------------------------------------------
---
```

```
  SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
  S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
  SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
      S   W W   M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
  SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9   =========
                                                       9   9  9   9   # 3772465
       StormWater Management HYdrologic Model           999    999    =========

*****************************************************************************
***************************** SWMHYMO Ver/4.05  *****************************
*********  A single event and continuous hydrologic simulation model  *********
*********     based on the principles of HYMO and its successors      *********
*********                  OTTHYMO-83 and OTTHYMO-89.                 *********
*****************************************************************************
********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
*********                   Ottawa,  Ontario: (613) 836-3884          *********
*********                   Gatineau, Quebec: (819) 243-6858          *********
*********                   E-Mail: swmhymo@jfsa.Com                  *********
*****************************************************************************

+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++++++++ Licensed user: Robinson Consultants Inc.                    +++++++++
+++++++++                Kanata                SERIAL#:3772465       +++++++++
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

*****************************************************************************
*********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++            *********
*********           Maximum value for ID numbers  :     10           *********
*********           Max. number of rainfall points: 105408           *********
*********           Max. number of flow points    : 105408           *********
*****************************************************************************

***** DESCRIPTION SUMMARY TABLE HEADERS (units depend on METOUT in START) *****
*****-------------------------------------------------------------------*****
*****    ID:  Hydrograph IDentification numbers, (1-10).                 *****
*****  NHYD:  Hydrograph reference numbers, (6 digits or characters).    *****
*****  AREA:  Drainage area associated with hydrograph, (ac.) or (ha.).  *****
***** QPEAK:  Peak flow of simulated hydrograph, (ft^3/s) or (m^3/s).    *****
***** TpeakDate_hh:mm is the date and time of the peak flow.             *****
*****  R.V.:  Runoff Volume of simulated hydrograph, (in) or (mm).       *****
*****  R.C.:  Runoff Coefficient of simulated hydrograph, (ratio).       *****
*****     *:  see WARNING or NOTE message printed at end of run.         *****
*****    **:  see  ERROR  message printed at end of run.                 *****
*****************************************************************************
*****************************************************************************
```

```
::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::

 ********************************************************************************

 **********************   S U M M A R Y   O U T P U T   **********************
 ********************************************************************************
 *         DATE: 2019-11-26     TIME: 08:48:16     RUN COUNTER: 001156         *
 ********************************************************************************
 * Input   filename: U:\SWMHYMO\6h5yr.dat                                       *
 * Output  filename: U:\SWMHYMO\6h5yr.out                                       *
 * Summary filename: U:\SWMHYMO\6h5yr.sum                                       *
 * User comments:                                                               *
 * 1:_____________________________________________________________________________*
 * 2:_____________________________________________________________________________*
 * 3:_____________________________________________________________________________*
 ********************************************************************************


#*******************************************************************************
#  Project Name: [19008]    Project Number: [Carp Subdivision-Langstaff Drive]
#  Date        : 07-08-2019
#  Modeller    : [CN]
#  Company     : Robinson Consultants Inc.
#  License #   :  3772465
#*******************************************************************************
 RUN:COMMAND#

001:0001-------------------------------------------------------------------------
--
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   0 ]
      [NRUN  =   1 ]

001:0002-------------------------------------------------------------------------
--
     MASS STORM
      Filename = U:\SWMHYMO\SCS6HII.MST
      Comment  = SCS 6 HOUR TYPE II STORM DISTRIBUTION
      [SDT=15.00:SDUR=   6.00:PTOT=  52.80]
#===============================================================================
#Rivington Phase A (S/C 4)
#===============================================================================

001:0003--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    01:105A           4.26     .336 No_date    3:00   21.95
```

```
.416
      [XIMP=.15:TIMP=.45]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 60.0]
#=============================================================================
#Rivington Phase B (S/C 2,3,5)
#=============================================================================

001:0004--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    02:105AA         10.80     .824 No_date    3:00   21.95
.416
      [XIMP=.15:TIMP=.45]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 60.0]
#=============================================================================
#Rivington Phase B Playing Field (S/C 2a)
#=============================================================================

001:0005--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     DESIGN SCSHYD      06:Field           .82     .005 No_date    3:45    3.99
.076
      [CN= 65.0: N= 5.00]
      [Tp=  .50:DT=15.00]

001:0006--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            01:105A           4.26     .336 No_date    3:00   21.95
n/a
                    +  02:105AA         10.80     .824 No_date    3:00   21.95
n/a
                    +  06:Field           .82     .005 No_date    3:45    3.99
n/a
      [DT=15.00]  SUM=  03:201           15.88    1.160 No_date    3:00   21.02
n/a
#=============================================================================
#Route through G-1 structure: 450 CONC w 90mm orifice; 10m weir @105.15m
#=============================================================================

001:0007--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ROUTE RESERVOIR -> 03:201          15.88    1.160 No_date    3:00   21.02
n/a
      [RDT= 1.88] out<- 04:G-1          15.88     .535 No_date    3:20   21.02
n/a
     {MxStoUsed=.1601E+00}
#=============================================================================
```

```
#Cavanagh developed (S/C 6,7)
#==============================================================================

001:0008--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    01:202           13.01     .861 No_date    3:00   19.63
.372
      [XIMP=.15:TIMP=.30]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 60.0]
#==============================================================================
#u/s Wetlands (S/C 8)- minor to Cavanagh, major diverted elsewhere
#==============================================================================

001:0009--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     DESIGN SCSHYD      02:Rural 106     15.15     .178 No_date    3:30    6.88
.130
      [CN= 70.0: N= 5.00]
      [Tp=  .50:DT=15.00]

001:0010--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     COMPUTE DUALHYD    02:Rural 106     15.15     .178 No_date    3:30    6.88
n/a
        Major System /  10:MAJ106          .00     .000 No_date    0:00     .00
n/a
        Minor System \  09:MIN106        15.15     .178 No_date    3:30    6.88
n/a

001:0011--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            01:202           13.01     .861 No_date    3:00   19.63
n/a
                     +  09:MIN106        15.15     .178 No_date    3:30    6.88
n/a
      [DT=15.00]  SUM=  08:202           28.16     .904 No_date    3:00   12.77
n/a
#==============================================================================
#Minor to ravine - controlled by 1060mm sewer at 0.47% and 675mm @1.4% Q=1.0m3/
#==============================================================================

001:0012--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     COMPUTE DUALHYD    08:202           28.16     .904 No_date    3:00   12.77
n/a
        Major System /  10:MAJ202          .00     .000 No_date    0:00     .00
n/a
```

```
        Minor System \  09:MIN202        28.16     .904 No_date    3:00   12.77
n/a

001:0013--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            04:G-1           15.88     .535 No_date    3:20   21.02
n/a
                     +  09:MIN202        28.16     .904 No_date    3:00   12.77
n/a
      [DT= 1.88]  SUM=  07:203           44.04    1.097 No_date    3:18   15.75
n/a
#==============================================================================
#Route through G-2: 675mm orifice; 1200mm CONC @2.2%, no weir
#==============================================================================

001:0014--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ROUTE RESERVOIR -> 07:203          44.04    1.097 No_date    3:18   15.75
n/a
      [RDT= 1.88] out<- 04:G-2          44.04    1.034 No_date    3:24   15.75
n/a
     {MxStoUsed=.1822E-01}
#==============================================================================
#d/s Langstaff (S/C 1)
#==============================================================================

001:0015--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    01:WESTG3          .91     .160 No_date    3:00   40.14
.760
      [XIMP=.45:TIMP=.56]
      [SLP=1.25:DT=15.00]
      [LOSS= 2 :CN= 85.0]

001:0016--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     COMPUTE DUALHYD    01:WESTG3          .91     .160 No_date    3:00   40.14
n/a
        Major System /  06:MAJG3W          .00     .000 No_date    0:00     .00
n/a
        Minor System \  07:MING3W          .91     .160 No_date    3:00   40.14
n/a

001:0017--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN SCSHYD      02:STM10           .95     .017 No_date    3:00    7.56
.143
      [CN= 71.0: N= 5.00]
```

```
      [Tp=  .19:DT=15.00]

001:0018--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    03:EASTG3          .31     .060 No_date    3:00   42.79
.810
      [XIMP=.50:TIMP=.60]
      [SLP=1.50:DT=15.00]
      [LOSS= 2 :CN= 88.0]

001:0019--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     COMPUTE DUALHYD    03:EASTG3          .31     .060 No_date    3:00   42.79
n/a
        Major System /  08:MAJG3E          .00     .000 No_date    0:00     .00
n/a
        Minor System \  09:MING3E          .31     .060 No_date    3:00   42.79
n/a

001:0020--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN SCSHYD      05:STM17           .52     .012 No_date    3:00    8.28
.157
      [CN= 72.0: N= 5.00]
      [Tp=  .13:DT=15.00]

001:0021--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            02:STM10           .95     .017 No_date    3:00    7.56
n/a
                     +  04:G-2           44.04    1.034 No_date    3:24   15.75
n/a
                     +  05:STM17           .52     .012 No_date    3:00    8.28
n/a
                     +  07:MING3W          .91     .160 No_date    3:00   40.14
n/a
                     +  09:MING3E          .31     .060 No_date    3:00   42.79
n/a
      [DT= 1.88]  SUM=  10:G3IN          46.73    1.113 No_date    3:20   16.15
n/a
#==============================================================================
#Route through G-3: 675mm outlet @1.2% invert @99.75m; 15m weir @102.5m
#==============================================================================

001:0022--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ROUTE RESERVOIR -> 10:G3IN          46.73    1.113 No_date    3:20   16.15
n/a
```

```
      [RDT=  .94] out<- 05:G-3           46.73    1.091 No_date    3:26   16.15
n/a
     {MxStoUsed=.3186E-01}
#===============================================================================
#d/s Langstaff (S/C 1a)
#===============================================================================

001:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    01:WESTG4          1.87     .292 No_date    3:00   36.84
.698
      [XIMP=.34:TIMP=.49]
      [SLP=1.50:DT=15.00]
      [LOSS= 2 :CN= 83.0]

001:0024---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    02:EASTG4          1.12     .164 No_date    3:00   35.42
.671
      [XIMP=.36:TIMP=.46]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 81.0]

001:0025---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN SCSHYD      03:STM11            .65     .010 No_date    3:00    6.88
.130
      [CN= 70.0: N= 5.00]
      [Tp=  .13:DT=15.00]

001:0026---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN SCSHYD      04:STM18            .48     .005 No_date    3:15    5.05
.096
      [CN= 67.0: N= 5.00]
      [Tp=  .13:DT=15.00]

001:0027---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            01:WESTG4          1.87     .292 No_date    3:00   36.84
n/a
                    +  02:EASTG4          1.12     .164 No_date    3:00   35.42
n/a
                    +  03:STM11            .65     .010 No_date    3:00    6.88
n/a
                    +  04:STM18            .48     .005 No_date    3:15    5.05
n/a
                    +  05:G-3            46.73    1.091 No_date    3:26   16.15
```

```
                                        6h5yr
n/a
                     +  06:MAJG3W          .00     .000 No_date    0:00     .00
n/a
                     +  08:MAJG3E          .00     .000 No_date    0:00     .00
n/a
      [DT=  .94]  SUM=  10:G4IN          50.85    1.317 No_date    3:05   17.11
n/a
#=============================================================================
#Route through G-4: 450mm outlet @4.2% invert @97.0m; 7.5m weir @99.70m
#=============================================================================

001:0028---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ROUTE RESERVOIR -> 10:G4IN          50.85    1.317 No_date    3:05   17.11
n/a
      [RDT=  .94] out<- 08:G-4           50.85     .951 No_date    3:40   17.11
n/a
     {MxStoUsed=.1967E+00}

001:0029-----------------------------------------------------------------------
--
      FINISH
-------------------------------------------------------------------------------
---
```

```
  SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
  S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
  SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
      S   W W   M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
  SSSSS   W W   M   M  H   H    Y    M   M   OOO          9      9    =========
                                                      9   9  9   9   # 3772465
       StormWater Management HYdrologic Model          999    999    =========

*****************************************************************************
***************************** SWMHYMO Ver/4.05  *****************************
*********  A single event and continuous hydrologic simulation model  *********
*********     based on the principles of HYMO and its successors      *********
*********                  OTTHYMO-83 and OTTHYMO-89.                 *********
*****************************************************************************
********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
*********                  Ottawa,  Ontario: (613) 836-3884           *********
*********                  Gatineau, Quebec: (819) 243-6858           *********
*********                  E-Mail: swmhymo@jfsa.Com                   *********
*****************************************************************************

+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++++++++ Licensed user: Robinson Consultants Inc.                    +++++++++
+++++++++               Kanata                SERIAL#:3772465        +++++++++
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

*****************************************************************************
*********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++            *********
*********           Maximum value for ID numbers  :     10           *********
*********           Max. number of rainfall points: 105408           *********
*********           Max. number of flow points    : 105408           *********
*****************************************************************************

***** DESCRIPTION SUMMARY TABLE HEADERS (units depend on METOUT in START) *****
*****-------------------------------------------------------------------*****
*****    ID:  Hydrograph IDentification numbers, (1-10).                 *****
*****  NHYD:  Hydrograph reference numbers, (6 digits or characters).    *****
*****  AREA:  Drainage area associated with hydrograph, (ac.) or (ha.).  *****
***** QPEAK:  Peak flow of simulated hydrograph, (ft^3/s) or (m^3/s).    *****
***** TpeakDate_hh:mm is the date and time of the peak flow.             *****
*****  R.V.:  Runoff Volume of simulated hydrograph, (in) or (mm).       *****
*****  R.C.:  Runoff Coefficient of simulated hydrograph, (ratio).       *****
*****     *:  see WARNING or NOTE message printed at end of run.         *****
*****    **:  see  ERROR  message printed at end of run.                 *****
*****************************************************************************
*****************************************************************************
```

```
::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::

 ********************************************************************************

 **********************   S U M M A R Y   O U T P U T   **********************
 ********************************************************************************
 *         DATE: 2019-11-26     TIME: 08:48:08     RUN COUNTER: 001155         *
 ********************************************************************************
 * Input   filename: U:\SWMHYMO\6h2yr.dat                                       *
 * Output  filename: U:\SWMHYMO\6h2yr.out                                       *
 * Summary filename: U:\SWMHYMO\6h2yr.sum                                       *
 * User comments:                                                               *
 * 1:_____________________________________________________________________________*
 * 2:_____________________________________________________________________________*
 * 3:_____________________________________________________________________________*
 ********************************************************************************


#*******************************************************************************
#  Project Name: [19008]    Project Number: [Carp Subdivision-Langstaff Drive]
#  Date        : 07-08-2019
#  Modeller    : [CN]
#  Company     : Robinson Consultants Inc.
#  License #   :  3772465
#*******************************************************************************
 RUN:COMMAND#

001:0001-------------------------------------------------------------------------
--
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   0 ]
      [NRUN  =   1 ]

001:0002-------------------------------------------------------------------------
--
     MASS STORM
      Filename = U:\SWMHYMO\SCS6HII.MST
      Comment  = SCS 6 HOUR TYPE II STORM DISTRIBUTION
      [SDT=15.00:SDUR=   6.00:PTOT=  37.80]
#===============================================================================
#Rivington Phase A (S/C 4)
#===============================================================================

001:0003--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    01:105A           4.26     .197 No_date    3:00   13.43
```

```
.355
      [XIMP=.15:TIMP=.45]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 60.0]
#=============================================================================
#Rivington Phase B (S/C 2,3,5)
#=============================================================================

001:0004--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    02:105AA         10.80     .481 No_date    3:00   13.43
.355
      [XIMP=.15:TIMP=.45]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 60.0]
#=============================================================================
#Rivington Phase B Playing Field (S/C 2a)
#=============================================================================

001:0005--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     DESIGN SCSHYD      06:Field           .82     .001 No_date    4:45     .74
.020
      [CN= 65.0: N= 5.00]
      [Tp=  .50:DT=15.00]

001:0006--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            01:105A           4.26     .197 No_date    3:00   13.43
n/a
                    +  02:105AA         10.80     .481 No_date    3:00   13.43
n/a
                    +  06:Field           .82     .001 No_date    4:45     .74
n/a
      [DT=15.00]  SUM=  03:201           15.88     .678 No_date    3:00   12.77
n/a
#=============================================================================
#Route through G-1 structure: 450 CONC w 90mm orifice; 10m weir @105.15m
#=============================================================================

001:0007--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ROUTE RESERVOIR -> 03:201          15.88     .678 No_date    3:00   12.77
n/a
      [RDT= 1.88] out<- 04:G-1          15.88     .098 No_date    4:09   12.77
n/a
     {MxStoUsed=.1486E+00}
#=============================================================================
```

```
#Cavanagh developed (S/C 6,7)
#===============================================================================

001:0008--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    01:202           13.01     .405 No_date    3:00   12.01
.318
      [XIMP=.15:TIMP=.30]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 60.0]
#===============================================================================
#u/s Wetlands (S/C 8)- minor to Cavanagh, major diverted elsewhere
#===============================================================================

001:0009--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     DESIGN SCSHYD      02:Rural 106     15.15     .041 No_date    3:45    2.06
.054
      [CN= 70.0: N= 5.00]
      [Tp=  .50:DT=15.00]

001:0010--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     COMPUTE DUALHYD    02:Rural 106     15.15     .041 No_date    3:45    2.06
n/a
        Major System /  10:MAJ106          .00     .000 No_date    0:00     .00
n/a
        Minor System \  09:MIN106        15.15     .041 No_date    3:45    2.06
n/a

001:0011--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            01:202           13.01     .405 No_date    3:00   12.01
n/a
                     +  09:MIN106        15.15     .041 No_date    3:45    2.06
n/a
      [DT=15.00]  SUM=  08:202           28.16     .407 No_date    3:00    6.65
n/a
#===============================================================================
#Minor to ravine - controlled by 1060mm sewer at 0.47% and 675mm @1.4% Q=1.0m3/
#===============================================================================

001:0012--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     COMPUTE DUALHYD    08:202           28.16     .407 No_date    3:00    6.65
n/a
        Major System /  10:MAJ202          .00     .000 No_date    0:00     .00
n/a
```

```
        Minor System \  09:MIN202        28.16     .407 No_date    3:00    6.65
n/a

001:0013--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            04:G-1           15.88     .098 No_date    4:09   12.77
n/a
                     +  09:MIN202        28.16     .407 No_date    3:00    6.65
n/a
      [DT= 1.88]  SUM=  07:203           44.04     .417 No_date    3:00    8.86
n/a
#==============================================================================
#Route through G-2: 675mm orifice; 1200mm CONC @2.2%, no weir
#==============================================================================

001:0014--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ROUTE RESERVOIR -> 07:203          44.04     .417 No_date    3:00    8.86
n/a
      [RDT= 1.88] out<- 04:G-2          44.04     .390 No_date    3:03    8.86
n/a
     {MxStoUsed=.6172E-02}
#==============================================================================
#d/s Langstaff (S/C 1)
#==============================================================================

001:0015--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    01:WESTG3          .91     .104 No_date    3:00   26.82
.709
      [XIMP=.45:TIMP=.56]
      [SLP=1.25:DT=15.00]
      [LOSS= 2 :CN= 85.0]

001:0016--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     COMPUTE DUALHYD    01:WESTG3          .91     .104 No_date    3:00   26.82
n/a
        Major System /  06:MAJG3W          .00     .000 No_date    0:00     .00
n/a
        Minor System \  07:MING3W          .91     .104 No_date    3:00   26.82
n/a

001:0017--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN SCSHYD      02:STM10           .95     .005 No_date    3:15    2.41
.064
      [CN= 71.0: N= 5.00]
```

```
      [Tp=  .19:DT=15.00]

001:0018--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    03:EASTG3          .31     .040 No_date    3:00   28.91
.765
      [XIMP=.50:TIMP=.60]
      [SLP=1.50:DT=15.00]
      [LOSS= 2 :CN= 88.0]

001:0019--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     COMPUTE DUALHYD    03:EASTG3          .31     .040 No_date    3:00   28.91
n/a
        Major System /  08:MAJG3E          .00     .000 No_date    0:00     .00
n/a
        Minor System \  09:MING3E          .31     .040 No_date    3:00   28.91
n/a

001:0020--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN SCSHYD      05:STM17           .52     .003 No_date    3:15    2.79
.074
      [CN= 72.0: N= 5.00]
      [Tp=  .13:DT=15.00]

001:0021--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            02:STM10           .95     .005 No_date    3:15    2.41
n/a
                     +  04:G-2           44.04     .390 No_date    3:03    8.86
n/a
                     +  05:STM17           .52     .003 No_date    3:15    2.79
n/a
                     +  07:MING3W          .91     .104 No_date    3:00   26.82
n/a
                     +  09:MING3E          .31     .040 No_date    3:00   28.91
n/a
      [DT= 1.88]  SUM=  10:G3IN          46.73     .520 No_date    3:01    9.14
n/a
#==============================================================================
#Route through G-3: 675mm outlet @1.2% invert @99.75m; 15m weir @102.5m
#==============================================================================

001:0022--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ROUTE RESERVOIR -> 10:G3IN          46.73     .520 No_date    3:01    9.14
n/a
```

```
      [RDT=  .94] out<- 05:G-3           46.73     .472 No_date    3:08    9.14
n/a
     {MxStoUsed=.1378E-01}
#==============================================================================
#d/s Langstaff (S/C 1a)
#==============================================================================

001:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    01:WESTG4          1.87     .185 No_date    3:00   24.11
.638
      [XIMP=.34:TIMP=.49]
      [SLP=1.50:DT=15.00]
      [LOSS= 2 :CN= 83.0]

001:0024---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    02:EASTG4          1.12     .105 No_date    3:00   23.16
.613
      [XIMP=.36:TIMP=.46]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 81.0]

001:0025---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN SCSHYD      03:STM11            .65     .003 No_date    3:15    2.06
.054
      [CN= 70.0: N= 5.00]
      [Tp=  .13:DT=15.00]

001:0026---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN SCSHYD      04:STM18            .48     .001 No_date    3:30    1.18
.031
      [CN= 67.0: N= 5.00]
      [Tp=  .13:DT=15.00]

001:0027---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            01:WESTG4          1.87     .185 No_date    3:00   24.11
n/a
                    +   02:EASTG4          1.12     .105 No_date    3:00   23.16
n/a
                    +   03:STM11            .65     .003 No_date    3:15    2.06
n/a
                    +   04:STM18            .48     .001 No_date    3:30    1.18
n/a
                    +   05:G-3             46.73     .472 No_date    3:08    9.14
```

```
                                        6h2yr
n/a
                     +  06:MAJG3W          .00     .000 No_date    0:00     .00
n/a
                     +  08:MAJG3E          .00     .000 No_date    0:00     .00
n/a
      [DT=  .94]  SUM=  10:G4IN          50.85     .691 No_date    3:04    9.84
n/a
#==============================================================================
#Route through G-4: 450mm outlet @4.2% invert @97.0m; 7.5m weir @99.70m
#==============================================================================

001:0028---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ROUTE RESERVOIR -> 10:G4IN          50.85     .691 No_date    3:04    9.84
n/a
      [RDT=  .94] out<- 08:G-4           50.85     .315 No_date    3:40    9.84
n/a
     {MxStoUsed=.7570E-01}

001:0029--------------------------------------------------------------------------
--
      FINISH
------------------------------------------------------------------------------
---
```

```
  SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
  S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
  SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
      S   W W   M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
  SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9   =========
                                                      9   9  9   9   # 3772465
       StormWater Management HYdrologic Model          999    999    =========

*****************************************************************************
***************************** SWMHYMO Ver/4.05  *****************************
*********  A single event and continuous hydrologic simulation model  *********
*********     based on the principles of HYMO and its successors      *********
*********                  OTTHYMO-83 and OTTHYMO-89.                 *********
*****************************************************************************
********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
*********                   Ottawa,  Ontario: (613) 836-3884          *********
*********                   Gatineau, Quebec: (819) 243-6858          *********
*********                   E-Mail: swmhymo@jfsa.Com                  *********
*****************************************************************************

+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++++++++ Licensed user: Robinson Consultants Inc.                    +++++++++
+++++++++                Kanata                SERIAL#:3772465       +++++++++
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

*****************************************************************************
*********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++            *********
*********           Maximum value for ID numbers  :     10           *********
*********           Max. number of rainfall points: 105408           *********
*********           Max. number of flow points    : 105408           *********
*****************************************************************************

***** DESCRIPTION SUMMARY TABLE HEADERS (units depend on METOUT in START) *****
*****-------------------------------------------------------------------*****
*****    ID:  Hydrograph IDentification numbers, (1-10).                 *****
*****  NHYD:  Hydrograph reference numbers, (6 digits or characters).    *****
*****  AREA:  Drainage area associated with hydrograph, (ac.) or (ha.).  *****
***** QPEAK:  Peak flow of simulated hydrograph, (ft^3/s) or (m^3/s).    *****
***** TpeakDate_hh:mm is the date and time of the peak flow.             *****
*****  R.V.:  Runoff Volume of simulated hydrograph, (in) or (mm).       *****
*****  R.C.:  Runoff Coefficient of simulated hydrograph, (ratio).       *****
*****     *:  see WARNING or NOTE message printed at end of run.         *****
*****    **:  see  ERROR  message printed at end of run.                 *****
*****************************************************************************
*****************************************************************************
```

```
::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::

 ********************************************************************************

 **********************   S U M M A R Y   O U T P U T   **********************
 ********************************************************************************
 *         DATE: 2019-11-26     TIME: 08:47:18     RUN COUNTER: 001154         *
 ********************************************************************************
 * Input   filename: U:\SWMHYMO\6h100yr.dat                                     *
 * Output  filename: U:\SWMHYMO\6h100yr.out                                     *
 * Summary filename: U:\SWMHYMO\6h100yr.sum                                     *
 * User comments:                                                               *
 * 1:_____________________________________________________________________________*
 * 2:_____________________________________________________________________________*
 * 3:_____________________________________________________________________________*
 ********************************************************************************


#*******************************************************************************
#  Project Name: [19008]    Project Number: [Carp Subdivision-Langstaff Drive]
#  Date        : 07-08-2019
#  Modeller    : [CN]
#  Company     : Robinson Consultants Inc.
#  License #   :  3772465
#*******************************************************************************
 RUN:COMMAND#

001:0001-------------------------------------------------------------------------
--
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   0 ]
      [NRUN  =   1 ]

001:0002-------------------------------------------------------------------------
--
     MASS STORM
      Filename = U:\SWMHYMO\SCS6HII.MST
      Comment  = SCS 6 HOUR TYPE II STORM DISTRIBUTION
      [SDT=15.00:SDUR=   6.00:PTOT=  94.20]
#===============================================================================
#Rivington Phase A (S/C 4)
#===============================================================================

001:0003--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    01:105A           4.26     .854 No_date    3:00   50.44
```

```
.535
      [XIMP=.15:TIMP=.45]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 60.0]
#=============================================================================
#Rivington Phase B (S/C 2,3,5)
#=============================================================================

001:0004--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    02:105AA         10.80    2.105 No_date    3:00   50.44
.535
      [XIMP=.15:TIMP=.45]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 60.0]
#=============================================================================
#Rivington Phase B Playing Field (S/C 2a)
#=============================================================================

001:0005--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     DESIGN SCSHYD      06:Field           .82     .035 No_date    3:30   21.95
.233
      [CN= 65.0: N= 5.00]
      [Tp=  .50:DT=15.00]

001:0006--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            01:105A           4.26     .854 No_date    3:00   50.44
n/a
                     +  02:105AA         10.80    2.105 No_date    3:00   50.44
n/a
                     +  06:Field           .82     .035 No_date    3:30   21.95
n/a
      [DT=15.00]  SUM=  03:201           15.88    2.971 No_date    3:00   48.97
n/a
#=============================================================================
#Route through G-1 structure: 450 CONC w 90mm orifice; 10m weir @105.15m
#=============================================================================

001:0007--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ROUTE RESERVOIR -> 03:201          15.88    2.971 No_date    3:00   48.97
n/a
      [RDT= 1.88] out<- 04:G-1          15.88    2.646 No_date    3:03   48.97
n/a
     {MxStoUsed=.1935E+00}
#=============================================================================
```

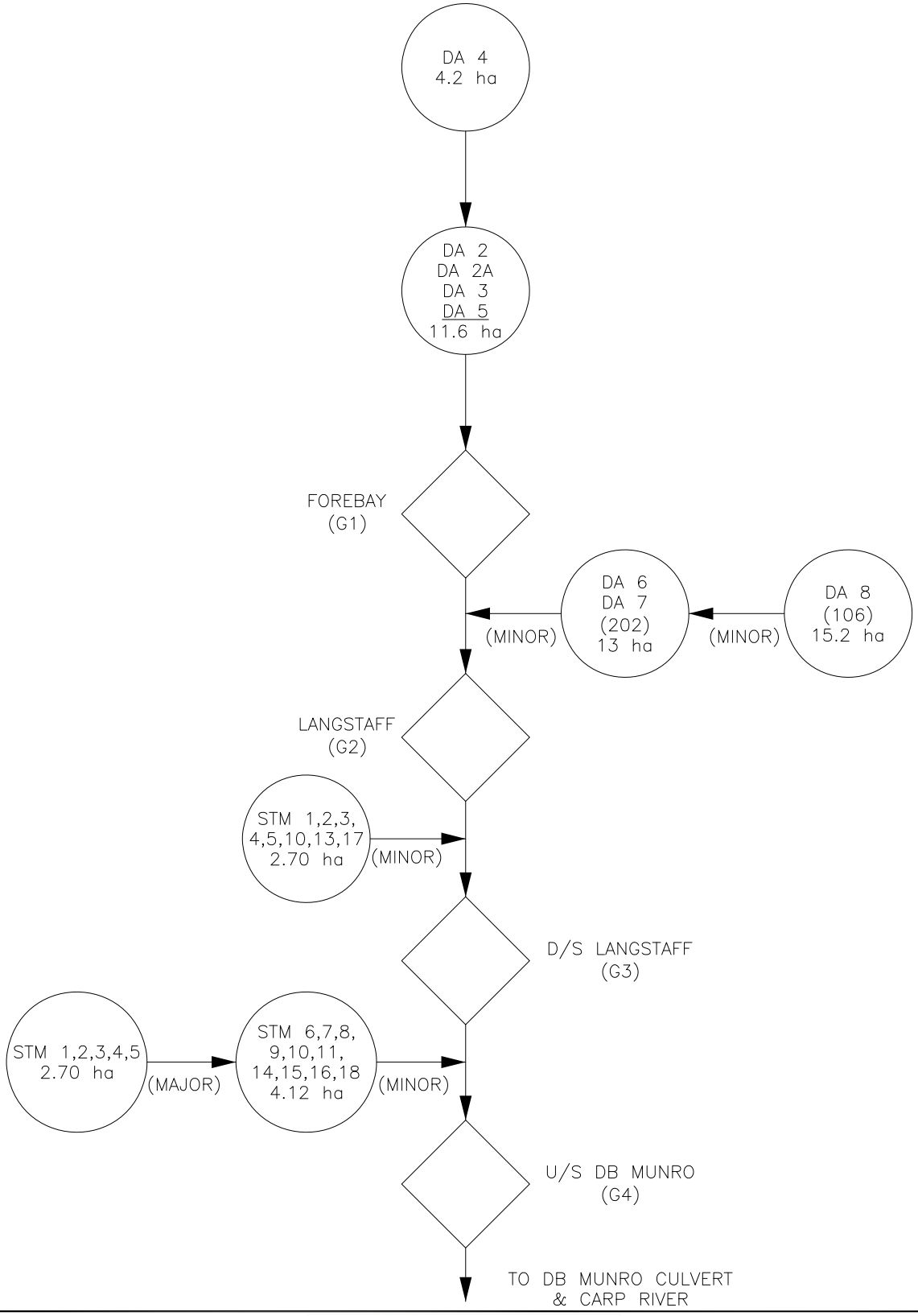
```
#Cavanagh developed (S/C 6,7)
#===============================================================================

001:0008--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    01:202           13.01    2.199 No_date    3:00   45.62
.484
      [XIMP=.15:TIMP=.30]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 60.0]
#===============================================================================
#u/s Wetlands (S/C 8)- minor to Cavanagh, major diverted elsewhere
#===============================================================================

001:0009--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     DESIGN SCSHYD      02:Rural 106     15.15     .913 No_date    3:30   28.94
.307
      [CN= 70.0: N= 5.00]
      [Tp=  .50:DT=15.00]

001:0010--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     COMPUTE DUALHYD    02:Rural 106     15.15     .913 No_date    3:30   28.94
n/a
        Major System /  10:MAJ106         6.37     .663 No_date    3:30   28.94
n/a
        Minor System \  09:MIN106         8.78     .250 No_date    3:00   28.94
n/a

001:0011--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            01:202           13.01    2.199 No_date    3:00   45.62
n/a
                     +  09:MIN106         8.78     .250 No_date    3:00   28.94
n/a
      [DT=15.00]  SUM=  08:202           21.79    2.449 No_date    3:00   38.90
n/a
#===============================================================================
#Minor to ravine - controlled by 1060mm sewer at 0.47% and 675mm @1.4% Q=1.0m3/
#===============================================================================

001:0012--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     COMPUTE DUALHYD    08:202           21.79    2.449 No_date    3:00   38.90
n/a
        Major System /  10:MAJ202         4.26    1.449 No_date    3:00   38.90
n/a
```

```
        Minor System \  09:MIN202        17.53    1.000 No_date    3:00   38.90
n/a

001:0013--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            04:G-1           15.88    2.646 No_date    3:03   48.97
n/a
                     +  09:MIN202        17.53    1.000 No_date    3:00   38.90
n/a
      [DT= 1.88]  SUM=  07:203           33.41    3.646 No_date    3:03   43.68
n/a
#==============================================================================
#Route through G-2: 675mm orifice; 1200mm CONC @2.2%, no weir
#==============================================================================

001:0014--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ROUTE RESERVOIR -> 07:203          33.41    3.646 No_date    3:03   43.68
n/a
      [RDT= 1.88] out<- 04:G-2          33.41    3.624 No_date    3:03   43.68
n/a
     {MxStoUsed=.5978E-01}
#==============================================================================
#d/s Langstaff (S/C 1)
#==============================================================================

001:0015--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    01:WESTG3          .91     .328 No_date    3:00   78.95
.838
      [XIMP=.45:TIMP=.56]
      [SLP=1.25:DT=15.00]
      [LOSS= 2 :CN= 85.0]

001:0016--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     COMPUTE DUALHYD    01:WESTG3          .91     .328 No_date    3:00   78.95
n/a
        Major System /  06:MAJG3W          .19     .168 No_date    3:00   78.95
n/a
        Minor System \  07:MING3W          .72     .160 No_date    3:00   78.95
n/a

001:0017--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN SCSHYD      02:STM10           .95     .116 No_date    3:00   30.45
.323
      [CN= 71.0: N= 5.00]
```

```
      [Tp=  .19:DT=15.00]

001:0018--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    03:EASTG3          .31     .120 No_date    3:00   82.53
.876
      [XIMP=.50:TIMP=.60]
      [SLP=1.50:DT=15.00]
      [LOSS= 2 :CN= 88.0]

001:0019--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     COMPUTE DUALHYD    03:EASTG3          .31     .120 No_date    3:00   82.53
n/a
        Major System /  08:MAJG3E          .03     .030 No_date    3:00   82.53
n/a
        Minor System \  09:MING3E          .28     .090 No_date    3:00   82.53
n/a

001:0020--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN SCSHYD      05:STM17           .52     .074 No_date    3:00   31.99
.340
      [CN= 72.0: N= 5.00]
      [Tp=  .13:DT=15.00]

001:0021--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            02:STM10           .95     .116 No_date    3:00   30.45
n/a
                     +  04:G-2           33.41    3.624 No_date    3:03   43.68
n/a
                     +  05:STM17           .52     .074 No_date    3:00   31.99
n/a
                     +  07:MING3W          .72     .160 No_date    3:00   78.95
n/a
                     +  09:MING3E          .28     .090 No_date    3:00   82.53
n/a
      [DT= 1.88]  SUM=  10:G3IN          35.87    4.015 No_date    3:03   44.17
n/a
#==============================================================================
#Route through G-3: 675mm outlet @1.2% invert @99.75m; 15m weir @102.5m
#==============================================================================

001:0022--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ROUTE RESERVOIR -> 10:G3IN          35.87    4.015 No_date    3:03   44.17
n/a
```

```
      [RDT=  .94] out<- 05:G-3           35.87    3.181 No_date    3:14   44.17
n/a
     {MxStoUsed=.1834E+00}
#===============================================================================
#d/s Langstaff (S/C 1a)
#===============================================================================

001:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    01:WESTG4          1.87     .630 No_date    3:00   74.64
.792
      [XIMP=.34:TIMP=.49]
      [SLP=1.50:DT=15.00]
      [LOSS= 2 :CN= 83.0]

001:0024---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN STANDHYD    02:EASTG4          1.12     .356 No_date    3:00   72.22
.767
      [XIMP=.36:TIMP=.46]
      [SLP=1.00:DT=15.00]
      [LOSS= 2 :CN= 81.0]

001:0025---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN SCSHYD      03:STM11            .65     .079 No_date    3:00   28.94
.307
      [CN= 70.0: N= 5.00]
      [Tp=  .13:DT=15.00]

001:0026---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
  *  DESIGN SCSHYD      04:STM18            .48     .046 No_date    3:00   24.63
.261
      [CN= 67.0: N= 5.00]
      [Tp=  .13:DT=15.00]

001:0027---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ADD HYD            01:WESTG4          1.87     .630 No_date    3:00   74.64
n/a
                    +   02:EASTG4          1.12     .356 No_date    3:00   72.22
n/a
                    +   03:STM11            .65     .079 No_date    3:00   28.94
n/a
                    +   04:STM18            .48     .046 No_date    3:00   24.63
n/a
                    +   05:G-3            35.87    3.181 No_date    3:14   44.17
```

```
                                        6h100yr
n/a
                     +  06:MAJG3W          .19     .168 No_date    3:00   78.95
n/a
                     +  08:MAJG3E          .03     .030 No_date    3:00   82.53
n/a
      [DT=  .94]  SUM=  10:G4IN          40.22    3.666 No_date    3:14   46.09
n/a
#===============================================================================
#Route through G-4: 450mm outlet @4.2% invert @97.0m; 7.5m weir @99.70m
#===============================================================================

001:0028---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C
.-
     ROUTE RESERVOIR -> 10:G4IN          40.22    3.666 No_date    3:14   46.09
n/a
      [RDT=  .94] out<- 08:G-4           40.22    2.353 No_date    3:27   46.09
n/a
     {MxStoUsed=.3203E+00}

001:0029--------------------------------------------------------------------------
--
      FINISH
-------------------------------------------------------------------------------
---
```



Robinson
Land Development

scale N.T.S.	147 LANGSTAFF DRIVE, CARP, ON	project no. 19008
date 05/12/19		
drawn by BLM	HYDROLOGIC MODEL – SWM	FIG 4

Runoff Coefficient Calculations

Drainage Area ID	Impervious Area (ha)	Pervious Area (ha)	Gravel Area (ha)	Total Area (ha)	C	C (100 YR)	Percent Impervious (%)
STM1	0.07	0.05	0.00	0.12	0.60	0.75	56.9
STM2	0.02	0.04	0.00	0.06	0.46	0.58	37.4
STM3	0.12	0.09	0.00	0.21	0.60	0.75	57.4
STM4	0.19	0.17	0.00	0.36	0.57	0.71	53.0
STM5	0.11	0.06	0.00	0.16	0.66	0.82	65.4
STM6	0.26	0.18	0.00	0.44	0.61	0.77	59.0
STM7	0.22	0.17	0.00	0.39	0.60	0.75	56.7
STM8	0.17	0.15	0.00	0.33	0.57	0.72	53.3
STM9	0.27	0.45	0.00	0.72	0.47	0.58	38.1
STM8/9	0.45	0.60	0.00	1.05	0.50	0.63	42.9
STM10	0.14	0.80	0.00	0.95	0.31	0.38	15.2
STM11	0.05	0.61	0.00	0.65	0.25	0.31	7.3
STM12	0.27	0.76	0.00	1.03	0.38	0.48	25.8
STM13	0.19	0.13	0.00	0.31	0.62	0.77	59.9
STM14	0.14	0.11	0.00	0.25	0.60	0.75	57.4
STM15	0.04	0.09	0.00	0.14	0.41	0.52	30.4
STM16	0.34	0.39	0.00	0.73	0.52	0.66	46.4
STM17	0.06	0.47	0.00	0.52	0.28	0.35	10.9
STM18	0.02	0.45	0.00	0.48	0.24	0.29	5.0

Runoff Coefficients:

C impervious = 0.90

C pervious = 0.20

C gravel = 0.80

C_{100} = C * 1.25