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STORMWATER MANAGEMENT REPORT
PROPOSED RESIDENTIAL SUBDIVISION
2050 DUNROBIN ROAD
CITY OF OTTAWA

Submitted to:

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165 Constance Lake Road
Kanata, Ontario
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PROJECT #: 200977

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1. INTRODUCTION

Mr. Zbigniew Hauderowicz retained Kollaard Associates Inc. to complete a Site Grading and Drainage Plan along with a Stormwater Management Report in support of the City of Ottawa Subdivision Approval Application for the proposed residential development at 2050 Dunrobin Road in the City of Ottawa, Ontario.

The increase in stormwater runoff on site, caused by the increased impervious area created during development, will be treated through a system of vegetated swales, road side ditches and sand filtration. The roadside ditches and stormwater management swale will provide stormwater storage while the vegetated swales and sand filter will promote infiltration and reduce suspended solids in order to achieve quantity and quality control parameters established by the City of Ottawa, Mississippi Valley Conservation Authority and the Ministry of Environment Conservation and Parks.

1.1. Background

The proposed residential development will be located on the northeast side of Dunrobin Road just southeast of Constance Lake Road in the City of Ottawa, Ontario. The total site development area is approximately 9.0 hectares (22 acres) and will create a total of eight residential lots, each with a respective single family dwelling. The proposed residential development will affect an additional 0.11 hectare portion of City of Ottawa property, in the form of landscaping between the site and the city street.

The proposed development has in general a rectangular shape and extends from Dunrobin Road to the former CN railway tracks located along the northeast side of the site. A narrow portion of the site projects southeast from the east corner of the site along the CN railway. The projection has an average width of about 14.5 metres, a maximum width of about 26.5 metres and extends about 160 metres to the south side of Harwood Creek.

The proposed development site is part of the Harwood Creek watershed. Harwood Creek is a tributary to Constance Lake and is adjacent the eastern extension of the site. Harwood Creek is a watercourse of record with sufficient size and capacity to receive the runoff from the proposed development.

A road will be extended through the development, northeast from Dunrobin Road, ending in a cul-de-sac on the site. Residential driveways will originate along both sides of the proposed development roadway. The single family dwellings will be serviced by wells, on-site septic leaching beds and side yard swales.

The proposed stormwater management design directs stormwater runoff to the east corner of the site by means of the ditch road side ditches and an outlet swale towards the Harwood Creek.

2. Stormwater Management Development Requirements

The subject lands are within the City of Ottawa and the Mississippi Valley Conservation Authority jurisdiction. Stormwater management guidelines set out by the Ministry of the Environment, *Stormwater Planning and Design Manual* (SWPDM) and the City of Ottawa, *Ottawa Sewer Design Guidelines* 2021 as amended (OSDG) include the following parameters for the stormwater management design at the development site:

- Post development peak runoff rates are to be equal to or less than pre development levels for all storms up to and including the 100 year storm event.
- Surface runoff volumes are to be minimized through infiltration techniques
- The design shall include enhanced quality treatment as recommended by the MOE (SWPDM)
- Downstream sedimentation shall be mitigated at 2050 Dunrobin Road by increasing particle settlement along runoff flow paths within the development
- Onsite stormwater storage and flow shall be controlled as to not affect lands adjacent the development site

2.1. Guidelines, Manuals and Reports

The following guidelines and manuals were utilized in the creation of the stormwater management design and the preparation of this report.

Ottawa Sewer Design Guildelines *(OSDG)*
City of Ottawa, October 2012 as amended.

Stormwater Management Planning and Design Manual *(SWMP Design Manual)*
Ministry of the Environment, March 2003

Visual OTTHYMO V2.0: Reference Manual
Greenland International Consulting Inc., July 2002

2.2. Best Management Practices

Best Management Practices (BMPs) will be incorporated into the subdivision design to reduce the post-development peak runoff rate, improve the quality of the water leaving the subdivision and to establish boundary conditions to control future runoff of surrounding developments that might potentially impact the proposed 2050 Dunrobin Road development.

The proposed BMPs will include both general and lot level BMPs. The general BMPs will include reduced swale slopes and an increased swale cross section to reduce flow rates and provide filtration and the removal of sediments. Lot level BMPs may include directing runoff from impervious surfaces to adjacent grassed areas, and re-vegetating any surface areas of the lot disturbed during construction as soon as possible.

3. PROPOSED HYDROLOGIC MODEL

3.1. Design Storm Intensity

Intensity-Duration-Frequency curves derived from Meteorological Services of Canada rainfall data for the MacDonald-Cartier Airport in Ottawa were used to determine the expected rainfall intensity for a given duration and storm frequency.

The IDF formulae obtained from the OSDG are as follows:

100 year Intensity $= 1735.688 / (\text{Time in min} + 6.014)^{0.820}$
10 year Intensity $= 1174.184 / (\text{Time in min} + 6.014)^{0.816}$
5 year Intensity $= 998.071 / (\text{Time in min} + 6.053)^{0.814}$

The information obtained from the IDF curves were used to generate 6 hour and 12 hour SCS Type II Design Storms which were used in the Model. The historical design storms from July 1, 1979 and August 4, 1988, the 4 hour and 12 hour Chicago storm distribution were also used in the analysis for comparison and quality control consideration. The 15 mm and

25 millimeter 4 hour Chicago storms are considered by the Ontario Ministry of Environment Conservation and Parks to be the design storm for quality control purposes.

3.2. Methodology

The hydrologic modeling software, Visual OTTHYMO (V2.6.3) was used to assess pre- and post-development stormwater conditions at the site.

The pre-development were calculated using the NASHYD watershed command. The post-development conditions were also calculated using the NASHYD watershed command as the average impervious ratio for the Subdivision is less than 20 percent.

The NASHYD hydrograph method uses the Nash instantaneous unit hydrograph which is made of a cascade of 'N' linear reservoirs and is used to model rural areas.

Both the Pre and Post-development conditions were modeled for quantity control purposes utilizing SCS Type II Storm Distributions and Chicago storm distributions of various duration and magnitude. The historical design storms from July 1, 1979 and August 4, 1988 were also considered. The parameters used in the model are presented in Appendix A.

The pre- and post-development conditions were modeled using the 15 mm and 25 mm 4 hour Chicago storm for quality control purposes.

The resulting pre and post-development models contain the storm events as follows:

Simulation Number 1 – 6 hour 5 year SCS Type II
Simulation Number 2 – 6 hour 100 year SCS Type II
Simulation Number 3 – 12 hour 5 year SCS Type II
Simulation Number 4 – 12 hour 10 year SCS Type II
Simulation Number 5 – 12 hour 100 year SCS Type II
Simulation Number 6 – 12 hour 5 year Chicago
Simulation Number 7 – 12 hour 100 year Chicago
Simulation Number 8 – Historical Storm July 1, 1979
Simulation Number 9 – Historical Storm August 4, 1988
Simulation Number 10 – 25mm 4 hour Chicago
Simulation Number 11 – 15mm 4 hour Chicago

The SCS Type II storm data was given priority in the SWM design as the proposed development is a rural residential development. The 12 SCS storms are generally applicable to undeveloped or rural basins where peak flow rates are largely influenced by the total volume of rainfall. The SCS Type II storm distribution is generally preferred for both large and small rural areas (OSDG). The Chicago storm is more commonly used for urban areas.

3.3. OTTHYMO Storm Analysis Variables

As previously indicated, the stormwater runoff was calculated using the NASHYD watershed command. The NASHYD command uses the Nash instantaneous unit hydrograph which is made of a cascade of 'N' linear reservoirs and is used to model rural areas.

The NASHYD command uses the following inputs:
DT – Simulation time step increment (min) – must be shorter than TP
Area – Watershed or catchment area (hectares)
DWF – A constant Dry Weather Flow or Baseflow (m3/s) assumed to be 0 (doesn't change from pre to post development)
CN – SCS Modified Curve Number
IA – Initial Abstraction (mm)
N – Number of Linear reservoir used for derivation of the Nash Unit Hydrograph
TP – Unit hydrograph time to peak (hr)

The Storm Analysis Model Variables for each catchment used in the storm water management model are summarized in Appendix A of this report.

3.3.1. Runoff Curve Numbers

The NasHyd hydrograph method which uses the SCS loss method for pervious areas was used to model both the pre- and post development conditions of the proposed subdivision. Runoff Curve Numbers (CN) are utilized in the SCS hydrology method. The Curve Number is a function of soil type, ground cover, and antecedent moisture conditions. The soil type was chosen to be Group B for the site in keeping with the Hydrogeological Investigation and Terrain Evaluation Report prepared for the proposed development. The subsurface conditions were found to consist of sand, silty sand and glacial till underlying the topsoil at the site. A calculation of the CN values for both the pre- and post-development conditions is presented in Appendix A.

The CN values used for each catchment area consist of a weighted average value based on the conditions and cover of the ground surface in the catchment area. For the purposes of analysis presented in this report, the surface cover was considered to be Open Space (lawns) in good condition 61, Woods/brush in good condition (the woods/brush on site is recent re-growth with dense undergrowth) 55, and Impervious 98. The offsite contributing area to the northwest was considered to be a combination of open space in good condition and woods in fair condition resulting in a CN of 61. The CN values were taken from OSDG Table 5.9 and from the United States Department of Agriculture Urban Hydrology for Small Watersheds Technical Release 55 (USDA TR55).

3.3.2. Initial Abstraction And Potential Storage

The initial abstraction includes all losses before runoff begins, and includes water retained in surface depressions, water taken up by vegetation, evaporation, and infiltration. This value is related to characteristics of the soil and the soil cover. Initial abstraction is a function of the potential storage and is generally assumed to be equal to 0.2S where S is the potential storage.

It is considered that for lower CN values, the relationship IA = 0.2S tends to overestimate the initial abstraction resulting in underestimated peak runoff. As such suggested guidelines are as follows:

CN ≤ 70 IA = 0.075S

CN > 70 ≤ 80 IA = 0.10S

CN > 80 ≤ 90 IA = 0.15S

CN > 90 IA = 0.2S

The potential storage S is related to the runoff coefficient as follows:

S = (25400/CN) - 254

The initial abstraction IA and potential storage S values for both the pre- and post-development conditions are also presented in Appendix A.

3.3.3. Time of Concentration and Time to Peak

The time to peak is generally considered to be 2/3rds of the time of concentration of a catchment area. The calculation for the time of concentration of each catchment is summarized in Appendix B. The time of concentration of each catchment was determined using the Velocity method. The velocity method assumes that the time of concentration is the sum of travel times for segments along the hydraulically most distant flow path. The segments used in the velocity method may be of three types: sheet flow T_s, shallow concentrated flow T_{sc}, and open channel flow T_c. The open channel flow will be modelled using the route Channel Command in OTTHYMO.

Travel time for sheet flow

$$T_s = \frac{0.091(nl)^{0.8}}{(P_2)^{0.5}S^{0.4}}$$

Where
T_s = travel time, h
n = Manning's roughness coefficient sheet flow
l = sheet flow length, 15 m
P_2 = 2-year 24-hour rainfall, = 48 mm
S = Slope of land surface m/m

The Manning's roughness coefficient for sheet flow for woods in good condition n = 0.6, for treed areas on residential lots outside of the developed area of the lots n = 0.4, for residential open space and lawns n = 0.25. During the analysis for post-development conditions, the Manning's roughness coefficient for each lot was taken as 0.25 as the exact amount of spaced cleared on each lot by the developer/home builder may vary from design. Since a roughness coefficient of 0.25 results in more runoff than a roughness coefficient of 0.4, the design accommodates a worst case scenario where an individual clears the entire lot.

Shallow concentrated flow was assumed to occur after a maximum of 15 metres on each catchment. The length of sheet flow is expected to end sooner in the catchments were a swale or ditch could intersect the flow.

Travel time for shallow concentrated flow

The flow velocity used to calculate the time of travel for shallow concentrated flow was determined using Figure 15-4 of Chapter 15 of the USDA handbook (Included in Appendix B of this Report). This figure can be used to determine the velocity when the slope and ground cover is known. The ground cover to be used in reading Figure 15-4 was determined as follows: Catchment areas with woods cover in good conditions Manning's n for concentrated flow = 0.101. For the residential lots, Manning's n for concentrated flow was also assumed to be = 0.1 as the length of the flow path and anticipated flow depth would not result in flows exceeding the height of the vegetation on the open space surface. The Manning's n was compared to the Flow Type identified in Table 15-3.

From Table 15-3 of the USDA handbook, a Manning's n of 0.1 corresponds to minimum Tillage Cultivation. As an example, the slope for Catchment C8 was determined to be 2.8 m over a distance of 56 m or 0.05. From Figure 15-4 of the USDA Handbook using a slope of 5.0% and minimum tillage cultivation, the velocity is estimated at 0.34 m/s (1.1ft/s) for catchment C8.

$$T_{sc} = \frac{l}{3600\ V}$$

Where T_{sc} = travel time, h

l = distance of shallow concentrated flow = 56 m

V = average velocity = 0.34 m/s

T_{sc} = 0.05 hrs

Travel time for open channel flow

The open channel flow will be modelled using the route Channel Command in OTTHYMO.

The main channels consist of the roadside and drainage easement ditches. The easement swales and roadside ditches in the development are channels which were designed to be excavated channels in earth with short grass and few weeds. Using Chow 1959, the channels having these characteristics will have a Manning's n of 0.027.

The channels are assumed to have the following characteristics – Trapezoidal shaped channel with side slopes of 3H:1V and a bottom width of about 0.3 metres.

3.4. Watershed or Catchment Areas

The catchment areas contributing runoff to the stormwater management works consist of both onsite and offsite catchment areas. The catchment areas used in the design for the proposed subdivision are presented in the attached drawings 200977-PRECA and 200977-POSTCA.

3.4.1. Delineation of Offsite Catchment Areas

A review of watershed drainage patterns surrounding the subdivision was completed using the Ministry of Natural Resources and Forestry Ontario Flow Assessment Tool, large scale topographic mapping, the City of Ottawa geoOttawa tool, and the Mississippi Valley Conservation Authority Flood Plain Mapping. Based on the information obtained from the above sources it is apparent that runoff is generally directed parallel to the site from Dunrobin Road to the rail corridor northeast of the site. The flood plain mapping and topographical information provided indicates that there is a 100 year flood plain from the Hardwood Creek which extends onto the lower portion of the site. Runoff is directed towards the flood plain and towards the Harwood Creek. Due to these drainage patterns there are no offsite areas southeast or northeast of the site which contribute runoff to the site.

The existing topography of the site adjacent the northwest property line and topographic information obtained from contours of the adjacent site indicate that a portion of the properties northwest of the site contribute runoff to the site. This off site area has been delineated on the pre- and post-development drainage plans.

3.4.2. Delineation of Onsite Catchment Areas

The onsite catchment areas were delineated based on the topography obtained of the site area on and on the proposed development. The catchment areas used in the analysis for the design of the stormwater management facility including determining quantity and quality storage requirements and determining the flow depth in the swales and ditches are presented in the attached drawing 200977-POSTCA – Post-Development Drainage Plan.

3.5. Open Channel Flow

Open Channel Flow will occur along the road side ditches and along the conveyance easement extending from the end of the cul-de-sac to Harwood Creek.

3.5.1. Conveyance of Offsite Runoff

Sheet flow and shallow concentrated flow from the offsite catchments will be collected by a shallow easement swale located along the northwest sides of the proposed development. This flow will be routed along the outside edge of the development to the ditch along the rail corridor.

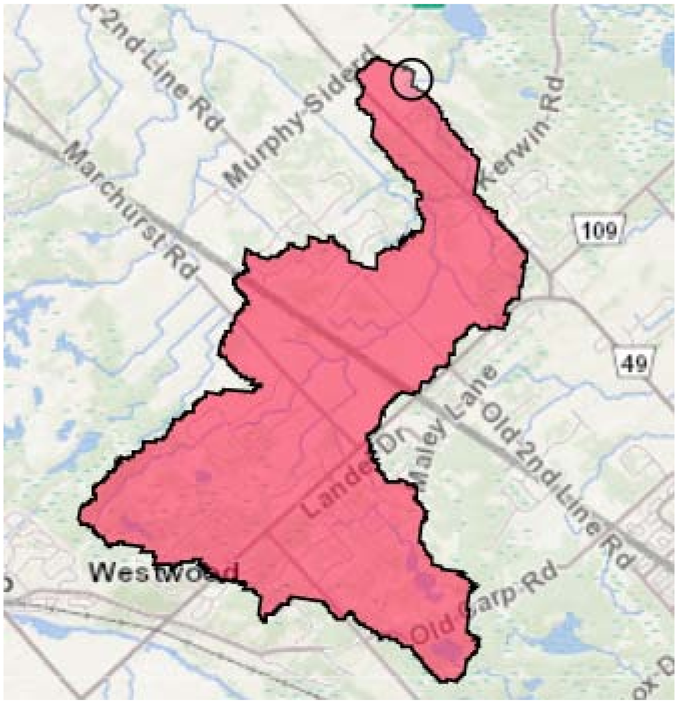
3.5.2. Conveyance of Internal Site Runoff

Internal site runoff will be conveyed along roadside ditches and easement swales as illustrated on the proposed subdivision grading plans.

4. Receiving Water Body - Harwood Creek

4.1. Estimated Flow Rate

The headwaters of the Harwood Creek adjacent to the site are located slightly east of the Village of Carp. The Harwood Creek passes through a double barrel box culvert beneath the railway adjacent to the east corner of the site immediately downstream of the site. The Harwood Creek outlets to Constance Lake about 1.2 kilometres downstream of the railway culvert. The drainage area of the branch upstream of the railway culvert was estimated from National Resources Canada Topographic Maps in combination with the outline of the water course indicated on the aerial photographs contained on the City of Ottawa Electronic Map to be about 13 square kilometers. This estimation was verified using the Ontario Flow Assessment Tool which was used to generate the catchment area illustrated in the figure below. The Catchment generated by OFAT has an area of 12.7 square kilometers which is in keeping with the above calculated area.



Flood plain mapping for the Harwood Creek was obtained from the Mississippi Valley Conservation Authority (MVAC) website. The flood plain mapping provides information with respect to the 100 year flood elevation along the Harwood Creek. Calculations or data with respect to the expected flow rates during various storm events were not available for this particular creek. In order to estimate flow rates within the Harwood Creek, a comparison of this Creek was made to other Creeks in the West Carlton Area of Ottawa for which flow rate calculations had been made by others.

A study of the Carp River watershed area was completed by Robinson Consultants Inc. dated December 2004. This study provided characteristics of several tributary creeks to the Carp River as well as calculated peak flows. The tributary creeks include Feedmill Creek, Corkery Creek, and Poole Creek.

The following tables indicates the calculated flows from the above creeks for various storm events at their outlet point to the Carp River as well as the catchment area and the flow per square kilometer of catchment. The calculated flows were obtained from the Carp River Watershed / Subwatershed Study Volume 1 Main Report prepared by Robinson Consultants Inc dated December 2004 Table 8.3.3.

Table 4-1: Estimated Flow Rates for Similar Creeks

Storm Event	2 Year	5 year	100 year	Catchment Area (km^2)
Creek	Flow Rate At Outlet (m^3/sec)			
Poole	8.8	12.1	21.5	20.9
Feedmill	3.5	4.8	8.8	7.4
Corkery	11.3	15.5	27.0	33.6
Creek	Flow Rate per square kilometre of catchment (m^3/sec/km^2)			
Poole	0.42	0.58	1.03	
Feedmill	0.47	0.65	1.19	
Corkery	0.34	0.46	0.80	
Average	0.41	0.56	1.01	

From the above table and considering the catchment area of Harwood Creek in question, the following estimated flow rates were determined adjacent the site. The Ontario Flow Assessment Tool was also used to generate flow rates for various return periods in the Harwood Creek using the Primary Multiple Regression Method. These flow rates have been added to the following table for comparison.

Table 4-2: Estimated Flow Rates for Harwood Creek Adjacent Site

Storm Event	2 Year	5 year	100 year	Catchment Area (km^2)
Creek	Flow Rate At Railroad Culvert (m^3/sec) based on similar Creeks			
Harwood	5.3	7.3	13.1	13
	Flow Rate At Railroad Culvert (m^3/sec) from OFAT			
Harwood	2.8	4.6	10.5	12.7

From the above, the estimated peak flow rate during a 100 year design storm in the Harwood Creek at the railway culvert is 13.1 m^3/sec.

4.2. Railroad Culvert Capacity – Estimate Flow Rate

The Harwood Creek passes under the Railroad Immediately east of the site by means of a double barrel cast-in-place concrete culvert. The culvert has the following dimensions. Right (south) Barrel 1.6 m high x 2.8 m wide, invert of 72.76, Left (north) barrel 1.4 m high by 2.9 m wide, invert of 72.96, beveled entrance and exits, and 33 degree wing walls. The obverts of the barrels are at an elevation of 74.38 m. The centre of the railroad tracks above the culvert is at an elevation of 75.8 m.

Based on the above, the culvert has the following capacities depending on flow conditions.

Table 4-3: Capacity of Culvert Under Railroad Tracks

Elevation (m)	Capacity under inlet control conditions (no restriction at outlet) m^3/sec	Capacity under full flow conditions (tail water restricting flow) m^3/sec
73.3	5.6	5.6
73.4	6.3	6.3
73.5	6.8	6.8
73.6	7.3	7.3
73.7	7.7	7.7
73.8	8.0	8.0
73.9	9.4	8.4
74	11.1	8.7
74.1	12.8	8.9
74.2	14.5	9.2
74.3	16.2	9.4
74.4	17.9	7.4
74.5	19.4	11.8
74.6	20.8	15.6
74.7	22.8	19.0
74.8	24.8	21.4
74.9	26.5	24.0
75	28.5	26.4
75.1	30.2	28.5

From the above capacities, and in consideration of the estimated flow rates from the various design storms, the railroad culvert will accommodate the calculated flows at the following elevations.

Table 4-4: Approximate Water Surface Elevation for Storm Events at Railway Crossing Culvert

Storm Event	Elevation with no restriction (m)	Elevation with elevated tail water (m)
2	< 73.3	< 73.3
5	73.6	73.6
100	74.15	74.55

The flood plain mapping obtained from MVCA indicates that the 100 year flood elevation in the Harwood creek is at an elevation of 75.2 m immediately adjacent to the southwest side of the railway at the crossing culverts and 74.8 m immediately adjacent to the northeast side of the railway. This indicates that the flood plain elevation within the Harwood Creek is a function of the capacity of the creek rather than the capacity of the crossing culverts. As such the proposed development will not have a significant effect on the railway crossing culverts.

4.3. Effect of Development on Flood Levels in Harwood Creek and Surrounding Area.

4.3.1. Flood Risk From Existing Conditions and Mitigation of Risk

Information obtained from site reconnaissance and from residents in the surrounding areas indicates that, the lower elevations of the site are subject to flooding during the spring and a result of damming of the creek by beavers. The existing ground surface elevation at the relatively level lower portion of the site ranges in elevation from about 74.9 to about 75.4 metres and extends southwest of the rear property line some 90 metres along the northeast side of the site and some 110 metres along the southeast side of the site. This lower level of the site acts as a natural buffer to the local flooding resulting from spring melt and from damming of the creek. This lower area is also a backwater of Harwood Creek.

Flood plain mapping obtained from the MVCA indicates the 100 year flood plain elevation of the Harwood Creek adjacent to the site is 75.45 m. This causes the eastern portion of the development to be located within a flood plain backwater area. In order to facilitate the proposed development of the two lots in this lower area of the site, fill material will be placed to raise the ground surface to a minimum of 75.75 m in the area of the proposed development. This fill will remove the development area from the flood plain backwater.

The existing flow through the flood plain backwater will be re-routed around the south east side of the fill to maintain the drainage of the property and the rear yards of the adjacent properties.

A permit for placement of fill within the flood plain will be applied for as part of the development process in order to remove the developed portion of the subdivision from the flood plain. Since the portion of the flood plain of the Harwood Creek that is located on the site is a backwater area, it does not contribute to the storage capacity of the Harwood Creek during a flood event. As such, its removal will not affect the flow capacity of the Harwood Creek.

The proposed dwellings will be constructed with a minimum underside of footing elevation of 75.80 metres. The proposed septic leaching beds should be constructed with a minimum tile elevation of 76.35 metres. The proposed area for development is above an elevation of 75.45 metres. It is intended that wells will be installed on the upslope side of the dwellings adjacent the lower level of the site.

4.3.2. During Storm Events

As demonstrated in the following Section 6 of this report, the 5 year and the 100 year post-development flow rates will be less than the calculated pre-development flow rates for each design storm event. As such it is considered that the proposed development will have negligible effect on the water level in the Harwood Creek during the design storm events.

Based on the above, it is considered that there will be no flood risk to the proposed development from the Harwood Creek during various storm events up to and including the 100 year storm events provided there are no extraneous circumstances such as damming of the creek downstream of the site. It is also considered that the proposed development will not affect adjacent landowners by increasing flood elevations.

5. PRE-DEVELOPMENT STORMWATER ANALYSIS

5.1. Adjacent Off Site Properties

As previously indicated, the site is located on the northeast side of Dunrobin Road in the City of Ottawa. The site is continuously sloped downward from the edge of Dunrobin Road with the predominate slope perpendicular to Dunrobin Road. There is essentially no defined road side ditch between the shoulder of Dunrobin Road and the site. As a result, all of the runoff generated from the northwest bound lane of Dunrobin Road and from the ditch along the northeast side of the road travels across the site. There is a slight cross slope towards the southeast such that the runoff at the bottom of the site travels along the ditch along the southwest side of the railway to the Hardwood Creek located southeast of the site.

Runoff from the adjacent properties northwest of the site is predominately directed to the roadside ditch along Constance Lake Rd and to the ditch along the railway. Runoff from a relatively small portion of the rear yards of these properties is directed to the site. This runoff is currently directed across the site by a shallow swale which outlets to the Harwood Creek. The portion of these properties contributing runoff to the site are predominately surfaced with grass and woods/brush. These offsite areas contribute runoff to the overall subdivision drainage basin during both pre- and post- development conditions.

Runoff from the adjacent property to the southeast flows in a southeasterly direction to the Harwood Creek.

5.2. On Site Predevelopment Conditions

As previously indicated, the property is generally rectangular with an about 160 m long projection towards the southeast along the existing railway corridor.

Historical imagery available on the geoOttawa website indicates that the site was historically occupied by farmland with a dwelling and outbuildings. These images show that no significant agricultural activity was carried out on the site within the last 20 to 30 years or more and that the dwelling has been abandoned. The ground surface across the site has a general downward slope of about 0.3 to 2 percent from the southwest end of the property to the northeast. Current site drainage takes the form of sheet flow following the general slope of the site.

The vegetative communities on the southwest portion of the site predominately consisted of Forb Meadow which transitions to Buckthorn Deciduous Shrub Thickets through the central portion of the site. The northeast end of the site adjacent the railway corridor is occupied by fresh-moist poplar deciduous woodland.

Harwood Creek Crosses the eastern most portion of the 160 m long projection of the property. This projection is almost entirely occupied by the 100 year flood plain of the Harwood Creek. A tailwater section of the Flood Plain extends on the site covering a significant portion of the eastern about 100 metres of the site.

5.3. Pre-Development Runoff

Table 5-1 summarizes the pre-development peak release rate and runoff volumes for the above storm events. Appendix C contains pre-development OTTHYMO summary output data. Also included in Appendix C is the detailed output data for the last link in the model. The detailed output data for the last link provides a summary of the predevelopment outflow from the proposed development including off site catchment areas.

Table 5-1: Pre-Development Runoff Rates and Runoff Volumes

Design Storm Event		Pre-Development Runoff Rate	Runoff Volume
		(m^3/s)	(mm)
Sim 1	6 hour 5 year SCS Type II	0.129	6.71
Sim 2	6 hour 100 year SCS Type II	0.483	22.91
Sim 3	12 hour 5 year SCS Type II	0.162	9.07
Sim 4	12 hour 10 year SCS Type II	0.244	13.03
Sim 5	12 hour 100 year SCS Type II	0.541	27.07
Sim 6	12 hour 5 year Chicago	0.144	8.69
Sim 7	12 hour 100 year Chicago	0.529	25.93
Sim 8	Historical Storm July 1, 1979	0.659	20.79
Sim 9	Historical Storm August 4, 1988	0.596	19.10
Sim 10	25mm 4 hour Chicago	0.010	0.79
Sim 11	15mm 4 hour Chicago	0.001	0.03

6. POST-DEVELOPMENT STORMWATER ANALYSIS

As stated in the *Background* section, the proposed development has a total site area of approximately 9.0 hectares and will be divided into eight residential lots with a minimum lot size of 0.8 hectares for a single family dwelling construction. A table summarizing the post-development sub-catchment areas and properties used in the stormwater management model is attached in Appendix A.

6.1. Stormwater Conveyance

Runoff for each lot will be managed as follows: Runoff originating from the front portion of each lot including all the impervious areas resulting from the construction of the proposed dwellings and driveways will be directed to the road side ditches along the subdivision roadway. This runoff will be conveyed to the stormwater management swale which extends east from the end of the cul-de-sac.

Any disturbed areas in the rear portion of the site will be rehabilitated and leveled to ensure any runoff is in the form of sheet flow. The sheet flow from the rear of the sites along the southeast side of the development will be left to flow in the existing pre-development drainage patterns. Runoff from the rear of the sites along the northwest side of the development as well as from the off-site area northwest of the development will be directed by means of a drainage easement swale constructed along the rear property lines of these lots. The swale will outlet to the stormwater management swale extended from the cul-de-sac and will replace the existing swale currently directing this runoff to the Harwood Creek.

It is considered that the low slope in the drainage easement swale will be insufficient to ensure that there are no localized high or low spots within the easement channel. The localized high and low spots will result in ponded water within the swales following a storm event. It is expected however that the ponding will be of limited depth.

Based on the sandy silt and glacial till materials encountered at the site, the coefficient of permeability k for the native soils at the site is expected to be in the order of $k=4x10^{-6}$ m/s. Based on this permeability it is expected that the infiltration rate through the bottom of the swales will be in the order of 0.02 $m^3/hr/m^2$ of swale bottom, assuming 0.1 metres of ponding depth and infiltration into the upper 0.3 metres below the swale bottom, where: q = ki; k = 1 x 10^{-3} cm/sec; i = 1.33 = ((h+d/d) where d is the upper 0.3 m of soil below the storage area and h is the ponding depth of 0.1 m. At a flow rate of 0.02 $m^3/hr/m^2$ it is estimated that a 0.1 m deep puddle would infiltrate in about 5 hours. It is expected that seasonally high ground water levels may affect the rate of infiltration through the bottom of the swales. However it is also expected that any ponding within the swales will dissipate under normal conditions due to infiltration.

6.1.1. Conveyance Along Roadside Ditches

As previously indicated, the runoff from the front of each lot will be conveyed along the subdivision roadside ditches to the stormwater management swale extending from the cul-de-sac. The ditch along the northwest side of road will receive runoff from the front of Lots 1, 3, 5 and 7. The ditch along the southeast side of road will receive runoff from the front of Lots 2, 4, 6 and 8.

The roadside ditches have been designed with sufficient capacity to fully contain the flow from a 100 year storm event within the confines of the road allowance. The longitudinal slope of the roadside ditches along the subdivision road between Dunrobin Road and station 0+180 (180 metres from the center of Dunrobin Road) varies between 1.1 and 3.7 percent. Station 0+180 corresponds to about the southeast side of Lot 3. The slope of the the roadside ditches decreases to about 0.85 percent between station 0+180 and 0+240 and to about 0.35 between station 0+240 and the stormwater management swale. Station 0+180 corresponds to about the southeast side of Lot 5. The roadside ditches will be subdrained where the slope is less than 1 percent.

The following Table 6.1 provides a detailed summary of the stormwater conveyance along the roadside ditches of the subdivision for various design storm events.

The design storm events are listed below and abbreviated in the table as follows:
12 hour 10 year SCS Type II - 12-10
12 hour 100 year SCS Type II - 12-100

Table 6-1: Flow within the Road Side Ditches

Ditch Section	Storm Event	Flow Rate	Flow Depth	Minimum Available Depth
		(m^3/s)	(m)	(m)
In front of Lots 1 and 3	12hr-10yr	0.06	0.10	0.5
	12hr-100yr	0.11	0.14	
In front of Lots 5 and 7	12hr-10yr	0.10	0.21	0.7
	12hr-100yr	0.20	0.28	
In front of Lots 2 and 4	12hr-10yr	0.06	0.10	0.5
	12hr-100yr	0.11	0.14	
In front of Lots 6 and 8	12hr-10yr	0.10	0.21	0.7
	12hr-100yr	0.20	0.28	

6.1.2. Conveyance Along Easement Swale

As previously indicated, Runoff from the rear of the sites along the northwest side of the development as well as from the off-site area northwest of the development will be directed by means of a drainage easement swale constructed along the rear property lines of these lots. The drainage easement swale has designed with sufficient capacity to fully contain the flow from a 100 year storm event within the confines of the swale. The following Table 6.2 provides a detailed summary of the stormwater conveyance along the easement swale for various design storm events.

The design storm events are listed below and abbreviated in the table as follows:
12 hour 10 year SCS Type II - 12hr-10yr
12 hour 100 year SCS Type II - 12hr-100yr

Table 6-2: Flow within the Easement Swale

Ditch Section	Storm Event	Flow Rate	Flow Depth	Minimum Available Depth
		(m^3/s)	(m)	(m)
Rear of Lot 3	12hr-10yr	0.06	0.10	0.3
	12hr-100yr	0.12	0.15	
Rear of Lot 5	12hr-10yr	0.07	0.13	0.3
	12hr-100yr	0.14	0.19	
Rear of Lot 7	12hr-10yr	0.09	0.17	0.35
	12hr-100yr	0.21	0.25	

The above analyses, which indicates the flow depth along each section of the easement swale and roadside ditches, demonstrates that the flow from the 100 year storm event is conveyed within the easement swales and roadside ditches.

6.2. Quantity Control

The proposed development has been divided into controlled and uncontrolled catchment areas. The uncontrolled catchment areas consist of those from which runoff is allowed to exit the site without restriction to the runoff rate. The controlled areas are those areas from which the runoff is collected and directed to the proposed stormwater management swale. The uncontrolled areas consist of the rear yards and the offsite catchment area northwest of the proposed development.

Due to the increased impervious area and decreased time of concentration resulting from the proposed development, the unrestricted runoff from the site will be greater than the pre-development flow rates. In order to meet the stormwater management criteria for the site with respect to runoff rate, temporary flow detention will be provided by means of the outlet control in the proposed stormwater management swale.

As previously indicated, the stormwater originating from the controlled areas of the proposed development will be collected and controlled through the use of the roadside ditches which will direct the runoff to the stormwater management swale.

6.2.1. Allowable Release Rate

As previously indicated, the post-development flow rate will be restricted such that the maximum release rate from the proposed development including offsite catchment areas will be less than or equal to the pre-development flow rate from the proposed development area including the offsite catchment areas during corresponding storm events up to and including the 100 year storm event. Runoff in excess of the pre-development runoff rate will be detained within the stormwater management swale to be released at a controlled rate during and following a storm event. The release rate from the stormwater management swale will be controlled by means of an outlet control structure.

The outlet control structure will consist of a berm placed across the stormwater management swale with one 375 mm diameter outlet culvert and one 525 mm diameter outlet culvert placed at different elevations. Flow through the 375 mm culvert which is the lower of the two outlet culverts will be restricted by means of a 210 mm diameter orifice set at an elevation equal to the bottom of the swale. Flow through the 525 mm culvert will be restricted by means of a 410 mm diameter orifice set at an elevation equal to 0.45 metres above the bottom of the swale.

The SWMP design verified the stormwater results for a range of storm types and durations to ensure that a conservative assessment of post development stormwater conditions is maintained. The storage requirements were determined by including a reservoir model in the stormwater management swale. The storage requirement is a function of the difference between the unrestricted flow rate and the allowable elease rate through the outlet control. The maximum allowable release rate through the outlet control was determined by subtracting the runoff rate from the uncontrolled areas from the pre-development runoff rates as indicated in the following Table 6-3. Table 6-3 also summarizes the post-development peak un-managed runoff rates for the various storm events.

Table 6-3: Unmanaged Post-Development and Calc. of Allowable Release Rate

Column 1	Column 2	Column 3	Column 4	Column 5
Design Storm Event	**Post-Develop. Runoff Rate**		**Pre-Develop. Runoff Rate**	**Allowable Release Rate***
	Unmanaged Controlled Area	**Uncontrolled Area**		
	(m^3/s)	**(m^3/s)**	**(m^3/s)**	**(m^3/s)**
6 hour 5 year SCS Type II	0.117	0.071	0.129	0.058
6 hour 100 year SCS Type II	0.361	0.271	0.483	0.212
12 hour 5 year SCS Type II	0.143	0.089	0.162	0.073
12 hour 10 year SCS Type II	0.197	0.135	0.244	0.109
12 hour 100 year SCS Type II	0.401	0.308	0.541	0.233
12 hour 5 year Chicago	0.143	0.079	0.144	0.065
12 hour 100 year Chicago	0.445	0.299	0.529	0.230
Historical Storm July 1, 1979	0.466	0.374	0.659	0.285
Historical August 4, 1988	0.451	0.343	0.596	0.253
25mm 4 hour Chicago	0.012	0.006	0.010	0.004
15mm 4 hour Chicago	0.001	0.001	0.001	0.000
Catchment Area (ha.)	4.63	6.39	11.02	

*The allowable release rate is equal to Column 4 – Column 3.

A review of the above table indicates that the un-managed post development rate for the controlled area is much greater than the allowable release rate.

Appendix D contains the OTTHYMO summary output data for the post-development storms. Also included in Appendix D is the detailed output file for the last link before the stormwater management swale, the last link before Harwood Creek and the swale before Harwood Creek. These output files summarize the unmanaged post-development flows into the stormwater management swale and the post-development flows exiting the proposed development.

6.2.2. Storage Swale Volume and Rating Curve

Details for the proposed storage swale are provided on drawing # 200977-GRD Grading and Drainage Plan. The proposed storage swale is to extend east from the bottom of the cul-de-sac. The storage swale will have a bottom with of 3 metres and a length of 85 metres between the edge of the roadside ditch and the outlet control structure. The storage swale bottom will be constructed of coarse grained sand and will be subdrained by a perforated storm pipe. The side slopes of the swale will be constructed at 3H:1V.

An outlet rating curve is entered into the reservoir model in the form of an allowable release rate as a function of available storage. The outlet rating curve was obtained in two steps. The first step consisted of calculating the available storage volume within the proposed swale at elevation increments using Auto Cad Civil 3D modeling software. The second step consisted of determining the outlet release rate for the storage swale with respect to ponding elevation or head on the outlet control structure and sand filter. The two results were combined to produce the outlet rating curve. The drawdown time is a function of the storage volume and the discharge rate.

The following Table 6-4 Storage Swale Volume and Release rate provides a summary of the available storage volume and release rate with respect to elevation and depth. The outlet rating curve and reservoir data from the model is also provided in Appendix E.

Table 6-4: Storage Swale Volume and Release Rate

Elevation (m)	Cumulative Volume (m^3)	Total Storage Depth / Heard on Sand Filer (m)	Discharge Rate Through Filter (m^3/s)	Ponding Depth Above Outlet Invert (m)	Head on Outlet Orifice (m)	Discharge Rate Through Outlet Orifice (m^3/s)	Total Discharge Rate (m^3/s)	Cumulative Volume (ha*m)
75.45	0	0.00	0.000	0.00	0.00	0.000	0.000	0.0000
75.50	2	0.05	0.003	0.00	0.00	0.000	0.003	0.0002
75.60	22	0.15	0.017	0.00	0.00	0.000	0.017	0.0022
75.70	58	0.25	0.024	0.00	0.00	0.000	0.024	0.0058
75.80	102	0.35	0.025	0.00	0.00	0.000	0.025	0.0102
75.90	156	0.45	0.026	0.10	0.00	0.013	0.039	0.0156
76.00	221	0.55	0.027	0.20	0.00	0.050	0.077	0.0221
76.10	299	0.65	0.027	0.30	0.00	0.103	0.130	0.0299
76.20	389	0.75	0.028	0.40	0.00	0.164	0.192	0.0389
76.30	498	0.85	0.029	0.50	0.28	0.214	0.243	0.0498
76.40	623	0.95	0.030	0.60	0.38	0.249	0.279	0.0623

6.2.3. Post Development Runoff Rate and Storage Requirements

The stormwater management model is re-run and the outlet control and associated rating curve is adjusted through iteration to ensure that the post-development flow rates do not exceed the pre-development flow rates. The inclusion of the reservoir routine in the stormwater management model results in the post-development flow rates presented in the following table 6-5. The pre-development flow rate has been added for comparison.

Table 6-5: Pre-development Vs Controlled Post Development

Design Storm Event	Pre-Dev. Max. Runoff Rate	Post-Dev Controlled Area Allowable Release Rate	Post-Dev Controlled Area Actual Release Rate	Post-Dev. Max. Runoff Rate	Difference Between Pre and Post-Development Runoff
	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/sec)
Quantity Control Design Storms					
6 hour 5 year SCS Type II	0.129	0.058	0.051	0.113	-0.016
6 hour 100 year SCS Type II	0.483	0.212	0.204	0.459	-0.024
12 hour 5 year SCS Type II	0.162	0.073	0.060	0.135	-0.027
12 hour 10 year SCS Type II	0.244	0.109	0.096	0.216	-0.028
12 hour 100 year SCS Type II	0.541	0.233	0.219	0.508	-0.033
12 hour 5 year Chicago	0.144	0.065	0.051	0.116	-0.028
12 hour 100 year Chicago	0.529	0.230	0.212	0.491	-0.038
Historical Storm July 1, 1979	0.659	0.285	0.258	0.614	-0.045
Historical August 4, 1988	0.596	0.253	0.236	0.551	-0.045
Quality Control Design Storms					
25mm 4 hour Chicago	0.010	0.004	0.010	0.016	0.006
15mm 4 hour Chicago	0.001	0.000	0.001	0.002	0.001

A negative value in the Difference column indicates that the post-development release rate from the entire catchment area including the all offsite contributing areas is less than the pre-development runoff rate for the design storm events.

It is noted that the post-development runoff rate for the quality control storms is greater than the pre-development runoff rate for these design storms. Because there is very little runoff generated during a quality control storm, the minor changes to the uncontrolled area result in an allowable release rate from the controlled area that is less than the minimum rate that is released by infiltration through the bottom of the storage swale.

The Otthymo Reservoir Report is provided in Appendix E. From the reservoir model the storage requirements for the various storm events are shown in the following Table 6-6.

Table 6-6: Storage Requirements

Design Storm Event		Maximum Storage Requirement	Approximate Maximum Ponding Elevation	Storage Swale Drawdown Time
		m^3	m	hrs
Quantity Control Design Storms				
Sim. 1	6 hour 5 year SCS Type II	176	75.93	2.4
Sim. 2	6 hour 100 year SCS Type II	415	76.23	3.0
Sim. 3	12 hour 5 year SCS Type II	191	75.95	2.4
Sim. 4	12 hour 10 year SCS Type II	249	76.04	2.7
Sim. 5	12 hour 100 year SCS Type II	448	76.26	3.0
Sim. 6	12 hour 5 year Chicago	176	75.93	2.4
Sim. 7	12 hour 100 year Chicago	434	76.24	3.0
Sim. 8	Historical Storm July 1, 1979	552	76.34	3.1
Sim. 9	Historical August 4, 1988	486	76.29	3.0
Quality Control Design Storms				
Sim. 10	25mm 4 hour Chicago	12	75.56	0.7
Sim. 11	15mm 4 hour Chicago	1	75.41	0.4

The invert of the outlet pipe from the storage swale has been set at an elevation of 75.80 meters resulting in a storage volume of 102 cubic metres below the outlet. There is a total available storage volume of 623 cubic metres within the storage swale below an elevation of 76.40 metres.

The maximum storage requirement of 552 cubic metres occurs during the July 1, 1979 historical storm. The minimum modeled storage requirement is 1 cubic meters during a 15 mm 4 hr Chicago storm. The maximum drawdown time is equal to 2.8 hours.

The available volume below the outlet is well in excess of the storage volume required during the quality control design storms.

Since the maximum storage requirement is less than the maximum available storage volume there is sufficient storage volume available within the proposed storage swale.

6.3. Quality Control

As previously stated, an enhanced level of treatment is required for the runoff from the site. An enhanced level of treatment corresponds to 80 percent total suspended solids removal. The main source of suspended solids in a residential development is the runoff from the roads and driveways. The vegetated landscaped surfaces and dwelling roofs are typically not considered to be significant sources of suspended solids. As previously indicated, the proposed driveways and subdivision road will be within the controlled area of the site.

Stormwater treatment of 80% TSS removal will be provided by a treatment train approach. The treatment train consists of sedimentation within the grass surfaced roadside ditches and first 10 metres of the stormwater management swale followed by filtration through a sand filter along the bottom of the treatment swale. Pre-treatment for the stormwater prior to sand filter will be by vegetative filtration and sedimentation within the first 10 m of the swale preceding the filter.

Quality Control will be provided by temporary detention of the entire quality control volume generated in the controlled area within the storage swale to be discharged through the filter only.

The quality storage swale has been designed to outlet the quality storage volume vertically through a sand filter into a perforated subdrain below the bottom of the stormwater management swale. The perforated subdrain outlets into the swale downstream of the outlet control structure.

The Ministry of Environment Stormwater Management Planning and Design Manual (March 2003)(MOE Manual) provides guidance on design for stormwater quality control. Quality control design is completed with the fundamental understanding that the majority of sediment and particulate pollutants are washed from the site surfaces during minor (frequent) storm events. Section 3.3.1 of the MOE Manual indicates that in most cases, quality control design storms range from 12.5 mm to 25 mm. The MOE Manual also indicates that an alternate approach to the volumetric sizing of stormwater facilities for quality control has been applied in Ontario. The alternate approach is summarized in Table 3.2 *Water Quality Storage Requirements Based on Receiving Waters.* Table 3.2 of the MOE manual specifies the storage volume required to achieve an enhanced minimum required quality control level of treatment using filtration.

In Part 4, the MOE Manual details the design requirements of several types of end of pipe stormwater management facilities. The proposed stormwater management design for quality control will consist of filtration. Design guidance for filtration is provided in Part 4 Section 4.6.7 Filters of the MOE Manual

6.3.1. Volumetric Sizing and Filter Size

The water quality storage volume requirement to achieve an enhanced level of treatment using the sand filter was determined from the MOE Manual Table 3.2 under infiltration. The impervious ratio for the controlled area of the site is 17%. From Table 3.2, for a 17% impervious ratio at an enhanced level of treatment the storage requirement was extrapolated to be 20.5 m^3/ha.

The total controlled area is 4.63 ha. 4.63 ha x 20.5 m^3/ha gives a quality storage requirement of 94.9 m^3.

The MOE Manual in section 4.6.7 under the heading Volumetric Sizing provides the following additional design guidance when using filtration for quality control:

"Water quality volumes to be used in the design are provided in Table 3.2 under the "infiltration" *heading. Erosion and quantity control volumes are not applicable to this type of SWMP. The design should be such that at a minimum, the by-pass of flows should not occur below or at the peak runoff from a 4 hour 15 mm design event."*

In order to ensure that by-pass would not occur below a 4 hr 15 mm design event, the 4 hr 15 mm design storm was added to the storm water management model and the runoff volume was calculated to be equal to 0.12 mm of depth across the entire catchment. The runoff volume generated during a 4hr 25mm design storm event was also calculated using the stormwater management model to be 1.18 mm of depth.

The MOE Manual indicates that the filter be sized to ensure a specified volume is discharged within a specified time period using the Darcy Equation. The size of the filter and storage volume must be sufficient to ensure that no overflow or by-pass occurs below the 4 hr 15 mm design storm.

The controlled catchments have a combined area of 4.63 ha. A 15mm quality storm event will result in a runoff volume of (4.63 ha x 0.12 mm) 5.6 m^3. A 25mm quality storm event will result in a runoff volume of 54.6 m^3. Both of these volumes are less than the quality storage requirement calculated using Table 3.2. As such the maximum quality storage requirement of was determined to be 94.9 m^3 using Table 3.2. There is a total storage volume for quality control purposes of 102 m^3 in the stormwater storage swale which is discharged by infiltration only.

As such the entire quality control volume required by the MOE Manual as calculated by Table 3.2 will be stored below the outlet ICD and no by-pass or overtopping will occur during a 4 hr 15mm storm event.

The proposed filter has been sized based on the space available for the filter. The flow rate through the filter was calculated and the drawdown time was determined based on the volume of the quality storage in the catchment. The proposed filter will be constructed with a width of 3 m and length of 75 m.

The sand used to construct the filter will consist of a medium poorly graded sand having a percolation rate “T” time of 4 min/cm and a maximum of 3 percent passing the 0.08 millimetre sieve size. This corresponds to a coefficient of permeability of k = 360 millimetres per hour or $1x10^{-4}$ m/s. The sand will be placed as shown in the details on Kollaard Associates Inc. drawing #200977 – GRD–Grading and Drainage Plan and will have a depth of 0.5 metres. The filter will be protected on the surface by a 100 mm thick layer of clearstone. A non-woven 6 ounce/square yard geotextile filter fabric (such as Terrafix 360R, Soleno TX-110 or an approved alternative) will be placed between the sand and the layer of clearstone. The filter fabric will also be extended beneath and beside the filter to avoid contamination of the filter sand from the adjacent native material. This fabric offers medium tensile strength at high elongation and good filtration, coupled with high permeability to allow for proper filtration, while holding the filter sand in place as designed.

6.3.2. Discharge Through Filter

The flow rate through the sand filters was calculated using Darcy’s Equation to be:

Q= A K i
A = the cross sectional area of the filter
K= coefficient of permeability

i= hydraulic gradient = head across the filter/ flow path across the filter

As an example: For a ponding depth of 0.35 metres which corresponds to the invert of the outlet pipe.

A= 3 m (width) x 75 m (filter length) = 225 m^2
K= $1x10^{-4}$ m/s
i = 1.1
Q = 25L/s

Based on the discharge rates through the filter, it is expected that the draw down time in the swale below the outlet elevation is approximately 1.8 hrs.

6.3.3. Filter Design Summary Table

Section 4.6.7 provides the design guidance with respect to the use of a filter as summarized in the table below. A column has been added to indicate how the proposed design conforms to the Criteria.

Table 6-7: Filter Design Summary Table

Design Element	Design Objective	Minimum Criteria	Design Conformance
Drainage Area		< 5 hectares	4.63 hectares
Pre-treatment	Longevity	Pre-treatment by means of sedimentation chamber, or forebay, vegetated filter strip, swale or oil/grit separator	Pre-treatment by vegetated filtration along ditch bottom, storage swale bottom and side slopes. Minimum length along bottom of 10 metres
Storage Depth	Avoid Filter Compaction	Subsurface sand and organic filters: 0.5 m Maximum 1.0 m	Maximum storage depth of storage swale of 0.89m
Filter Media Depth	Filtering	Sand: 0.5 m	sand: 0.5m

Under-drain	Discharge	Minimum 100 mm perforated pipes bedded in 150 – 300 mm of 50 mm gravel	Discharge to 250mm diameter perforated pipe surrounded in in 25 to 50 mm clear stone.
Land use		any land use, often employed for commercial and industrial	Residential
Volumetric Sizing		Calculated using Table 3.2 – infiltration = 94.9 m^3. By-pass flows should not occur below a 4 hr 15 mm design event	Storage for Quality Storm = 102 m^3 No bypass or overflow during a 4 hr 25 mm storm event
Filter Size		Determined using the Darcy Equation	Determined using the Darcy Equation
Filter Lining	prevent clogging	liner to prevent native material from entering filter	Non-woven geotextile filter cloth used between native material and filter and between filter and clearstone
Overflow / by-pass		required	overflow is provided above the quality storage requirement
Drawdown time	prevent standing water	maximum from 24 to 48 hours - 24 hours preferred	storage swale: approximately 3 hrs following a storm event

Since the proposed design meets the design criteria as demonstrated in the table above, the proposed design will meet the quality control criteria.

6.4. Best Management Practices

The proposed residential subdivision development will employ Best Management Practices wherever possible. The intent of implementing BMPs is to ensure that water quality and quantity concerns are considered at all stages of development. BMPs will be implemented at both a lot level and at a conveyance level.

Proposed lot level BMPs include minimizing ground slopes and maximizing the landscaped surfaces of the lots. Ministry of Environment of Ontario (MOE) advocates yard grading as flat as 0.5% in order to reduce runoff from residential lots. The minimum slope required to ensure proper drainage away from a dwelling is 2%. As such, the proposed finished ground slopes for the lots will be sloped at greater than 2% adjacent to the dwelling envelope, and then kept within the range of 0.5 to 5% where possible beyond the immediate dwelling envelope. As part of these practices, the slope of the side yard swales are reduced to 1% in order to promote vegetative filtration, sedimentation and infiltration.

7. Driveway Culverts

From Table 6-1 above the maximum flow rate in the roadside ditches during the 10 year and 100 year design storm events is 0.10 m^3/sec and 0.20 m^3/sec respectively. The maximum flow depths along the roadside ditches is 0.21 and 0.28 m for the 10 year and 100 year design storms respectively. The longitudinal slope of the ditch along this section is 0.3 percent.

The flow rate and headwater depth for the driveway culverts using the above worst case flow rates was also calculated using Hydroflow Express extension for Autodesk AutoCAD Civil 3D. Summary reports are including in Appendix F.

Table 7-1: Culvert Flow Demand and Capacity

Culvert Number	Diameter / Embedment Depth (m)	Culvert Capacity (gravity) (m^3/s)	10 year Storm		100 year storm	
			Flow Demand (m^3/s)	Headwater Depth (m)	Flow Demand (m^3/s)	Headwater Depth (m)
Driveway	0.5 / 0.05	0.12	0.10	0.24	0.20	0.60

From the above analyses, there is sufficient capacity to convey the maximum flow rate generated during a 10 year design storm in the roadside ditches through the driveway culverts without exceeding the minimum available ditch depth and without surcharging the culvert. There is sufficient capacity through the driveway culverts to convey the flows generated during a 100 year design storm without exceeding the minimum available ditch depth.

8. Operation and Maintenance

The responsibility for the operation and maintenance of the stormwater management facility in the subdivision is that of the owner/developer until the subdivision is accepted by the City of Ottawa. Once the subdivision is accepted by the City of Ottawa, the operation and maintenance of the stormwater management facility in the subdivision is the responsibility of the City of Ottawa

8.1. Operation and Maintenance

8.1.1. Grassed Swales and Roadside Ditches

The grassed swales and ditches proposed for the development will require occasional maintenance. Periodic grass trimming along the drainage easements and ditches represents the bulk of the maintenance required. Temporary straw bale check dams should be used to trap the debris and sediment disrupted during ditch cleaning operations.

Should excavation be required during maintenance, re-vegetation of disturbed areas should be completed after maintenance operations have been completed.

8.1.2. Stormwater Management Swale

The stormwater management swale should be inspected on a weekly basis and after any rain fall event after construction until vegetation is well established. Once the vegetation is well established and during the first year of operation, the stormwater management swale should be visually inspected on a bi-monthly basis and following significant storm event. For inspection purposes, a rain fall event of more than 25 mm in 4 hours would be considered to be a significant event.

The grassed bottom and side slopes of the stormwater management swale should be subjected to the same maintenance schedule as municipal roadside ditches. That is, the grass should be mowed and cared for as required to maintain a normal healthy appearance. Minimum recommended grass height in the storm pond is 100 mm.

Removal of accumulated sediment from the stormwater management swale should be conducted when the accumulation of the sediment begins to significantly affect the quality of the grass growth and/or the drainage patterns along the grassed surfaces. The sand filter should be replaced / remediated when the drawdown time increases significantly beyond the design value and when standing water remains within the stormwater management swale more than 24 hrs after the rainfall event.

8.2. Site Runoff Protection

The agricultural residential land surrounding the site has been lightly developed. Further development of the adjacent site areas is not expected to have a significant impact on the proposed development site and its respective SWMP design functionality. The rear portion of each lot is expected to remain undeveloped. As such existing drainage patterns will be preserved with runoff from the rear portions of each lot and from adjacent properties ultimately being directed to Harwood Creek.

9. EROSION AND SEDIMENT CONTROL

Before construction begins, silt fence barriers will be placed along the east and south property lines of the site.

Straw bale flow check dams will be installed at select locations as indicated on drawing 200977-ESC Erosion and Sediment Control Plan. These controls will be cleaned after large storm events and maintained throughout construction. If deemed necessary, additional straw bale check dams and silt fences can be installed where required during construction.

All activities, including equipment maintenance and refueling, shall be controlled to prevent entry of petroleum products or other deleterious substances, including any debris, waste, rubble or concrete material into a watercourse. The refueling and maintenance of vehicles will occur at least 120 metres in distance from Harwood Creek. Any material which is inadvertently spilt shall be cleaned up and removed by the contractor at the contractor's expense in a manner satisfactory to the Contract Administrator. Construction material, excess material, construction debris, and empty containers shall be stored a minimum of 120 metres away from the Creek.

The Contractor shall have on site at all times an emergency spill kit that will include as a minimum the following items:

- 2-3 in. diameter by 4 ft long floating absorbent boom suitable for water installation
- 10 – 18 in x 18 in absorbent pads,
- 5 lbs Zorbal absorbing material
- 1 pair goggles, 1 pair PVC gloves.

Contractor to have a supply of 20 – 40 lb. bags of Zorbal, 2 boxes of 4 ft floating absorbent boom (suitable for water installation, 40 pcs) and 1 box of 18 in. x 18 in. absorbent pads (100 pcs.) on site.

All spills will be reported to the local office of the Ministry of Environment as well as the Contract Administrator as soon as they happen. The spills action centre phone hotline is # 1–800-268-6060.

Every effort will be made to ensure that all disturbed areas are topsoiled and seeded as soon as reasonably possible.

As each lot is developed, proper sediment and erosion controls will be installed and maintained until the development of the lot is completed and the vegetative cover is established. Sediment controls shall consist of, at minimum straw bales or a silt fence barrier at the downgradient property line. Grass shall be established as soon as reasonably possible.

The attached drawing 200977-ESC Erosion and Sediment Control for the subdivision includes the above noted measures. These measures are intended to ensure no sediment laden runoff leaves the site or impacts the water way either during construction or after development has been completed.

10. STORMWATER MANAGEMENT CONCLUSIONS

- The proposed Dunrobin subdivision covers a total of about 9.0 hectares. The subdivision will consist of 8 lots proposed for single family residential development.
- The property has been previously used for farming and currently drains to the eastern portion of the site. The proposed development will ensure that the existing overall drainage patterns of the site are not changed.
- The stormwater runoff will be treated using road side ditches, grassed swales and filtration to ensure that an enhanced level of protection is achieved.
- Runoff will be managed from the site to ensure that the post-development runoff does not exceed the pre-development runoff.
- Erosion measures will be placed prior to construction and during development and will remain in place until construction is complete.
- Disturbed areas will be topsoiled and seeded as soon as reasonably possible.

We trust that this report provides sufficient information for your present purposes. If you have any questions concerning this report or if we can be of any further assistance to you on this project, please do not hesitate to contact our office.

Sincerely,

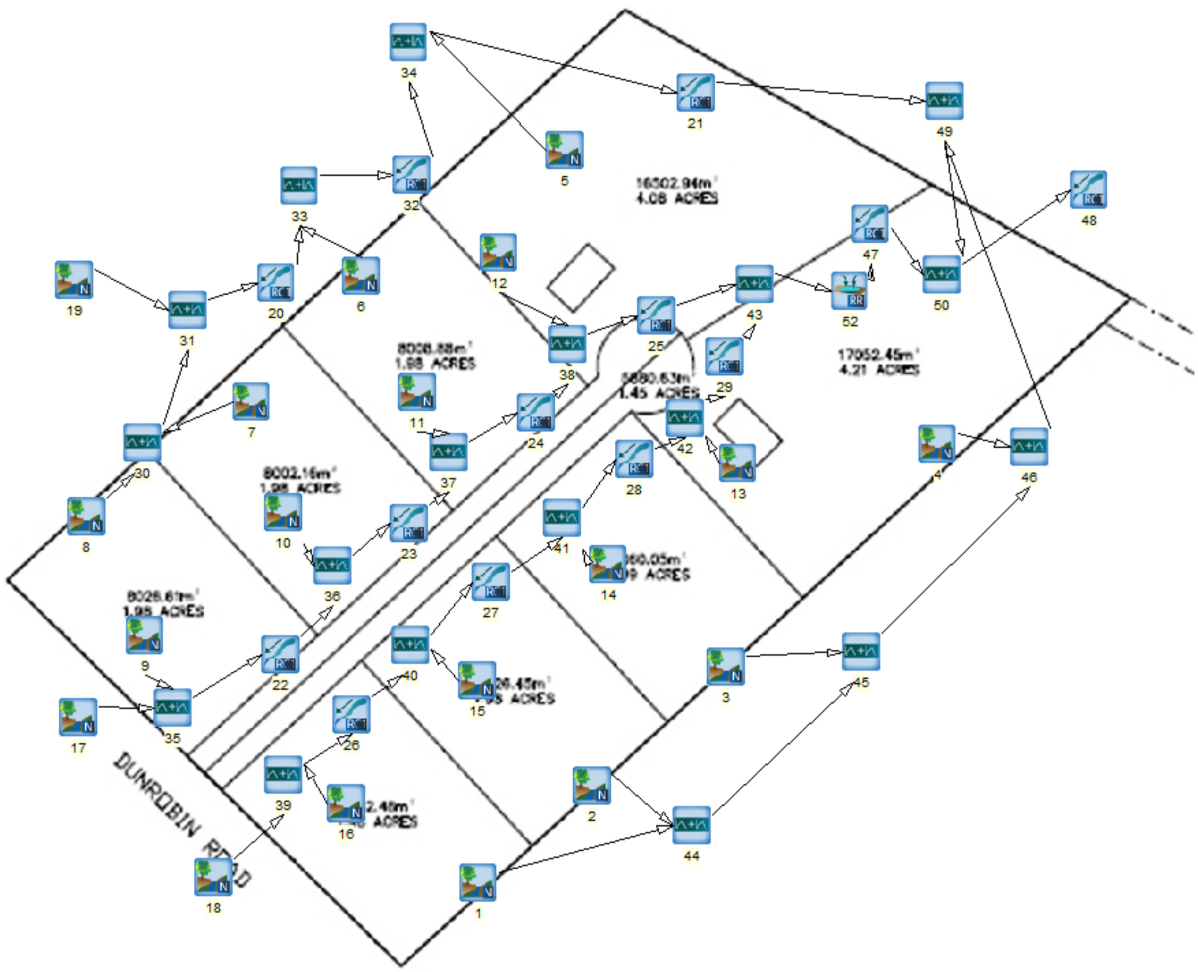
Kollaard Associates Inc.

LICENSED PROFESSIONAL ENGINEER
24.SEP.2021
S.E. deWit
100079612
PROVINCE OF ONTARIO

Steven deWit, P.Eng.

APPENDIX A: POST-DEVELOPMENT CATCHMENT AREAS AND SITE PARAMETERS

Post-development OTTHYMO Model Schematic



Schematic Summary Table

Hydrograph No.	Model Type	Item Represented	Comment
1	NASHYD	Sub-Catchment C1	Catchment represents rear yard of Lot 2. Uncontrolled.
2	NASHYD	Sub-Catchment C2	Catchment represents rear yard of Lot 4. Uncontrolled.
3	NASHYD	Sub-Catchment C3	Catchment represents rear yard of Lot 6. Uncontrolled.
4	NASHYD	Sub-Catchment C4	Catchment represents rear yard of Lot 8. Uncontrolled.
5	StandHyd	Sub-Catchment C5	Catchment represents rear yard of Lot 7. Uncontrolled.
6	StandHyd	Sub-Catchment C6	Catchment represents rear yard of Lot 5. Uncontrolled.
7	StandHyd	Sub-Catchment C7	Catchment represents rear yard of Lot 3. Uncontrolled.
8	StandHyd	Sub-Catchment C8	Catchment represents rear yard of Lot 1. Uncontrolled.
9	StandHyd	Sub-Catchment C9	Catchment includes front yard of Lot 1 and contains dwelling, driveway and half of road. Controlled
10	StandHyd	Sub-Catchment C10	Catchment includes front yard of Lot 3 and contains dwelling, driveway and half of road. Controlled
11	StandHyd	Sub-Catchment C11	Catchment includes front yard of Lot 5 and contains dwelling, driveway and half of road. Controlled
12	StandHyd	Sub-Catchment C12	Catchment includes front yard of Lot 7 and contains dwelling, driveway and half of road. Controlled
13	StandHyd	Sub-Catchment C13	Catchment includes front yard of Lot 8 and contains dwelling, driveway and half of road. Controlled
14	StandHyd	Sub-Catchment C14	Catchment includes front yard of Lot 6 and contains dwelling, driveway and half of road. Controlled
15	StandHyd	Sub-Catchment C15	Catchment includes front yard of Lot 4 and contains dwelling, driveway and half of road. Controlled

16	StandHyd	Sub-Catchment C16	Catchment includes front yard of Lot 2 and contains dwelling, driveway and half of road. Controlled
17	StandHyd	Sub-Catchment C-A	Catchment includes northwest side of Lot 1 and southeast half of Dunrobin Road Controlled
18	StandHyd	Sub-Catchment C-B	Catchment includes southwest side of Lot 2 and southeast half of Dunrobin Road Controlled
19	StandHyd	Sub-Catchment C-OFF1	Catchment includes offsite area northwest of the proposed development Controlled
20, 32, 21	Route Channel	Open Channel Flow along grassed swale	Models the open channel flow component of the runoff during post-development conditions along the northwest side of the development and along the northeast side of Lot 7
22,23,26,27	Route Channel	Open Channel Flow, Road side ditches	Models the open channel flow component of the runoff during post-development conditions along the front of Lots 1, 3, 2 and 4 respectively.
24,25,28,29	Route Channel	Open Channel Flow, Road side ditches	Models the open channel flow component of the runoff during post-development conditions along the front of Lots 5, 7, 6 and 8 respectively.
47,48	Route Channel	Open Channel Flow, Grassed Swales	Models the open channel flow component of the runoff during post-development conditions following the stormwater management swale to Harwood Creek
52	Route Reservoir	The stormwater management swale	Provides a model of the storm pond storage and release.
30,31,33-46,49,50	NASHYD	Add Hydrograph	Used to add two hydrographs in the routing

Catchment Areas and Model Parameters

Refer to Drawing # 200977-PRECA and Drawing # 200977-POSTCA for an illustration of the specified catchment areas.

Pre-development Catchment Areas								
Catchment Area Label	Total Catchment Area (ha)	Impervious Area (ha)	Open Space (ha)	Woodland / Brush (ha)	Weighted Average CN number	Potential Storage (mm)	Initial Abstraction (mm)	Impervious Ratio
		CN = 98	CN = 60	CN = 55				
C-Pre1	4.304	0	2.152	2.152	59	180	13.5	0
C-Pre2	4.307	0	2.303	2.303	59	180	13.5	0
C-A	0.209	0.047	0.161	0	69	112	8.5	0.23
C-B	0.210	0.048	0.162	0	69	112	8.4	0.23
C-OFF1	1.6901	0.039	0.826	0.826	61	160	12	0.02

Post-development Catchment Areas								
Catchment Area Label	Total Catchment Area (ha)	Impervious Area (ha)	Open Space (ha)	Woodland / Brush (ha)	Weighted Average CN number	Potential Storage (mm)	Initial Abstraction (mm)	Impervious Ratio
		CN = 98	CN = 61	CN = 55				
On site Catchment Areas								
C1	0.330	0.000	0.330	0.000	61	162	12.2	0.00
C16	0.525	0.087	0.439	0.000	67	125	9.3	0.16
C2	0.345	0.000	0.172	0.172	58	184	13.8	0.00
C15	0.535	0.087	0.448	0.000	67	125	9.4	0.16
C3	0.352	0.000	0.176	0.176	58	184	13.8	0.00
C14	0.519	0.084	0.435	0.000	67	125	9.4	0.16
C4	1.486	0.000	0.743	0.743	58	184	13.8	0.00
C13	0.514	0.084	0.430	0.000	67	125	9.4	0.16
C5	1.171	0.000	0.585	0.585	58	184	13.8	0.00
C12	0.555	0.096	0.459	0.000	67	123	9.2	0.17
C6	0.341	0.000	0.171	0.171	58	184	13.8	0.00
C11	0.534	0.086	0.448	0.000	67	125	9.4	0.16
C7	0.341	0.000	0.171	0.171	58	184	13.8	0.00
C10	0.535	0.087	0.449	0.000	67	125	9.4	0.16
C8	0.332	0.000	0.332	0.000	61	162	12.2	0.00
C9	0.493	0.084	0.409	0.000	67	123	9.3	0.17
Offsite Areas								
C-A	0.209	0.047	0.161	0.000	69	112	8.4	0.23
C-B	0.210	0.048	0.162	0.000	69	112	8.4	0.23
C-OFF1	1.691	0.039	0.826	0.000	61	160	12.0	0.02

APPENDIX B: **TIME OF CONCENTRATION AND TIME TO PEAK CALCULATION**

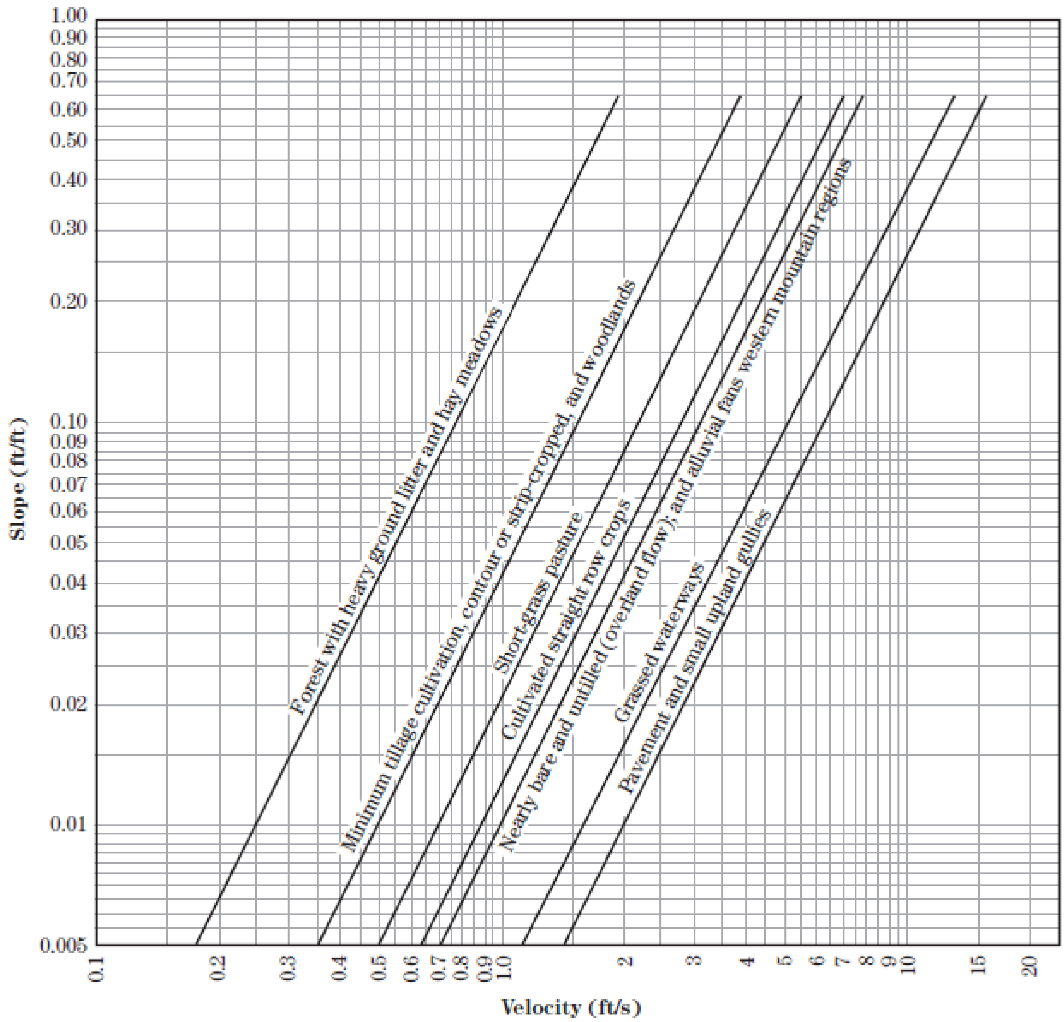
Pre-Development

Tributary Area	Sheet Flow: Manning's n sheet flow	Sheet Flow: Length of Sheet Flow (m)	Sheet Flow: 2 year 24 hr Rainfall (mm)	Sheet Flow: Slope of Land Surface	Sheet Flow: Time of Sheet Flow (hr)	Shallow Conc.: Flow Length to Major Channel (m)	Shallow Conc.: Slope of Land Surface	Shallow Conc.: velocity (m/s)	Shallow Conc.: Time of Shallow Conc. Flow (hr)	total Time of Conc. (hr)	Time to Peak (hr)
Label											
C-Pre1	0.30	15	48.00	0.010	0.28	162	0.006	0.33	0.14	0.41	0.27
C-Pre2	0.30	15	48.00	0.010	0.28	225	0.006	0.33	0.19	0.47	0.31
C-A	0.30	3	48.00	0.030	0.05	180	0.006	0.33	0.15	0.20	0.13
C-B	0.30	3	48.00	0.030	0.05	250	0.006	0.33	0.21	0.26	0.17
C-OFF1	0.30	15	48.00	0.010	0.28	247	0.000	0.33	0.21	0.48	0.32

Post-Development

Tributary Area	Sheet Flow: Manning's n sheet flow	Sheet Flow: Length of Sheet Flow (m)	Sheet Flow: 2 year 24 hr Rainfall (mm)	Sheet Flow: Slope of Land Surface	Sheet Flow: Time of Sheet Flow (hr)	Shallow Conc.: Flow Length to Major Channel (m)	Shallow Conc.: Slope of Land Surface	Shallow Conc.: velocity (m/s)	Shallow Conc.: Time of Shallow Conc. Flow (hr)	total Time of Conc. (hr)	Time to Peak (hr)
Label											
C1	0.30	15	48.00	0.045	0.15	305	0.015	0.18	0.47	0.62	0.41
C16	0.30	15	48.00	0.049	0.15	52	0.015	0.18	0.08	0.23	0.15
C2	0.30	15	48.00	0.013	0.25	270	0.012	0.21	0.36	0.61	0.40
C15	0.30	15	48.00	0.044	0.15	52	0.015	0.18	0.08	0.23	0.15
C3	0.30	15	48.00	0.010	0.28	190	0.015	0.18	0.30	0.57	0.38
C14	0.30	15	48.00	0.033	0.17	52	0.015	0.18	0.08	0.25	0.17
C4	0.30	15	48.00	0.039	0.16	125	0.017	0.19	0.18	0.34	0.23
C13	0.30	15	48.00	0.036	0.17	36	0.015	0.18	0.05	0.22	0.15
C5	0.30	15	48.00	0.023	0.20	40	0.049	0.33	0.03	0.23	0.15
C12	0.30	15	48.00	0.037	0.16	36	0.015	0.18	0.05	0.22	0.15
C6	0.30	15	48.00	0.029	0.18	30	0.067	0.40	0.02	0.20	0.13
C11	0.30	15	48.00	0.039	0.16	52	0.015	0.18	0.08	0.24	0.16
C7	0.30	15	48.00	0.019	0.21	107	0.018	0.38	0.08	0.29	0.19
C10	0.30	15	48.00	0.048	0.15	52	0.015	0.18	0.08	0.23	0.15
C8	0.30	15	48.00	0.022	0.20	175	0.016	0.34	0.14	0.35	0.23
C9	0.30	15	48.00	0.034	0.17	52	0.015	0.18	0.08	0.25	0.17
C-A	0.30	3	48.00	0.030	0.05	0	0.000	6.00	0.00	0.05	0.03
C-B	0.30	3	48.00	0.030	0.05	0	0.000	6.00	0.00	0.05	0.03
C-OFF1	0.30	15	48.00	0.010	0.28	247	0.002	0.33	0.21	0.48	0.32

Figure 15–4 Velocity versus slope for shallow concentrated flow



APPENDIX C: PRE-DEVELOPMENT STORM DATA

Pre-development OTTHYMO summary output file

Pre-development Detailed Output file from last link in model

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

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

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


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


  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

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

      START @   .00 hrs
      --------------------
      READ STORM                  30.0
      [ Ptot= 50.41 mm ]
      fname : G:\Projects\2020\200977 - Zbigniew Hauderowicz - 2050 Dunrobin Rd
- Additional lots\Storm\Design Sto
      remark: SCS II 6hr 5yr Ottawa
*
  **  CALIB NASHYD       0002  1  5.0    4.61     .05  3.33   6.38  .13    .000
      [CN=59.0          ]
      [ N = 3.0:Tp  .31]
*
  **  CALIB NASHYD       0007  1  5.0     .21     .01  3.08  11.26  .22    .000
      [CN=69.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0003  1  5.0    1.69     .02  3.33   7.34  .15    .000
      [CN=61.0          ]
      [ N = 3.0:Tp  .32]
*
  **  CALIB NASHYD       0001  1  5.0    4.30     .05  3.25   6.38  .13    .000
      [CN=59.0          ]
      [ N = 3.0:Tp  .27]
*
  **  CALIB NASHYD       0004  1  5.0     .21     .01  3.08  11.26  .22    .000
      [CN=69.0          ]
      [ N = 3.0:Tp  .17]
*
      ADD [0002 + 0007]  0005  3  5.0    4.82     .06  3.33   6.59  n/a    .000
*
      ADD [0001 + 0004]  0008  3  5.0    4.51     .06  3.25   6.61  n/a    .000
*
      CHANNEL[ 2 : 0005] 0011  1  5.0    4.82     .05  3.50   6.59  n/a    .000
*
      ADD [0003 + 0008]  0009  3  5.0    6.20     .08  3.25   6.81  n/a    .000
```

```
*
     CHANNEL[ 2 : 0009] 0010  1  5.0    6.20     .07  3.33   6.80  n/a    .000
*
     ADD [0011 + 0010]  0012  3  5.0   11.02     .13  3.42   6.71  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   2 **
  ****************************

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

     START @   .00 hrs
     --------------------
     READ STORM                    30.0
     [ Ptot= 87.00 mm ]
     fname : G:\Projects\2020\200977 - Zbigniew Hauderowicz - 2050 Dunrobin Rd
- Additional lots\Storm\Design Sto
     remark: SCS II 6hr 100yr Ottawa
*
  **  CALIB NASHYD       0002  1  5.0    4.61     .19  3.25  21.60  .25    .000
     [CN=59.0          ]
     [ N = 3.0:Tp  .31]
*
  **  CALIB NASHYD       0007  1  5.0     .21     .02  3.00  31.94  .37    .000
     [CN=69.0          ]
     [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0003  1  5.0    1.69     .08  3.25  23.69  .27    .000
     [CN=61.0          ]
     [ N = 3.0:Tp  .32]
*
  **  CALIB NASHYD       0001  1  5.0    4.30     .19  3.17  21.60  .25    .000
     [CN=59.0          ]
     [ N = 3.0:Tp  .27]
*
  **  CALIB NASHYD       0004  1  5.0     .21     .02  3.00  31.94  .37    .000
     [CN=69.0          ]
     [ N = 3.0:Tp  .17]
*
     ADD [0002 + 0007]  0005  3  5.0    4.82     .21  3.17  22.05  n/a    .000
*
     ADD [0001 + 0004]  0008  3  5.0    4.51     .21  3.17  22.07  n/a    .000
*
     CHANNEL[ 2 : 0005] 0011  1  5.0    4.82     .20  3.25  22.05  n/a    .000
*
     ADD [0003 + 0008]  0009  3  5.0    6.20     .29  3.17  22.51  n/a    .000
*
     CHANNEL[ 2 : 0009] 0010  1  5.0    6.20     .28  3.25  22.51  n/a    .000
*
     ADD [0011 + 0010]  0012  3  5.0   11.02     .48  3.25  22.31  n/a    .000
*
```

```
  ****************************
  ** SIMULATION NUMBER:   3 **
  ****************************

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

      START @   .00 hrs
      --------------------
      READ STORM                   30.0
      [ Ptot= 57.20 mm ]
      fname : G:\Projects\2020\200977 - Zbigniew Hauderowicz - 2050 Dunrobin Rd
- Additional lots\Storm\Design Sto
      remark: SCS II 12hr 5yr Ottawa
*
  **  CALIB NASHYD        0002  1  5.0    4.61     .06  6.25   8.67  .15    .000
      [CN=59.0          ]
      [ N = 3.0:Tp  .31]
*
  **  CALIB NASHYD        0007  1  5.0     .21     .01  6.00  14.56  .25    .000
      [CN=69.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD        0003  1  5.0    1.69     .03  6.25   9.84  .17    .000
      [CN=61.0          ]
      [ N = 3.0:Tp  .32]
*
  **  CALIB NASHYD        0001  1  5.0    4.30     .07  6.17   8.67  .15    .000
      [CN=59.0          ]
      [ N = 3.0:Tp  .27]
*
  **  CALIB NASHYD        0004  1  5.0     .21     .01  6.00  14.56  .25    .000
      [CN=69.0          ]
      [ N = 3.0:Tp  .17]
*
      ADD [0002 + 0007]  0005  3  5.0    4.82     .07  6.17   8.93  n/a    .000
*
      ADD [0001 + 0004]  0008  3  5.0    4.51     .07  6.17   8.94  n/a    .000
*
      CHANNEL[ 2 : 0005] 0011  1  5.0    4.82     .07  6.25   8.92  n/a    .000
*
      ADD [0003 + 0008]  0009  3  5.0    6.20     .10  6.17   9.18  n/a    .000
*
      CHANNEL[ 2 : 0009] 0010  1  5.0    6.20     .09  6.25   9.18  n/a    .000
*
      ADD [0011 + 0010]  0012  3  5.0   11.02     .16  6.25   9.07  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   4 **
  ****************************

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

      START @   .00 hrs
      --------------------
      READ STORM                   30.0
      [ Ptot= 67.20 mm ]
      fname : G:\Projects\2020\200977 - Zbigniew Hauderowicz - 2050 Dunrobin Rd
- Additional lots\Storm\Design Sto
      remark: SCS II 12hr 10yr Ottawa
```

```
*
  **  CALIB NASHYD        0002  1  5.0    4.61     .10  6.17  12.52  .19    .000
      [CN=59.0          ]
      [ N = 3.0:Tp  .31]
*
  **  CALIB NASHYD        0007  1  5.0     .21     .01  6.00  19.92  .30    .000
      [CN=69.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD        0003  1  5.0    1.69     .04  6.17  14.00  .21    .000
      [CN=61.0          ]
      [ N = 3.0:Tp  .32]
*
  **  CALIB NASHYD        0001  1  5.0    4.30     .10  6.17  12.52  .19    .000
      [CN=59.0          ]
      [ N = 3.0:Tp  .27]
*
  **  CALIB NASHYD        0004  1  5.0     .21     .01  6.00  19.92  .30    .000
      [CN=69.0          ]
      [ N = 3.0:Tp  .17]
*
      ADD [0002 + 0007]   0005  3  5.0    4.82     .11  6.17  12.84  n/a    .000
*
      ADD [0001 + 0004]   0008  3  5.0    4.51     .11  6.17  12.86  n/a    .000
*
      CHANNEL[ 2 : 0005]  0011  1  5.0    4.82     .10  6.25  12.84  n/a    .000
*
      ADD [0003 + 0008]   0009  3  5.0    6.20     .15  6.17  13.17  n/a    .000
*
      CHANNEL[ 2 : 0009]  0010  1  5.0    6.20     .14  6.25  13.17  n/a    .000
*
      ADD [0011 + 0010]   0012  3  5.0   11.02     .24  6.25  13.03  n/a    .000
*
```

```
  ****************************
  ** SIMULATION NUMBER:   5 **
  ****************************

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

      START @   .00 hrs
      --------------------
      READ STORM                   30.0
      [ Ptot= 96.00 mm ]
      fname : G:\Projects\2020\200977 - Zbigniew Hauderowicz - 2050 Dunrobin Rd
- Additional lots\Storm\Design Sto
      remark: SCS II 12hr 100yr Ottawa
*
  **  CALIB NASHYD       0002  1  5.0    4.61     .22  6.17  26.27  .27    .000
      [CN=59.0         ]
      [ N = 3.0:Tp  .31]
*
  **  CALIB NASHYD       0007  1  5.0     .21     .02  6.00  37.90  .39    .000
      [CN=69.0         ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0003  1  5.0    1.69     .09  6.17  28.63  .30    .000
      [CN=61.0         ]
      [ N = 3.0:Tp  .32]
*
  **  CALIB NASHYD       0001  1  5.0    4.30     .22  6.08  26.26  .27    .000
      [CN=59.0         ]
      [ N = 3.0:Tp  .27]
*
  **  CALIB NASHYD       0004  1  5.0     .21     .02  6.00  37.90  .39    .000
      [CN=69.0         ]
      [ N = 3.0:Tp  .17]
*
      ADD [0002 + 0007]  0005  3  5.0    4.82     .23  6.17  26.78  n/a    .000
*
      ADD [0001 + 0004]  0008  3  5.0    4.51     .24  6.08  26.80  n/a    .000
*
      CHANNEL[ 2 : 0005] 0011  1  5.0    4.82     .23  6.25  26.77  n/a    .000
*
      ADD [0003 + 0008]  0009  3  5.0    6.20     .32  6.17  27.30  n/a    .000
*
      CHANNEL[ 2 : 0009] 0010  1  5.0    6.20     .32  6.17  27.30  n/a    .000
*
      ADD [0011 + 0010]  0012  3  5.0   11.02     .54  6.17  27.07  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   6 **
  ****************************

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

      START @   .00 hrs
      --------------------
      CHIC STORM                   10.0
      [ Ptot= 56.17 mm ]
*
  **  CALIB NASHYD       0002  1  5.0    4.61     .06  4.42   8.30  .15    .000
      [CN=59.0         ]
```

```
     [ N = 3.0:Tp  .31]
*
  **  CALIB NASHYD        0007  1  5.0     .21     .01  4.17  14.04  .25    .000
      [CN=69.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD        0003  1  5.0    1.69     .02  4.42   9.44  .17    .000
      [CN=61.0          ]
      [ N = 3.0:Tp  .32]
*
  **  CALIB NASHYD        0001  1  5.0    4.30     .06  4.33   8.30  .15    .000
      [CN=59.0          ]
      [ N = 3.0:Tp  .27]
*
  **  CALIB NASHYD        0004  1  5.0     .21     .01  4.17  14.04  .25    .000
      [CN=69.0          ]
      [ N = 3.0:Tp  .17]
*
      ADD [0002 + 0007]   0005  3  5.0    4.82     .06  4.33   8.55  n/a    .000
*
      ADD [0001 + 0004]   0008  3  5.0    4.51     .06  4.33   8.57  n/a    .000
*
      CHANNEL[ 2 : 0005]  0011  1  5.0    4.82     .06  4.50   8.55  n/a    .000
*
      ADD [0003 + 0008]   0009  3  5.0    6.20     .09  4.33   8.81  n/a    .000
*
      CHANNEL[ 2 : 0009]  0010  1  5.0    6.20     .08  4.42   8.80  n/a    .000
*
      ADD [0011 + 0010]   0012  3  5.0   11.02     .14  4.42   8.69  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   7 **
  ****************************

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

      START @   .00 hrs
      --------------------
      CHIC STORM                   10.0
      [ Ptot= 93.90 mm ]
*
  **  CALIB NASHYD        0002  1  5.0    4.61     .21  4.33  25.15  .27    .000
      [CN=59.0          ]
      [ N = 3.0:Tp  .31]
*
  **  CALIB NASHYD        0007  1  5.0     .21     .02  4.08  36.49  .39    .000
      [CN=69.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD        0003  1  5.0    1.69     .09  4.33  27.45  .29    .000
      [CN=61.0          ]
      [ N = 3.0:Tp  .32]
*
  **  CALIB NASHYD        0001  1  5.0    4.30     .21  4.25  25.15  .27    .000
      [CN=59.0          ]
      [ N = 3.0:Tp  .27]
*
  **  CALIB NASHYD        0004  1  5.0     .21     .02  4.08  36.49  .39    .000
      [CN=69.0          ]
      [ N = 3.0:Tp  .17]
```

```
*
     ADD [0002 + 0007]  0005  3  5.0    4.82     .23  4.33  25.65  n/a    .000
*
     ADD [0001 + 0004]  0008  3  5.0    4.51     .23  4.25  25.67  n/a    .000
*
     CHANNEL[ 2 : 0005] 0011  1  5.0    4.82     .22  4.42  25.65  n/a    .000
*
     ADD [0003 + 0008]  0009  3  5.0    6.20     .31  4.25  26.16  n/a    .000
*
     CHANNEL[ 2 : 0009] 0010  1  5.0    6.20     .31  4.33  26.15  n/a    .000
*
     ADD [0011 + 0010]  0012  3  5.0   11.02     .53  4.33  25.93  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   8 **
  ****************************

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

     START @   .00 hrs
     --------------------
     READ STORM                     5.0
     [ Ptot= 83.99 mm ]
     fname : G:\Projects\2020\200977 - Zbigniew Hauderowicz - 2050 Dunrobin Rd
- Additional lots\Storm\Design Sto
     remark: Ottawa July 1 1979
*
  ** CALIB NASHYD       0002  1  5.0    4.61     .27  1.83  20.11  .24    .000
     [CN=59.0          ]
     [ N = 3.0:Tp  .31]
*
  ** CALIB NASHYD       0007  1  5.0     .21     .02  1.67  30.01  .36    .000
     [CN=69.0          ]
     [ N = 3.0:Tp  .17]
*
  ** CALIB NASHYD       0003  1  5.0    1.69     .11  1.83  22.10  .26    .000
     [CN=61.0          ]
     [ N = 3.0:Tp  .32]
*
  ** CALIB NASHYD       0001  1  5.0    4.30     .26  1.75  20.10  .24    .000
     [CN=59.0          ]
     [ N = 3.0:Tp  .27]
*
  ** CALIB NASHYD       0004  1  5.0     .21     .02  1.67  30.01  .36    .000
     [CN=69.0          ]
     [ N = 3.0:Tp  .17]
*
     ADD [0002 + 0007]  0005  3  5.0    4.82     .28  1.83  20.54  n/a    .000
*
     ADD [0001 + 0004]  0008  3  5.0    4.51     .29  1.75  20.56  n/a    .000
*
     CHANNEL[ 2 : 0005] 0011  1  5.0    4.82     .28  1.92  20.54  n/a    .000
*
     ADD [0003 + 0008]  0009  3  5.0    6.20     .39  1.75  20.98  n/a    .000
*
     CHANNEL[ 2 : 0009] 0010  1  5.0    6.20     .38  1.83  20.98  n/a    .000
*
     ADD [0011 + 0010]  0012  3  5.0   11.02     .66  1.83  20.79  n/a    .000
*
```

```
 ****************************
 ** SIMULATION NUMBER:   9 **
 ****************************

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

     START @   .00 hrs
     --------------------
     READ STORM                   5.0
     [ Ptot= 80.57 mm ]
     fname : G:\Projects\2020\200977 - Zbigniew Hauderowicz - 2050 Dunrobin Rd
- Additional lots\Storm\Design Sto
     remark: Ottawa Aug 4 1988
*
 **  CALIB NASHYD       0002  1  5.0    4.61     .24  2.17  18.46  .23     .000
     [CN=59.0          ]
     [ N = 3.0:Tp  .31]
*
 **  CALIB NASHYD       0007  1  5.0     .21     .02  2.08  27.86  .35     .000
     [CN=69.0          ]
     [ N = 3.0:Tp  .17]
*
 **  CALIB NASHYD       0003  1  5.0    1.69     .10  2.17  20.35  .25     .000
     [CN=61.0          ]
     [ N = 3.0:Tp  .32]
*
 **  CALIB NASHYD       0001  1  5.0    4.30     .24  2.17  18.46  .23     .000
     [CN=59.0          ]
     [ N = 3.0:Tp  .27]
*
 **  CALIB NASHYD       0004  1  5.0     .21     .02  2.08  27.86  .35     .000
     [CN=69.0          ]
     [ N = 3.0:Tp  .17]
*
     ADD [0002 + 0007]  0005  3  5.0    4.82     .26  2.17  18.87  n/a     .000
*
     ADD [0001 + 0004]  0008  3  5.0    4.51     .27  2.08  18.89  n/a     .000
*
     CHANNEL[ 2 : 0005] 0011  1  5.0    4.82     .25  2.17  18.87  n/a     .000
*
     ADD [0003 + 0008]  0009  3  5.0    6.20     .36  2.17  19.29  n/a     .000
*
     CHANNEL[ 2 : 0009] 0010  1  5.0    6.20     .35  2.17  19.29  n/a     .000
*
     ADD [0011 + 0010]  0012  3  5.0   11.02     .60  2.17  19.10  n/a     .000
*
```

```
 ****************************
 ** SIMULATION NUMBER:  10 **
 ****************************

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

     START @   .00 hrs
     --------------------
     READ STORM                   10.0
     [ Ptot= 25.00 mm ]
     fname : G:\Projects\2020\200977 - Zbigniew Hauderowicz - 2050 Dunrobin Rd
- Additional lots\Storm\Design Sto
     remark: twentyfive mm 4 hr chicago storm
*
 **  CALIB NASHYD          0002  1  5.0    4.61     .00  2.67    .70  .03    .000
     [CN=59.0          ]
     [ N = 3.0:Tp  .31]
*
 **  CALIB NASHYD          0007  1  5.0     .21     .00  1.75   2.10  .08    .000
     [CN=69.0          ]
     [ N = 3.0:Tp  .17]
*
 **  CALIB NASHYD          0003  1  5.0    1.69     .00  2.42    .96  .04    .000
     [CN=61.0          ]
     [ N = 3.0:Tp  .32]
*
 **  CALIB NASHYD          0001  1  5.0    4.30     .00  2.50    .70  .03    .000
     [CN=59.0          ]
     [ N = 3.0:Tp  .27]
*
 **  CALIB NASHYD          0004  1  5.0     .21     .00  1.75   2.10  .08    .000
     [CN=69.0          ]
     [ N = 3.0:Tp  .17]
*
     ADD [0002 + 0007]  0005  3  5.0    4.82     .00  2.58    .76  n/a    .000
*
     ADD [0001 + 0004]  0008  3  5.0    4.51     .00  2.50    .77  n/a    .000
*
     CHANNEL[ 2 : 0005] 0011  1  5.0    4.82     .00  2.83    .76  n/a    .000
*
     ADD [0003 + 0008]  0009  3  5.0    6.20     .01  2.42    .82  n/a    .000
*
     CHANNEL[ 2 : 0009] 0010  1  5.0    6.20     .01  2.75    .82  n/a    .000
*
     ADD [0011 + 0010]  0012  3  5.0   11.02     .01  2.83    .79  n/a    .000
*
 FINISH

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

```
 ****************************
 ** SIMULATION NUMBER:   1 **
 ****************************
--------------------
| ADD HYD   (0012) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0011):     4.82    .055     3.50     6.59
        + ID2= 2 (0010):     6.20    .075     3.33     6.80
          ==================================================
          ID = 3 (0012):    11.02    .129     3.42     6.71

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
 ****************************
 ** SIMULATION NUMBER:   2 **
 ****************************
--------------------
| ADD HYD   (0012) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0011):     4.82    .203     3.25    22.05
        + ID2= 2 (0010):     6.20    .280     3.25    22.51
          ==================================================
          ID = 3 (0012):    11.02    .483     3.25    22.31

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
 ****************************
 ** SIMULATION NUMBER:   3 **
 ****************************
--------------------
| ADD HYD   (0012) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0011):     4.82    .068     6.25     8.92
        + ID2= 2 (0010):     6.20    .094     6.25     9.18
          ==================================================
          ID = 3 (0012):    11.02    .162     6.25     9.07

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
 ****************************
 ** SIMULATION NUMBER:   4 **
 ****************************
--------------------
| ADD HYD   (0012) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0011):     4.82    .102     6.25    12.84
        + ID2= 2 (0010):     6.20    .142     6.25    13.17
          ==================================================
          ID = 3 (0012):    11.02    .244     6.25    13.03

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
```

```
  ****************************
  ** SIMULATION NUMBER:   5 **
  ****************************

--------------------
| ADD HYD   (0012) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0011):     4.82    .229     6.25    26.77
        + ID2= 2 (0010):     6.20    .315     6.17    27.30
          ==================================================
          ID = 3 (0012):    11.02    .541     6.17    27.07

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
  ****************************
  ** SIMULATION NUMBER:   6 **
  ****************************

--------------------
| ADD HYD   (0012) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0011):     4.82    .060     4.50     8.55
        + ID2= 2 (0010):     6.20    .084     4.42     8.80
          ==================================================
          ID = 3 (0012):    11.02    .144     4.42     8.69

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
  ****************************
  ** SIMULATION NUMBER:   7 **
  ****************************

--------------------
| ADD HYD   (0012) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0011):     4.82    .222     4.42    25.65
        + ID2= 2 (0010):     6.20    .309     4.33    26.15
          ==================================================
          ID = 3 (0012):    11.02    .529     4.33    25.93

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
```

```
 ****************************
 ** SIMULATION NUMBER:   8 **
 ****************************

--------------------
| ADD HYD   (0012) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0011):     4.82    .279     1.92    20.54
        + ID2= 2 (0010):     6.20    .382     1.83    20.98
          ==================================================
          ID = 3 (0012):    11.02    .659     1.83    20.79

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
 ****************************
 ** SIMULATION NUMBER:   9 **
 ****************************

--------------------
| ADD HYD   (0012) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0011):     4.82    .249     2.17    18.87
        + ID2= 2 (0010):     6.20    .348     2.17    19.29
          ==================================================
          ID = 3 (0012):    11.02    .596     2.17    19.10

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
 ****************************
 ** SIMULATION NUMBER:  10 **
 ****************************

--------------------
| ADD HYD   (0012) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0011):     4.82    .004     2.83      .76
        + ID2= 2 (0010):     6.20    .006     2.75      .82
          ==================================================
          ID = 3 (0012):    11.02    .010     2.83      .79

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
```

APPENDIX D: POST-DEVELOPMENT OTTHYMO STORM DATA

Post-Development OTTHYMO summary output file

Post-Development Detailed Output file Last Link before Stormwater Management Swale

Post-Development Detailed Output file Last Link before Harwood Creek

Post-Development Detailed Output file Swale Discharging to Harwood Creek

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


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

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


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


  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

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

      START @   .00 hrs
      --------------------
      READ STORM                   30.0
      [ Ptot= 50.41 mm ]
      fname : G:\Projects\2020\200977 - Zbigniew Hauderowicz - 2050 Dunrobin Rd
- Additional lots\Storm\Design Sto
      remark: SCS II 6hr 5yr Ottawa
*
  **  CALIB NASHYD        0004  1  5.0    1.49     .02  3.25   6.07  .12    .000
      [CN=58.0         ]
      [ N = 3.0:Tp  .28]
*
  **  CALIB NASHYD        0003  1  5.0     .35     .00  3.50   6.07  .12    .000
      [CN=58.0         ]
      [ N = 3.0:Tp  .38]
*
  **  CALIB NASHYD        0002  1  5.0     .34     .00  3.58   6.07  .12    .000
      [CN=58.0         ]
      [ N = 3.0:Tp  .40]
*
  **  CALIB NASHYD        0001  1  5.0     .33     .00  3.50   7.27  .14    .000
      [CN=61.0         ]
      [ N = 3.0:Tp  .41]
*
  **  CALIB NASHYD        0005  1  5.0    1.17     .02  3.08   6.06  .12    .000
      [CN=58.0         ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD        0006  1  5.0     .34     .00  3.08   6.05  .12    .000
      [CN=58.0         ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD        0019  1  5.0    1.69     .02  3.33   7.34  .15    .000
      [CN=61.0         ]
      [ N = 3.0:Tp  .32]
*
```

```
  **  CALIB NASHYD       0007  1  5.0     .34     .00  3.08   6.06  .12    .000
      [CN=58.0         ]
      [ N = 3.0:Tp  .19]
*
  **  CALIB NASHYD       0008  1  5.0     .33     .00  3.17   7.27  .14    .000
      [CN=61.0         ]
      [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0013  1  5.0     .51     .01  3.08  10.09  .20    .000
      [CN=67.0         ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0014  1  5.0     .52     .01  3.08  10.09  .20    .000
      [CN=67.0         ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0015  1  5.0     .53     .01  3.08  10.09  .20    .000
      [CN=67.0         ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0016  1  5.0     .53     .01  3.08  10.13  .20    .000
      [CN=67.0         ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0018  1  5.0     .21     .01  3.08  11.26  .22    .000
      [CN=69.0         ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0012  1  5.0     .56     .01  3.08  10.17  .20    .000
      [CN=67.0         ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0011  1  5.0     .53     .01  3.08  10.09  .20    .000
      [CN=67.0         ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0010  1  5.0     .54     .01  3.08  10.09  .20    .000
      [CN=67.0         ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0009  1  5.0     .49     .01  3.08  10.13  .20    .000
      [CN=67.0         ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0017  1  5.0     .21     .01  3.08  11.26  .22    .000
      [CN=69.0         ]
      [ N = 3.0:Tp  .17]
*
      ADD [0002 + 0001]  0044  3  5.0     .67     .01  3.58   6.66  n/a    .000
*
      ADD [0007 + 0008]  0030  3  5.0     .67     .01  3.08   6.66  n/a    .000
*
      ADD [0016 + 0018]  0039  3  5.0     .73     .02  3.08  10.45  n/a    .000
*
      ADD [0009 + 0017]  0035  3  5.0     .70     .02  3.08  10.47  n/a    .000
*
      ADD [0003 + 0044]  0045  3  5.0    1.03     .01  3.50   6.46  n/a    .000
*
      ADD [0019 + 0030]  0031  3  5.0    2.36     .03  3.25   7.15  n/a    .000
*
      CHANNEL[ 2 : 0039] 0026  1  5.0     .73     .02  3.08  10.45  n/a    .000
*
```

```
     CHANNEL[ 2 : 0035] 0022  1  5.0      .70     .02  3.08  10.47  n/a    .000
*
     ADD [0004 + 0045]  0046  3  5.0     2.51     .03  3.42   6.23  n/a    .000
*
     CHANNEL[ 2 : 0031] 0020  1  5.0     2.36     .03  3.25   7.15  n/a    .000
*
     ADD [0015 + 0026]  0040  3  5.0     1.27     .03  3.08  10.30  n/a    .000
*
     ADD [0010 + 0022]  0036  3  5.0     1.24     .03  3.08  10.30  n/a    .000
*
     ADD [0006 + 0020]  0033  3  5.0     2.71     .03  3.25   7.01  n/a    .000
*
     CHANNEL[ 2 : 0040] 0027  1  5.0     1.27     .03  3.08  10.30  n/a    .000
*
     CHANNEL[ 2 : 0036] 0023  1  5.0     1.24     .03  3.08  10.30  n/a    .000
*
     CHANNEL[ 2 : 0033] 0032  1  5.0     2.71     .03  3.25   7.01  n/a    .000
*
     ADD [0014 + 0027]  0041  3  5.0     1.79     .05  3.08  10.24  n/a    .000
*
     ADD [0011 + 0023]  0037  3  5.0     1.77     .05  3.08  10.24  n/a    .000
*
     ADD [0005 + 0032]  0034  3  5.0     3.88     .05  3.25   6.72  n/a    .000
*
     CHANNEL[ 2 : 0041] 0028  1  5.0     1.79     .05  3.08  10.24  n/a    .000
*
     CHANNEL[ 2 : 0037] 0024  1  5.0     1.77     .05  3.08  10.24  n/a    .000
*
     CHANNEL[ 2 : 0034] 0021  1  5.0     3.88     .04  3.42   6.72  n/a    .000
*
     ADD [0013 + 0028]  0042  3  5.0     2.30     .06  3.08  10.20  n/a    .000
*
     ADD [0012 + 0024]  0038  3  5.0     2.33     .06  3.08  10.22  n/a    .000
*
     ADD [0046 + 0021]  0049  3  5.0     6.39     .07  3.42   6.53  n/a    .000
*
     CHANNEL[ 2 : 0042] 0029  1  5.0     2.30     .06  3.17  10.20  n/a    .000
*
     CHANNEL[ 2 : 0038] 0025  1  5.0     2.33     .06  3.17  10.22  n/a    .000
*
     ADD [0029 + 0025]  0043  3  5.0     4.63     .12  3.17  10.21  n/a    .000
*
     RESRVR [ 2 : 0043] 0052  1  5.0     4.63     .05  3.83  10.21  n/a    .000
     {ST=    .02 ha.m }
*
     CHANNEL[ 2 : 0052] 0047  1  5.0     4.63     .05  3.83  10.21  n/a    .000
*
     ADD [0049 + 0047]  0050  3  5.0    11.02     .11  3.67   8.07  n/a    .000
*
     CHANNEL[ 2 : 0050] 0048  1  5.0    11.02     .11  3.67   8.07  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   2 **
  ****************************

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

     START @   .00 hrs
     --------------------
     READ STORM                  30.0
     [ Ptot= 87.00 mm ]
```

```
      fname : G:\Projects\2020\200977 - Zbigniew Hauderowicz - 2050 Dunrobin Rd
- Additional lots\Storm\Design Sto
      remark: SCS II 6hr 100yr Ottawa
*
  **  CALIB NASHYD        0004  1  5.0    1.49     .06  3.17  20.83  .24    .000
      [CN=58.0          ]
      [ N = 3.0:Tp  .28]
*
  **  CALIB NASHYD        0003  1  5.0     .35     .01  3.33  20.83  .24    .000
      [CN=58.0          ]
      [ N = 3.0:Tp  .38]
*
  **  CALIB NASHYD        0002  1  5.0     .34     .01  3.42  20.83  .24    .000
      [CN=58.0          ]
      [ N = 3.0:Tp  .40]
*
  **  CALIB NASHYD        0001  1  5.0     .33     .01  3.42  23.58  .27    .000
      [CN=61.0          ]
      [ N = 3.0:Tp  .41]
*
  **  CALIB NASHYD        0005  1  5.0    1.17     .06  3.08  20.76  .24    .000
      [CN=58.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD        0006  1  5.0     .34     .02  3.08  20.76  .24    .000
      [CN=58.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD        0019  1  5.0    1.69     .08  3.25  23.69  .27    .000
      [CN=61.0          ]
      [ N = 3.0:Tp  .32]
*
  **  CALIB NASHYD        0007  1  5.0     .34     .02  3.08  20.79  .24    .000
      [CN=58.0          ]
      [ N = 3.0:Tp  .19]
*
  **  CALIB NASHYD        0008  1  5.0     .33     .02  3.08  23.56  .27    .000
      [CN=61.0          ]
      [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD        0013  1  5.0     .51     .04  3.00  29.60  .34    .000
      [CN=67.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD        0014  1  5.0     .52     .04  3.00  29.60  .34    .000
      [CN=67.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD        0015  1  5.0     .53     .04  3.00  29.60  .34    .000
      [CN=67.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD        0016  1  5.0     .53     .04  3.00  29.66  .34    .000
      [CN=67.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD        0018  1  5.0     .21     .02  3.00  31.94  .37    .000
      [CN=69.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD        0012  1  5.0     .56     .04  3.00  29.72  .34    .000
      [CN=67.0          ]
```

```
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0011  1  5.0     .53     .04  3.00  29.60  .34    .000
      [CN=67.0         ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0010  1  5.0     .54     .04  3.00  29.60  .34    .000
      [CN=67.0         ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0009  1  5.0     .49     .04  3.00  29.66  .34    .000
      [CN=67.0         ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0017  1  5.0     .21     .02  3.00  31.94  .37    .000
      [CN=69.0         ]
      [ N = 3.0:Tp  .17]
*
      ADD [0002 + 0001]  0044  3  5.0     .67     .03  3.42  22.18  n/a    .000
*
      ADD [0007 + 0008]  0030  3  5.0     .67     .04  3.08  22.16  n/a    .000
*
      ADD [0016 + 0018]  0039  3  5.0     .73     .06  3.00  30.31  n/a    .000
*
      ADD [0009 + 0017]  0035  3  5.0     .70     .06  3.00  30.34  n/a    .000
*
      ADD [0003 + 0044]  0045  3  5.0    1.03     .04  3.42  21.72  n/a    .000
*
      ADD [0019 + 0030]  0031  3  5.0    2.36     .11  3.17  23.25  n/a    .000
*
      CHANNEL[ 2 : 0039] 0026  1  5.0     .73     .06  3.08  30.31  n/a    .000
*
      CHANNEL[ 2 : 0035] 0022  1  5.0     .70     .06  3.08  30.34  n/a    .000
*
      ADD [0004 + 0045]  0046  3  5.0    2.51     .10  3.25  21.19  n/a    .000
*
      CHANNEL[ 2 : 0031] 0020  1  5.0    2.36     .11  3.17  23.25  n/a    .000
*
      ADD [0015 + 0026]  0040  3  5.0    1.27     .10  3.08  30.01  n/a    .000
*
      ADD [0010 + 0022]  0036  3  5.0    1.24     .10  3.08  30.02  n/a    .000
*
      ADD [0006 + 0020]  0033  3  5.0    2.71     .13  3.17  22.94  n/a    .000
*
      CHANNEL[ 2 : 0040] 0027  1  5.0    1.27     .10  3.08  30.01  n/a    .000
*
      CHANNEL[ 2 : 0036] 0023  1  5.0    1.24     .10  3.08  30.02  n/a    .000
*
      CHANNEL[ 2 : 0033] 0032  1  5.0    2.71     .13  3.17  22.94  n/a    .000
*
      ADD [0014 + 0027]  0041  3  5.0    1.79     .14  3.08  29.89  n/a    .000
*
      ADD [0011 + 0023]  0037  3  5.0    1.77     .14  3.08  29.89  n/a    .000
*
      ADD [0005 + 0032]  0034  3  5.0    3.88     .18  3.08  22.28  n/a    .000
*
      CHANNEL[ 2 : 0041] 0028  1  5.0    1.79     .14  3.08  29.89  n/a    .000
*
      CHANNEL[ 2 : 0037] 0024  1  5.0    1.77     .14  3.08  29.89  n/a    .000
*
      CHANNEL[ 2 : 0034] 0021  1  5.0    3.88     .17  3.25  22.28  n/a    .000
*
```

```
      ADD [0013 + 0028]  0042  3  5.0    2.30     .18  3.08  29.83  n/a    .000
*
      ADD [0012 + 0024]  0038  3  5.0    2.33     .19  3.08  29.85  n/a    .000
*
      ADD [0046 + 0021]  0049  3  5.0    6.39     .27  3.25  21.85  n/a    .000
*
      CHANNEL[ 2 : 0042] 0029  1  5.0    2.30     .18  3.08  29.82  n/a    .000
*
      CHANNEL[ 2 : 0038] 0025  1  5.0    2.33     .18  3.08  29.85  n/a    .000
*
      ADD [0029 + 0025]  0043  3  5.0    4.63     .37  3.08  29.83  n/a    .000
*
      RESRVR [ 2 : 0043] 0052  1  5.0    4.63     .20  3.50  29.83  n/a    .000
      {ST=   .04 ha.m }
*
      CHANNEL[ 2 : 0052] 0047  1  5.0    4.63     .20  3.50  29.83  n/a    .000
*
      ADD [0049 + 0047]  0050  3  5.0   11.02     .46  3.33  25.20  n/a    .000
*
      CHANNEL[ 2 : 0050] 0048  1  5.0   11.02     .46  3.33  25.20  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   3 **
  ****************************

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

      START @   .00 hrs
      --------------------
      READ STORM                  30.0
      [ Ptot= 57.20 mm ]
      fname : G:\Projects\2020\200977 - Zbigniew Hauderowicz - 2050 Dunrobin Rd
- Additional lots\Storm\Design Sto
      remark: SCS II 12hr 5yr Ottawa
*
  **  CALIB NASHYD       0004  1  5.0    1.49     .02  6.17   8.28  .14    .000
      [CN=58.0         ]
      [ N = 3.0:Tp  .28]
*
  **  CALIB NASHYD       0003  1  5.0     .35     .00  6.33   8.28  .14    .000
      [CN=58.0         ]
      [ N = 3.0:Tp  .38]
*
  **  CALIB NASHYD       0002  1  5.0     .34     .00  6.33   8.28  .14    .000
      [CN=58.0         ]
      [ N = 3.0:Tp  .40]
*
  **  CALIB NASHYD       0001  1  5.0     .33     .00  6.33   9.76  .17    .000
      [CN=61.0         ]
      [ N = 3.0:Tp  .41]
*
  **  CALIB NASHYD       0005  1  5.0    1.17     .02  6.08   8.26  .14    .000
      [CN=58.0         ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0006  1  5.0     .34     .01  6.08   8.25  .14    .000
      [CN=58.0         ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0019  1  5.0    1.69     .03  6.25   9.84  .17    .000
      [CN=61.0         ]
```

```
      [ N = 3.0:Tp  .32]
*
 **   CALIB NASHYD       0007  1  5.0     .34     .01  6.08   8.26  .14    .000
      [CN=58.0         ]
      [ N = 3.0:Tp  .19]
*
 **   CALIB NASHYD       0008  1  5.0     .33     .01  6.08   9.75  .17    .000
      [CN=61.0         ]
      [ N = 3.0:Tp  .23]
*
 **   CALIB NASHYD       0013  1  5.0     .51     .02  6.00  13.17  .23    .000
      [CN=67.0         ]
      [ N = 3.0:Tp  .17]
*
 **   CALIB NASHYD       0014  1  5.0     .52     .02  6.00  13.17  .23    .000
      [CN=67.0         ]
      [ N = 3.0:Tp  .17]
*
 **   CALIB NASHYD       0015  1  5.0     .53     .02  6.00  13.17  .23    .000
      [CN=67.0         ]
      [ N = 3.0:Tp  .17]
*
 **   CALIB NASHYD       0016  1  5.0     .53     .02  6.00  13.21  .23    .000
      [CN=67.0         ]
      [ N = 3.0:Tp  .17]
*
 **   CALIB NASHYD       0018  1  5.0     .21     .01  6.00  14.56  .25    .000
      [CN=69.0         ]
      [ N = 3.0:Tp  .17]
*
 **   CALIB NASHYD       0012  1  5.0     .56     .02  6.00  13.26  .23    .000
      [CN=67.0         ]
      [ N = 3.0:Tp  .17]
*
 **   CALIB NASHYD       0011  1  5.0     .53     .02  6.00  13.17  .23    .000
      [CN=67.0         ]
      [ N = 3.0:Tp  .17]
*
 **   CALIB NASHYD       0010  1  5.0     .54     .02  6.00  13.17  .23    .000
      [CN=67.0         ]
      [ N = 3.0:Tp  .17]
*
 **   CALIB NASHYD       0009  1  5.0     .49     .02  6.00  13.21  .23    .000
      [CN=67.0         ]
      [ N = 3.0:Tp  .17]
*
 **   CALIB NASHYD       0017  1  5.0     .21     .01  6.00  14.56  .25    .000
      [CN=69.0         ]
      [ N = 3.0:Tp  .17]
*
      ADD [0002 + 0001]  0044  3  5.0     .67     .01  6.33   9.00  n/a    .000
*
      ADD [0007 + 0008]  0030  3  5.0     .67     .01  6.08   9.00  n/a    .000
*
      ADD [0016 + 0018]  0039  3  5.0     .73     .02  6.00  13.60  n/a    .000
*
      ADD [0009 + 0017]  0035  3  5.0     .70     .02  6.00  13.62  n/a    .000
*
      ADD [0003 + 0044]  0045  3  5.0    1.03     .01  6.33   8.76  n/a    .000
*
      ADD [0019 + 0030]  0031  3  5.0    2.36     .04  6.17   9.60  n/a    .000
*
```

```
      CHANNEL[ 2 : 0039] 0026  1  5.0      .73      .02  6.08  13.60  n/a    .000
*
      CHANNEL[ 2 : 0035] 0022  1  5.0      .70      .02  6.08  13.62  n/a    .000
*
      ADD [0004 + 0045]  0046  3  5.0     2.51      .03  6.25   8.48  n/a    .000
*
      CHANNEL[ 2 : 0031] 0020  1  5.0     2.36      .04  6.17   9.60  n/a    .000
*
      ADD [0015 + 0026]  0040  3  5.0     1.27      .04  6.08  13.42  n/a    .000
*
      ADD [0010 + 0022]  0036  3  5.0     1.24      .04  6.08  13.42  n/a    .000
*
      ADD [0006 + 0020]  0033  3  5.0     2.71      .04  6.17   9.43  n/a    .000
*
      CHANNEL[ 2 : 0040] 0027  1  5.0     1.27      .04  6.08  13.42  n/a    .000
*
      CHANNEL[ 2 : 0036] 0023  1  5.0     1.24      .04  6.08  13.42  n/a    .000
*
      CHANNEL[ 2 : 0033] 0032  1  5.0     2.71      .04  6.17   9.43  n/a    .000
*
      ADD [0014 + 0027]  0041  3  5.0     1.79      .06  6.08  13.34  n/a    .000
*
      ADD [0011 + 0023]  0037  3  5.0     1.77      .06  6.08  13.34  n/a    .000
*
      ADD [0005 + 0032]  0034  3  5.0     3.88      .06  6.17   9.07  n/a    .000
*
      CHANNEL[ 2 : 0041] 0028  1  5.0     1.79      .06  6.08  13.34  n/a    .000
*
      CHANNEL[ 2 : 0037] 0024  1  5.0     1.77      .06  6.08  13.34  n/a    .000
*
      CHANNEL[ 2 : 0034] 0021  1  5.0     3.88      .06  6.25   9.07  n/a    .000
*
      ADD [0013 + 0028]  0042  3  5.0     2.30      .07  6.08  13.30  n/a    .000
*
      ADD [0012 + 0024]  0038  3  5.0     2.33      .07  6.08  13.32  n/a    .000
*
      ADD [0046 + 0021]  0049  3  5.0     6.39      .09  6.25   8.84  n/a    .000
*
      CHANNEL[ 2 : 0042] 0029  1  5.0     2.30      .07  6.08  13.30  n/a    .000
*
      CHANNEL[ 2 : 0038] 0025  1  5.0     2.33      .07  6.08  13.32  n/a    .000
*
      ADD [0029 + 0025]  0043  3  5.0     4.63      .14  6.08  13.31  n/a    .000
*
      RESRVR [ 2 : 0043] 0052  1  5.0     4.63      .06  6.67  13.31  n/a    .000
      {ST=   .02 ha.m }
*
      CHANNEL[ 2 : 0052] 0047  1  5.0     4.63      .06  6.67  13.31  n/a    .000
*
      ADD [0049 + 0047]  0050  3  5.0    11.02      .14  6.50  10.71  n/a    .000
*
      CHANNEL[ 2 : 0050] 0048  1  5.0    11.02      .13  6.50  10.71  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   4 **
  ****************************

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

      START @   .00 hrs
      --------------------
```

```
      READ STORM                  30.0
      [ Ptot= 67.20 mm ]
      fname : G:\Projects\2020\200977 - Zbigniew Hauderowicz - 2050 Dunrobin Rd
- Additional lots\Storm\Design Sto
      remark: SCS II 12hr 10yr Ottawa
*
  **  CALIB NASHYD       0004  1  5.0    1.49     .03  6.17  12.01  .18    .000
      [CN=58.0          ]
      [ N = 3.0:Tp  .28]
*
  **  CALIB NASHYD       0003  1  5.0     .35     .01  6.33  12.01  .18    .000
      [CN=58.0          ]
      [ N = 3.0:Tp  .38]
*
  **  CALIB NASHYD       0002  1  5.0     .34     .01  6.33  12.01  .18    .000
      [CN=58.0          ]
      [ N = 3.0:Tp  .40]
*
  **  CALIB NASHYD       0001  1  5.0     .33     .01  6.33  13.91  .21    .000
      [CN=61.0          ]
      [ N = 3.0:Tp  .41]
*
  **  CALIB NASHYD       0005  1  5.0    1.17     .03  6.00  11.97  .18    .000
      [CN=58.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0006  1  5.0     .34     .01  6.00  11.97  .18    .000
      [CN=58.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0019  1  5.0    1.69     .04  6.17  14.00  .21    .000
      [CN=61.0          ]
      [ N = 3.0:Tp  .32]
*
  **  CALIB NASHYD       0007  1  5.0     .34     .01  6.08  11.99  .18    .000
      [CN=58.0          ]
      [ N = 3.0:Tp  .19]
*
  **  CALIB NASHYD       0008  1  5.0     .33     .01  6.08  13.90  .21    .000
      [CN=61.0          ]
      [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0013  1  5.0     .51     .02  6.00  18.20  .27    .000
      [CN=67.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0014  1  5.0     .52     .02  6.00  18.20  .27    .000
      [CN=67.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0015  1  5.0     .53     .02  6.00  18.20  .27    .000
      [CN=67.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0016  1  5.0     .53     .02  6.00  18.25  .27    .000
      [CN=67.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0018  1  5.0     .21     .01  6.00  19.92  .30    .000
      [CN=69.0          ]
      [ N = 3.0:Tp  .17]
*
```

```
  **   CALIB NASHYD        0012  1  5.0     .56      .02  6.00  18.31  .27    .000
       [CN=67.0          ]
       [ N = 3.0:Tp  .17]
*
  **   CALIB NASHYD        0011  1  5.0     .53      .02  6.00  18.20  .27    .000
       [CN=67.0          ]
       [ N = 3.0:Tp  .17]
*
  **   CALIB NASHYD        0010  1  5.0     .54      .02  6.00  18.20  .27    .000
       [CN=67.0          ]
       [ N = 3.0:Tp  .17]
*
  **   CALIB NASHYD        0009  1  5.0     .49      .02  6.00  18.25  .27    .000
       [CN=67.0          ]
       [ N = 3.0:Tp  .17]
*
  **   CALIB NASHYD        0017  1  5.0     .21      .01  6.00  19.92  .30    .000
       [CN=69.0          ]
       [ N = 3.0:Tp  .17]
*
       ADD [0002 + 0001]   0044  3  5.0     .67      .01  6.33  12.94  n/a    .000
*
       ADD [0007 + 0008]   0030  3  5.0     .67      .02  6.08  12.93  n/a    .000
*
       ADD [0016 + 0018]   0039  3  5.0     .73      .03  6.00  18.73  n/a    .000
*
       ADD [0009 + 0017]   0035  3  5.0     .70      .03  6.00  18.75  n/a    .000
*
       ADD [0003 + 0044]   0045  3  5.0    1.03      .02  6.33  12.62  n/a    .000
*
       ADD [0019 + 0030]   0031  3  5.0    2.36      .06  6.17  13.69  n/a    .000
*
       CHANNEL[ 2 : 0039]  0026  1  5.0     .73      .03  6.08  18.73  n/a    .000
*
       CHANNEL[ 2 : 0035]  0022  1  5.0     .70      .03  6.08  18.75  n/a    .000
*
       ADD [0004 + 0045]   0046  3  5.0    2.51      .05  6.17  12.26  n/a    .000
*
       CHANNEL[ 2 : 0031]  0020  1  5.0    2.36      .06  6.17  13.69  n/a    .000
*
       ADD [0015 + 0026]   0040  3  5.0    1.27      .06  6.08  18.51  n/a    .000
*
       ADD [0010 + 0022]   0036  3  5.0    1.24      .05  6.08  18.51  n/a    .000
*
       ADD [0006 + 0020]   0033  3  5.0    2.71      .07  6.17  13.48  n/a    .000
*
       CHANNEL[ 2 : 0040]  0027  1  5.0    1.27      .06  6.08  18.50  n/a    .000
*
       CHANNEL[ 2 : 0036]  0023  1  5.0    1.24      .06  6.08  18.51  n/a    .000
*
       CHANNEL[ 2 : 0033]  0032  1  5.0    2.71      .07  6.17  13.48  n/a    .000
*
       ADD [0014 + 0027]   0041  3  5.0    1.79      .08  6.08  18.42  n/a    .000
*
       ADD [0011 + 0023]   0037  3  5.0    1.77      .08  6.08  18.42  n/a    .000
*
       ADD [0005 + 0032]   0034  3  5.0    3.88      .09  6.08  13.02  n/a    .000
*
       CHANNEL[ 2 : 0041]  0028  1  5.0    1.79      .08  6.08  18.42  n/a    .000
*
       CHANNEL[ 2 : 0037]  0024  1  5.0    1.77      .08  6.08  18.42  n/a    .000
*
```

```
      CHANNEL[ 2 : 0034] 0021  1  5.0    3.88     .09  6.25  13.02  n/a    .000
*
      ADD [0013 + 0028]  0042  3  5.0    2.30     .10  6.08  18.37  n/a    .000
*
      ADD [0012 + 0024]  0038  3  5.0    2.33     .10  6.08  18.39  n/a    .000
*
      ADD [0046 + 0021]  0049  3  5.0    6.39     .14  6.25  12.72  n/a    .000
*
      CHANNEL[ 2 : 0042] 0029  1  5.0    2.30     .10  6.08  18.36  n/a    .000
*
      CHANNEL[ 2 : 0038] 0025  1  5.0    2.33     .10  6.08  18.39  n/a    .000
*
      ADD [0029 + 0025]  0043  3  5.0    4.63     .20  6.08  18.38  n/a    .000
*
      RESRVR [ 2 : 0043] 0052  1  5.0    4.63     .10  6.50  18.37  n/a    .000
      {ST=   .02 ha.m }
*
      CHANNEL[ 2 : 0052] 0047  1  5.0    4.63     .10  6.50  18.37  n/a    .000
*
      ADD [0049 + 0047]  0050  3  5.0   11.02     .22  6.33  15.09  n/a    .000
*
      CHANNEL[ 2 : 0050] 0048  1  5.0   11.02     .22  6.42  15.09  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   5 **
  ****************************

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

      START @   .00 hrs
      --------------------
      READ STORM                  30.0
      [ Ptot= 96.00 mm ]
      fname : G:\Projects\2020\200977 - Zbigniew Hauderowicz - 2050 Dunrobin Rd
- Additional lots\Storm\Design Sto
      remark: SCS II 12hr 100yr Ottawa
*
  **  CALIB NASHYD       0004  1  5.0    1.49     .07  6.17  25.38  .26    .000
      [CN=58.0         ]
      [ N = 3.0:Tp  .28]
*
  **  CALIB NASHYD       0003  1  5.0     .35     .01  6.25  25.38  .26    .000
      [CN=58.0         ]
      [ N = 3.0:Tp  .38]
*
  **  CALIB NASHYD       0002  1  5.0     .34     .01  6.25  25.38  .26    .000
      [CN=58.0         ]
      [ N = 3.0:Tp  .40]
*
  **  CALIB NASHYD       0001  1  5.0     .33     .01  6.33  28.52  .30    .000
      [CN=61.0         ]
      [ N = 3.0:Tp  .41]
*
  **  CALIB NASHYD       0005  1  5.0    1.17     .07  6.00  25.30  .26    .000
      [CN=58.0         ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0006  1  5.0     .34     .02  6.00  25.30  .26    .000
      [CN=58.0         ]
      [ N = 3.0:Tp  .17]
*
```

```
  **  CALIB NASHYD        0019  1  5.0    1.69     .09  6.17  28.63  .30     .000
      [CN=61.0         ]
      [ N = 3.0:Tp  .32]
*
  **  CALIB NASHYD        0007  1  5.0     .34     .02  6.08  25.33  .26     .000
      [CN=58.0         ]
      [ N = 3.0:Tp  .19]
*
  **  CALIB NASHYD        0008  1  5.0     .33     .02  6.08  28.49  .30     .000
      [CN=61.0         ]
      [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD        0013  1  5.0     .51     .05  6.00  35.30  .37     .000
      [CN=67.0         ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD        0014  1  5.0     .52     .05  6.00  35.30  .37     .000
      [CN=67.0         ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD        0015  1  5.0     .53     .05  6.00  35.30  .37     .000
      [CN=67.0         ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD        0016  1  5.0     .53     .05  6.00  35.36  .37     .000
      [CN=67.0         ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD        0018  1  5.0     .21     .02  6.00  37.90  .39     .000
      [CN=69.0         ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD        0012  1  5.0     .56     .05  6.00  35.43  .37     .000
      [CN=67.0         ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD        0011  1  5.0     .53     .05  6.00  35.30  .37     .000
      [CN=67.0         ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD        0010  1  5.0     .54     .05  6.00  35.30  .37     .000
      [CN=67.0         ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD        0009  1  5.0     .49     .04  6.00  35.36  .37     .000
      [CN=67.0         ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD        0017  1  5.0     .21     .02  6.00  37.90  .39     .000
      [CN=69.0         ]
      [ N = 3.0:Tp  .17]
*
      ADD [0002 + 0001]   0044  3  5.0     .67     .03  6.33  26.92  n/a     .000
*
      ADD [0007 + 0008]   0030  3  5.0     .67     .04  6.08  26.89  n/a     .000
*
      ADD [0016 + 0018]   0039  3  5.0     .73     .07  6.00  36.09  n/a     .000
*
      ADD [0009 + 0017]   0035  3  5.0     .70     .06  6.00  36.12  n/a     .000
*
      ADD [0003 + 0044]   0045  3  5.0    1.03     .04  6.25  26.39  n/a     .000
*
```

```
      ADD [0019 + 0030]  0031  3  5.0    2.36     .12  6.17  28.13  n/a     .000
*
      CHANNEL[ 2 : 0039] 0026  1  5.0     .73     .07  6.08  36.09  n/a     .000
*
      CHANNEL[ 2 : 0035] 0022  1  5.0     .70     .06  6.08  36.12  n/a     .000
*
      ADD [0004 + 0045]  0046  3  5.0    2.51     .11  6.17  25.79  n/a     .000
*
      CHANNEL[ 2 : 0031] 0020  1  5.0    2.36     .12  6.17  28.13  n/a     .000
*
      ADD [0015 + 0026]  0040  3  5.0    1.27     .11  6.00  35.75  n/a     .000
*
      ADD [0010 + 0022]  0036  3  5.0    1.24     .11  6.00  35.76  n/a     .000
*
      ADD [0006 + 0020]  0033  3  5.0    2.71     .14  6.08  27.77  n/a     .000
*
      CHANNEL[ 2 : 0040] 0027  1  5.0    1.27     .11  6.08  35.75  n/a     .000
*
      CHANNEL[ 2 : 0036] 0023  1  5.0    1.24     .11  6.08  35.76  n/a     .000
*
      CHANNEL[ 2 : 0033] 0032  1  5.0    2.71     .14  6.17  27.77  n/a     .000
*
      ADD [0014 + 0027]  0041  3  5.0    1.79     .16  6.08  35.62  n/a     .000
*
      ADD [0011 + 0023]  0037  3  5.0    1.77     .15  6.08  35.62  n/a     .000
*
      ADD [0005 + 0032]  0034  3  5.0    3.88     .21  6.08  27.03  n/a     .000
*
      CHANNEL[ 2 : 0041] 0028  1  5.0    1.79     .16  6.08  35.62  n/a     .000
*
      CHANNEL[ 2 : 0037] 0024  1  5.0    1.77     .16  6.08  35.62  n/a     .000
*
      CHANNEL[ 2 : 0034] 0021  1  5.0    3.88     .20  6.17  27.02  n/a     .000
*
      ADD [0013 + 0028]  0042  3  5.0    2.30     .20  6.08  35.55  n/a     .000
*
      ADD [0012 + 0024]  0038  3  5.0    2.33     .20  6.08  35.57  n/a     .000
*
      ADD [0046 + 0021]  0049  3  5.0    6.39     .31  6.17  26.54  n/a     .000
*
      CHANNEL[ 2 : 0042] 0029  1  5.0    2.30     .20  6.08  35.54  n/a     .000
*
      CHANNEL[ 2 : 0038] 0025  1  5.0    2.33     .20  6.08  35.57  n/a     .000
*
      ADD [0029 + 0025]  0043  3  5.0    4.63     .40  6.08  35.56  n/a     .000
*
      RESRVR [ 2 : 0043] 0052  1  5.0    4.63     .22  6.42  35.55  n/a     .000
      {ST=    .04 ha.m }
*
      CHANNEL[ 2 : 0052] 0047  1  5.0    4.63     .22  6.42  35.55  n/a     .000
*
      ADD [0049 + 0047]  0050  3  5.0   11.02     .51  6.25  30.32  n/a     .000
*
      CHANNEL[ 2 : 0050] 0048  1  5.0   11.02     .50  6.25  30.32  n/a     .000
*
  ****************************
  ** SIMULATION NUMBER:   6 **
  ****************************

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

```
      START @   .00 hrs
      --------------------
      CHIC STORM               10.0
      [ Ptot= 56.17 mm ]
*
  **  CALIB NASHYD       0004  1  5.0    1.49     .02  4.33   7.93  .14    .000
      [CN=58.0          ]
      [ N = 3.0:Tp  .28]
*
  **  CALIB NASHYD       0003  1  5.0     .35     .00  4.50   7.93  .14    .000
      [CN=58.0          ]
      [ N = 3.0:Tp  .38]
*
  **  CALIB NASHYD       0002  1  5.0     .34     .00  4.50   7.93  .14    .000
      [CN=58.0          ]
      [ N = 3.0:Tp  .40]
*
  **  CALIB NASHYD       0001  1  5.0     .33     .00  4.50   9.36  .17    .000
      [CN=61.0          ]
      [ N = 3.0:Tp  .41]
*
  **  CALIB NASHYD       0005  1  5.0    1.17     .02  4.17   7.90  .14    .000
      [CN=58.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0006  1  5.0     .34     .01  4.17   7.90  .14    .000
      [CN=58.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0019  1  5.0    1.69     .02  4.42   9.44  .17    .000
      [CN=61.0          ]
      [ N = 3.0:Tp  .32]
*
  **  CALIB NASHYD       0007  1  5.0     .34     .01  4.25   7.91  .14    .000
      [CN=58.0          ]
      [ N = 3.0:Tp  .19]
*
  **  CALIB NASHYD       0008  1  5.0     .33     .01  4.25   9.36  .17    .000
      [CN=61.0          ]
      [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0013  1  5.0     .51     .02  4.17  12.68  .23    .000
      [CN=67.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0014  1  5.0     .52     .02  4.17  12.68  .23    .000
      [CN=67.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0015  1  5.0     .53     .02  4.17  12.68  .23    .000
      [CN=67.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0016  1  5.0     .53     .02  4.17  12.73  .23    .000
      [CN=67.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0018  1  5.0     .21     .01  4.17  14.04  .25    .000
      [CN=69.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0012  1  5.0     .56     .02  4.17  12.77  .23    .000
```

```
       [CN=67.0          ]
       [ N = 3.0:Tp  .17]
*
  **   CALIB NASHYD       0011  1  5.0     .53     .02  4.17  12.68  .23    .000
       [CN=67.0          ]
       [ N = 3.0:Tp  .17]
*
  **   CALIB NASHYD       0010  1  5.0     .54     .02  4.17  12.68  .23    .000
       [CN=67.0          ]
       [ N = 3.0:Tp  .17]
*
  **   CALIB NASHYD       0009  1  5.0     .49     .02  4.17  12.73  .23    .000
       [CN=67.0          ]
       [ N = 3.0:Tp  .17]
*
  **   CALIB NASHYD       0017  1  5.0     .21     .01  4.17  14.04  .25    .000
       [CN=69.0          ]
       [ N = 3.0:Tp  .17]
*
       ADD [0002 + 0001]  0044  3  5.0     .67     .01  4.50   8.63  n/a    .000
*
       ADD [0007 + 0008]  0030  3  5.0     .67     .01  4.25   8.63  n/a    .000
*
       ADD [0016 + 0018]  0039  3  5.0     .73     .02  4.17  13.10  n/a    .000
*
       ADD [0009 + 0017]  0035  3  5.0     .70     .02  4.17  13.12  n/a    .000
*
       ADD [0003 + 0044]  0045  3  5.0    1.03     .01  4.50   8.39  n/a    .000
*
       ADD [0019 + 0030]  0031  3  5.0    2.36     .03  4.33   9.21  n/a    .000
*
       CHANNEL[ 2 : 0039] 0026  1  5.0     .73     .02  4.17  13.10  n/a    .000
*
       CHANNEL[ 2 : 0035] 0022  1  5.0     .70     .02  4.17  13.12  n/a    .000
*
       ADD [0004 + 0045]  0046  3  5.0    2.51     .03  4.42   8.12  n/a    .000
*
       CHANNEL[ 2 : 0031] 0020  1  5.0    2.36     .03  4.33   9.21  n/a    .000
*
       ADD [0015 + 0026]  0040  3  5.0    1.27     .04  4.17  12.92  n/a    .000
*
       ADD [0010 + 0022]  0036  3  5.0    1.24     .04  4.17  12.93  n/a    .000
*
       ADD [0006 + 0020]  0033  3  5.0    2.71     .04  4.33   9.04  n/a    .000
*
       CHANNEL[ 2 : 0040] 0027  1  5.0    1.27     .04  4.17  12.92  n/a    .000
*
       CHANNEL[ 2 : 0036] 0023  1  5.0    1.24     .04  4.17  12.93  n/a    .000
*
       CHANNEL[ 2 : 0033] 0032  1  5.0    2.71     .04  4.33   9.04  n/a    .000
*
       ADD [0014 + 0027]  0041  3  5.0    1.79     .06  4.17  12.85  n/a    .000
*
       ADD [0011 + 0023]  0037  3  5.0    1.77     .05  4.17  12.85  n/a    .000
*
       ADD [0005 + 0032]  0034  3  5.0    3.88     .06  4.33   8.70  n/a    .000
*
       CHANNEL[ 2 : 0041] 0028  1  5.0    1.79     .06  4.25  12.85  n/a    .000
*
       CHANNEL[ 2 : 0037] 0024  1  5.0    1.77     .05  4.25  12.85  n/a    .000
*
       CHANNEL[ 2 : 0034] 0021  1  5.0    3.88     .05  4.50   8.70  n/a    .000
```

```
*
     ADD [0013 + 0028]  0042  3  5.0    2.30     .07  4.17  12.81  n/a    .000
*
     ADD [0012 + 0024]  0038  3  5.0    2.33     .07  4.17  12.83  n/a    .000
*
     ADD [0046 + 0021]  0049  3  5.0    6.39     .08  4.42   8.47  n/a    .000
*
     CHANNEL[ 2 : 0042] 0029  1  5.0    2.30     .07  4.25  12.81  n/a    .000
*
     CHANNEL[ 2 : 0038] 0025  1  5.0    2.33     .07  4.25  12.83  n/a    .000
*
     ADD [0029 + 0025]  0043  3  5.0    4.63     .14  4.25  12.82  n/a    .000
*
     RESRVR [ 2 : 0043] 0052  1  5.0    4.63     .05  4.83  12.82  n/a    .000
     {ST=   .02 ha.m }
*
     CHANNEL[ 2 : 0052] 0047  1  5.0    4.63     .05  4.83  12.82  n/a    .000
*
     ADD [0049 + 0047]  0050  3  5.0   11.02     .12  4.67  10.30  n/a    .000
*
     CHANNEL[ 2 : 0050] 0048  1  5.0   11.02     .12  4.67  10.29  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   7 **
  ****************************

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

     START @   .00 hrs
     --------------------
     CHIC STORM                     10.0
     [ Ptot= 93.90 mm ]
*
  **  CALIB NASHYD       0004  1  5.0    1.49     .07  4.33  24.29  .26    .000
     [CN=58.0         ]
     [ N = 3.0:Tp  .28]
*
  **  CALIB NASHYD       0003  1  5.0     .35     .01  4.42  24.29  .26    .000
     [CN=58.0         ]
     [ N = 3.0:Tp  .38]
*
  **  CALIB NASHYD       0002  1  5.0     .34     .01  4.42  24.29  .26    .000
     [CN=58.0         ]
     [ N = 3.0:Tp  .40]
*
  **  CALIB NASHYD       0001  1  5.0     .33     .01  4.50  27.34  .29    .000
     [CN=61.0         ]
     [ N = 3.0:Tp  .41]
*
  **  CALIB NASHYD       0005  1  5.0    1.17     .07  4.17  24.21  .26    .000
     [CN=58.0         ]
     [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0006  1  5.0     .34     .02  4.17  24.21  .26    .000
     [CN=58.0         ]
     [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0019  1  5.0    1.69     .09  4.33  27.45  .29    .000
     [CN=61.0         ]
     [ N = 3.0:Tp  .32]
*
```

```
  **  CALIB NASHYD       0007  1  5.0      .34      .02  4.17  24.24  .26    .000
      [CN=58.0          ]
      [ N = 3.0:Tp  .19]
*
  **  CALIB NASHYD       0008  1  5.0      .33      .02  4.25  27.31  .29    .000
      [CN=61.0          ]
      [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0013  1  5.0      .51      .05  4.17  33.94  .36    .000
      [CN=67.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0014  1  5.0      .52      .05  4.17  33.94  .36    .000
      [CN=67.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0015  1  5.0      .53      .05  4.17  33.94  .36    .000
      [CN=67.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0016  1  5.0      .53      .05  4.17  34.01  .36    .000
      [CN=67.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0018  1  5.0      .21      .02  4.08  36.49  .39    .000
      [CN=69.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0012  1  5.0      .56      .05  4.17  34.07  .36    .000
      [CN=67.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0011  1  5.0      .53      .05  4.17  33.94  .36    .000
      [CN=67.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0010  1  5.0      .54      .05  4.17  33.94  .36    .000
      [CN=67.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0009  1  5.0      .49      .05  4.17  34.01  .36    .000
      [CN=67.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0017  1  5.0      .21      .02  4.08  36.49  .39    .000
      [CN=69.0          ]
      [ N = 3.0:Tp  .17]
*
      ADD [0002 + 0001]  0044  3  5.0      .67      .03  4.50  25.78  n/a    .000
*
      ADD [0007 + 0008]  0030  3  5.0      .67      .04  4.17  25.76  n/a    .000
*
      ADD [0016 + 0018]  0039  3  5.0      .73      .07  4.08  34.71  n/a    .000
*
      ADD [0009 + 0017]  0035  3  5.0      .70      .07  4.08  34.75  n/a    .000
*
      ADD [0003 + 0044]  0045  3  5.0     1.03      .04  4.42  25.27  n/a    .000
*
      ADD [0019 + 0030]  0031  3  5.0     2.36      .12  4.25  26.97  n/a    .000
*
      CHANNEL[ 2 : 0039] 0026  1  5.0      .73      .07  4.17  34.71  n/a    .000
*
```

```
      CHANNEL[ 2 : 0035] 0022  1  5.0     .70     .07  4.17  34.75  n/a    .000
*
      ADD [0004 + 0045]  0046  3  5.0    2.51     .11  4.33  24.69  n/a    .000
*
      CHANNEL[ 2 : 0031] 0020  1  5.0    2.36     .12  4.33  26.97  n/a    .000
*
      ADD [0015 + 0026]  0040  3  5.0    1.27     .12  4.17  34.39  n/a    .000
*
      ADD [0010 + 0022]  0036  3  5.0    1.24     .12  4.17  34.40  n/a    .000
*
      ADD [0006 + 0020]  0033  3  5.0    2.71     .14  4.25  26.62  n/a    .000
*
      CHANNEL[ 2 : 0040] 0027  1  5.0    1.27     .13  4.17  34.39  n/a    .000
*
      CHANNEL[ 2 : 0036] 0023  1  5.0    1.24     .12  4.17  34.40  n/a    .000
*
      CHANNEL[ 2 : 0033] 0032  1  5.0    2.71     .14  4.33  26.62  n/a    .000
*
      ADD [0014 + 0027]  0041  3  5.0    1.79     .17  4.17  34.26  n/a    .000
*
      ADD [0011 + 0023]  0037  3  5.0    1.77     .17  4.17  34.26  n/a    .000
*
      ADD [0005 + 0032]  0034  3  5.0    3.88     .20  4.25  25.89  n/a    .000
*
      CHANNEL[ 2 : 0041] 0028  1  5.0    1.79     .18  4.17  34.26  n/a    .000
*
      CHANNEL[ 2 : 0037] 0024  1  5.0    1.77     .18  4.17  34.26  n/a    .000
*
      CHANNEL[ 2 : 0034] 0021  1  5.0    3.88     .19  4.33  25.89  n/a    .000
*
      ADD [0013 + 0028]  0042  3  5.0    2.30     .23  4.17  34.19  n/a    .000
*
      ADD [0012 + 0024]  0038  3  5.0    2.33     .23  4.17  34.21  n/a    .000
*
      ADD [0046 + 0021]  0049  3  5.0    6.39     .30  4.33  25.42  n/a    .000
*
      CHANNEL[ 2 : 0042] 0029  1  5.0    2.30     .22  4.17  34.18  n/a    .000
*
      CHANNEL[ 2 : 0038] 0025  1  5.0    2.33     .23  4.17  34.21  n/a    .000
*
      ADD [0029 + 0025]  0043  3  5.0    4.63     .45  4.17  34.20  n/a    .000
*
      RESRVR [ 2 : 0043] 0052  1  5.0    4.63     .21  4.50  34.19  n/a    .000
      {ST=   .04 ha.m }
*
      CHANNEL[ 2 : 0052] 0047  1  5.0    4.63     .21  4.58  34.19  n/a    .000
*
      ADD [0049 + 0047]  0050  3  5.0   11.02     .49  4.42  29.10  n/a    .000
*
      CHANNEL[ 2 : 0050] 0048  1  5.0   11.02     .49  4.42  29.10  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   8 **
  ****************************

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

      START @   .00 hrs
      --------------------
      READ STORM                   5.0
      [ Ptot= 83.99 mm ]
```

```
     fname : G:\Projects\2020\200977 - Zbigniew Hauderowicz - 2050 Dunrobin Rd
- Additional lots\Storm\Design Sto
     remark: Ottawa July 1 1979
*
  **  CALIB NASHYD        0004  1  5.0    1.49     .09  1.83  19.38  .23    .000
      [CN=58.0          ]
      [ N = 3.0:Tp  .28]
*
  **  CALIB NASHYD        0003  1  5.0     .35     .02  1.92  19.38  .23    .000
      [CN=58.0          ]
      [ N = 3.0:Tp  .38]
*
  **  CALIB NASHYD        0002  1  5.0     .34     .02  2.00  19.38  .23    .000
      [CN=58.0          ]
      [ N = 3.0:Tp  .40]
*
  **  CALIB NASHYD        0001  1  5.0     .33     .02  2.00  22.00  .26    .000
      [CN=61.0          ]
      [ N = 3.0:Tp  .41]
*
  **  CALIB NASHYD        0005  1  5.0    1.17     .08  1.67  19.32  .23    .000
      [CN=58.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD        0006  1  5.0     .34     .02  1.67  19.32  .23    .000
      [CN=58.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD        0019  1  5.0    1.69     .11  1.83  22.10  .26    .000
      [CN=61.0          ]
      [ N = 3.0:Tp  .32]
*
  **  CALIB NASHYD        0007  1  5.0     .34     .02  1.67  19.34  .23    .000
      [CN=58.0          ]
      [ N = 3.0:Tp  .19]
*
  **  CALIB NASHYD        0008  1  5.0     .33     .02  1.75  21.98  .26    .000
      [CN=61.0          ]
      [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD        0013  1  5.0     .51     .05  1.67  27.76  .33    .000
      [CN=67.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD        0014  1  5.0     .52     .05  1.67  27.76  .33    .000
      [CN=67.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD        0015  1  5.0     .53     .05  1.67  27.76  .33    .000
      [CN=67.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD        0016  1  5.0     .53     .05  1.67  27.82  .33    .000
      [CN=67.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD        0018  1  5.0     .21     .02  1.67  30.01  .36    .000
      [CN=69.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD        0012  1  5.0     .56     .06  1.67  27.88  .33    .000
      [CN=67.0          ]
```

```
        [ N = 3.0:Tp  .17]
*
  **    CALIB NASHYD       0011  1  5.0     .53     .05  1.67  27.76  .33    .000
        [CN=67.0         ]
        [ N = 3.0:Tp  .17]
*
  **    CALIB NASHYD       0010  1  5.0     .54     .05  1.67  27.76  .33    .000
        [CN=67.0         ]
        [ N = 3.0:Tp  .17]
*
  **    CALIB NASHYD       0009  1  5.0     .49     .05  1.67  27.82  .33    .000
        [CN=67.0         ]
        [ N = 3.0:Tp  .17]
*
  **    CALIB NASHYD       0017  1  5.0     .21     .02  1.67  30.01  .36    .000
        [CN=69.0         ]
        [ N = 3.0:Tp  .17]
*
        ADD [0002 + 0001]  0044  3  5.0     .67     .03  2.00  20.66  n/a    .000
*
        ADD [0007 + 0008]  0030  3  5.0     .67     .05  1.75  20.64  n/a    .000
*
        ADD [0016 + 0018]  0039  3  5.0     .73     .08  1.67  28.44  n/a    .000
*
        ADD [0009 + 0017]  0035  3  5.0     .70     .07  1.67  28.47  n/a    .000
*
        ADD [0003 + 0044]  0045  3  5.0    1.03     .05  2.00  20.22  n/a    .000
*
        ADD [0019 + 0030]  0031  3  5.0    2.36     .15  1.75  21.69  n/a    .000
*
        CHANNEL[ 2 : 0039] 0026  1  5.0     .73     .08  1.67  28.44  n/a    .000
*
        CHANNEL[ 2 : 0035] 0022  1  5.0     .70     .07  1.67  28.47  n/a    .000
*
        ADD [0004 + 0045]  0046  3  5.0    2.51     .14  1.83  19.72  n/a    .000
*
        CHANNEL[ 2 : 0031] 0020  1  5.0    2.36     .15  1.83  21.69  n/a    .000
*
        ADD [0015 + 0026]  0040  3  5.0    1.27     .13  1.67  28.16  n/a    .000
*
        ADD [0010 + 0022]  0036  3  5.0    1.24     .13  1.67  28.16  n/a    .000
*
        ADD [0006 + 0020]  0033  3  5.0    2.71     .17  1.75  21.39  n/a    .000
*
        CHANNEL[ 2 : 0040] 0027  1  5.0    1.27     .13  1.67  28.15  n/a    .000
*
        CHANNEL[ 2 : 0036] 0023  1  5.0    1.24     .13  1.67  28.16  n/a    .000
*
        CHANNEL[ 2 : 0033] 0032  1  5.0    2.71     .17  1.83  21.39  n/a    .000
*
        ADD [0014 + 0027]  0041  3  5.0    1.79     .18  1.67  28.04  n/a    .000
*
        ADD [0011 + 0023]  0037  3  5.0    1.77     .18  1.67  28.04  n/a    .000
*
        ADD [0005 + 0032]  0034  3  5.0    3.88     .25  1.75  20.76  n/a    .000
*
        CHANNEL[ 2 : 0041] 0028  1  5.0    1.79     .18  1.67  28.04  n/a    .000
*
        CHANNEL[ 2 : 0037] 0024  1  5.0    1.77     .18  1.67  28.04  n/a    .000
*
        CHANNEL[ 2 : 0034] 0021  1  5.0    3.88     .24  1.83  20.76  n/a    .000
*
```

```
      ADD [0013 + 0028]  0042  3  5.0    2.30     .23  1.67  27.98  n/a    .000
*
      ADD [0012 + 0024]  0038  3  5.0    2.33     .24  1.67  28.00  n/a    .000
*
      ADD [0046 + 0021]  0049  3  5.0    6.39     .37  1.83  20.35  n/a    .000
*
      CHANNEL[ 2 : 0042] 0029  1  5.0    2.30     .23  1.75  27.97  n/a    .000
*
      CHANNEL[ 2 : 0038] 0025  1  5.0    2.33     .23  1.75  28.00  n/a    .000
*
      ADD [0029 + 0025]  0043  3  5.0    4.63     .46  1.75  27.98  n/a    .000
*
      RESRVR [ 2 : 0043] 0052  1  5.0    4.63     .26  2.08  27.98  n/a    .000
      {ST=   .06 ha.m }
*
      CHANNEL[ 2 : 0052] 0047  1  5.0    4.63     .26  2.08  27.98  n/a    .000
*
      ADD [0049 + 0047]  0050  3  5.0   11.02     .61  1.92  23.55  n/a    .000
*
      CHANNEL[ 2 : 0050] 0048  1  5.0   11.02     .61  1.92  23.55  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   9 **
  ****************************

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

      START @   .00 hrs
      --------------------
      READ STORM                   5.0
      [ Ptot= 80.57 mm ]
      fname : G:\Projects\2020\200977 - Zbigniew Hauderowicz - 2050 Dunrobin Rd
- Additional lots\Storm\Design Sto
      remark: Ottawa Aug 4 1988
*
  **  CALIB NASHYD       0004  1  5.0    1.49     .08  2.17  17.77  .22    .000
      [CN=58.0         ]
      [ N = 3.0:Tp  .28]
*
  **  CALIB NASHYD       0003  1  5.0     .35     .02  2.25  17.78  .22    .000
      [CN=58.0         ]
      [ N = 3.0:Tp  .38]
*
  **  CALIB NASHYD       0002  1  5.0     .34     .01  2.25  17.78  .22    .000
      [CN=58.0         ]
      [ N = 3.0:Tp  .40]
*
  **  CALIB NASHYD       0001  1  5.0     .33     .02  2.25  20.25  .25    .000
      [CN=61.0         ]
      [ N = 3.0:Tp  .41]
*
  **  CALIB NASHYD       0005  1  5.0    1.17     .09  2.08  17.72  .22    .000
      [CN=58.0         ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0006  1  5.0     .34     .02  2.08  17.72  .22    .000
      [CN=58.0         ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0019  1  5.0    1.69     .10  2.17  20.35  .25    .000
      [CN=61.0         ]
```

```
      [ N = 3.0:Tp  .32]
*
  **  CALIB NASHYD        0007  1  5.0      .34      .02  2.08  17.74  .22     .000
      [CN=58.0          ]
      [ N = 3.0:Tp  .19]
*
  **  CALIB NASHYD        0008  1  5.0      .33      .02  2.08  20.23  .25     .000
      [CN=61.0          ]
      [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD        0013  1  5.0      .51      .05  2.08  25.71  .32     .000
      [CN=67.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD        0014  1  5.0      .52      .05  2.08  25.71  .32     .000
      [CN=67.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD        0015  1  5.0      .53      .05  2.08  25.71  .32     .000
      [CN=67.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD        0016  1  5.0      .53      .05  2.08  25.77  .32     .000
      [CN=67.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD        0018  1  5.0      .21      .02  2.08  27.86  .35     .000
      [CN=69.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD        0012  1  5.0      .56      .06  2.08  25.83  .32     .000
      [CN=67.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD        0011  1  5.0      .53      .05  2.08  25.71  .32     .000
      [CN=67.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD        0010  1  5.0      .54      .05  2.08  25.71  .32     .000
      [CN=67.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD        0009  1  5.0      .49      .05  2.08  25.77  .32     .000
      [CN=67.0          ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD        0017  1  5.0      .21      .02  2.08  27.86  .35     .000
      [CN=69.0          ]
      [ N = 3.0:Tp  .17]
*
      ADD [0002 + 0001]   0044  3  5.0      .67      .03  2.25  18.99  n/a     .000
*
      ADD [0007 + 0008]   0030  3  5.0      .67      .05  2.08  18.97  n/a     .000
*
      ADD [0016 + 0018]   0039  3  5.0      .73      .08  2.08  26.36  n/a     .000
*
      ADD [0009 + 0017]   0035  3  5.0      .70      .07  2.08  26.39  n/a     .000
*
      ADD [0003 + 0044]   0045  3  5.0     1.03      .05  2.25  18.57  n/a     .000
*
      ADD [0019 + 0030]   0031  3  5.0     2.36      .14  2.08  19.96  n/a     .000
*
```

```
      CHANNEL[ 2 : 0039] 0026  1  5.0     .73     .08  2.08  26.36  n/a    .000
*
      CHANNEL[ 2 : 0035] 0022  1  5.0     .70     .08  2.08  26.39  n/a    .000
*
      ADD [0004 + 0045]  0046  3  5.0    2.51     .12  2.17  18.10  n/a    .000
*
      CHANNEL[ 2 : 0031] 0020  1  5.0    2.36     .14  2.17  19.96  n/a    .000
*
      ADD [0015 + 0026]  0040  3  5.0    1.27     .13  2.08  26.09  n/a    .000
*
      ADD [0010 + 0022]  0036  3  5.0    1.24     .13  2.08  26.10  n/a    .000
*
      ADD [0006 + 0020]  0033  3  5.0    2.71     .16  2.08  19.67  n/a    .000
*
      CHANNEL[ 2 : 0040] 0027  1  5.0    1.27     .13  2.08  26.09  n/a    .000
*
      CHANNEL[ 2 : 0036] 0023  1  5.0    1.24     .13  2.08  26.10  n/a    .000
*
      CHANNEL[ 2 : 0033] 0032  1  5.0    2.71     .16  2.17  19.67  n/a    .000
*
      ADD [0014 + 0027]  0041  3  5.0    1.79     .18  2.08  25.98  n/a    .000
*
      ADD [0011 + 0023]  0037  3  5.0    1.77     .18  2.08  25.98  n/a    .000
*
      ADD [0005 + 0032]  0034  3  5.0    3.88     .24  2.08  19.08  n/a    .000
*
      CHANNEL[ 2 : 0041] 0028  1  5.0    1.79     .18  2.08  25.98  n/a    .000
*
      CHANNEL[ 2 : 0037] 0024  1  5.0    1.77     .18  2.08  25.98  n/a    .000
*
      CHANNEL[ 2 : 0034] 0021  1  5.0    3.88     .22  2.17  19.08  n/a    .000
*
      ADD [0013 + 0028]  0042  3  5.0    2.30     .23  2.08  25.92  n/a    .000
*
      ADD [0012 + 0024]  0038  3  5.0    2.33     .24  2.08  25.94  n/a    .000
*
      ADD [0046 + 0021]  0049  3  5.0    6.39     .34  2.17  18.69  n/a    .000
*
      CHANNEL[ 2 : 0042] 0029  1  5.0    2.30     .22  2.08  25.91  n/a    .000
*
      CHANNEL[ 2 : 0038] 0025  1  5.0    2.33     .22  2.08  25.94  n/a    .000
*
      ADD [0029 + 0025]  0043  3  5.0    4.63     .44  2.08  25.93  n/a    .000
*
      RESRVR [ 2 : 0043] 0052  1  5.0    4.63     .24  2.33  25.92  n/a    .000
      {ST=   .05 ha.m }
*
      CHANNEL[ 2 : 0052] 0047  1  5.0    4.63     .24  2.33  25.92  n/a    .000
*
      ADD [0049 + 0047]  0050  3  5.0   11.02     .55  2.25  21.73  n/a    .000
*
      CHANNEL[ 2 : 0050] 0048  1  5.0   11.02     .55  2.25  21.73  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:  10 **
  ****************************

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

      START @   .00 hrs
      --------------------
```

```
      READ STORM                    10.0
      [ Ptot= 25.00 mm ]
      fname : G:\Projects\2020\200977 - Zbigniew Hauderowicz - 2050 Dunrobin Rd
- Additional lots\Storm\Design Sto
      remark: twentyfive mm 4 hr chicago storm
*
  **  CALIB NASHYD       0004  1  5.0    1.49     .00  2.67    .64  .03    .000
      [CN=58.0         ]
      [ N = 3.0:Tp  .28]
*
  **  CALIB NASHYD       0003  1  5.0     .35     .00  2.92    .64  .03    .000
      [CN=58.0         ]
      [ N = 3.0:Tp  .38]
*
  **  CALIB NASHYD       0002  1  5.0     .34     .00  3.00    .64  .03    .000
      [CN=58.0         ]
      [ N = 3.0:Tp  .40]
*
  **  CALIB NASHYD       0001  1  5.0     .33     .00  2.67    .93  .04    .000
      [CN=61.0         ]
      [ N = 3.0:Tp  .41]
*
  **  CALIB NASHYD       0005  1  5.0    1.17     .00  2.33    .64  .03    .000
      [CN=58.0         ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0006  1  5.0     .34     .00  2.33    .64  .03    .000
      [CN=58.0         ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0019  1  5.0    1.69     .00  2.42    .96  .04    .000
      [CN=61.0         ]
      [ N = 3.0:Tp  .32]
*
  **  CALIB NASHYD       0007  1  5.0     .34     .00  2.33    .64  .03    .000
      [CN=58.0         ]
      [ N = 3.0:Tp  .19]
*
  **  CALIB NASHYD       0008  1  5.0     .33     .00  2.17    .93  .04    .000
      [CN=61.0         ]
      [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0013  1  5.0     .51     .00  1.75   1.72  .07    .000
      [CN=67.0         ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0014  1  5.0     .52     .00  1.75   1.72  .07    .000
      [CN=67.0         ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0015  1  5.0     .53     .00  1.75   1.72  .07    .000
      [CN=67.0         ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0016  1  5.0     .53     .00  1.75   1.74  .07    .000
      [CN=67.0         ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0018  1  5.0     .21     .00  1.75   2.10  .08    .000
      [CN=69.0         ]
      [ N = 3.0:Tp  .17]
*
```

```
  **  CALIB NASHYD       0012  1  5.0     .56     .00  1.75   1.76  .07    .000
      [CN=67.0         ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0011  1  5.0     .53     .00  1.75   1.72  .07    .000
      [CN=67.0         ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0010  1  5.0     .54     .00  1.75   1.72  .07    .000
      [CN=67.0         ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0009  1  5.0     .49     .00  1.75   1.74  .07    .000
      [CN=67.0         ]
      [ N = 3.0:Tp  .17]
*
  **  CALIB NASHYD       0017  1  5.0     .21     .00  1.75   2.10  .08    .000
      [CN=69.0         ]
      [ N = 3.0:Tp  .17]
*
      ADD [0002 + 0001]  0044  3  5.0     .67     .00  2.75    .78  n/a    .000
*
      ADD [0007 + 0008]  0030  3  5.0     .67     .00  2.25    .78  n/a    .000
*
      ADD [0016 + 0018]  0039  3  5.0     .73     .00  1.75   1.84  n/a    .000
*
      ADD [0009 + 0017]  0035  3  5.0     .70     .00  1.75   1.85  n/a    .000
*
      ADD [0003 + 0044]  0045  3  5.0    1.03     .00  2.83    .73  n/a    .000
*
      ADD [0019 + 0030]  0031  3  5.0    2.36     .00  2.33    .91  n/a    .000
*
      CHANNEL[ 2 : 0039] 0026  1  5.0     .73     .00  1.83   1.84  n/a    .000
*
      CHANNEL[ 2 : 0035] 0022  1  5.0     .70     .00  1.83   1.85  n/a    .000
*
      ADD [0004 + 0045]  0046  3  5.0    2.51     .00  2.75    .68  n/a    .000
*
      CHANNEL[ 2 : 0031] 0020  1  5.0    2.36     .00  2.42    .91  n/a    .000
*
      ADD [0015 + 0026]  0040  3  5.0    1.27     .00  1.83   1.79  n/a    .000
*
      ADD [0010 + 0022]  0036  3  5.0    1.24     .00  1.83   1.79  n/a    .000
*
      ADD [0006 + 0020]  0033  3  5.0    2.71     .00  2.42    .88  n/a    .000
*
      CHANNEL[ 2 : 0040] 0027  1  5.0    1.27     .00  1.83   1.79  n/a    .000
*
      CHANNEL[ 2 : 0036] 0023  1  5.0    1.24     .00  1.83   1.79  n/a    .000
*
      CHANNEL[ 2 : 0033] 0032  1  5.0    2.71     .00  2.50    .88  n/a    .000
*
      ADD [0014 + 0027]  0041  3  5.0    1.79     .01  1.83   1.77  n/a    .000
*
      ADD [0011 + 0023]  0037  3  5.0    1.77     .01  1.83   1.77  n/a    .000
*
      ADD [0005 + 0032]  0034  3  5.0    3.88     .00  2.42    .81  n/a    .000
*
      CHANNEL[ 2 : 0041] 0028  1  5.0    1.79     .01  1.92   1.77  n/a    .000
*
      CHANNEL[ 2 : 0037] 0024  1  5.0    1.77     .01  1.92   1.77  n/a    .000
*
```

```
      CHANNEL[ 2 : 0034] 0021  1  5.0    3.88     .00  2.83   .80  n/a    .000
*
      ADD [0013 + 0028]  0042  3  5.0    2.30     .01  1.83  1.76  n/a    .000
*
      ADD [0012 + 0024]  0038  3  5.0    2.33     .01  1.83  1.77  n/a    .000
*
      ADD [0046 + 0021]  0049  3  5.0    6.39     .01  2.83   .75  n/a    .000
*
      CHANNEL[ 2 : 0042] 0029  1  5.0    2.30     .01  2.00  1.76  n/a    .000
*
      CHANNEL[ 2 : 0038] 0025  1  5.0    2.33     .01  2.00  1.77  n/a    .000
*
      ADD [0029 + 0025]  0043  3  5.0    4.63     .01  2.00  1.76  n/a    .000
*
      RESRVR [ 2 : 0043] 0052  1  5.0    4.63     .01  2.42  1.76  n/a    .000
      {ST=   .00 ha.m }
*
      CHANNEL[ 2 : 0052] 0047  1  5.0    4.63     .01  2.50  1.76  n/a    .000
*
      ADD [0049 + 0047]  0050  3  5.0   11.02     .02  2.58  1.18  n/a    .000
*
      CHANNEL[ 2 : 0050] 0048  1  5.0   11.02     .02  2.67  1.17  n/a    .000
*
 FINISH

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

```
****************************
  ** SIMULATION NUMBER:   1 **
  ****************************
--------------------
| ADD HYD   (0043) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0029):      2.30    .058     3.17    10.20
        + ID2= 2 (0025):      2.33    .059     3.17    10.22
          ==================================================
          ID = 3 (0043):      4.63    .117     3.17    10.21

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
  ****************************
  ** SIMULATION NUMBER:   2 **
  ****************************
--------------------
| ADD HYD   (0043) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0029):      2.30    .182     3.08    29.82
        + ID2= 2 (0025):      2.33    .184     3.08    29.85
          ==================================================
          ID = 3 (0043):      4.63    .367     3.08    29.83

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
  ****************************
  ** SIMULATION NUMBER:   3 **
  ****************************
--------------------
| ADD HYD   (0043) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0029):      2.30    .070     6.08    13.30
        + ID2= 2 (0025):      2.33    .071     6.08    13.32
          ==================================================
          ID = 3 (0043):      4.63    .142     6.08    13.31

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
  ****************************
  ** SIMULATION NUMBER:   4 **
  ****************************
--------------------
| ADD HYD   (0043) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0029):      2.30    .099     6.08    18.36
        + ID2= 2 (0025):      2.33    .101     6.08    18.39
          ==================================================
          ID = 3 (0043):      4.63    .200     6.08    18.38

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
```

```
  ****************************
  ** SIMULATION NUMBER:   5 **
  ****************************

--------------------
| ADD HYD   (0043) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0029):     2.30    .201     6.08    35.54
        + ID2= 2 (0025):     2.33    .203     6.08    35.57
          ==================================================
          ID = 3 (0043):     4.63    .404     6.08    35.56

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
  ****************************
  ** SIMULATION NUMBER:   6 **
  ****************************

--------------------
| ADD HYD   (0043) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0029):     2.30    .071     4.25    12.81
        + ID2= 2 (0025):     2.33    .072     4.25    12.83
          ==================================================
          ID = 3 (0043):     4.63    .142     4.25    12.82

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
  ****************************
  ** SIMULATION NUMBER:   7 **
  ****************************

--------------------
| ADD HYD   (0043) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0029):     2.30    .225     4.17    34.18
        + ID2= 2 (0025):     2.33    .227     4.17    34.21
          ==================================================
          ID = 3 (0043):     4.63    .452     4.17    34.20

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
```

```
 ****************************
 ** SIMULATION NUMBER:   8 **
 ****************************

--------------------
| ADD HYD   (0043) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0029):     2.30    .230     1.75    27.97
        + ID2= 2 (0025):     2.33    .232     1.75    28.00
          ================================================
          ID = 3 (0043):     4.63    .462     1.75    27.98

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
 ****************************
 ** SIMULATION NUMBER:   9 **
 ****************************

--------------------
| ADD HYD   (0043) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0029):     2.30    .220     2.08    25.91
        + ID2= 2 (0025):     2.33    .223     2.08    25.94
          ================================================
          ID = 3 (0043):     4.63    .444     2.08    25.93

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
 ****************************
 ** SIMULATION NUMBER:   10 **
 ****************************

--------------------
| ADD HYD   (0043) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0029):     2.30    .006     2.00     1.76
        + ID2= 2 (0025):     2.33    .006     2.00     1.77
          ================================================
          ID = 3 (0043):     4.63    .013     2.00     1.76

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
```

```
****************************
  ** SIMULATION NUMBER:   1 **
  ****************************
--------------------
| ADD HYD   (0050) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0049):     6.39    .071     3.42     6.53
        + ID2= 2 (0047):     4.63    .051     3.83    10.21
          ==================================================
          ID = 3 (0050):    11.02    .113     3.67     8.07

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
  ****************************
  ** SIMULATION NUMBER:   2 **
  ****************************
--------------------
| ADD HYD   (0050) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0049):     6.39    .271     3.25    21.85
        + ID2= 2 (0047):     4.63    .204     3.50    29.83
          ==================================================
          ID = 3 (0050):    11.02    .459     3.33    25.20

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
  ****************************
  ** SIMULATION NUMBER:   3 **
  ****************************
--------------------
| ADD HYD   (0050) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0049):     6.39    .089     6.25     8.84
        + ID2= 2 (0047):     4.63    .060     6.67    13.31
          ==================================================
          ID = 3 (0050):    11.02    .135     6.50    10.71

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
  ****************************
  ** SIMULATION NUMBER:   4 **
  ****************************
--------------------
| ADD HYD   (0050) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0049):     6.39    .136     6.25    12.72
        + ID2= 2 (0047):     4.63    .096     6.50    18.37
          ==================================================
          ID = 3 (0050):    11.02    .216     6.33    15.09

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
```

```
****************************
** SIMULATION NUMBER:   5 **
****************************

--------------------
| ADD HYD   (0050) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (0049):      6.39    .307     6.17    26.54
       + ID2= 2 (0047):      4.63    .219     6.42    35.55
         ==================================================
         ID = 3 (0050):     11.02    .508     6.25    30.32

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
****************************
** SIMULATION NUMBER:   6 **
****************************

--------------------
| ADD HYD   (0050) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (0049):      6.39    .079     4.42     8.47
       + ID2= 2 (0047):      4.63    .051     4.83    12.82
         ==================================================
         ID = 3 (0050):     11.02    .116     4.67    10.30

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
****************************
** SIMULATION NUMBER:   7 **
****************************

--------------------
| ADD HYD   (0050) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (0049):      6.39    .298     4.33    25.42
       + ID2= 2 (0047):      4.63    .212     4.58    34.19
         ==================================================
         ID = 3 (0050):     11.02    .491     4.42    29.10

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
```

```
 ****************************
  ** SIMULATION NUMBER:   8 **
  ****************************

--------------------
| ADD HYD   (0050) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0049):     6.39    .375     1.83    20.35
        + ID2= 2 (0047):     4.63    .258     2.08    27.98
          ==================================================
          ID = 3 (0050):    11.02    .614     1.92    23.55

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
  ****************************
  ** SIMULATION NUMBER:   9 **
  ****************************

--------------------
| ADD HYD   (0050) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0049):     6.39    .343     2.17    18.69
        + ID2= 2 (0047):     4.63    .236     2.33    25.92
          ==================================================
          ID = 3 (0050):    11.02    .551     2.25    21.73

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
  ****************************
  ** SIMULATION NUMBER:  10 **
  ****************************

--------------------
| ADD HYD   (0050) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0049):     6.39    .006     2.83      .75
        + ID2= 2 (0047):     4.63    .010     2.50     1.76
          ==================================================
          ID = 3 (0050):    11.02    .015     2.58     1.18

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
```

```
****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

--------------------
| ROUTE CHN (0048) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                    .00        101.10         .0500
                   5.00        101.00     .0500 / .0250  Main Channel
                   8.00        100.00         .0250      Main Channel
                   8.30        100.00         .0250      Main Channel
                  11.30        101.00     .0250 / .0500  Main Channel
                  16.00        101.10         .0500
                  20.00        101.30         .0500

<---------------------- TRAVEL TIME TABLE ----------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .06   100.06    .259E+01        .0           .26       6.53
        .11   100.11    .704E+01        .0           .37       4.47
        .17   100.17    .133E+02        .1           .47       3.57
        .22   100.22    .215E+02        .1           .55       3.03
        .28   100.28    .315E+02        .2           .63       2.66
        .33   100.33    .433E+02        .3           .70       2.39
        .39   100.39    .570E+02        .4           .77       2.18
        .44   100.44    .726E+02        .6           .83       2.01
        .50   100.50    .900E+02        .8           .89       1.87
        .56   100.56    .109E+03       1.0           .95       1.75
        .61   100.61    .130E+03       1.3          1.01       1.65
        .67   100.67    .153E+03       1.6          1.07       1.56
        .72   100.72    .178E+03       2.0          1.12       1.49
        .78   100.78    .205E+03       2.4          1.17       1.42
        .83   100.83    .233E+03       2.9          1.23       1.36
        .89   100.89    .264E+03       3.4          1.28       1.30
        .94   100.94    .296E+03       3.9          1.33       1.26
       1.00   101.00    .330E+03       4.5          1.38       1.21
       1.06   101.06    .380E+03       5.4          1.42       1.18

                                     <---- hydrograph ---->   <-pipe / channel->
                               AREA    QPEAK    TPEAK   R.V.   MAX DEPTH   MAX VEL
                               (ha)    (cms)    (hrs)   (mm)      (m)       (m/s)
     INFLOW : ID= 2 (0050)    11.02      .11     3.67   8.07        .22        .54
     OUTFLOW: ID= 1 (0048)    11.02      .11     3.67   8.07        .22        .54

-------------------------------------------------------------------------------
```

```
 ****************************
 ** SIMULATION NUMBER:   2 **
 ****************************

--------------------
| ROUTE CHN (0048) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                    .00        101.10         .0500
                   5.00        101.00      .0500 / .0250  Main Channel
                   8.00        100.00         .0250      Main Channel
                   8.30        100.00         .0250      Main Channel
                  11.30        101.00      .0250 / .0500  Main Channel
                  16.00        101.10         .0500
                  20.00        101.30         .0500

<--------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)       (m/s)       (min)
        .06   100.06    .259E+01        .0          .26        6.53
        .11   100.11    .704E+01        .0          .37        4.47
        .17   100.17    .133E+02        .1          .47        3.57
        .22   100.22    .215E+02        .1          .55        3.03
        .28   100.28    .315E+02        .2          .63        2.66
        .33   100.33    .433E+02        .3          .70        2.39
        .39   100.39    .570E+02        .4          .77        2.18
        .44   100.44    .726E+02        .6          .83        2.01
        .50   100.50    .900E+02        .8          .89        1.87
        .56   100.56    .109E+03       1.0          .95        1.75
        .61   100.61    .130E+03       1.3         1.01        1.65
        .67   100.67    .153E+03       1.6         1.07        1.56
        .72   100.72    .178E+03       2.0         1.12        1.49
        .78   100.78    .205E+03       2.4         1.17        1.42
        .83   100.83    .233E+03       2.9         1.23        1.36
        .89   100.89    .264E+03       3.4         1.28        1.30
        .94   100.94    .296E+03       3.9         1.33        1.26
       1.00   101.00    .330E+03       4.5         1.38        1.21
       1.06   101.06    .380E+03       5.4         1.42        1.18

                                      <---- hydrograph ---->   <-pipe / channel->
                                AREA    QPEAK    TPEAK   R.V.   MAX DEPTH  MAX VEL
                                (ha)    (cms)    (hrs)   (mm)     (m)       (m/s)
     INFLOW : ID= 2 (0050)     11.02      .46     3.33  25.20      .40        .77
     OUTFLOW: ID= 1 (0048)     11.02      .46     3.33  25.20      .40        .77

-------------------------------------------------------------------------------
```

```
 ****************************
 ** SIMULATION NUMBER:   3 **
 ****************************

--------------------
| ROUTE CHN (0048) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                    .00        101.10         .0500
                   5.00        101.00     .0500 / .0250  Main Channel
                   8.00        100.00         .0250      Main Channel
                   8.30        100.00         .0250      Main Channel
                  11.30        101.00     .0250 / .0500  Main Channel
                  16.00        101.10         .0500
                  20.00        101.30         .0500

<--------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .06   100.06    .259E+01       .0           .26       6.53
        .11   100.11    .704E+01       .0           .37       4.47
        .17   100.17    .133E+02       .1           .47       3.57
        .22   100.22    .215E+02       .1           .55       3.03
        .28   100.28    .315E+02       .2           .63       2.66
        .33   100.33    .433E+02       .3           .70       2.39
        .39   100.39    .570E+02       .4           .77       2.18
        .44   100.44    .726E+02       .6           .83       2.01
        .50   100.50    .900E+02       .8           .89       1.87
        .56   100.56    .109E+03      1.0           .95       1.75
        .61   100.61    .130E+03      1.3          1.01       1.65
        .67   100.67    .153E+03      1.6          1.07       1.56
        .72   100.72    .178E+03      2.0          1.12       1.49
        .78   100.78    .205E+03      2.4          1.17       1.42
        .83   100.83    .233E+03      2.9          1.23       1.36
        .89   100.89    .264E+03      3.4          1.28       1.30
        .94   100.94    .296E+03      3.9          1.33       1.26
       1.00   101.00    .330E+03      4.5          1.38       1.21
       1.06   101.06    .380E+03      5.4          1.42       1.18

                                       <---- hydrograph ---->   <-pipe / channel->
                                 AREA    QPEAK   TPEAK   R.V.    MAX DEPTH   MAX VEL
                                 (ha)    (cms)   (hrs)   (mm)       (m)       (m/s)
     INFLOW : ID= 2 (0050)      11.02      .14    6.50  10.71        .23        .57
     OUTFLOW: ID= 1 (0048)      11.02      .13    6.50  10.71        .23        .56

-------------------------------------------------------------------------------
```

```
 ****************************
 ** SIMULATION NUMBER:   4 **
 ****************************

--------------------
| ROUTE CHN (0048) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                    .00        101.10          .0500
                   5.00        101.00     .0500 / .0250  Main Channel
                   8.00        100.00          .0250     Main Channel
                   8.30        100.00          .0250     Main Channel
                  11.30        101.00     .0250 / .0500  Main Channel
                  16.00        101.10          .0500
                  20.00        101.30          .0500

<--------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)       (m/s)       (min)
        .06   100.06    .259E+01       .0           .26        6.53
        .11   100.11    .704E+01       .0           .37        4.47
        .17   100.17    .133E+02       .1           .47        3.57
        .22   100.22    .215E+02       .1           .55        3.03
        .28   100.28    .315E+02       .2           .63        2.66
        .33   100.33    .433E+02       .3           .70        2.39
        .39   100.39    .570E+02       .4           .77        2.18
        .44   100.44    .726E+02       .6           .83        2.01
        .50   100.50    .900E+02       .8           .89        1.87
        .56   100.56    .109E+03      1.0           .95        1.75
        .61   100.61    .130E+03      1.3          1.01        1.65
        .67   100.67    .153E+03      1.6          1.07        1.56
        .72   100.72    .178E+03      2.0          1.12        1.49
        .78   100.78    .205E+03      2.4          1.17        1.42
        .83   100.83    .233E+03      2.9          1.23        1.36
        .89   100.89    .264E+03      3.4          1.28        1.30
        .94   100.94    .296E+03      3.9          1.33        1.26
       1.00   101.00    .330E+03      4.5          1.38        1.21
       1.06   101.06    .380E+03      5.4          1.42        1.18

                                          <---- hydrograph ---->   <-pipe / channel->
                                    AREA    QPEAK   TPEAK   R.V.   MAX DEPTH   MAX VEL
                                    (ha)    (cms)   (hrs)   (mm)      (m)       (m/s)
     INFLOW : ID= 2 (0050)         11.02      .22    6.33  15.09       .29        .64
     OUTFLOW: ID= 1 (0048)         11.02      .22    6.42  15.09       .29        .64

-------------------------------------------------------------------------------
```

```
 ****************************
 ** SIMULATION NUMBER:   5 **
 ****************************

--------------------
| ROUTE CHN (0048) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                    .00        101.10         .0500
                   5.00        101.00     .0500 / .0250  Main Channel
                   8.00        100.00         .0250      Main Channel
                   8.30        100.00         .0250      Main Channel
                  11.30        101.00     .0250 / .0500  Main Channel
                  16.00        101.10         .0500
                  20.00        101.30         .0500

<--------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .06   100.06    .259E+01        .0           .26       6.53
        .11   100.11    .704E+01        .0           .37       4.47
        .17   100.17    .133E+02        .1           .47       3.57
        .22   100.22    .215E+02        .1           .55       3.03
        .28   100.28    .315E+02        .2           .63       2.66
        .33   100.33    .433E+02        .3           .70       2.39
        .39   100.39    .570E+02        .4           .77       2.18
        .44   100.44    .726E+02        .6           .83       2.01
        .50   100.50    .900E+02        .8           .89       1.87
        .56   100.56    .109E+03       1.0           .95       1.75
        .61   100.61    .130E+03       1.3          1.01       1.65
        .67   100.67    .153E+03       1.6          1.07       1.56
        .72   100.72    .178E+03       2.0          1.12       1.49
        .78   100.78    .205E+03       2.4          1.17       1.42
        .83   100.83    .233E+03       2.9          1.23       1.36
        .89   100.89    .264E+03       3.4          1.28       1.30
        .94   100.94    .296E+03       3.9          1.33       1.26
       1.00   101.00    .330E+03       4.5          1.38       1.21
       1.06   101.06    .380E+03       5.4          1.42       1.18

                                     <---- hydrograph ---->   <-pipe / channel->
                               AREA    QPEAK    TPEAK   R.V.   MAX DEPTH   MAX VEL
                               (ha)    (cms)    (hrs)   (mm)      (m)       (m/s)
     INFLOW : ID= 2 (0050)    11.02      .51     6.25  30.32       .41        .79
     OUTFLOW: ID= 1 (0048)    11.02      .50     6.25  30.32       .41        .79

-------------------------------------------------------------------------------
```

```
  ****************************
  ** SIMULATION NUMBER:   6 **
  ****************************

--------------------
| ROUTE CHN (0048) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                    .00        101.10         .0500
                   5.00        101.00     .0500 / .0250  Main Channel
                   8.00        100.00         .0250      Main Channel
                   8.30        100.00         .0250      Main Channel
                  11.30        101.00     .0250 / .0500  Main Channel
                  16.00        101.10         .0500
                  20.00        101.30         .0500

<---------------------- TRAVEL TIME TABLE ----------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .06   100.06    .259E+01        .0           .26       6.53
        .11   100.11    .704E+01        .0           .37       4.47
        .17   100.17    .133E+02        .1           .47       3.57
        .22   100.22    .215E+02        .1           .55       3.03
        .28   100.28    .315E+02        .2           .63       2.66
        .33   100.33    .433E+02        .3           .70       2.39
        .39   100.39    .570E+02        .4           .77       2.18
        .44   100.44    .726E+02        .6           .83       2.01
        .50   100.50    .900E+02        .8           .89       1.87
        .56   100.56    .109E+03       1.0           .95       1.75
        .61   100.61    .130E+03       1.3          1.01       1.65
        .67   100.67    .153E+03       1.6          1.07       1.56
        .72   100.72    .178E+03       2.0          1.12       1.49
        .78   100.78    .205E+03       2.4          1.17       1.42
        .83   100.83    .233E+03       2.9          1.23       1.36
        .89   100.89    .264E+03       3.4          1.28       1.30
        .94   100.94    .296E+03       3.9          1.33       1.26
       1.00   101.00    .330E+03       4.5          1.38       1.21
       1.06   101.06    .380E+03       5.4          1.42       1.18

                                    <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK    TPEAK   R.V.   MAX DEPTH   MAX VEL
                              (ha)    (cms)    (hrs)   (mm)      (m)       (m/s)
     INFLOW : ID= 2 (0050)   11.02      .12     4.67  10.30      .22         .55
     OUTFLOW: ID= 1 (0048)   11.02      .12     4.67  10.29      .22         .55

-------------------------------------------------------------------------------
```

```
  ****************************
  ** SIMULATION NUMBER:   7 **
  ****************************

--------------------
| ROUTE CHN (0048) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                    .00        101.10         .0500
                   5.00        101.00     .0500 / .0250  Main Channel
                   8.00        100.00         .0250      Main Channel
                   8.30        100.00         .0250      Main Channel
                  11.30        101.00     .0250 / .0500  Main Channel
                  16.00        101.10         .0500
                  20.00        101.30         .0500

<--------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .06   100.06    .259E+01       .0           .26        6.53
        .11   100.11    .704E+01       .0           .37        4.47
        .17   100.17    .133E+02       .1           .47        3.57
        .22   100.22    .215E+02       .1           .55        3.03
        .28   100.28    .315E+02       .2           .63        2.66
        .33   100.33    .433E+02       .3           .70        2.39
        .39   100.39    .570E+02       .4           .77        2.18
        .44   100.44    .726E+02       .6           .83        2.01
        .50   100.50    .900E+02       .8           .89        1.87
        .56   100.56    .109E+03      1.0           .95        1.75
        .61   100.61    .130E+03      1.3          1.01        1.65
        .67   100.67    .153E+03      1.6          1.07        1.56
        .72   100.72    .178E+03      2.0          1.12        1.49
        .78   100.78    .205E+03      2.4          1.17        1.42
        .83   100.83    .233E+03      2.9          1.23        1.36
        .89   100.89    .264E+03      3.4          1.28        1.30
        .94   100.94    .296E+03      3.9          1.33        1.26
       1.00   101.00    .330E+03      4.5          1.38        1.21
       1.06   101.06    .380E+03      5.4          1.42        1.18

                                       <---- hydrograph ---->   <-pipe / channel->
                                 AREA    QPEAK   TPEAK   R.V.   MAX DEPTH   MAX VEL
                                 (ha)    (cms)   (hrs)   (mm)      (m)       (m/s)
     INFLOW : ID= 2 (0050)      11.02      .49    4.42  29.10       .41        .79
     OUTFLOW: ID= 1 (0048)      11.02      .49    4.42  29.10       .41        .79


-------------------------------------------------------------------------------
```

```
 ****************************
 ** SIMULATION NUMBER:   8 **
 ****************************

--------------------
| ROUTE CHN (0048) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                    .00        101.10         .0500
                   5.00        101.00     .0500 / .0250  Main Channel
                   8.00        100.00         .0250      Main Channel
                   8.30        100.00         .0250      Main Channel
                  11.30        101.00     .0250 / .0500  Main Channel
                  16.00        101.10         .0500
                  20.00        101.30         .0500

<---------------------- TRAVEL TIME TABLE ----------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)       (m/s)       (min)
        .06   100.06    .259E+01       .0           .26        6.53
        .11   100.11    .704E+01       .0           .37        4.47
        .17   100.17    .133E+02       .1           .47        3.57
        .22   100.22    .215E+02       .1           .55        3.03
        .28   100.28    .315E+02       .2           .63        2.66
        .33   100.33    .433E+02       .3           .70        2.39
        .39   100.39    .570E+02       .4           .77        2.18
        .44   100.44    .726E+02       .6           .83        2.01
        .50   100.50    .900E+02       .8           .89        1.87
        .56   100.56    .109E+03      1.0           .95        1.75
        .61   100.61    .130E+03      1.3          1.01        1.65
        .67   100.67    .153E+03      1.6          1.07        1.56
        .72   100.72    .178E+03      2.0          1.12        1.49
        .78   100.78    .205E+03      2.4          1.17        1.42
        .83   100.83    .233E+03      2.9          1.23        1.36
        .89   100.89    .264E+03      3.4          1.28        1.30
        .94   100.94    .296E+03      3.9          1.33        1.26
       1.00   101.00    .330E+03      4.5          1.38        1.21
       1.06   101.06    .380E+03      5.4          1.42        1.18

                                     <---- hydrograph ---->   <-pipe / channel->
                               AREA    QPEAK    TPEAK   R.V.   MAX DEPTH  MAX VEL
                               (ha)    (cms)    (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (0050)    11.02      .61     1.92  23.55       .45       .83
     OUTFLOW: ID= 1 (0048)    11.02      .61     1.92  23.55       .45       .83

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```

```
 ****************************
 ** SIMULATION NUMBER:   9 **
 ****************************

--------------------
| ROUTE CHN (0048) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                    .00        101.10         .0500
                   5.00        101.00     .0500 / .0250  Main Channel
                   8.00        100.00         .0250      Main Channel
                   8.30        100.00         .0250      Main Channel
                  11.30        101.00     .0250 / .0500  Main Channel
                  16.00        101.10         .0500
                  20.00        101.30         .0500

<---------------------- TRAVEL TIME TABLE ----------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .06   100.06    .259E+01        .0           .26       6.53
        .11   100.11    .704E+01        .0           .37       4.47
        .17   100.17    .133E+02        .1           .47       3.57
        .22   100.22    .215E+02        .1           .55       3.03
        .28   100.28    .315E+02        .2           .63       2.66
        .33   100.33    .433E+02        .3           .70       2.39
        .39   100.39    .570E+02        .4           .77       2.18
        .44   100.44    .726E+02        .6           .83       2.01
        .50   100.50    .900E+02        .8           .89       1.87
        .56   100.56    .109E+03       1.0           .95       1.75
        .61   100.61    .130E+03       1.3          1.01       1.65
        .67   100.67    .153E+03       1.6          1.07       1.56
        .72   100.72    .178E+03       2.0          1.12       1.49
        .78   100.78    .205E+03       2.4          1.17       1.42
        .83   100.83    .233E+03       2.9          1.23       1.36
        .89   100.89    .264E+03       3.4          1.28       1.30
        .94   100.94    .296E+03       3.9          1.33       1.26
       1.00   101.00    .330E+03       4.5          1.38       1.21
       1.06   101.06    .380E+03       5.4          1.42       1.18

                                          <---- hydrograph ---->   <-pipe / channel->
                                    AREA    QPEAK    TPEAK   R.V.   MAX DEPTH   MAX VEL
                                    (ha)    (cms)    (hrs)   (mm)      (m)       (m/s)
     INFLOW : ID= 2 (0050)         11.02      .55     2.25  21.73       .43        .81
     OUTFLOW: ID= 1 (0048)         11.02      .55     2.25  21.73       .43        .81

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```

```
 ****************************
  ** SIMULATION NUMBER:   10 **
  ****************************

--------------------
| ROUTE CHN (0048) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                    .00        101.10         .0500
                   5.00        101.00     .0500 / .0250  Main Channel
                   8.00        100.00         .0250      Main Channel
                   8.30        100.00         .0250      Main Channel
                  11.30        101.00     .0250 / .0500  Main Channel
                  16.00        101.10         .0500
                  20.00        101.30         .0500

<--------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .06   100.06    .259E+01       .0           .26       6.53
        .11   100.11    .704E+01       .0           .37       4.47
        .17   100.17    .133E+02       .1           .47       3.57
        .22   100.22    .215E+02       .1           .55       3.03
        .28   100.28    .315E+02       .2           .63       2.66
        .33   100.33    .433E+02       .3           .70       2.39
        .39   100.39    .570E+02       .4           .77       2.18
        .44   100.44    .726E+02       .6           .83       2.01
        .50   100.50    .900E+02       .8           .89       1.87
        .56   100.56    .109E+03      1.0           .95       1.75
        .61   100.61    .130E+03      1.3          1.01       1.65
        .67   100.67    .153E+03      1.6          1.07       1.56
        .72   100.72    .178E+03      2.0          1.12       1.49
        .78   100.78    .205E+03      2.4          1.17       1.42
        .83   100.83    .233E+03      2.9          1.23       1.36
        .89   100.89    .264E+03      3.4          1.28       1.30
        .94   100.94    .296E+03      3.9          1.33       1.26
       1.00   101.00    .330E+03      4.5          1.38       1.21
       1.06   101.06    .380E+03      5.4          1.42       1.18

                                     <---- hydrograph ---->   <-pipe / channel->
                               AREA    QPEAK    TPEAK   R.V.   MAX DEPTH   MAX VEL
                               (ha)    (cms)    (hrs)   (mm)      (m)       (m/s)
     INFLOW : ID= 2 (0050)    11.02      .02     2.58   1.18       .08        .30
     OUTFLOW: ID= 1 (0048)    11.02      .02     2.67   1.17       .08        .30

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APPENDIX E: STORMWATER MANAGEMENT SWALE

Storage Calculations

Model Rating Curve

OTTHYMO Reservoir Model Detailed Report

Kollaard Associates Inc

Client: Hauderowicz, Zbigniew and Teresa
File No.: 200977
Location: 2050 Dunrobin Road, Ottawa
Date: September 21, 2021

InfiltrationThrough Bottom
Permeability k = 0.000042 m/s
Percolation Time T = 4 min/cm
Percolation Rate = 360 mm/hr
Permeability k = 1.0E-04 m/s

Orifice Information
Dia (m): 0.440
Area (mm.): 0.1521
Orifice Coeff, C: 0.60
Weir Coeff, C: 0.62

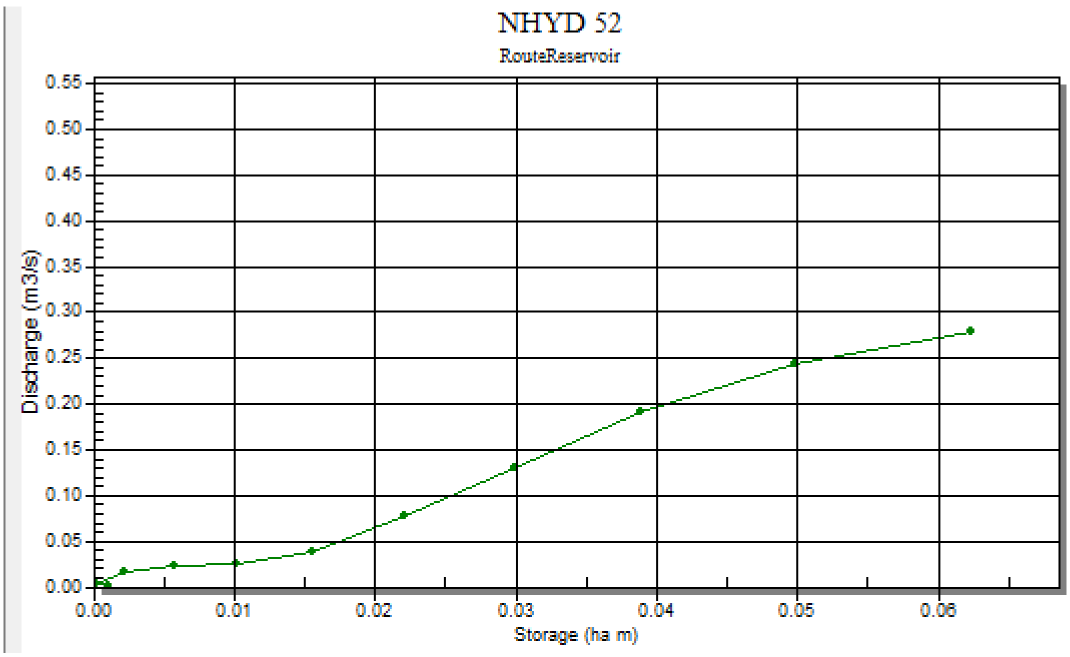
Orifice Top (m): 76.24
Orifice Cen (m): 76.02
Orifice Inv (m): 75.80

Elevation	Layer Thickness	Layer Area	Layer Volume	Cumulative Volume		Infiltration Head*	Infiltration Hydraulic Gradient	Infiltration Rate		Orifice Flow Depth of Flow - Orifice	Orifice Flow Head*	Orifice Flow		Combined Outflow	Cumulative Volume
(m)	(m)	(m^2)	(m^3)	(m^3)		(m)	(m/m)	(m^3/sec)		(m)	(m)	(m^3/sec)		(m^3/sec)	(ha.m)
75.45	0.00	0.0	0.0	0.0		0.000	1.00	0.000			0.000	0.000		0.000	0.0000
75.5	0.05	0.0	1.6	1.6		0.050	1.02	0.001			0.000	0.000		0.001	0.0002
75.55	0.05	93.5	7.3	8.8		0.100	1.03	0.007			0.000	0.000		0.007	0.0009
75.6	0.05	204.0	13.3	22.1		0.150	1.05	0.017			0.000	0.000		0.017	0.0022
75.65	0.05	331.5	17.3	39.4		0.200	1.07	0.024			0.000	0.000		0.024	0.0039
75.7	0.05	362.0	19.0	58.3		0.250	1.08	0.024			0.000	0.000		0.024	0.0058
75.75	0.05	397.5	20.9	79.2		0.300	1.10	0.025			0.000	0.000		0.025	0.0079
75.8	0.05	438.0	23.0	102.2		0.350	1.12	0.025		0.00	0.000	0.000		0.025	0.0102
75.85	0.05	483.5	25.4	127.6		0.400	1.13	0.025		0.05	0.000	0.003		0.029	0.0128
75.9	0.05	534.0	28.1	155.7		0.450	1.15	0.026		0.10	0.000	0.013		0.039	0.0156
75.95	0.05	589.5	31.0	186.6		0.500	1.17	0.026		0.15	0.000	0.029		0.055	0.0187
76	0.05	650.0	34.1	220.8		0.550	1.18	0.027		0.20	0.000	0.050		0.077	0.0221
76.05	0.05	715.5	37.5	258.3		0.600	1.20	0.027		0.25	0.000	0.075		0.102	0.0258
76.1	0.05	786.0	41.2	299.4		0.650	1.22	0.027		0.30	0.000	0.103		0.130	0.0299
76.15	0.05	708.5	40.9	340.3		0.700	1.23	0.028		0.35	0.000	0.133		0.161	0.0340
76.2	0.05	932.9	48.5	388.8		0.750	1.25	0.028		0.40	0.000	0.164		0.192	0.0389
76.25	0.05	1007.8	52.3	441.2		0.800	1.27	0.028		0.45	0.230	0.194		0.222	0.0441
76.3	0.05	1086.3	56.3	497.5		0.850	1.28	0.029		0.50	0.280	0.214		0.243	0.0498
76.35	0.05	1168.2	60.5	558.0		0.900	1.30	0.029		0.55	0.330	0.232		0.261	0.0558
76.4	0.05	1253.5	64.9	622.9		0.950	1.32	0.030		0.60	0.380	0.249		0.279	0.0623

Storm Pond Model Storage Discharge Rating Curve

Discharge-Storage Table

	DISCH [m³/s]	STORAGE [ha.m]
1	0.000	0.0000
2	0.003	0.0002
3	0.017	0.0022
4	0.024	0.0058
5	0.025	0.0102
6	0.039	0.0156
7	0.077	0.0221
8	0.130	0.0299
9	0.192	0.0389
10	0.243	0.0498
11	0.279	0.0623
*		



```
 ****************************
 ** SIMULATION NUMBER:   1 **
 ****************************

--------------------
| RESERVOIR (0052) |
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .0770       .0221
                           .0030      .0002   |    .1300       .0299
                           .0170      .0022   |    .1920       .0389
                           .0240      .0058   |    .2430       .0498
                           .0250      .0102   |    .2790       .0623
                           .0390      .0156   |    .0000       .0000

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
    INFLOW : ID= 2 (0043)       4.627       .117        3.17       10.21
    OUTFLOW: ID= 1 (0052)       4.627       .050        3.83       10.21

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 43.02
                  TIME SHIFT OF PEAK FLOW         (min)= 40.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=   .0176

-------------------------------------------------------------------------------
 ****************************
 ** SIMULATION NUMBER:   2 **
 ****************************

--------------------
| RESERVOIR (0052) |
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .0770       .0221
                           .0030      .0002   |    .1300       .0299
                           .0170      .0022   |    .1920       .0389
                           .0240      .0058   |    .2430       .0498
                           .0250      .0102   |    .2790       .0623
                           .0390      .0156   |    .0000       .0000

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
    INFLOW : ID= 2 (0043)       4.627       .367        3.08       29.83
    OUTFLOW: ID= 1 (0052)       4.627       .204        3.50       29.83

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 55.74
                  TIME SHIFT OF PEAK FLOW         (min)= 25.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=   .0415

-------------------------------------------------------------------------------
```

```
 ****************************
 ** SIMULATION NUMBER:   3 **
 ****************************

--------------------
| RESERVOIR (0052) |
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .0770      .0221
                           .0030      .0002   |    .1300      .0299
                           .0170      .0022   |    .1920      .0389
                           .0240      .0058   |    .2430      .0498
                           .0250      .0102   |    .2790      .0623
                           .0390      .0156   |    .0000      .0000

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
    INFLOW : ID= 2 (0043)       4.627       .142        6.08       13.31
    OUTFLOW: ID= 1 (0052)       4.627       .059        6.67       13.31

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 41.94
                   TIME SHIFT OF PEAK FLOW         (min)= 35.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .0191

--------------------------------------------------------------------------------
 ****************************
 ** SIMULATION NUMBER:   4 **
 ****************************

--------------------
| RESERVOIR (0052) |
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .0770      .0221
                           .0030      .0002   |    .1300      .0299
                           .0170      .0022   |    .1920      .0389
                           .0240      .0058   |    .2430      .0498
                           .0250      .0102   |    .2790      .0623
                           .0390      .0156   |    .0000      .0000

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
    INFLOW : ID= 2 (0043)       4.627       .200        6.08       18.38
    OUTFLOW: ID= 1 (0052)       4.627       .096        6.50       18.37

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 47.94
                   TIME SHIFT OF PEAK FLOW         (min)= 25.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .0249

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```

```
 ****************************
 ** SIMULATION NUMBER:   5 **
 ****************************

--------------------
| RESERVOIR (0052) |
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .0770      .0221
                           .0030      .0002   |    .1300      .0299
                           .0170      .0022   |    .1920      .0389
                           .0240      .0058   |    .2430      .0498
                           .0250      .0102   |    .2790      .0623
                           .0390      .0156   |    .0000      .0000

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
    INFLOW : ID= 2 (0043)       4.627       .404        6.08       35.56
    OUTFLOW: ID= 1 (0052)       4.627       .218        6.42       35.55

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 53.93
                   TIME SHIFT OF PEAK FLOW         (min)= 20.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .0448

-------------------------------------------------------------------------------
 ****************************
 ** SIMULATION NUMBER:   6 **
 ****************************

--------------------
| RESERVOIR (0052) |
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .0770      .0221
                           .0030      .0002   |    .1300      .0299
                           .0170      .0022   |    .1920      .0389
                           .0240      .0058   |    .2430      .0498
                           .0250      .0102   |    .2790      .0623
                           .0390      .0156   |    .0000      .0000

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
    INFLOW : ID= 2 (0043)       4.627       .142        4.25       12.82
    OUTFLOW: ID= 1 (0052)       4.627       .050        4.83       12.82

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 35.44
                   TIME SHIFT OF PEAK FLOW         (min)= 35.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .0176

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```
 ****************************
  ** SIMULATION NUMBER:   7 **
  ****************************

--------------------
| RESERVOIR (0052) |
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .0770       .0221
                           .0030      .0002   |    .1300       .0299
                           .0170      .0022   |    .1920       .0389
                           .0240      .0058   |    .2430       .0498
                           .0250      .0102   |    .2790       .0623
                           .0390      .0156   |    .0000       .0000

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (0043)      4.627        .452        4.17       34.20
     OUTFLOW: ID= 1 (0052)      4.627        .212        4.50       34.19

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 46.87
                  TIME SHIFT OF PEAK FLOW         (min)= 20.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=   .0434

--------------------------------------------------------------------------------
  ****************************
  ** SIMULATION NUMBER:   8 **
  ****************************

--------------------
| RESERVOIR (0052) |
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .0770       .0221
                           .0030      .0002   |    .1300       .0299
                           .0170      .0022   |    .1920       .0389
                           .0240      .0058   |    .2430       .0498
                           .0250      .0102   |    .2790       .0623
                           .0390      .0156   |    .0000       .0000

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (0043)      4.627        .462        1.75       27.98
     OUTFLOW: ID= 1 (0052)      4.627        .258        2.08       27.98

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 55.92
                  TIME SHIFT OF PEAK FLOW         (min)= 20.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=   .0552

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```
  ****************************
  ** SIMULATION NUMBER:   9 **
  ****************************

--------------------
| RESERVOIR (0052) |
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .0770       .0221
                           .0030      .0002   |    .1300       .0299
                           .0170      .0022   |    .1920       .0389
                           .0240      .0058   |    .2430       .0498
                           .0250      .0102   |    .2790       .0623
                           .0390      .0156   |    .0000       .0000

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (0043)      4.627       .444        2.08       25.93
     OUTFLOW: ID= 1 (0052)      4.627       .235        2.33       25.92

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 52.99
                  TIME SHIFT OF PEAK FLOW         (min)= 15.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=   .0486

-------------------------------------------------------------------------------
  ****************************
  ** SIMULATION NUMBER:   10 **
  ****************************

--------------------
| RESERVOIR (0052) |
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .0770       .0221
                           .0030      .0002   |    .1300       .0299
                           .0170      .0022   |    .1920       .0389
                           .0240      .0058   |    .2430       .0498
                           .0250      .0102   |    .2790       .0623
                           .0390      .0156   |    .0000       .0000

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (0043)      4.627       .013        2.00        1.76
     OUTFLOW: ID= 1 (0052)      4.627       .010        2.42        1.76

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 77.90
                  TIME SHIFT OF PEAK FLOW         (min)= 25.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=   .0012

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APPENDIX F: CULVERT ANALYSIS AND HYDRAFLOW EXPRESS ANALYSIS RESULTS

Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Aug 18 2021

Driveway Culvert 10 yr

Invert Elev Dn (m)	=	75.6000
Pipe Length (m)	=	10.0000
Slope (%)	=	0.3000
Invert Elev Up (m)	=	75.6300
Rise (mm)	=	500.0
Shape	=	Circular
Span (mm)	=	500.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

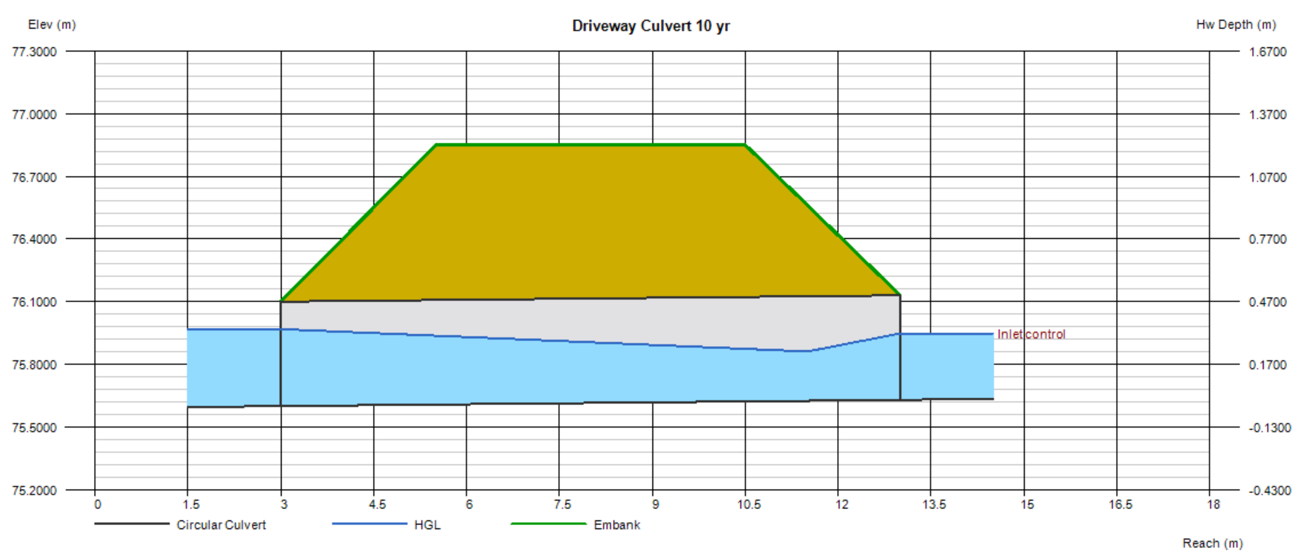
Top Elevation (m)	=	76.8500
Top Width (m)	=	5.0000
Crest Width (m)	=	3.0000

Calculations

Qmin (cms)	=	0.1000
Qmax (cms)	=	0.2000
Tailwater Elev (m)	=	Normal

Highlighted

Qtotal (cms)	=	0.1000
Qpipe (cms)	=	0.1000
Qovertop (cms)	=	0.0000
Veloc Dn (m/s)	=	0.6445
Veloc Up (m/s)	=	1.2584
HGL Dn (m)	=	75.9686
HGL Up (m)	=	75.8424
Hw Elev (m)	=	75.9478
Hw/D (m)	=	0.6356
Flow Regime	=	Inlet Control



Culvert Report

Driveway Culvert 100 yr

Invert Elev Dn (m)	=	75.6000
Pipe Length (m)	=	10.0000
Slope (%)	=	0.3000
Invert Elev Up (m)	=	75.6300
Rise (mm)	=	500.0
Shape	=	Circular
Span (mm)	=	500.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

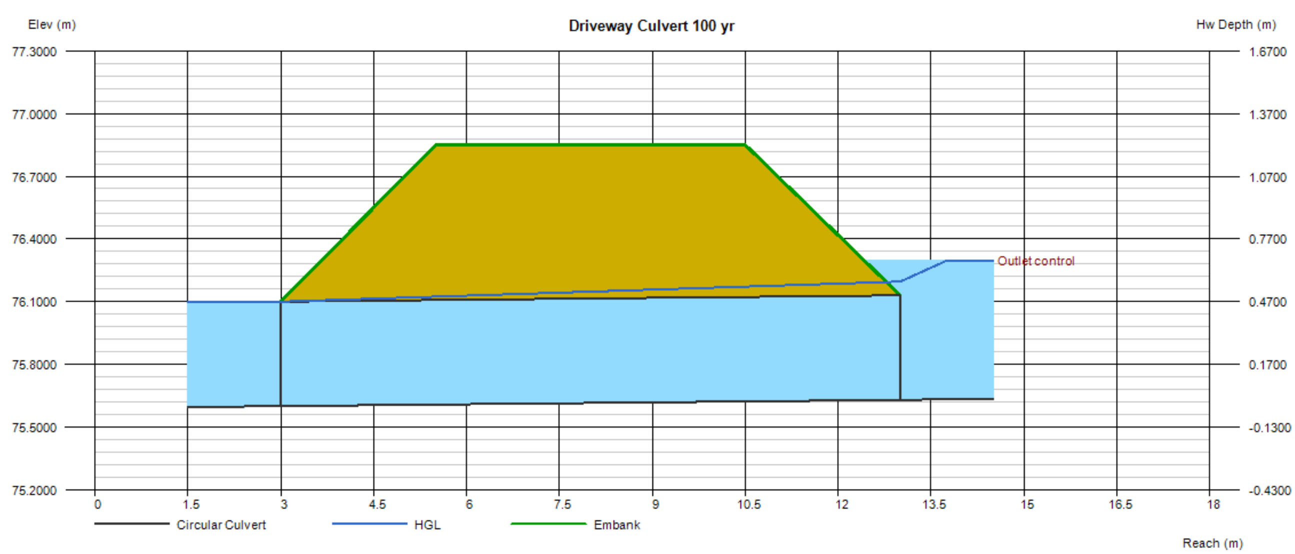
Top Elevation (m)	=	76.8500
Top Width (m)	=	5.0000
Crest Width (m)	=	3.0000

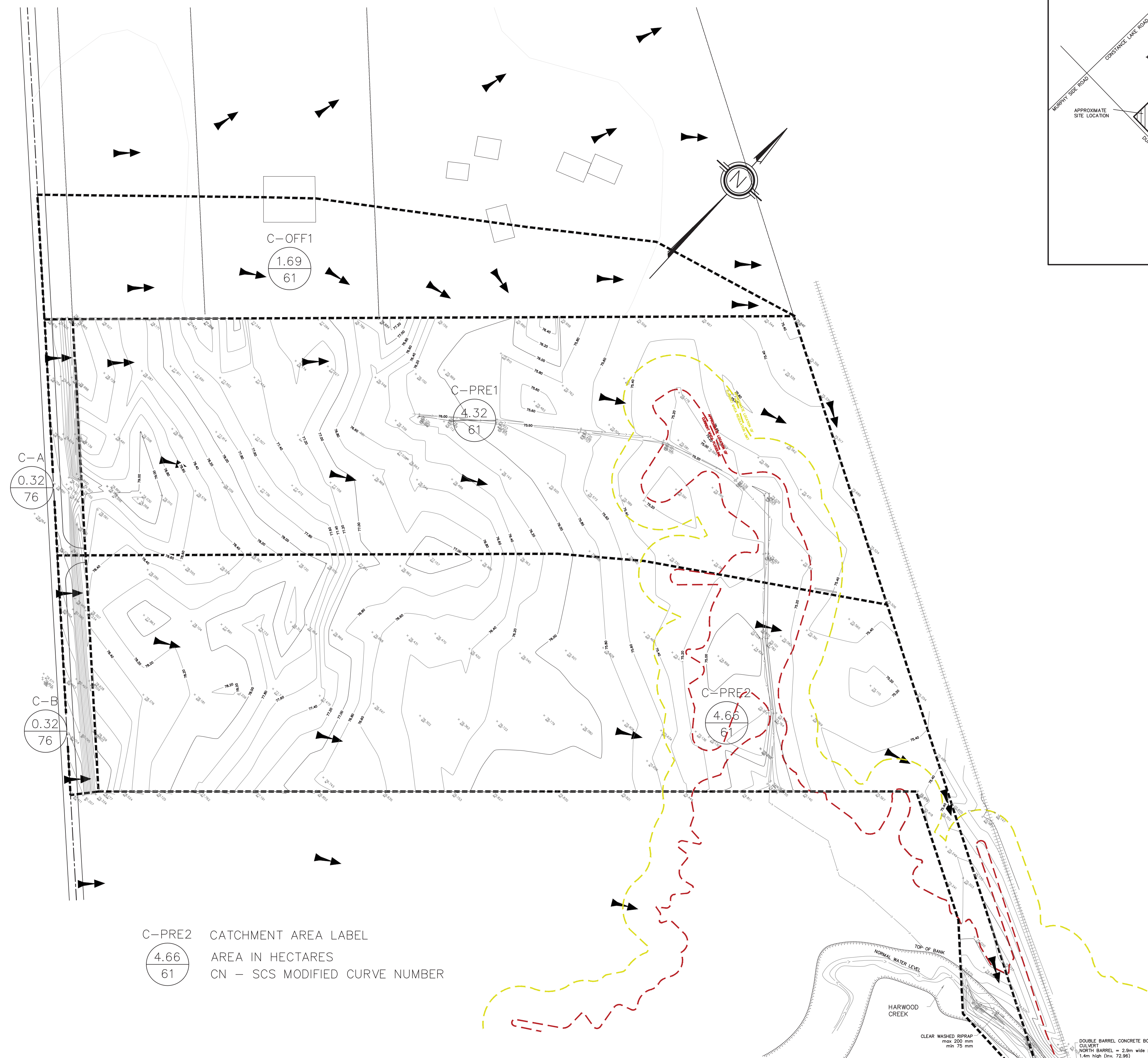
Calculations

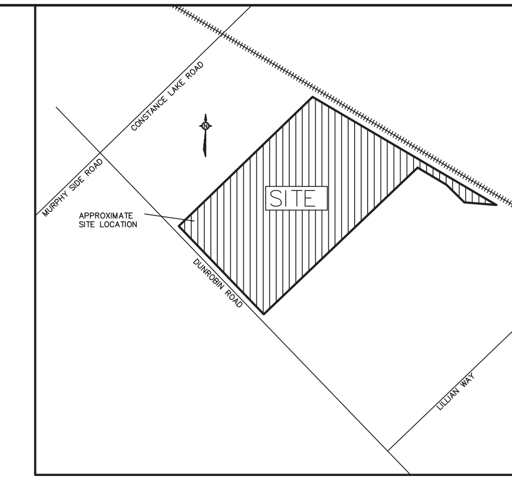
Qmin (cms)	=	0.1000
Qmax (cms)	=	0.2000
Tailwater Elev (m)	=	Normal

Highlighted

Qtotal (cms)	=	0.2000
Qpipe (cms)	=	0.2000
Qovertop (cms)	=	0.0000
Veloc Dn (m/s)	=	1.0188
Veloc Up (m/s)	=	1.0186
HGL Dn (m)	=	76.1000
HGL Up (m)	=	76.1957
Hw Elev (m)	=	76.2963
Hw/D (m)	=	1.3325
Flow Regime	=	Outlet Control







KEY PLAN
NOT TO SCALE

NOTE:

1. All dimensions are in metres.
2. All elevations are in metres and are based on a geodetic benchmark. TBM = Bell kiosk located sout/westh side of Dunrobin Road, across from proposed lot #2 , elevation = 79.82 m (geodetic)
3. This drawing does not represent a legal survey.
4. Finished grade to slope away from proposed building at a minimum of 2%. Grade elevations are as indicated.
5. All dimensions to be verified on site by contractor prior to construction.
6. All materials and construction methods to be in accordance with City of Ottawa Standards and Ontario Provincial Standards and Specifications.
7. All disturbed areas to be reinstated to the satisfaction of the engineer and the City of Ottawa.
8. The owner (and/or Contractor) agrees to prepare and implement an erosion and sediment control plan at least equal to the stated minimum requirements and to the satisfaction of the City of Ottawa, appropriate to the site conditions, prior to undertaking any site alterations (filling, grading, removal of vegetation, etc.) and during all phases of site preparation and construction in accordance with the current Best Management Practices for Erosion and Sediment Control
9. Any changes made to this plan must be verified and approved by Kollaard Associates Inc.

No.	REVISION	DATE	BY
0	ISSUED FOR SUBDIVISION APPROVAL	SEP. 23/2021	ML

Kollaard Associates
Engineers

BOX 189
210 PRESCOTT STREET
KEMPTVILLE, ONTARIO
K0G 1J0
FACSIMILE (613) 258–0475

(613) 860–0923

LICENCED PROFESSIONAL ENGINEER
OCT.2.2012
S.E. deWit
100079612
PROVINCE OF ONTARIO

DESIGN	--
CHECKED	SD
DRAWN	ML/SD
CHECKED	SD
APPROVED	SD

SCALE
1:1000
0 5 10 20 30

PROJECT LOCATION	2050 DUNROBIN ROAD, CITY OF OTTAWA, ONTARIO
CLIENT NAME	ZBIGNIEW HAUDEROWICZ
PROJECT NAME	PROPOSED RESIDENTIAL SUBDIVISION
DRAWING	PRE–DEVELOPMENT DRAINAGE
PROJECT No.	200977
DRAWING No.	200977–PRECA
DATE	MARCH 09, 2021
SHEET SET	

NOTE:

1. All dimensions are in metres.
2. All elevations are in metres and are based on a geodetic benchmark. TBM = Bell kiosk located sout/westh side of Dunrobin Road, across from proposed lot #2 , elevation = 79.82 m (geodetic)
3. This drawing does not represent a legal survey.
4. Finished grade to slope away from proposed building at a minimum of 2%. Grade elevations are as indicated.
5. All dimensions to be verified on site by contractor prior to construction.
6. All materials and construction methods to be in accordance with City of Ottawa Standards and Ontario Provincial Standards and Specifications.
7. All disturbed areas to be reinstated to the satisfaction of the engineer and the City of Ottawa.
8. The owner (and/or Contractor) agrees to prepare and implement an erosion and sediment control plan at least equal to the stated minimum requirements and to the satisfaction of the City of Ottawa, appropriate to the site conditions, prior to undertaking any site alterations (filling, grading, removal of vegetation, etc.) and during all phases of site preparation and construction in accordance with the current Best Management Practices for Erosion and Sediment Control
9. Any changes made to this plan must be verified and approved by Kollaard Associates Inc.

No.	REVISION	DATE	BY
0	ISSUED FOR SUBDIVISION APPROVAL	SEP.23/2021	ML/SD

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Engineers
BOX 189
210 PRESCOTT STREET
KEMPTVILLE, ONTARIO
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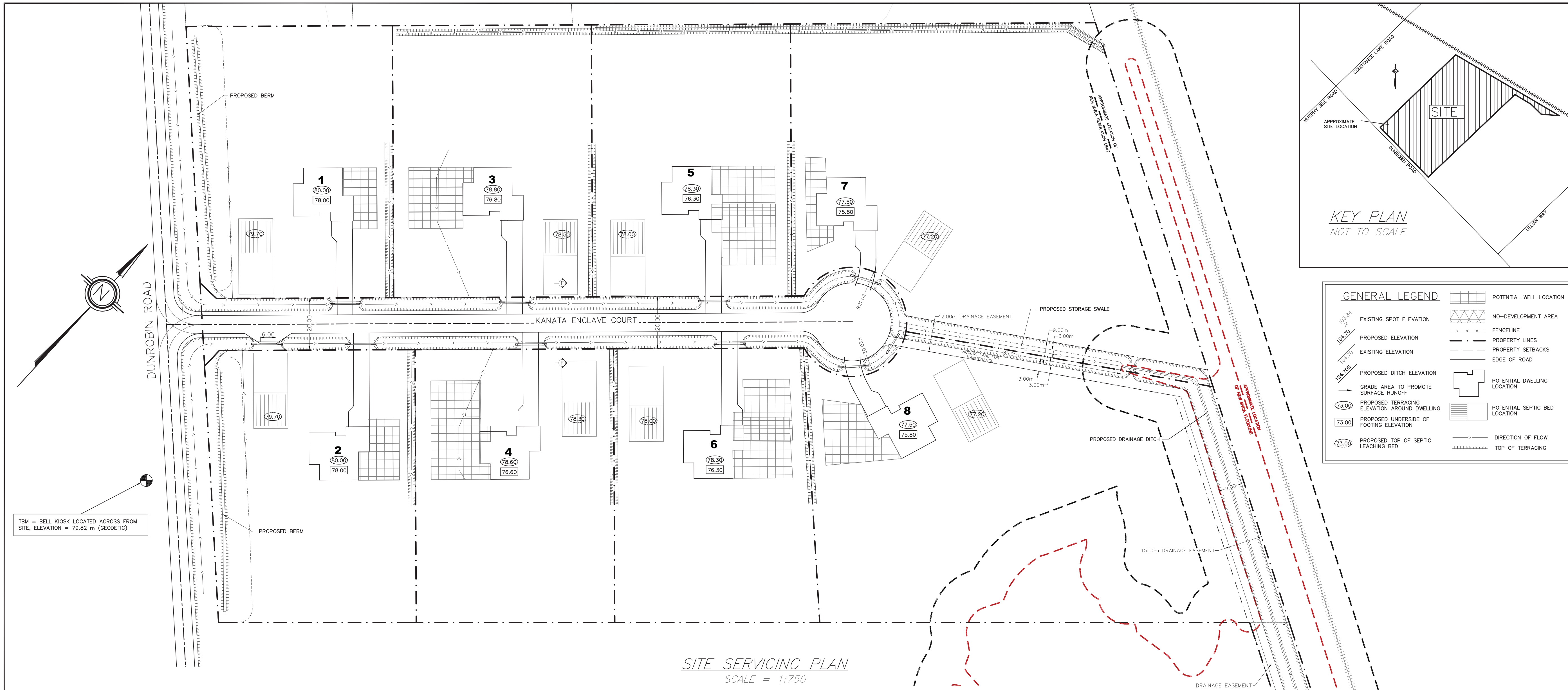
LICENCED PROFESSIONAL ENGINEER
OCT.2.2012
S.E. deWit
100079612
PROVINCE OF ONTARIO

DESIGN	SD
CHECKED	SD
DRAWN	ML/SD
CHECKED	SD
APPROVED	SD

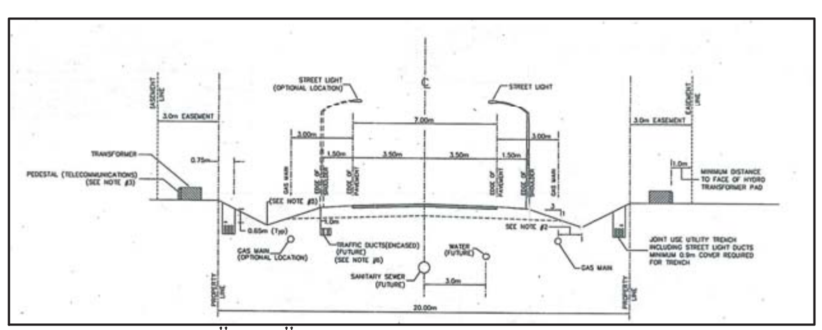
SCALE 1:1000

PROJECT LOCATION	2050 DUNROBIN ROAD, CITY OF OTTAWA, ONTARIO
CLIENT NAME	ZBIGNIEW HAUDEROWICZ
PROJECT NAME	PROPOSED RESIDENTIAL SUBDIVISION
DRAWING	POST-DEVELOPMENT DRAINAGE
PROJECT No.	200977
DRAWING No.	200977-POSTCA
DATE	MARCH 09, 2021
SHEET SET	



SITE SERVICING PLAN

SCALE = 1:750



"F–F" PROPOSED ROAD SECTION

NOT TO SCALE

GRADING & DRAINAGE NOTES

1. Finished grade to slope away from proposed and existing buildings at a minimum of 2% grade for the first 5.0 metres from building. Grade elevations are as indicated.
2. All roadside ditches, swales and exposed drainage channels to be treated with 75mm of topsoil and seeded/mulched or hydroseeded as soon as possible. (Unless noted otherwise)
3. All materials and construction methods to be in accordance with the City of Ottawa.
4. All disturbed areas to be reinstated to the satisfaction of the engineer and the City of Ottawa.
5. The owner (and/or Contractor) agrees to prepare and implement an erosion and sediment control plan at least equal to the stated minimum requirements and to the satisfaction of the City of Ottawa and the Mississippi Conservation, appropriate to the site conditions, prior to undertaking any site alterations (filling, grading, removal of vegetaiton, etc…) and during all phases of site preparation and construction in accordance with the current Best Management Practices for Erosion and Sediment Control such as but not limited to installing a light duty silt fence barrier as shown of Kollaard Associates Inc. dwg. No. 070415-3 (Erosion & Sediment Control Plan).
6. Match existing elevations at all exterior property lines. Ensure positive drainage whether indicated or not.
7. All lots to be graded to allow positive drainage away from tile beds and dwellings consistent with the drainage patterns outlined on this plan. All isolated low areas are to be eliminated.
8. Undersides of footing and terrace elevations have been set for grading drainage purposes only. Builders should consult the geotechnical report for the subdivision prior to construction. Builders should obtain a subgrade inspection report from qualified engineer prior to concrete placement.
9. Driveway entrance culverts to will consist of non-perforated 12.00 METRE ~ 600mm Ø Corragated Steel Pipel.
10. Roadway subgrade shall be inspected by a licensed Geotechnical engineer prior to the placement of granulars.
11. All drainage easements, road side ditches, and property line swales with slopes one percent (1%) or less require a subdrain (see typical detail).
12. Subdrain cover material to consist of a sand/peat mixture capable of supporting vegetative growth.

NOTE:

1. All dimensions are in metres.
2. All elevations are in metres and are based on a geodetic benchmark. TBM = Bell kiosk located sout/westh side of Dunrobin Road, across from proposed lot #2 , elevation = 79.82 m (geodetic)
3. This drawing does not represent a legal survey.
4. Finished grade to slope away from proposed building at a minimum of 2%. Grade elevations are as indicated.
5. All dimensions to be verified on site by contractor prior to construction.
6. All materials and construction methods to be in accordance with City of Ottawa Standards and Ontario Provincial Standards and Specifications.
7. All disturbed areas to be reinstated to the satisfaction of the engineer and the City of Ottawa.
8. The owner (and/or Contractor) agrees to prepare and implement an erosion and sediment control plan at least equal to the stated minimum requirements and to the satisfaction of the City of Ottawa, appropriate to the site conditions, prior to undertaking any site alterations (filling, grading, removal of vegetation, etc.) and during all phases of site preparation and construction in accordance with the current Best Management Practices for Erosion and Sediment Control
9. Any changes made to this plan must be verified and approved by Kollaard Associates Inc.

No.	REVISION	DATE	BY
0	ISSUED FOR SUBDIVISION APPROVAL	SEP. 23/2021	SD/ML

Kollaard Associates
Engineers
BOX 189
210 PRESCOTT STREET
KEMPTVILLE, ONTARIO
K0G 1J0
FACSIMILE (613) 258–0475
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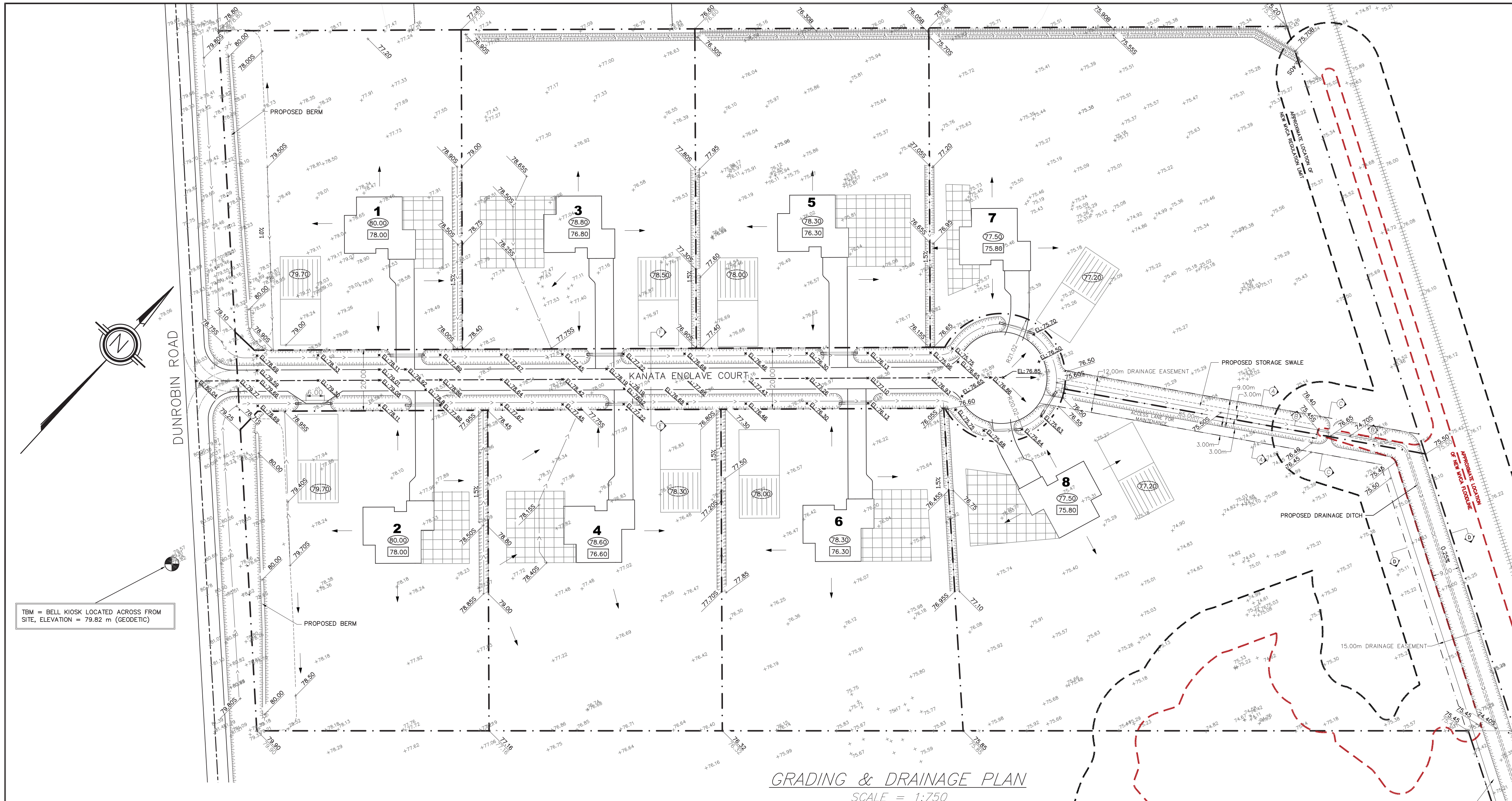
LICENSED PROFESSIONAL ENGINEER
SEPT. 23, 2021
S.E. deWit
100079612
PROVINCE OF ONTARIO

DESIGN	KL/SD/WK
CHECKED	SD
DRAWN	PV/RR/ML
CHECKED	SD
APPROVED	SD

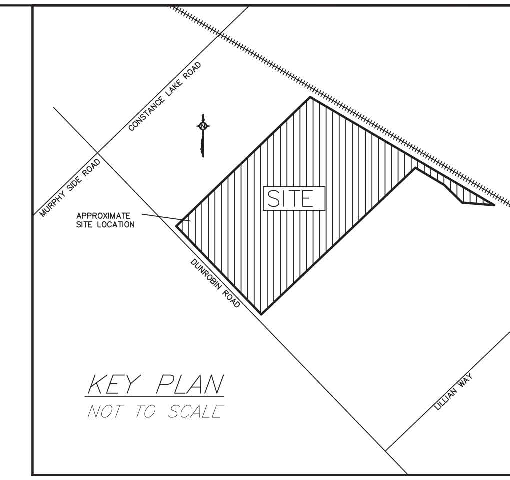
SCALE 1:750

PROJECT LOCATION	2050 DUNROBIN ROAD, CITY OF OTTAWA, ONTARIO
CLIENT NAME	ZBIGNIEW HAUDEROWICZ
PROJECT NAME	PROPOSED RESIDENTIAL SUBDIVISION
DRAWING	SITE SERVICING PLAN
PROJECT No.	200977
DRAWING No.	200977–SER
DATE	MARCH 09, 2021
SHEET SET	



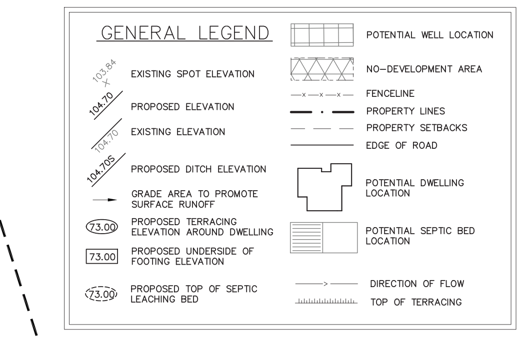
GRADING & DRAINAGE PLAN

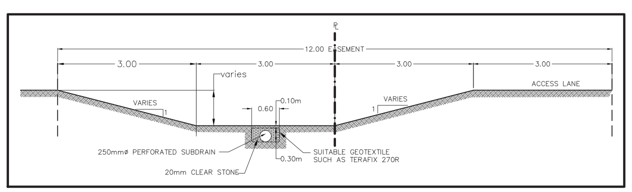
SCALE = 1:750



KEY PLAN

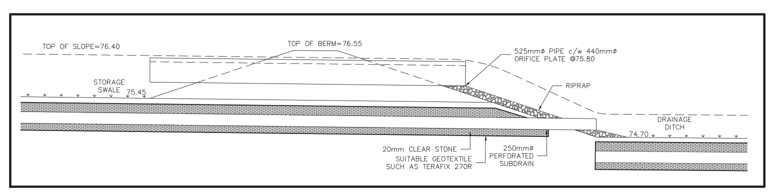
NOT TO SCALE





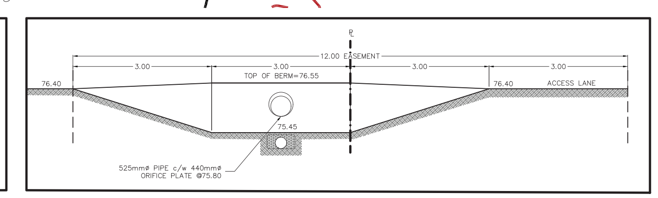
"A–A" PROPOSED STORAGE SWALE SECTION

NOT TO SCALE



"B–B" PROPOSED DRAINAGE DITCH PROFILE

NOT TO SCALE

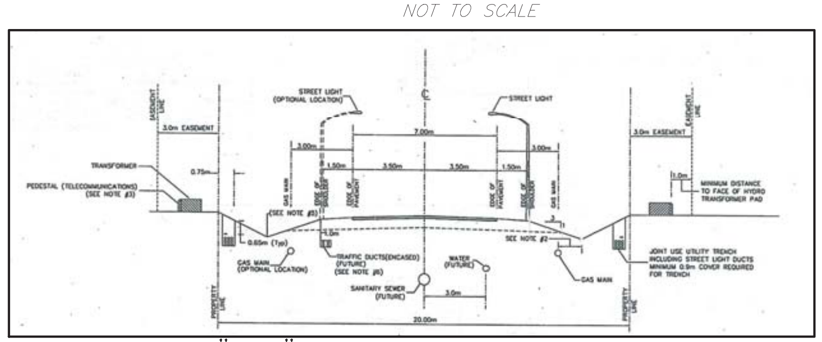


"C–C" ORIFICE DETAIL

NOT TO SCALE

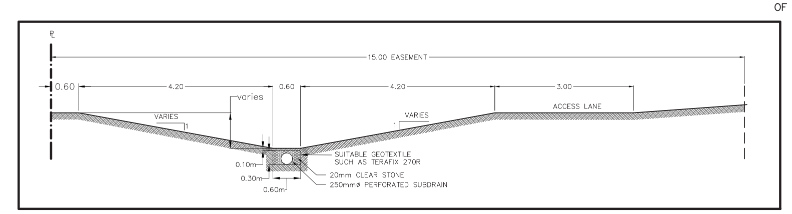
GRADING & DRAINAGE NOTES

1. Finished grade to slope away from proposed and existing buildings at a minimum of 2% grade for the first 5.0 metres from building. Grade elevations are as indicated.
2. All roadside ditches, swales and exposed drainage channels to be treated with 75mm of topsoil and seeded/mulched or hydroseeded as soon as possible. (Unless noted otherwise)
3. All materials and construction methods to be in accordance with the City of Ottawa.
4. All disturbed areas to be reinstated to the satisfaction of the engineer and the City of Ottawa.
5. The owner (and/or Contractor) agrees to prepare and implement an erosion and sediment control plan at least equal to the stated minimum requirements and to the satisfaction of the City of Ottawa and the Mississippi Conservation, appropriate to the site conditions, prior to undertaking any site alterations (filling, grading, removal of vegetaiton, etc…) and during all phases of site preparation and construction in accordance with the current Best Management Practices for Erosion and Sediment Control such as but not limited to installing a light duty silt fence barrier as shown of Kollaard Associates Inc. dwg. No. 070415-3 (Erosion & Sediment Control Plan).
6. Match existing elevations at all exterior property lines. Ensure positive drainage whether indicated or not.
7. All lots to be graded to allow positive drainage away from tile beds and dwellings consistent with the drainage patterns outlined on this plan. All isolated low areas are to be eliminated.
8. Undersides of footing and terrace elevations have been set for grading drainage purposes only. Builders should consult the geotechnical report for the subdivision prior to construction. Builders should obtain a subgrade inspection report from qualified engineer prior to concrete placement.
9. Driveway entrance culverts to will consist of non-perforated 12.00 METRE ~ 600mm Ø Corragated Steel Pipel.
10. Roadway subgrade shall be inspected by a licensed Geotechnical engineer prior to the placement of granulars.
11. All drainage easements, road side ditches, and property line swales with slopes one percent (1%) or less require a subdrain (see typical detail).
12. Subdrain cover material to consist of a sand/peat mixture capable of supporting vegetative growth.



"F–F" PROPOSED ROAD SECTION

NOT TO SCALE



"D–D" PROPOSED DRAINAGE DITCH SECTION

NOT TO SCALE

NOTE:

1. All dimensions are in metres.
2. All elevations are in metres and are based on a geodetic benchmark. TBM = Bell kiosk located sout/westh side of Dunrobin Road, across from proposed lot #2 , elevation = 79.82 m (geodetic)
3. This drawing does not represent a legal survey.
4. Finished grade to slope away from proposed building at a minimum of 2%. Grade elevations are as indicated.
5. All dimensions to be verified on site by contractor prior to construction.
6. All materials and construction methods to be in accordance with City of Ottawa Standards and Ontario Provincial Standards and Specifications.
7. All disturbed areas to be reinstated to the satisfaction of the engineer and the City of Ottawa.
8. The owner (and/or Contractor) agrees to prepare and implement an erosion and sediment control plan at least equal to the stated minimum requirements and to the satisfaction of the City of Ottawa, appropriate to the site conditions, prior to undertaking any site alterations (filling, grading, removal of vegetation, etc.) and during all phases of site preparation and construction in accordance with the current Best Management Practices for Erosion and Sediment Control
9. Any changes made to this plan must be verified and approved by Kollaard Associates Inc.

No.	REVISION	DATE	BY
0	ISSUED FOR SUBDIVISION APPROVAL	SEP. 23/2021	SD/ML

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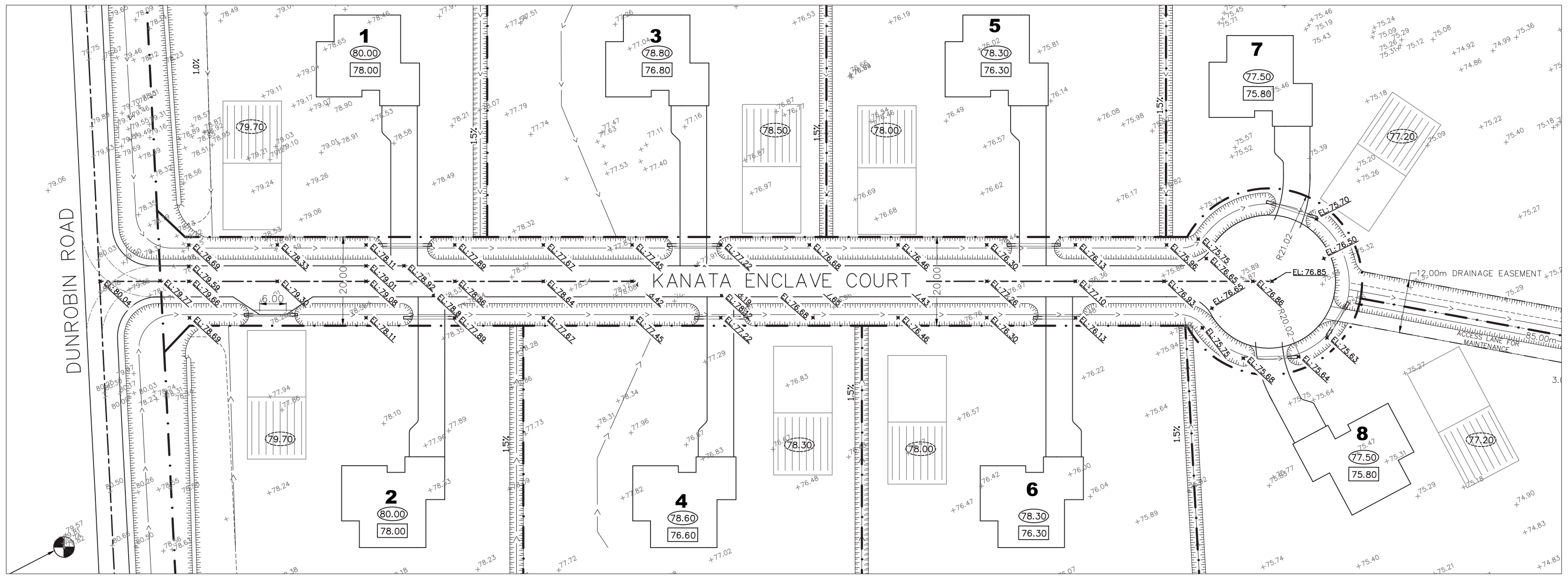
SEPT. 23, 2021
S.E. deWit
100079612
PROVINCE OF ONTARIO

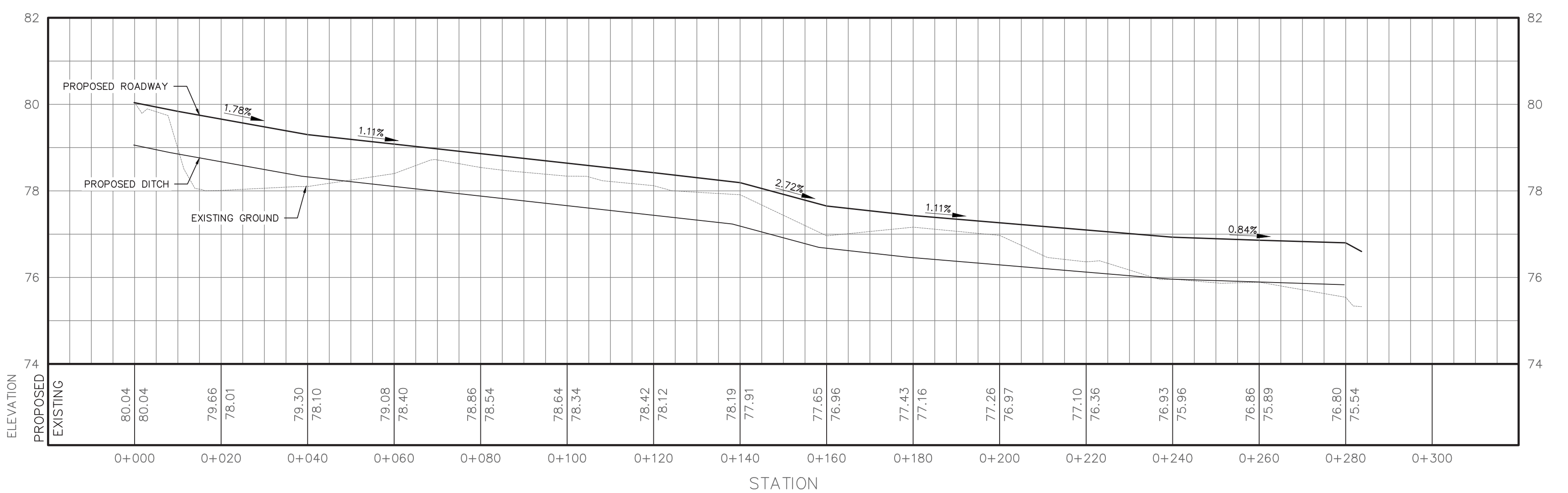
DESIGN	KL/SD/WK
CHECKED	SD
DRAWN	PV/RR/ML
CHECKED	SD
APPROVED	SD

SCALE 1:750

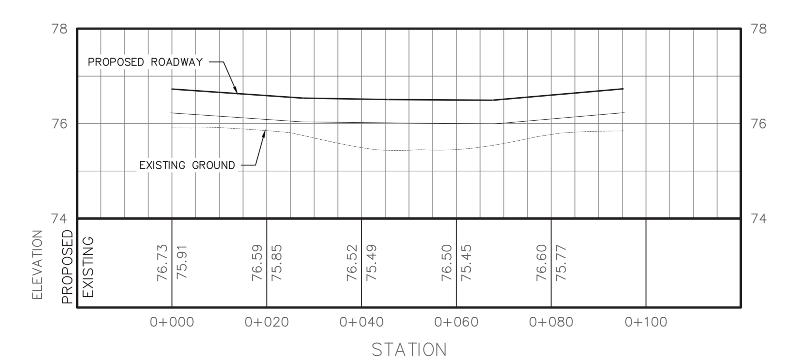
PROJECT LOCATION	2050 DUNROBIN ROAD, CITY OF OTTAWA, ONTARIO
CLIENT NAME	ZBIGNIEW HAUDEROWICZ
PROJECT NAME	PROPOSED RESIDENTIAL SUBDIVISION
DRAWING	GRADING & DRAINAGE PLAN
PROJECT No.	200977
DRAWING No.	200977–GRD
DATE	MARCH 09, 2021
SHEET SET	



STREET 1 PLAN
SCALE = 1:750



STREET 1 PROFILE
SCALE HORIZ. = 1:750 VERT. = 1:75



CUL-DE-SAC EDGE PROFILE
SCALE HORIZ. = 1:750 VERT. = 1:75

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3. This drawing does not represent a legal survey.
4. Finished grade to slope away from proposed building at a minimum of 2%. Grade elevations are as indicated.
5. All dimensions to be verified on site by contractor prior to construction.
6. All materials and construction methods to be in accordance with City of Ottawa Standards and Ontario Provincial Standards and Specifications.
7. All disturbed areas to be reinstated to the satisfaction of the engineer and the City of Ottawa.
8. The owner (and/or Contractor) agrees to prepare and implement an erosion and sediment control plan at least equal to the stated minimum requirements and to the satisfaction of the City of Ottawa, appropriate to the site conditions, prior to undertaking any site alterations (filling, grading, removal of vegetation, etc.) and during all phases of site preparation and construction in accordance with the current Best Management Practices for Erosion and Sediment Control
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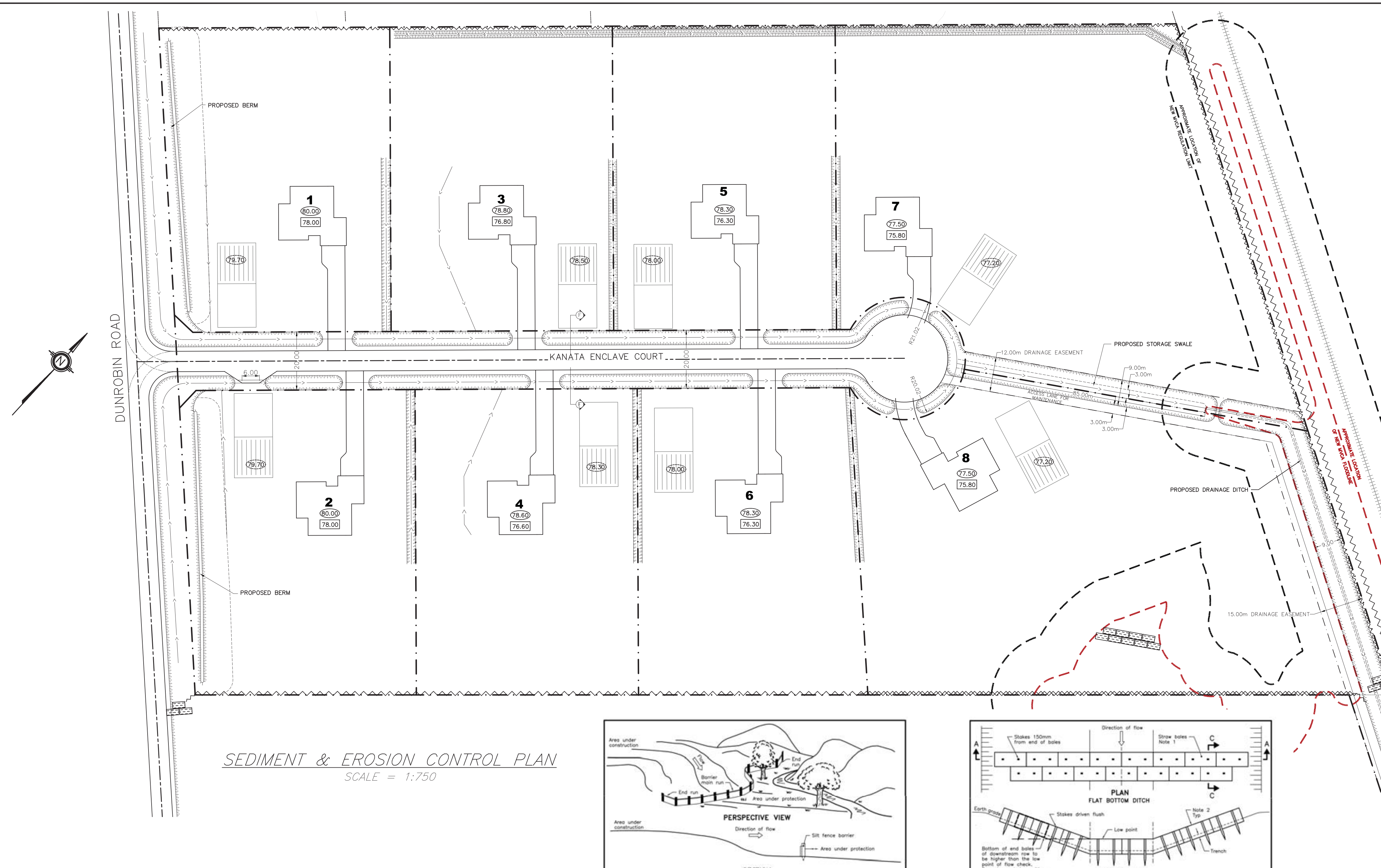
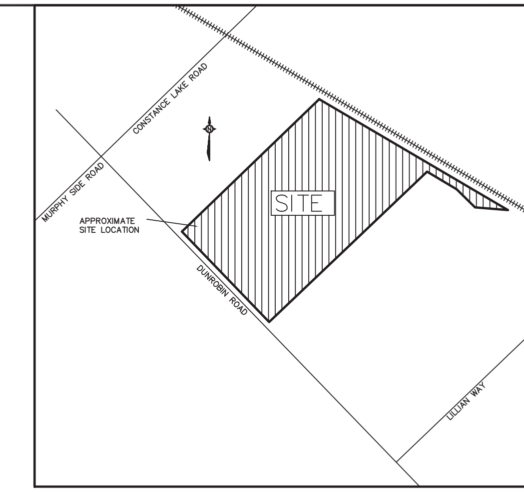
SEPT. 23, 2021
S.E. deWit
100079612
PROVINCE OF ONTARIO

DESIGN	KL/SD/WK
CHECKED	SD
DRAWN	PV/RR/ML
CHECKED	SD
APPROVED	SD

SCALE
1:750
0 5 10 20 30

PROJECT LOCATION	2050 DUNROBIN ROAD, CITY OF OTTAWA, ONTARIO
CLIENT NAME	ZBIGNIEW HAUDEROWICZ
PROJECT NAME	PROPOSED RESIDENTIAL SUBDIVISION
DRAWING	STREET 1 PLAN & PROFILES
PROJECT No.	200977
DRAWING No.	200977-PP
DATE	MARCH 09, 2021
SHEET SET	



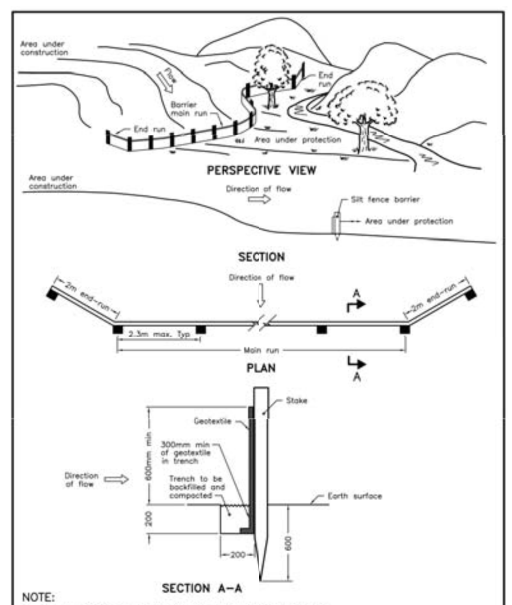


KEY PLAN
NOT TO SCALE

SEDIMENT & EROSION CONTROL PLAN
SCALE = 1:750

SEDIMENT & EROSION NOTES

1. Prior to construction, silt fence barriers will be placed along the front of the site as indicated on the drawing.
2. Straw bale flow check dams to be installed in swales as indicated. These controls will be cleaned after large storm events and maintained throughout construction. If deemed necessary, additional straw bale check dams and silt fences can be installed where required throughout construction.
3. All activities, including equipment maintenance and refueling, shall be controlled to prevent entry of petroleum products or other deleterious substances, including any debris, waste, rubble or concrete material into a watercourse. Refueling and maintenance of vehicles will take place at least 120 metres from the municipal drainage ditch. Any material which is inadvertently spilt shall be cleaned up and removed by the contractor at the contractor's expense in a manner satisfactory to the Contract Administrator. Construction material, excess material, construction debris, and empty containers shall be stored a minimum of 120 metres away from the municipal drainage ditch.
4. The Contractor shall have on site at all times an emergency spill kit that will include as a minimum the following items:
   a) 2-3 in. diameter by 4 ft long floating absorbent boom suitable for water installation
   b) 10 - 18 in x 18 in absorbent pads,
   c) 5 lbs Zorbal absorbing material
   d) 1 pair goggles, 1 pair PVC gloves.
5. Contractor to have a supply of 20 - 40 lb. bags of Zorbal, 2 boxes of 4 ft floating absorbent boom (suitable for water installation, 40 pcs) and 1 box of 18 in. x 18 in. absorbent pads (100 pcs.) on site.
6. All spills will be reported to the local office of the Ministry of Environment as well as the Contract Administrator as soon as they happen. Spills action centre phone hotline # 1-800-268-6060.
7. Every effort will be made to ensure that all disturbed areas are topsoiled and seeded as soon as reasonably possible.
8. As each lot is developed, proper sediment and erosion controls will be installed and maintained until the development of the lot is completed and the vegetative cover is established. Sediment controls shall consist of, at minimum straw bales or a silt fence barrier at the down gradient property line. Grass shall be established as soon as reasonably possible.
9. This drawing is a living document which can be amended as required by the Conservation Authority, City of Ottawa, or Engineer during construction.

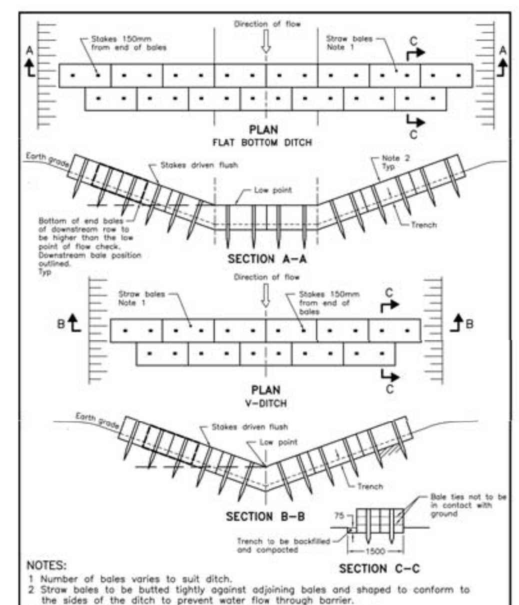


NOTE:
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING — Nov 2006 — Rev 1

LIGHT-DUTY SILT FENCE BARRIER

OPSD 219.110



NOTES:
1 Number of bales varies to suit ditch.
2 Straw bales to be butted tightly against adjoining bales and shaped to conform to the sides of the ditch to prevent water flow through barrier.
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING — Nov 2006 — Rev 1

STRAW BALE FLOW CHECK DAM

OPSD 219.180

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LICENSED PROFESSIONAL ENGINEER — SEPT. 23, 2021 — S.E. deWit — 100079612 — PROVINCE OF ONTARIO

DESIGN	KL/SD/WK
CHECKED	SD
DRAWN	PV/RR
CHECKED	SD
APPROVED	SD

SCALE 1:750

PROJECT LOCATION	2050 DUNROBIN ROAD, CITY OF OTTAWA, ONTARIO
CLIENT NAME	ZBIGNIEW HAUDEROWICZ
PROJECT NAME	PROPOSED RESIDENTIAL SUBDIVISION
DRAWING	EROSION & SEDIMENT CONTROL PLAN
PROJECT No.	200977
DRAWING No.	200977–ESC
DATE	MARCH 09, 2021
SHEET SET	