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

Submitted to:

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PROJECT #: 200977

DISTRIBUTION
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SUMMARY OF MAJOR REVISIONS

Kollaard Associates Inc. (Kollaard) is pleased to present the following fourth revision of the stormwater management design for the proposed residential subdivision to be located at 2050 Dunrobin Road. The stormwater management design and associated report has been revised in response to review comments received from the City of Ottawa, the Conservation Authority and peer review.

The following presents a summary of the major revisions to the stormwater management report in point form. The response to the review comments is included in Appendix J.

- Added section 7.1 Water Balance. Section numbers of the remaining subsections sections in Section 7 were adjusted accordingly.
- Added section 8.4.4 Downstream Erosion. Section numbers of the remaining subsections sections in Section 8 were adjusted accordingly.
- Section 11.1 has been modified to further clarify the operation and maintenance expectations for the subdrains within the conveyance swales.
- Section 11.2.2 has been added to provide guidance on operation and maintenance of the subdrains within the stormwater management swale.

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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 subdivision development at 2050 Dunrobin Road in the City of Ottawa, Ontario. The proposed subdivision will occupy a currently undeveloped parcel of land located along the northeast side of Dunrobin Road southeast of Constance Lake Road. The development will be accessed by extending a roadway northeast from Dunrobin Road. The proposed roadway will terminate with a cul-de-sac. The proposed development area will be divided into 8 single family residential estate lots with a block reserved for stormwater management.

For the remainder of this report Dunrobin Road will be considered to be on a north-south axis and the site is considered to be located on the east side of Dunrobin Road.

This report is intended to present the results of a stormwater management design in support of the application for subdivision approval. The report will summarize the stormwater management (SWM) design requirements and proposed works that will address stormwater flows arising from the site under post-development conditions on a level sufficient to ensure that stormwater management facility is adequately designed to meet the criteria for the site.

The total site development area is approximately 8.96 hectares (22 acres). A road will be extended through the development, east from Dunrobin Road, ending in a cul-de-sac on the site. Residential driveways will originate along both sides of the proposed development roadway. As a result, the most impacted portion of the site by the development will consist of the central corridor which includes the roadway, driveways and dwellings. The single family dwellings will be serviced by wells, on-site septic leaching beds and side yard swales. The proposed residential development will affect an additional 0.11 hectare portion of City of Ottawa property, in the form of re-grading of the roadside between the site and Dunrobin Road.

The report is to be read in conjunction with the stormwater management system design presented in the Kollaard Civil Drawings: 200977 - PRE, 200977 - POST, 200977 – GR-W, 200977 – GR-E, 200977 - ESC, 200977 - PP, 200977 – SVC, 200977 – FC, and 200977 - Details.

1.1. Background

The proposed development has in general a rectangular shape and extends from Dunrobin Road to the former CN railway tracks located along the east side of the site. A narrow portion of the site projects south from the southeast 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 southeastern extension of the site. Harwood Creek is a watercourse of record with sufficient size and capacity to receive the runoff from the proposed development. The initial design for the proposed development was completed in 2010 with various revision following. Conditions for Draft plan approval were received in 2015. At the time the initial design was completed and draft plan approval conditions were provided, flood plain mapping had not been completed for the Harwood Creek and no flood plain was identified on site. It is understood that the flood plain modeling for the Harwood Creek was completed in 2020 by MVCA. As a result of the mapping, a backwater flood plain was identified on the eastern portion of the site.

Modeling of the affect of the proposed development on the backwater flood plain was completed by J.F. Sabourin and Associates Inc. (JFSA) October 25, 2022 and has been presented in a separate report (included in Appendix D).

1.2. Summary

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

The proposed stormwater management plan for the subdivision will make use of best management practices in combination with a treatment train approach to meet the requirements for stormwater management on the site. Stormwater from the majority of the developed portion of each lot, including the driveways and dwelling footprints, and from the adjacent roadway will be collected by means of the roadside ditches and directed to the stormwater management swale. The stormwater management swale will consist of a flat bottomed low sloped swale complete with an enhanced topsoil layer on the bottom underlain by a clear stone layer.

The roadside ditches and stormwater management swale will provide stormwater storage and promote sedimentation, infiltration and filtration while the vegetated swales will promote infiltration and vegetative filtration in order to achieve the quantity and quality control parameters established by the City of Ottawa, Mississippi Valley Conservation Authority and the Ministry of Environment Conservation and Parks.

1.3. Governing Authorities

This Stormwater Management Report has been prepared to present the design information to satisfy conditions set by the following authorities:

City of Ottawa (City)
Mississippi Valley Conservation Authority (MVCA)
Ministry of Environment, Conservation and Parks (MECP) formerly Ministry of Environment (MOE)

1.4. Guidelines and Manuals

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 *(MOE Manual)*
Ministry of the Environment, March 2003

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

CITY OF OTTAWA, Low Impact Development Technical Guidance Report
City of Ottawa, February 2021

Low Impact Development Stormwater Management Planning and Design Guide Version 1.0 **(CVC LID Guide)**
Credit Valley Conservation & Toronto and Region Conservation 2010

MTO Drainage Management Manual
Ontario Ministry of Transportation

Part 650 Hydrology National Engineering Handbook – Chapter 15 Time of Concentration
United States Department of Agriculture (USDA Chapter 15)

Urban Hydrology for Small Watersheds Technical Release 55
United States Department of Agriculture (USDA TR55)

Storm Water Management Model Reference Manual Volume I – Hydrology (Revised)
United States Environmental Protection Agency (US EPA RM)

Low Impact Development Stormwater Management Guidance Manual (Draft January 2022)
Ministry of the Environment Conservation and Parks (MECP LID Guide)

Technical Guide - River and Stream Systems: Erosion Hazard Limit 2002
Ontario Ministry of Natural Resources (Tech Guide EHL)

2. STORMWATER MANAGEMENT DESIGN

The subject lands are within the City of Ottawa and the Mississippi Valley Conservation Authority jurisdiction. Stormwater management criteria were established based on the nature and location of the development and on the nature of the receiving watercourse for the stormwater discharge from the site.

2.1. Design Criteria

2.1.1. Quantity Control Criteria

- Post-development peak runoff rates are to be equal to or less than pre-development levels for all design storm events up to and including the 100 year storm event for the central corridor of the development for all design quantity storm events,
- The net increase in post-development runoff due to uncontrolled rear yard area is mitigated such that there is no downstream impact on the Harwood Creek,
- Onsite stormwater storage and flow shall be controlled as to not affect lands adjacent the development site,
- Surface runoff volumes are to be minimized through infiltration techniques,
- Incorporate low impact design techniques.

2.1.2. Quality Control Criteria

- The design shall include enhanced quality treatment to 80% long-term suspended solids removal for the central controlled area portion of the development,
- Provide treatment by vegetative filtration and naturalization of the rear uncontrolled yard areas of the development,
- Downstream sedimentation shall be mitigated at 2050 Dunrobin Road by increasing particle settlement along runoff flow paths within the development.

2.2. Best Management Practices

As indicated in the MOE Manual, the recommended strategy for stormwater management is to provide an integrated treatment train approach to stormwater management. Each element of the treatment train within the development when combined forms the stormwater management facility for the development.

In general, best management practices for stormwater management are divided into three categories: source control, conveyance control and end-of-pipe control. As indicated in the Ministry of Transportation Drainage Management Manual, the priority in applying these BMPs should follow the sequence presented with end of pipe measures applied as the last resort.

The MECP LID Guide provides the following guidance with respect to Lot Impact Design: Low impact development begins with the application of the principles of 'better site design' or best management practices. From a stormwater management perspective, better site design involves considering site-level opportunities and constraints to stormwater management infrastructure from the beginning of the site design process. While not all of the techniques will apply to every development, the goal is to apply as many of them as possible to maximize stormwater reduction benefits before the use of structural LID best management practice.

Better site design techniques applicable to the propose development include:

- Preserving natural areas and natural area conservation;
- Stream and shoreline buffers;
- Disconnecting and distributing runoff;
- Disconnection of surface impervious cover;
- Rooftop disconnection;
- Disconnection of foundation drainage disposal from a municipal stormwater collection system;
- Reduced lot grading;
- Reduced swale slopes and increased swale cross sections where possible;

The BMPs are intended to reduce flow rates and promote filtration and the removal of sediments.

2.3. Low Impact Design Techniques

LID stormwater management practices include source controls and conveyance controls. LID incorporated within the development will include;

- Downspout disconnection;
    - Rainfall collected from the roof of each dwelling will be directed by downspouts to a the pervious grassed surfaces beside each dwelling. This prevents stormwater from directly flowing across a connected impervious surface. It also prevents the

downspouts from being connected to a storm pipe which discharges to the ditches and therefore disconnects the downspout from the receiving sewer. This downspout disconnection is further facilitated by the proposed grading which slopes away from the dwellings ensure downspout drainage will not negatively impact the foundation drainage.

- Foundation drain disconnection;
  - Each dwelling will be serviced with a sump pump which discharges to the ground surface within the property limits. As such the foundation drains will be disconnected from any receiving sewer.

- Enhanced Grassed Swales or Vegetated swales;
  - Simple grass channels or ditches have long been used for stormwater conveyance, particularly for roadway drainage. Enhanced grass swales incorporate design features such as modified geometry that improve the contaminant removal and runoff reduction functions of simple grass channel and roadside ditch designs.
  - As further discussed in Section 5.2, the swales utilized within the proposed development have wide flat bottoms to decrease the flow depth and increase contact between the flow and vegetation. This enhances the removal of contaminate from stormwater runoff.

- Dry Swale or Bioswale;
  - The proposed stormwater storage swale has been designed in part as a bioswale as further described in Section 6.1.

- Soil Amendments;
  - The soil layer within the storage swale will be amended to increase the void ratio improving infiltration as further described in Section 6.1.

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 / (Time in min + 6.053)$^{0.814}$

2 year Intensity = 732.951 / (Time in min + 6.199)$^{0.810}$

The data obtained from the IDF curves for the site was used to generate SCS Type II Design and Storms and Chicago Storms with select durations and return periods up to and including the 100 year storm event. The historical design storms from July 1, 1979 and August 4, 1988 were included in the analysis to verify the sufficiency of the design. The 25 millimeter 4 hour Chicago storm is considered by the Ontario Ministry of Environment Conservation and Parks to be the design storm for quality control purposes and was also included in the analysis. The City of Ottawa requires that the drainage system be stress tested on the basis of a 20% increase to the City's IDF curves rainfall values. The 120% 12 hour 100 Year Chicago storm was also added to the analysis to satisfy this requirement. *Table 3-1* summarizes the selected design storms included for analysis.

Table 3-1: Design Storms Considered

Quantity Control Storm Events	
Simulation 01.	SCS II 6 hr 5 yr
Simulation 02.	SCS II 6 hr 100 yr
Simulation 03.	SCS II 12 hr 5 yr
Simulation 04.	SCS II 12 hr 10 yr
Simulation 05.	SCS II 12 hr 100 yr
Simulation 06.	12 HR 2 YR Chicago
Simulation 07.	12 HR 100 YR Chicago
Simulation 08.	Historical July 1 1979
Simulation 09.	Historical Aug 4 1988
Quality Control Storm Events	
Simulation 10.	25mm 4 hr Chicago
Stress Test	
Simulation 11	120% 12 HR 100 YR Chicago

3.2. Methodology

The hydrologic modeling software, Visual OTTHYMO (V6.2) 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 listed for Simulations 1 to 9 in Table 3-1 above.

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

The SCS Type II storm data was given priority in the SWM design as the proposed development is a rural residential development. The 12 hour 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. With the exception of a portion of the site at about the midpoint of the property line between proposed Lot 7 and proposed Lot 8, the subsurface conditions were found to consist of sand, silty sand and glacial till underlying the topsoil at the site. Test pit TP14, put down at about the property line between proposed Lots 7 and 8, encountered silty clay below about 0.3 metres of topsoil. The Hydrologic soil type was chosen to be Group B for the majority of the site and Group D for the area surrounding Test Pit TP14 in keeping with the Hydrogeological Investigation and Terrain Evaluation Report prepared for the proposed development. A calculation of the CN values for both the pre- and post-development conditions is presented in Appendix A. The difference in soil group classification between Soil Group B (SG B) and Soil Group D (SG D) was accounted for during the weighted average calculation of the CN number for each catchment area.

The CN values used for each catchment area consist of a weighted average value based on the conditions and cover of the ground surface and the soil type 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 (CN = 61 for SG B and 80 for SG D), Woods/brush in good condition (the woods/brush on site is recent re-growth with dense undergrowth) (CN = 55 for SG B and 77 for SG D), Unmaintained and overgrown rear yards and Woods/brush in fair condition (CN = 60 for SG B and 79 for SG D), and Impervious 98. The offsite contributing area to the northwest was considered to be a combination of unmaintained and overgrown rear yards and woods/brush in good condition resulting in a CN of 57.5. 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. Impervious Ratio

The impervious ratio for the development consists of the total onsite impervious area divided by the total site area and is equal to 0.849 ha / 8.960 ha = 0.095. The site has an imperviousness of 9.5 percent.

The imperviousness for each post-development catchment area was calculated as indicated by the following example calculation for Catchment C11:

Assumed total house area = 600 m^2. Area of house to rear (catchment C6) is 300 m^2. Area of house to front or catchment C11 is 300 m^2

Contribution of Roadway to catchment C11 is 270m^2. Area of Driveway is 180 m^2.

Total impervious area in catchment C11 = 300 + 270 + 180 = 750 m^2. Imperviousness is calculated as the total impervious area / total area and is equal to 750/3767 = 0.199 or 20%.

3.3.3. 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 (OTTHYMO). 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.

3.3.4. 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 (overland) flow T_{sc}, and open channel flow T_c. The open channel flow has been modelled using the route Channel Command in OTTHYMO.

3.3.4.1. Travel time for sheet flow

Sheet flow is defined as flow over plane surfaces. Sheet flow usually occurs at the upper end of each individual catchment and typically occurs for no more than 30 metres before transitioning to shallow concentrated flow. The Manning's roughness coefficients used for sheet flow only apply for flow depth of less than 3 cm and vary from those used in shallow concentrated flow and open channel flow.

The travel time for sheet flow is calculated using the simplified Manning's Kinematic solution as follows:

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

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

The Manning's roughness coefficient for sheet flow includes the effects of roughness as well as the effects of raindrop impact, drag over the surface, obstacles such as litter and rocks and transportation of sediment.

The Manning's n for sheet flow ranges from 0.8 for Woods (with dense underbrush and no clearing of deadfall and other detritus) to 0.018 for bare hard packed earth. The Manning's n for grass ranges from 0.15 (short grass prairie or lawn grass with bare patches), 0.24 (dense prairie grasses (long stems grasses)) to 0.41 (Bermuda grass or dense lush lawn grass).

The ground surface conditions during pre-development beginning on the western portion of the site consist of meadow which transitions to deciduous shrub thickets through the center to woodland at the east end of the site. Since the sheet flow occurs at the upper end of the catchment area, the sheet flow during pre-development conditions on site will occur through the meadow portion of the site. As such a Manning's roughness coefficient of 0.24 corresponding to dense prairie grass cover was used for pre-development conditions for the site.

During post-development conditions, the runoff originating on each lot will be divided and will be either directed across the front yard to the roadside ditch or across the back yard to the swale along the rear property lines. Based on the proposed grading plan, it is anticipated that the front yards and the portion of the rear yard beside and immediately behind the proposed dwelling will be completely developed and regraded. These regraded portions of the lot will be surfaced with a maintained lawn upon completion of development. Since the sheet flow portion of the runoff for these catchment areas will occur over the regraded portions of each lot, a Manning's roughness coefficient of 0.4 was used for post-development conditions assuming a maintained lawn with lawn grass in good condition cut to not less than 3 cm in height (It is noted that the average recommended grass height for lawns subjected to cool weather varies from 1.5 to 3 inches or 3 to 7.5 cm).

Shallow concentrated flow was assumed to occur after a maximum of 30 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.

3.3.4.2. Travel time for shallow concentrated flow

Shallow concentrated flow follows sheet flow and is expected to occur at depths of greater than 3 cm and less than 15 cm. The Manning's roughness coefficients for shallow concentrated or overland flow was obtained from Table 3-5 of the US EPA RM. The flow velocity used to calculate the time of travel for shallow concentrated flow was determined using Table 15-3 and Figure 15-4 of Chapter 15 of the USDA handbook (Included in Appendix B of this Report). Since the ground surface cover descriptions provided on Table 15-3 are agricultural in nature, they do not readily relate to the expected ground surface cover to be encountered in the proposed development. As such, the corresponding Manning's n value provided in Table 15-3 was used to relate the ground surface cover description used in Figure 15-4. From US EPA RM Table 3-5, when considering shallow concentrated flow or overland flow, a Manning's n of 0.075 is used for parks and lawns, 0.09 for dense grass and 0.12 for shrubs and bushes. A Manning's n of 0.202 is used for forest with heavy ground litter and hay meadows.

As previously discussed, it is expected that the shallow concentrated flow during pre-development conditions will occur through shrubs and bushes which corresponds to a Manning's n of 0.12. This value is between the n values corresponding to the descriptions given in Table 15-3 for Minimum tillage and Forest. The flow velocity for both descriptions was obtained from Figure 15-4 for the average slope of the catchment and then liner interpolation was used to determine the flow velocity for a Manning's n of 0.12 as follows:.

Catchment Area C-PRE1 has a slope of 0.9%. From Figure 15-4 the flow velocity assuming minimum tillage n = 0.101 is 0.48 ft/s and for forest n = 0.202 is 0.24 ft/s. Using linear interpolation for n = 0.12 results in a flow velocity of 0.28 ft/s or 0.09 m/s.

During post development conditions, the shallow concentrated flow resulting from runoff generated in the front yards is expected to occur in the side yard swales where the ground surface will be covered with lawn corresponding to a Manning's n of 0.075. Referencing Table 15-4 this n value closely corresponds to the description of Short-grass pasture n = 0.073. The shallow concentrated flow in the rear yards is expected to occur along less defined flow paths than in the front completely regraded portion of each lot. As such, it expected that the grass growth will be less maintained, relatively higher in relation to the flow depth and there will be more litter on the ground surface obstruction the flows. Based on these expected conditions, the Manning's n for the rear yard catchments during post development conditions is expected to be between n = 0.09 and n =0.202. Referencing Table 15-4 an n value of 0.09 closely corresponds to the description of minimum tillage. Flow velocities for minimum tillage and for forest were obtained for each rear yard catchment and averaged to obtain the flow velocity for shallow concentrated flow during post development conditions in the rear yards.

As an example: The slope in Catchment C8 for shallow concentrated flow was determined to be 1.28 m over a distance of 58 m or 0.022. From Figure 15-4 of the USDA Handbook using a slope of 0.022 the velocity is estimated at 0.75 ft/s for minimum tillage and 0.37 ft/sec for forest. Averaging these two values results in a flow velocity of 0.56 ft/s or 0.17 m/s.

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

Where T_{sc} = travel time, hrs

l = distance of shallow concentrated flow = 58 m

V = average velocity = 0.17 m/s

T_{sc} = 0.09 hrs

3.3.4.3. 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 ditches and drainage swales. The drainage swales and roadside ditches in the development are channels which were designed to be excavated channels in earth. Further discussion on these channels is included in sections 3.4, 6.2 and 6.3.

3.4. Open Channel Flow

Open Channel Flow will occur in the road side ditches and the storage and conveyance swale extending from the end of the cul-de-sac to Harwood Creek and in the proposed swales along the north, south and east sides of the site.

3.4.1. Conveyance of Offsite Runoff

Sheet flow and shallow concentrated flow from the offsite catchment north of the site will be collected by the proposed shallow swale located along the north side of the proposed development. This flow will be routed along the outside edge of the development to the proposed swale along the east side of the development which will discharge into the outlet swale for the proposed storm water storage facility.

3.4.2. Conveyance of Internal Site Runoff

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

3.5. 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-PRE and 200977-POST.

3.5.1. 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, the Mississippi Valley Conservation Authority Flood Plain Mapping and LIDAR imagery. 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 east 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 south of the site which contribute runoff to the site.

As indicated by the LIDAR image underlain on the pre-development drawing and topographic information obtained from contours of the adjacent site, a portion of the properties north of the site contribute runoff to the site. The north limit of the off-site catchment, as shown on the pre-development drawing, essentially passes through the high points indicated by the contour lines. Since the north limit is located on the high points, it represents a flow divide with runoff originating north of the line being directed towards Constance Lake Road. Runoff originating on this offsite area south of the high point will be directed towards the site. This offsite area has been delineated on the pre- and post-development drainage plans and is the same for both pre and post conditions.

3.5.2. Delineation of Onsite Catchment Areas

The onsite catchment areas were delineated based on the topography obtained for the site area and on the proposed development. Since the general flow direction during pre-development conditions is from west to east, the onsite pre-development catchment areas were simplified to 3 catchments. The central catchment area C-PRE3 consists of the area that will be controlled during post-development conditions and represent the majority of the area that will be most impacted by the development. The remaining two onsite catchments consist of the areas south and north of the central catchment.

The catchment areas used in the analysis during post-development conditions for the design of the stormwater management facility are presented in the attached drawing 200977-POST – Post-Development Drainage Plan. These catchment areas have been delineated based on the proposed lot grading and have been divided between front yard and rear yard grading.

4. PRE-DEVELOPMENT STORMWATER ANALYSIS

4.1. Adjacent Off Site Properties

4.1.1. Delineation of Catchments

As previously indicated, the site is located on the east side of Dunrobin Road in the City of Ottawa. The site is continuously sloped downward from the edge of Dunrobin Road towards the former railway along the east side of the development. The predominate slope is oriented perpendicular to Dunrobin Road. There is a slight cross slope towards the southeast such that the runoff at the east end of the site is directed to the Hardwood Creek located south of the site.

The existing road side ditch between the shoulder of Dunrobin Road and the site is poorly defined with minimal back slope at many locations. As a result, all of the runoff generated from the north bound lane of Dunrobin Road and from the ditch along the east side of the road is considered to travel across the site. Catchment areas C-A and C-B have been used to model the runoff contributed from Dunrobin Road during both pre- and post-development conditions. C-A includes the portion of the east lane and shoulder of Dunrobin Road as well as the east roadside ditch adjacent the site, north of the proposed site entrance. C-B includes the portion of the east lane and shoulder of Dunrobin Road as well as the east roadside ditch adjacent the site, south of the proposed site entrance. C-A and C-B are used to model the contribution to the site from Dunrobin Road during both pre- and post-development conditions.

As indicated by the LiDAR image underlain on the pre-development drawing and topographic information obtained from contours of the adjacent site, a portion of the properties north of the site contribute runoff to the site. The north limit of the off-site catchment as shown on the pre-development drawing essentially passes through the high points indicated by the contour lines. Since the north limit is located on the high points, it represents a flow divide with runoff originating north of the line being directed towards Constance Lake Road. Runoff originating on this offsite area south of the high point will be directed towards the site. This off site area has been delineated on the pre- and post-development drainage plans as catchment area C-OFF1 and is the same for both pre and post conditions.

During pre-development conditions, runoff from C-OFF1 is directed across the site by a shallow swale which outlets to the Harwood Creek. A review of aerial photographic images of this catchment indicates that C-OFF1 is predominately surfaced with a mixture of lawn, unmaintained rear yards (grass/brush) and woods/brush with the upper portion of the catchment consisting of unmaintained rear yards.

Catchment C-OFF1 is indicated in both the pre- and post- development drawings to include the Dunrobin Road allowance to the center of the Roadway. As such the portion of Dunrobin Road north of the site that could contribute runoff to the site is included in Catchment C-OFF1. There is not runoff contributed to the site from Dunrobin Road south of the site. Catchments C-A, C-B and C-OFF1 are considered to include the entire runoff contribution from Dunrobin Road to the Site.

Runoff from the adjacent property to the south flows in a southeasterly direction to the Harwood Creek and does not contribute to the site.

4.1.2. Catchment Area Curve Numbers

As indicated in Section 3 of this report, the analysis was completed using Visual OTTHymo which uses the Runoff Curve Number CN as opposed to the runoff coefficient commonly used in combination with the Rational Method. Also as indicated in Section 3, the hydrologic soil group was considered to be Group B and the various ground surface covers and associated Curve Numbers are 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; Unmaintained and overgrown rear yards and Woods/brush in fair condition 60; and Impervious 98. These Runoff Curve Numbers would correspond to runoff coefficients as follows: CN of 61 ≈ n of 28; CN of 60 ≈ n of 25; CN of 55 ≈ n of 14; CN of 98 ≈ n of 0.99.

The Runoff Curve Number for each off site pre-development catchment area was calculated using a weighted average of the ground surface covers within each catchment as shown in the following Table 4-1.

Table 4-1: Pre-Development Runoff Curve Numbers – Offsite Areas

Catchment	Surface	Area Ha	CN	Weighted Average CN
C-OFF1 (1.68 ha)	Unmaintained Rear Yard	0.80	60	59.5
	Wood/brush good cond.	0.88	55	
	Impervious	0.04	98	
C-A (0.17 ha)	Open Space (grass)	0.11	61	73.9
	Impervious	0.06	98	
C-B (0.17 ha)	Open Space (grass)	0.11	61	73.9
	Impervious	0.06	98	

4.2. On Site Pre-Development Catchments

4.2.1. Onsite 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 and shallow concentrated 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.

4.2.2. Onsite Delineation Catchments and Curve Numbers

As previously indicated, since the general flow direction during pre-development conditions is from west to east, the onsite pre-development catchment areas were simplified to 2 catchments divided by the approximate centerline of the future roadway. Based on the ground surface cover the Runoff Curve Numbers for the onsite pre-development conditions are as shown in Table 4-2.

Table 4-2: Pre-Development Runoff Curve Numbers – Onsite Areas

Catchment	Total Area (ha)	Maintained Lawn CN		Impervious CN=98	Unmaintained Rear Yard CN		Wood Good Cond. CN		Weighted Average CN
		61	80		60	79	55	77	
		Area (ha)		Area (ha)	Area (ha)		Area (ha)		
C-PRE1	2.903	0.968	0.0	0.00	0.968	0.0	0.792	0.175	60.0
C-PRE2	2.874	1.061	0.0	0.00	1.061	0.0	0.854	0.208	60.1
C-PRE3	3.184	0.958	0.0	0.00	0.958	0.0	0.779	0.179	60.0

4.3. Pre-Development Runoff

As previously indicated, the runoff criteria from a quantity control perspective were given as: post-development peak runoff rates are to be equal to or less than pre-development levels for all quantity control storms up to and including the 100 year storm event; and surface runoff volumes are to be minimized through infiltration techniques.

The pre-development peak runoff rate and runoff volume were calculated using the OTTHYMO model. Table 4-3 summarizes the pre-development peak runoff rate and runoff volumes calculated using the OTTHYMO model. Appendix E contains pre-development OTTHYMO summary output data as well as 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.

The pre-development runoff rate for each design storm was calculated for the central catchment area and for the entire site to facilitate comparison to the post-development flow rates in keeping with the stormwater management criteria. The results of the calculations are presented in the following Table 4.3

Table 4-3: Pre-Development Runoff Rates and Runoff Volumes

Design Storm Event		Pre-Development Runoff Rate		Runoff Volume
		Central Catchments 3.22 ha[1]	Entire Site 10.99ha[2]	
		(m^3/s)	(m^3/s)	(mm)
Sim 1	6 hour 5 year SCS Type II	0.027	0.092	6.78
Sim 2	6 hour 100 year SCS Type II	0.096	0.329	22.63
Sim 3	12 hour 5 year SCS Type II	0.031	0.106	9.18
Sim 4	12 hour 10 year SCS Type II	0.046	0.158	13.20
Sim 5	12 hour 100 year SCS Type II	0.100	0.348	27.46
Sim 6	12 hour 2 year Chicago	0.012	0.039	4.33
Sim 7	12 hour 100 year Chicago	0.091	0.321	26.30
Sim 8	Historical Storm July 1, 1979	0.122	0.429	21.08
Sim 9	Historical Storm August 4, 1988	0.098	0.336	19.37
Sim 10	25mm 4 hour Chicago	0.003	0.009	0.78
Sim 11	120% 12hr 100 year Chicago	0.132	0.471	37.15

1) Central Catchments include onsite catchment area C-PRE3 and offsite catchments C-A and C-B
2) Entire Site includes all of the onsite and offsite catchment areas.

5. POST-DEVELOPMENT MODEL

5.1. Post-Development Catchment Areas

5.1.1. Adjacent Off Site Properties

The offsite catchment areas delineated in section 4.1.1 will not be significantly altered as a result of the proposed development. As such, the offsite catchments delineated to model pre-development conditions were used without alteration in the post-development model.

5.1.2. Onsite Post-Development Catchment Areas

5.1.2.1. Post-development Conditions

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. During post-development conditions, the runoff originating on each lot will be divided and will be either directed across the front yard to the roadside ditch or across the back yard to the swale along the rear property lines. Based on the proposed grading plan, it is anticipated that the front yards and the portion of the rear yard beside and immediately behind the proposed dwelling will be completely developed and regraded. These regraded portions of the lot will be surfaced with a maintained lawn upon completion of development. The remaining areas of the rear yards are expected to be left in a more natural condition resulting in an unmaintained condition.

5.1.2.2. Delineation of Catchments and Runoff Curve Numbers

In order to model the post-development conditions onsite, the proposed development area was divided into a total of 16 catchment areas. These catchments were delineated on a lot by lot basis such that the area of each lot draining towards the proposed road was considered as one catchment and the lot area directing runoff to the rear of the lot was considered as a second catchment for each lot. It is considered that the runoff from the roofs of the proposed dwellings will be split with runoff the back half of the dwelling being directed to the backyard while the runoff from the remainder of the dwelling and garage is directed to the front yard. The half of the road allowance for the proposed roadway immediately adjacent each lot was also included within the front yard catchment.

Based on the ground surface cover the Runoff Curve Numbers for the onsite post-development conditions are as shown in Table 5-1.

Table 5-1: Post-Development Runoff Curve Numbers – Onsite Areas

Catchment	Total Area (ha)	Maintained Lawn CN		Impervious CN=98	Unmaintained Rear Yard CN		Wood Good Cond. CN		Weighted Average CN
		61	80		60	79	55	77	
		Area (ha)		Area (ha)	Area (ha)		Area (ha)		
C1	0.496	0.080	0.0	0.030	0.386	0.0	0.0		62.5
C2	0.503	0.080	0.0	0.030	0.393	0.0	0.0		62.4
C3	0.510	0.080	0.0	0.030	0.400	0.0	0.0		62.4
C4	1.676	0.603	0.035	0.030	0.661	0.097	0.206	0.044	62.4
C5	1.408	0.563	0.075	0.030	0.444	0.110	0.164	0.022	63.5
C6	0.501	0.120	0.0	0.030	0.351	0.0	0.0		62.5
C7	0.501	0.080	0.0	0.030	0.391	0.0	0.0		62.4
C8	0.493	0.080	0.0	0.030	0.383	0.0	0.0		62.5
C9	0.359	0.286	0.0	0.073	0.0	0.0	0.0		68.5
C10	0.376	0.301	0.0	0.075	0.0	0.0	0.0		68.4
C11	0.377	0.302	0.0	0.075	0.0	0.0	0.0		68.4
C12	0.295	0.157	0.055	0.083	0.0	0.0	0.0		75.0
C13	0.340	0.137	0.124	0.079	0.0	0.0	0.0		76.5

C14	0.363	0.290	0.0	0.073	0.0	0.0	0.0		68.4
C15	0.376	0.301	0.0	0.075	0.0	0.0	0.0		68.4
C16	0.387	0.311	0.0	0.076	0.0	0.0	0.0		68.3

5.1.2.3. Comparison of Pre- to Post- Development Onsite Conditions

As previously indicated, the pre-development onsite catchments were divided into three catchment areas consisting of the central portion which will be most affected by the proposed development and the two outside areas. The above post-development catchments were combined into three post-development areas matching the pre-development catchments in order to directly compare the pre- and post- development runoff curve numbers to illustrate the affect of the proposed development on the Runoff Curve Numbers. This comparison is provided in Table 5-2.

Table 5-2: Comparison of Pre- to Post-Development Runoff Curve Numbers

Catchment	Total Area (ha)	Maintained Lawn CN = 61 / CN = 80	Impervious CN=98	Unmain. Rear Yard CN = 60 / CN = 79	Wood Good Cond. CN = 55 / CN = 77	Weighted Average CN
		Area (ha)	Area (ha)	Area (ha)	Area (ha)	
Central Area (post areas C9 – C16)						
C-PRE3	2.874	0.958 /	0.000	0.958/	0.779/ 0.179	60.0
Post	2.873	2.085 / 0.179	0.609	0	0	70.0
North Side (post areas C5 – C8)						
C-PRE1	2.903	0.968 /	0.000	0.968/	0.792/ 0.176	60.0
Post	2.903	0.843/ 0.075	0.120	1.569 / 0.110	0.164 / 0.022	62.9
South side (post areas C1 – C4)						
C-PRE2	3.184	1.061 /	0.000	1.061 /	0.854 / 0.207	60.1
Post	3.184	0.843 / 0.035	0.120	1.839 / 0.097	0.206 / 0.044	62.4

5.2. Stormwater Conveyance

5.2.1. Proposed Swales

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 driveways, attached garages and front half of the proposed dwellings will be directed to the road side ditches along the subdivision roadway. This runoff will be conveyed to the stormwater storage 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 south side of the development will be directed to a proposed swale along the south side of the site. This swale will discharge into the outlet swale downstream of the outlet control in the stormwater storage swale. 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 swale constructed along the rear property lines of these lots. The swale will discharge to the outlet swale extended from the outlet control structure following the stormwater storage swale and will replace the existing swale currently directing this runoff to the Harwood Creek.

5.2.2. Permeability of Native Soils along Proposed Swales

Permeability testing was completed on the native glacial till materials along the north and south sides of the proposed development and within the area of the proposed stormwater storage swale. The test results are included in Appendix F. The test results indicate that the permeability k for the native soils at the site at the north and south sides of the site ranges from 1.26×10^{-6} m/s to 9.44×10^{-7} m/s. The permeability of the native soils in the area of the proposed stormwater storage swale was determined to be 1.64×10^{-7} m/s. It is noted that the permeability of a soil and the hydraulic conductivity of water in the same soil have the same value.

The following table obtained from Appendix C of the CVC LID guide indicates the relationship between the Percolation Time, Coefficient of Permeability and Infiltration Rate.

Table C1: Approximate relationships between hydraulic conductivity, percolation time and infiltration rate

Hydraulic Conductivity, K_{fs} (centimetres/second)	Percolation Time, T (minutes/centimetre)	Infiltration Rate, 1/T (millimetres/hour)
0.1	2	300
0.01	4	150
0.001	8	75
0.0001	12	50
0.00001	20	30
0.000001	50	12

Source: Ontario Ministry of Municipal Affairs and Housing (OMMAH). 1997. Supplementary Guidelines to the Ontario Building Code 1997. SG-6 Percolation Time and Soil Descriptions. Toronto, Ontario.

From the above comparison, the native soils at the site would have an estimated infiltration rate of 30 to 50 mm/hr and a Percolation Time T of 12 to 20 min/cm.

5.2.3. Limits to Longitudinal Slope of Swales

The swale along the north side of the proposed development is required to intersect and convey off site runoff occurring during the existing conditions. This means that the bottom of the swale plus a minimum swale depth must be below the existing ground surface. This results in a maximum elevation at the start of the channel section due to actual physical constraints which cannot be altered because the constraints are established by the ground surface elevation of the adjacent private property. The outlet elevation is fixed by the normal flow conditions and bottom elevation of the receiving water course. In a similar manner, the maximum bottom of swale elevation along the south side of the site is also fixed by existing conditions and is limited such that the bottom of the swale is below the existing ground surface in order to receive runoff from the adjacent surface areas.

Due to these limiting constraints there will be sections of the proposed swales with longitudinal slopes of 0.3% which meets the criteria for minimum allowable slope but is less than the minimum recommended longitudinal slope of 0.5%. It is considered that these low slopes in the swales will result in insufficient slope to ensure that there are no localized high or low spots within the swale channel. In order to prevent ponded water in the localized depressions along the bottom of the swale, a 150 mm diameter perforated subdrain complete with clearstone will be installed along the swale bottoms. The clearstone and perforated drain will have a nominal depth of 0.4 metres below the bottom of the swale. The clearstone and perforated drain will ensure any ponded water within the swale is within the clearstone below the ground surface. The clearstone and subdrain should be installed in the rear yard and side yard swales where the slope is less than 1.5%. The resulting swales will essentially be a design variation of the enhanced grass swales specified in CVC LID guide as they will incorporate a perforated pipe underdrain.

A subdrain in keeping with the City of Ottawa Drawing S9 is not considered to be suitable and is not recommended for the swales at the site due to the depth of the S9 profile and the cross sectional design. The minimum profile depth of the section specified by S9 would be about 750 mm which places the subdrain profile in close proximity to or on the underlying bedrock.

The subdrains will outlet into the Harwood Creek at the 2 year flood elevation within the creek. The subdrains are intended to prevent surface ponding and intermittent ponding along the length of the swales. The subdrains will ensure that any ponding is within the clearstone below the bottom of the swales eliminating any standing water along the rear of the lots. Since the subdrain trenches have a shallow depth of 400 mm, maintenance of the subdrain can be completed by exposing the subdrain section of concern from the ground surface.

5.2.3.1. Duration of Ponding in Swales

The clearstone and perforated pipe underdrain below the swales have will outlet to the Harwood Creek at about the 2 year flood level. Discharge from the clearstone and underdrain will be by infiltration and by flow through the pipe. Since there is direct outlet for the subdrains within the perimeter swales, it is expected that potential temporary ponding within the swales can be attributed to a major storm event or to elevated flood levels within the Harwood Creek. The duration of the temporary ponding will be a function of the depth of water required to convey the flow or the duration of the elevated flood levels within the Creek. It is expected that the ponding levels within the swales will be contained within the clear stone below the swale surface following the completion of the storm event.

The total time for the water to infiltrate or discharge from the subdrains following a rainfall event would be less than 24 hours which is less than the time required for one mosquito breeding cycle.

5.2.4. Description of Main Swales

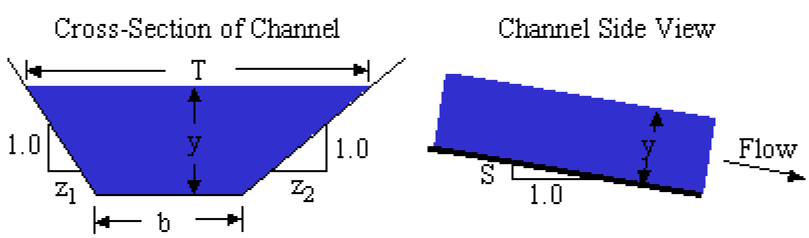
There are five main swales proposed for the site. These swales consist of:

1. The north swale begins near Dunrobin Road and is located along the north side of the site. A review of the proposed grading plan indicates that the flow in the Dunrobin Road ditch adjacent the north half of the site is directed to the proposed roadside ditch along the north side of the proposed roadway. Based on the proposed grading, the flow in the north swale will be negligible at the west end or beginning of the swale and will increase in magnitude to a maximum at the east end of the swale. The north swale has a bottom width of 1.0 m and a slope which ranges from 2.4% to 0.3%. With the exception of the first about 20 m, the swale depth ranges from about 0.4 m to 0.7 m.

2. The south swale begins near Dunrobin Road and is located along the south side of the site. A review of the proposed grading plan indicates that the flow in the Dunrobin Road ditch adjacent the south half of the site is directed to the proposed roadside ditch along the south side of the proposed roadway. Based on the proposed grading, the flow in the south swale will be negligible at the west end or beginning of the swale and will increase in magnitude to a maximum at the east end of the swale. The south swale has a bottom width of 1.0 m and a slope which ranges from 3.2% to 0.3%. With the exception of the first about 20 m, the swale depth ranges from about 0.32 m to 0.7 m.
3. The east swale continues from the north swale at the northeast corner of the site and discharges into the outlet swale at about the center of the east end of the site. The east swale has a bottom width of 1.0 m and a slope of 0.3%. The swale depth ranges from about 0.49 m to 0.7 m.
4. The stormwater storage swale begins at the east end of the cul-de-sac and discharges into the outlets swale near the east end of the site. The stormwater storage swale will be discussed in detail in Section 6.1
5. The outlet swale begins at the east end of the storage swale, extends east to the east end of the site then south to discharge into Harwood Creek. The outlet swale receives flow from the storage swale, north swale and south swale at various points along its length. The outlet swale has a bottom width of 1.0 m and a slope which ranges from 1.5% to 0.4%. The swale depth ranges from 0.7 m to 1.5 m.

5.2.5. Capacity and Flow Level in the Main Swales

The capacity and flow depth were determined using the equations for open channel flow shown below. A Manning's roughness coefficient for open channel flow of n = 0.035 was obtained from the OSDG Appendix 6-C assuming an earth channel with a fairly uniform section that will not be maintained resulting in dense weeds and grass. The swales will in general have side slopes of 3H to 1V.



$$Q = VA \qquad V = \frac{k}{n} R^{2/3} S^{1/2} \qquad R = \frac{A}{P} \qquad A = \frac{y}{2}(b + T)$$

$$P = b + y\left(\sqrt{1 + z_1^2} + \sqrt{1 + z_2^2}\right) \qquad T = b + y(z_1 + z_2)$$

$$F = V\sqrt{\frac{T}{gA\cos\theta}} \qquad \theta = Tan^{-1}(S)$$

The design storm events are listed below and abbreviated in the table as follows:

12 hour 2 year SCS Type II - 12-2
12 hour 10 year SCS Type II - 12-10
12 hour 100 year SCS Type II - 12-100

Swale sections are abbreviated in the table as follows:
North swale behind Lot 1 is North 1; South swale behind Lot 2 is South 2; Outlet Swale between Lot 7 and Lot 8 is Outlet 7/8 etc. The swale sections are labelled on the site servicing plan.

The following Table 5-3 provides a summary of the capacity and flow level along the above swales for the 10 year and 100 year SCS Type II design storms.

Table 5-3: Capacity and Flow Level in Main Swales

Swale Section	Storm Event	Contributing Catchment / Swale Section	Flow Rate	Flow Depth	Flow Vel.	Min. Slope	(1)Min. Available Depth	(2)Min Capacity
			m^3/sec	m	m/s	%	m	m^3/sec
North 1	12-10	C8	0.02	0.07	0.26	0.4	0.44	0.77
	12-100		0.04	0.10	0.33			
North 3	12-10	North 1 + C7	0.03	0.08	0.32	0.5	0.55	1.39
	12-100		0.07	0.12	0.42			
North 5	12-10	North 3 + C6	0.04	0.09	0.32	0.4	0.31	0.37
	12-100		0.09	0.15	0.45			
North 7	12-10	North 5 + C5	0.10	0.17	0.39	0.3	0.35	0.41
	12-100		0.22	0.25	0.48			
South 2	12-10	C1	0.02	0.04	0.42	1.8	0.58	2.97
	12-100		0.04	0.06	0.53			
South 4	12-10	South 2 + C2	0.03	0.07	0.36	0.7	0.61	2.07
	12-100		0.07	0.11	0.47			
South 6	12-10	South 4 + C3	0.04	0.10	0.29	0.3	0.48	0.80
	12-100		0.10	0.17	0.39			
South 8	12-10	South 6 + C4	0.08	0.15	0.36	0.3	0.32	0.34
	12-100		0.17	0.22	0.45			
East 7	12-10	North 7	0.10	0.17	0.39	0.3	0.38	0.49
	12-100		0.22	0.26	0.49			
Outlet 7/8	12-2	Storage Swale (SS)	0.01	0.03	0.32	1.5	0.7	4.12
	12-10		0.03	0.06	0.48			
	12-100		0.10	0.11	0.68			
Outlet 8	12-2	East 7 + Outlet 7/8	0.02	0.07	0.27	0.4	0.94	3.78
	12-10		0.12	0.18	0.45			
	12-100		0.29	0.27	0.58			
Outlet SE Corner	12-2	Outlet 8 + South 8	0.04	0.10	0.33	0.4	0.8	2.88
	12-10		0.15	0.20	0.49			
	12-100		0.33	0.29	0.6			

1) The minimum available depth was determined by calculating the elevation difference between the top of the ditch slope and the bottom of the ditch slope at the location of the shallowest point along each respective section.

2) The minimum available capacity of each ditch section was is a function of the ditch slope and depth in each section. The minimum available capacity corresponds to the location of the lowest flow capacity within each respective section.

The above summary of results, which indicates the flow depth during various storm events as well as the available depth along each section of the swales, demonstrates that the flow from the 100 year storm event will be conveyed within the drainage swales without overflow.

5.3. Conveyance Along Roadside Ditches

5.3.1. Proposed and Existing Ditches

As previously indicated, the runoff from the front of each lot will be conveyed along the proposed roadside ditches to the stormwater storage swale extending east from the cul-de-sac. The ditch along the north side of the proposed roadway will receive runoff from the section of ditch along the east side of Dunrobin Road immediately west of Lot 1 and from the front of Lots 1, 3, 5 and 7. The ditch along the south side of the proposed roadway will receive runoff the section of ditch along the east side of Dunrobin Road immediately west of Lot 2 and from the front of Lots 2, 4, 6 and 8.

The existing ditch along the east side of Dunrobin Road adjacent the site has a discontinuous longitudinal slope. The height of the back slope along this section varies along the existing ditch from undefined to about 0.3 metres in height. In order to prevent stormwater runoff originating on public property from flowing across private land, the east ditch of Dunrobin Road will be re-sloped adjacent to Lot 1 and Lot 2 to direct the runoff to the ditches along the proposed roadway. The height of the back slope will be increased to a minimum of 0.5 metres to prevent runoff from the public road being directed onto private lands.

The ditches along the proposed roadway have been designed with a "V" shaped bottom and have 3H:1V side slopes. With the exception of the portion of the ditch along the north side of the proposed roadway to Station 0+080 and the ditches around the proposed cul-de-sac, the ditches for the proposed roadway have been designed to have a slope greater than 1%. The slope along the first section of the north ditch was reduced in order to facilitate continuous drainage of the ditch along the east side of Dunrobin Road adjacent to Lot 1. The slope of the ditch around the cul-de-sac has been reduced to between 0.9% and 0.2% in order to maintain a bottom elevation above the 100 year flood level of the backwater flood plain.

The proposed slope of the re-graded ditch bottom along Dunrobin road varies from 0.5% south of the proposed roadway to 0.3% north of the proposed roadway. The bottom slope of the ditch is limited by the existing grades.

5.3.2. Limits to Longitudinal Slope of Ditches

As discussed in Section 5.2.3 above, the constraints cause by existing conditions external to the proposed development will limit the slope of some sections of the ditch to less than 1% and less than 0.5% in some cases. As discussed above, this reduced slope will likely result in some discontinuous positive grading in the downstream direction which in turn will result in localized ponding at the bottom of the ditches. It is considered that the depth of this ponding will be limited by the relative difference between the undulations and that the ponding will occur during any rainfall event of significant magnitude to generate runoff. The duration of the ponding is expected to be limited.

5.3.3. Capacity and Flow Level in the Ditches

The capacity and flow depth were determined using the equations for open channel flow provided above. A Manning's roughness coefficient for open channel flow of n = 0.03 was obtained from the OSDG Appendix 6-C assuming an earth channel with a fairly uniform section that will be moderately maintained resulting in grass, some weeds.

The Ditch sections are abbreviated in the table as follows:
Ditch along the east side of Dunrobin Road west of Lot 1 is Dunrobin 1; The proposed ditch along the south side of the proposed road adjacent to Lot 2 is South D2; The proposed ditch along the north side of the proposed road adjacent to Lot 1 is North D1 etc. The ditch sections are labelled on the site servicing plan.

The following Table 5-4 provides a summary of the capacity and flow level along the proposed and regraded ditches for the 2 year, 10 year and 100 year SCS Type II design storms.

Table 5-4: Capacity and Flow Level in Proposed Ditches

Ditch Section	Storm Event	Contributing Catchment / Ditch Section	Flow Rate	Flow Depth	Flow Vel.	Min. Slope	(1)Min. Avail. Depth	(2)Min Capacity
			m^3/sec	m	m/s	%	m	m^3/sec
Dunrobin 1	12-10	CA	0.01	0.11	0.23	0.3	0.5	0.52
	12-100		0.02	0.14	0.28			
Dunrobin 2	12-10	CB	0.01	0.09	0.27	0.5	0.5	0.68
	12-100		0.02	0.13	0.34			
North D1	12-10	Dunrobin 1 + C9	0.02	0.14	0.28	0.3	0.81	1.89
	12-100		0.04	0.19	0.33			
North D3	12-10	North D1 + C10	0.04	0.14	0.53	1.1	0.82	3.76
	12-100		0.07	0.18	0.62			

North D5	12-2	North D3 + C11	0.02	0.11	0.41	0.9	0.80	4.32
	12-10		0.05	0.16	0.52			
	12-100		0.1	0.22	0.62			
North D7	12-2	North D5 + C12	0.02	0.13	0.34	0.5	0.81	3.31
	12-10		0.06	0.2	0.44			
	12-100		0.13	0.27	0.53			
South D2	12-10	Dunrobin 2 + C16	0.02	0.11	0.46	1.1	0.83	3.88
	12-100		0.05	0.16	0.57			
South D4	12-10	South D2 + C15	0.04	0.14	0.53	1.1	0.84	4.01
	12-100		0.07	0.18	0.62			
South D6	12-2	South D4 + C14	0.02	0.11	0.41	0.9	0.81	4.45
	12-10		0.05	0.16	0.52			
	12-100		0.1	0.22	0.62			
South D8	12-2	South D6 + C13	0.02	0.12	0.36	0.6	0.83	3.84
	12-10		0.07	0.2	0.48			
	12-100		0.14	0.27	0.59			
Storage Swale (SS)	12-2	North D7 + South D8	0.10	N/A	N/A	N/A	N/A	N/A
	12-10		0.14	N/A	N/A			
	12-100		0.27	N/A	N/A			

1) The minimum available depth was determined by calculating the elevation difference between the top of the ditch slope and the bottom of the ditch slope at the location of the shallowest point along each respective section.

2) The minimum available capacity of each ditch section was is a function of the ditch slope and depth in each section. The minimum available capacity corresponds to the location of the lowest flow capacity within each respective section.

The above results, which indicate the flow depth for various storm events as well as the minimum available depth along each section of the ditches, demonstrate that the flow from the 100 year storm event is conveyed within the ditches. It is noted that the above Table 6-4 is not intended to indicate the elevation of the 100 year flood level in the ditch resulting from the outlet restriction and subsequent ponding of the downstream stormwater storage swale. The table is intended to illustrate that the roadside ditch has sufficient capacity to convey the flow arising from various storm events within the road right of way.

5.4. Unmitigated Post-Development Runoff

The post-development peak runoff rate and runoff volume were calculated using the OTTHYMO model assuming no mitigation or detention and storage of the runoff. Table 5-5 summarizes the unmitigated post-development peak runoff rate and runoff volumes calculated using the OTTHYMO model.

Table 5-5: Unmitigated Post-Development Runoff Rates and Runoff Volumes

Design Storm Event		Unmitigated Post Runoff Rate (m^3/s)		Runoff Volume
		Central Catchments 3.22 ha	**Entire Site 10.99 ha**	**(mm)**
Sim 1	6 hour 5 year SCS Type II	0.079	0.162	8.67
Sim 2	6 hour 100 year SCS Type II	0.242	0.566	26.73
Sim 3	12 hour 5 year SCS Type II	0.096	0.200	11.47
Sim 4	12 hour 10 year SCS Type II	0.135	0.297	16.11
Sim 5	12 hour 100 year SCS Type II	0.265	0.628	32.08
Sim 6	12 hour 2 year Chicago	0.044	0.078	5.74
Sim 7	12 hour 100 year Chicago	0.278	0.621	30.81
Sim 8	Historical Storm July 1, 1979	0.307	0.753	25.00
Sim 9	Historical Storm August 4, 1988	0.288	0.686	23.09
Sim 10	25mm 4 hour Chicago	0.010	0.015	1.28
Sim 11	120% 12hr 100 year Chicago	0.391	0.903	42.72

Comparison of the OTTHYMO model results provided in Table 5-5 to the OTTHYMO model results provided in Table 4-3 indicate that the post-development runoff rates and volumes are higher than the pre-development runoff rates and volumes for all storm events if no stormwater management controls are provided during post-development conditions.

6. Post-Development Quantity Control – Flow Rate

6.1. Storm Water Management Model

As previously indicated, the stormwater management design has been completed in a manner which will control the runoff from the central post-development catchment areas such that the maximum runoff rate from the central catchment areas most affected by the proposed development during post-development conditions will be less than or equal to the pre-development flow rate for each storm event up to and including the 100 year design storm event. In addition, the runoff rate from the remaining areas will be mitigated by low impact development techniques to minimize the additional runoff generated from the proposed development during post-development conditions.

The stormwater management storage swale is located where it will receive all of the runoff from the Central Catchment areas which include the proposed onsite roadway, driveways and majority of the area most affected by the proposed development as well as the offsite roadway surface. In order to make the stormwater storage swale accessible and outside of the 100 year flood plain, a significant portion of the subdivision area will remain uncontrolled. Due to the relatively large uncontrolled area the post-development runoff rates will increase from pre-development runoff rates for the total subdivision area.

The affect of the increased runoff rate generated during post-development conditions on the receiving water body is further discussed in Section 8.4 of this report.

The uncontrolled catchment areas consist of the catchment areas from which runoff exits the site without restriction to the runoff rate. Controlled catchment areas consist of the areas from which the runoff rate is controlled and temporarily detained prior to being released from the site. The total post development runoff is then the sum of the runoff rates from both the uncontrolled and the controlled areas.

If the stormwater management design were completed using a simple calculation method such as the rational method, the allowable discharge from the controlled area would be equal to the pre-development runoff rate minus the discharge from the uncontrolled areas during post development conditions. Since the discharge from the uncontrolled areas is too large, the resulting calculation results in a negative allowable release rate which is not possible to meet.

6.1.1. Contributing Area to Stormwater Storage Swale

For the purposes of the stormwater management design, the catchment areas of the site have been divided into central controlled areas and the exterior uncontrolled areas. The central controlled areas consist of the majority of the area most affected by the proposed development and from which the runoff is collected and directed to the proposed stormwater storage swale. These areas consist of the Dunrobin Road Catchments CA and CB as well as the front yard catchments C9 to C16. The uncontrolled areas consist of the rear yard catchments and the offsite catchment area C-OFF1 north of the proposed development. The runoff from these areas is collected by the north and south swales, and will be directed to Harwood Creek without restriction.

6.1.2. Stormwater Storage Swale

Stormwater storage for the purposes of restricting the post-development runoff rate to the pre-development runoff rate for each storm event from the controlled areas will be provided within the stormwater storage swale extending east from the cul-de-sac. The proposed storage swale has been designed in conjunction with the quality control criteria to ensure that both the quantity and quality control criteria will be met. The storage volume of the storage swale was calculated using the AutoCad program Civil 3D and consists of the available void space or storage space above the bottom of the storage swale and between the side slopes of the storage swale. The storage volume does not include void space in granular material and does not include storage within the roadside ditches. As such, the actual available storage volume is underestimated and the actual flood levels will be slightly lower than that indicated by this design. This also means that the actual release rates will be slightly less than indicated providing a slight intrinsic and uncalculated factor of safety to the design

6.1.2.1. Description and Construction

It is noted that the bottom of the stormwater storage swale will be constructed with no slope at an elevation of 75.15 m which is 33 cm below the 100 year flood level of the backwater flood plain of the Harwood Creek. The invert of the V-notch weir in the outlet structure from the storage swale has been set at 75.40 m or 25 cm above the bottom of the storage swale and 8 cm below the 100 year flood level. As such, the discharge from, and flood level in, the storage swale will be impacted if the Harwood Creek was experiencing 100 year flood levels during a storm event within the subdivision.

Since the bottom of the storage swale is 25 cm below the lowest outlet elevation, outlet for the first 103.55 m^3 of stored water will be by filtration through the amended topsoil to the subdrains and by infiltration.

The stormwater storage swale has been designed as follows:

- The bottom of the storage swale extends downward from an elevation of 75.60 m at the bottom of the roadside ditch at the east end of the cul-de-sac at a slope of 6.9 percent for a distance of 25 m to the flat portion of the swale.
- The flat portion of the bottom of the storage swale has an elevation of 75.15 metres, a bottom width of 5 metres and a length of 65.8 m.
- The storage swale has been constructed with depth of 1.25 metres and side slopes of about 3 horizontal to 1 vertical.
- Discharge from the swale will be controlled by an outlet structure consisting of a V-notch weir within a weir wall at the east end of the storage swale. Details of the outlet structure are provided in Section 6.3 of this report.
- Overflow from the storage swale will be over top of the weir wall at the east end of the storage swale.
- The topsoil should be removed from below the footprint of the proposed storage swale and stockpiled on the upper third (west third) of the site.

- Once the topsoil has been removed, the bottom of the storage swale is expected to be between 0.2 metres below and 0.2 metres above the subgrade surface. The subgrade should be further excavated as required to ensure a minimum of 0.5 m of separation between the bottom of the swale and the native subgrade.
- Construction traffic on the foot print of the storage swale should be limited as much as possible to avoid compaction of the underlying soils.
- The subgrade surface should be scarified or ripped using the teeth of an excavator following removal of the topsoil.
- The subgrade should be built up to 0.5 metres below the bottom of the storage swale using a sandy material such as the native silty sand or silty sand glacial till present on site. Alternatively silty sands or sand-silt mixes identified as SM using the United Soils Classification System as illustrated in the Ontario Building Code Supplementary Standard SB-6 could be imported to raise the subgrade to the underside of the storage swale bottom soil structure.
- 200 mm of amended topsoil should be placed on the raised or native subgrade. The subdrains should then be trenched into the amended topsoil / subgrade such that the top of the subdrain is even with the top of the 200 mm thick amended topsoil layer. The subdrains should consist of 150 mm diameter perforated drain tile surrounded by clearstone having a depth of 0.3 m and a width of 0.4 metres. The subdrain should be surrounded with a non-woven geotextile fabric having a weight of 6 ounces per square yard.
- Each subdrain pipe should consist of BOSS 2000 (or approved alternative) perforated 150 mm diameter HDPE pipe. Each subdrain should extend through the outlet control weir wall and discharge to the outlet swale. The ends of each subdrain should be protected with a short section of CSP as illustrated on OPSD 206.050.
- An additional 300 mm thickness of amended existing site topsoil should be placed to the proposed bottom elevation of the swale.
- The existing site topsoil can be stripped and stock piled prior to amending. The site topsoil should be amended by mixing 1 part amendment material with 3 parts by volume of site topsoil. The amendment material shall consist of organic matter primarily leaf, yard and bark waste compost of 20 – 30% by dry weight as determined by Loss-on-ignition. No uncomposted manure should be used.
- The swale shall be seeded with deep rooted grasses and planted with vegetation that can tolerate both wet and dry soil conditions.
- Discharge from the swale below an elevation of 75.40 metres is by filtration through the amended topsoil to the subdrains and by infiltration.
- The outlet control structure is described in Section 6.1.3

The physical characteristics of the stormwater storage swale and outlet control will result in the storage - discharge relationship as indicated in Figures 6-2 and 6-3 in section 6.1.3.

6.1.2.2. Freeboard for Storage Swale

It is considered that MOE Manual requires a minimum of 0.3 metres of freeboard between the 100 year flood level in a storm pond and the top of bank of the storm pond.

The proposed storage swale has been designed with a freeboard between the 100 year ponding level and the top of the swale of 0.43 metres during a non-coincident storm event and 0.38 metres during a coincident storm event.

The proposed grade of the finished ground surface will continue to slope upwards towards the proposed adjacent dwellings such that the minimum grade around the proposed dwellings will be more than 1.1 metres above the 100 year ponding level. This will ensure that the proposed dwellings are protected in the advent that the 100 year ponding level is exceeded.

The proposed private properties are protected from potential overflow of the side slope of the storage swale by the overflow over the outlet weir. The overflow weir is rectangular in shape and has a bottom width of 6 metres and a minimum depth of 0.1 metres. The overflow weir has a flow capacity of 0.346 m3/sec which exceeds the flow rate into the storage swale generated during a 100 year storm event. The overflow over the weir is also directed into the outlet channel.

Since the free board exceeds the minimum requirement, there is an overflow weir that will ensure flood levels in excess of the design storm event are directed safely away from private property and the actual proposed grade adjacent the proposed dwellings is much higher than the 100 year flood levels it is considered that the provided free board is sufficient.

6.1.2.3. Separation between the 100 Year Flood Level and Building USF

The City of Ottawa sewer design guidelines require that there be a minimum vertical separation between the proposed underside of footing elevations and the 100 year flood level or hydraulic grade line in adjacent infrastructure of 0.3 metres in order to prevent flooding of the dwelling foundation as a result of an elevated ground water level caused by the 100 year flood level.

The proposed underside of footing elevations for the dwellings adjacent the storage swale have been set at about 0.2 to 0.3 metres below the design 100 year flood levels. It is however considered that there is no potential risk to the proposed dwelling foundations from the 100 year ponding level for the following reasons:

- The proposed foundation drainage system of each dwelling will be connected to a sump pit which will be discharged to the ground surface by means of a sump pump. There is no connection and no potential for a connection between the 100 year flood level and the foundation drainage system resulting from the storm service.
- The foundation of each dwelling will be separated horizontally from the 100 year ponding level by a distance of at least 14 metres.

- From Section 6.2.2 above, the permeability of the native soils at the site ranges from 1.26 x 10^{-6} m/s to 1.64 x 10^{-7} m/s. Referencing Table 2 and Table 3 of MMAH Supplementary Standard SB6 contained in Volume 2 of the Ontario Building Code indicates that soils with permeabilities ranging from 1x10^{-4} to 1x10^{-5} cm/sec are expected to have a percolation time T of 12 to 20 min/cm. This means that water is expected to take between 12 and 20 min to travel 1 cm through the material. (It is noted that a direct conversion of 1x10^{-4} to 1x10^{-5} cm/sec by rearranging units would result in a range of 128 to 1016 min/cm which is not accurate.)
- Since the distance between the underside of footing and the 100 year flood level is at least 14 metres, the time it would take for water to reach the underside of footing from the storage swale would be in the order of 14 m x 100 cm/m x 12 min / cm = 16,800 min = 280 hrs or more than 11.5 days.
- Since this time period is much greater than the draw down time of the 100 year storm event, the water within the storage swale will not be elevated long enough for water to flow from the stormwater storage facility to the underside of footing.

6.1.3. Storage Swale Outlet Control Structure and Release Rate

The flow rate from the storage swale was restricted such that the runoff rate from the controlled catchment areas of the proposed development including offsite catchment areas during post-development conditions will be limited as much as reasonably possible such that the total post-development rate is as close to the total pre-development rate for the subdivision and off-site catchment areas.

As a result, the post-development discharge rate, during each design storm up to and including the 100 year storm event, from the central controlled areas will be much less than the pre-development flow rate for each respective design storm from the central controlled area.

The release rate from the stormwater storage swale will be controlled by means of an outlet control structure.

The outlet control structure will consist of V-notch weir in a cast in place concrete weir wall. The cast in place weir wall will have a rectangular cutout above the invert of the ditch that will allow an aluminum weir plate to be installed. The weir plate will have a 25 degree V-notch weir with an invert of 75.40 m. It is acknowledged that further reducing the notch would further reduce the release rate. However a further reduction of the notch angle would significantly increase the susceptibility of the V-notch weir to plugging resulting in significantly higher maintenance requirements.

The weir wall construction will be similar in appearance to the illustration in Figure 6-1 included on the following page. Since the flow above the V-notch is overflow, the weir plate will not extend above the poured concrete. Overflow of the storage swale will be over top of the weir wall. The bottom and side slopes of the outlet swale on the outside (eastside) of the weir wall should be protected with Rip-Rap and geotextile. The Rip-Rap should conform to the grading requirements for OPSS 1004 G-10 Gabion Stone. The geotextile should consist of a minimum 6 ounce per square yard non-woven geotextile fabric. The Rip-Rap and geotextile should be placed in keeping with OPSS 511 and OPSD 810.010.

Figure 6-1: V-notch Cast-In-place Concrete Weir Wall Illustration

The discharge rate through the V notch weir was calculated using the Kindswater-Shen relationship (Kulin, G and Compton, P., *A Guide to Methods and Standards for the Measurement of Water Flow,* NBS Special Publication 421 May 1975, Institute of Basic Standards, National Bureau of Standards, Washington, D.C. 20234) as the discharge will be passing over the weir in free flow conditions.

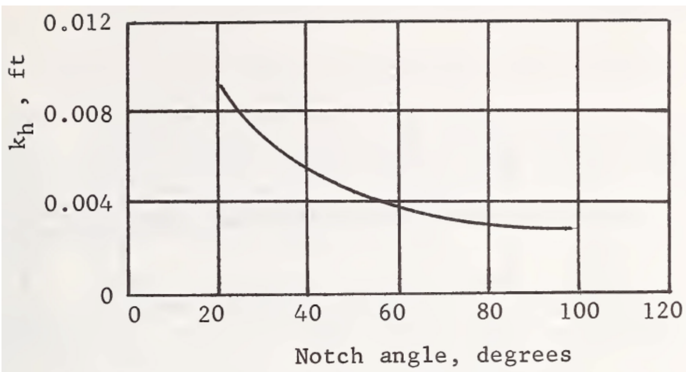
The equation is as follows:

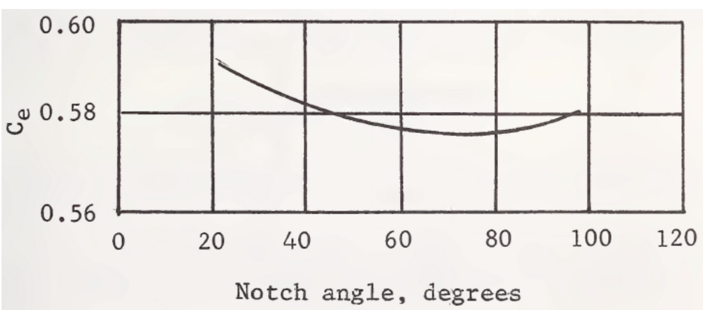
$$Q = 4.28\, C_e \tan\left(\frac{\theta}{2}\right) h_{1e}^{2.5}$$

Where: Q = discharge in cfs
C_e = effective discharge coefficient (see figure copied on following page)

h_1 = head on the weir (ft)
$h_{1e} = h_1 + k_h$
k_h = head correction factor (ft) (see figure copied on following page)
θ = angle of V- notch

It is noted that the head on the weir was converted from metres to feet to facilitate the use of the equation and then the results were converted from cfs to m^3/s.





The notch angle was set to a minimum angle from a functional perspective to limit the discharge from the storage swale as much as reasonably possible while avoiding a weir design that would result in an unacceptably high risk of blockage by floating debris.

In a relatively large storm water storage facility, it is generally assumed that the hydraulic gradient is a function of the water surface elevation only. Since the discharge rate Q is a function of the depth of water-head relative to the orifice inverts, the discharge rate will be directly related to the water surface elevation relative to the orifice inverts. The volume of the storage swale is also directly related to the depth of water or water surface elevation. Since the discharge rate and storage swale volume are both related, a Discharge vs Storage curve can be developed. A discharge storage curve was developed in excel and was then programmed into the Route Reservoir block within the OTTHYMO hydrologic model.

Since the invert of the V-notch weir is below the 100 year backwater flood plain elevation (75.48 m) of the Harwood Creek there are two outlet scenarios. These two scenarios consist of a non-coincident or normal event and a coincident or surcharged event.

Non-Coincident Events

Non-coincident events are those where a high intensity rainstorm would result in a significant storm event that affect the site without causing flooding in the Harwood Creek and larger watershed of the Harwood Creek. During this scenario relatively localized storm event will occur which will result in a 100 year design storm occurring on the subject development area without causing 100 year flooding within the Harwood Creek.

Coincident Event

Coincident Events are those where the high intensity storm event that causes runoff in the proposed development also affects the watershed of the Harwood Creek and causes flooding of the Harwood Creek. The storm event will be sufficiently wide spread that the flooding within the Harwood Creek would reach the 100 year level and a 100 year design storm would occur within the subject development area at the same time. During these events the rising water levels in the Harwood Creek would cause tail water flooding or surcharge of the outlet structure reducing the head across the structure. This reduction in head across the structure would reduce the flow rate from the development. With receding flood levels in the Harwood Creek, the outlet structure would begin to function as intended discharging closer to design rates.

Separate analysis were completed to determine the release rate from the storm water storage swale and flood levels within the storage swale as well as the overall runoff rate from the development during both scenarios. The storage discharge curves generated for each scenario are summarized in the following sections.

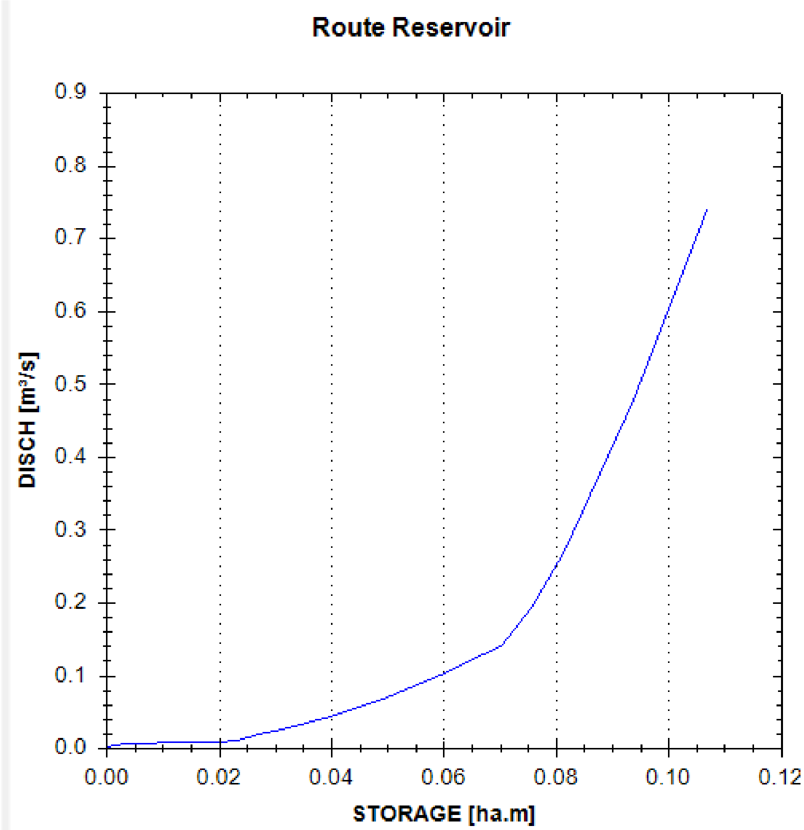
The stormwater storage swale and outlet structure for each scenario are modeled in the OTTHYMO program using a Route Reservoir Hydrograph command inserted between the outlet swale, receiving the runoff from the front yard catchments by means of the roadside ditch channels, and the swale along the east side of the site.

6.1.3.1. Storage Discharge Relationship During a Non-Coincident or Normal Event

The detailed worksheet has been included in Appendix G1. Figure 6-2 below illustrates the storage-discharge relationship that was copied into the Route Reservoir command (NHYD 93) within the OTTHYMO model. The combined storage and detention in the storage swale and the Outlet Swale provide the post-development results summarized in Table 6-1 below.

Figure 6-2: Storage Swale Storage-Discharge Relationship – Non Coincident Event

	DISCH [m³/s]	STORAGE [ha.m]
1	0.001300	0.000000
2	0.003300	0.001600
3	0.004500	0.003500
4	0.006200	0.007800
5	0.006800	0.010400
6	0.007400	0.013200
7	0.008000	0.016200
8	0.008600	0.019600
9	0.009300	0.023300
10	0.019300	0.027100
11	0.025400	0.031200
12	0.042400	0.039800
13	0.066700	0.049200
14	0.099100	0.059300
15	0.118700	0.064600
16	0.140600	0.070100
17	0.192600	0.075700
18	0.270500	0.081600



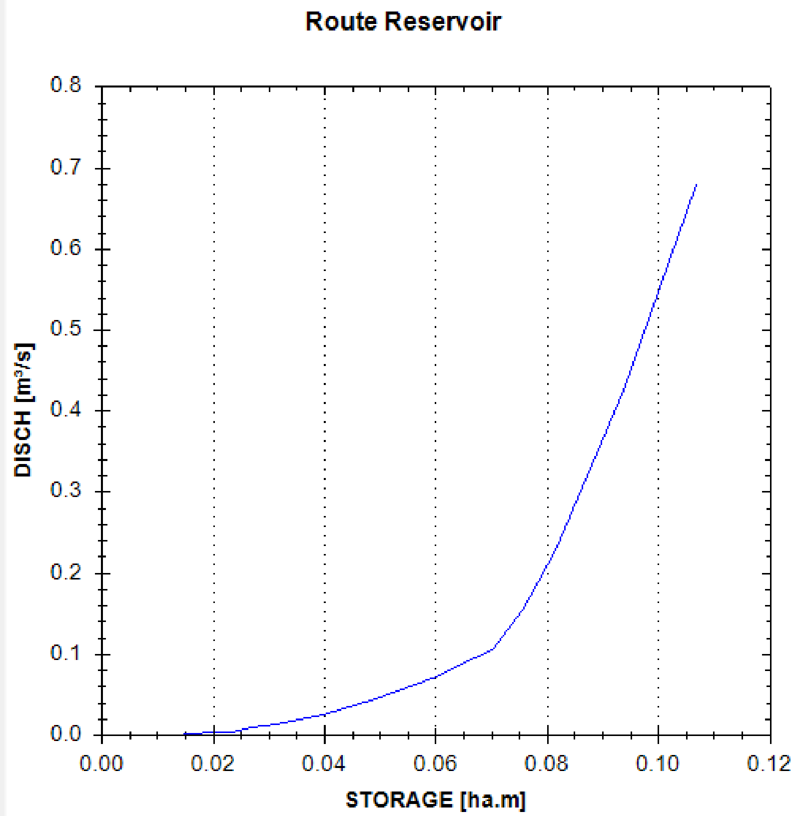
Discharge from the Outlet control structure will enter the outlet swale where it will merge with the flow from the uncontrolled areas which in turn discharges to the Harwood Creek.

6.1.3.2. Storage Discharge Relationship During a Coincident or Surcharge Event

The detailed worksheet has been included in Appendix G2. Figure 6-3 below illustrates the storage-discharge relationship that was copied into the Route Reservoir command (NHYD 93) within the OTTHYMO model. The storage and detention in the storage swale provide the post-development results summarized in Table 6-1 below.

Figure 6-3: Storage Swale Storage-Discharge Relationship –Coincident Event

	DISCH [m³/s]	STORAGE [ha.m]
1	0.000000	0.000000
2	0.000010	0.010400
3	0.000020	0.013200
4	0.000200	0.016200
5	0.002200	0.019600
6	0.003900	0.023300
7	0.008700	0.027100
8	0.012900	0.031200
9	0.025300	0.039800
10	0.044000	0.049200
11	0.070000	0.059300
12	0.086100	0.064600
13	0.104400	0.070100
14	0.152700	0.075700
15	0.226600	0.081600
16	0.425100	0.093800
17	0.678300	0.106800
18		



Discharge from the Outlet control structure will enter the outlet swale where it will merge with the flow from the uncontrolled areas which in turn discharges to the Harwood Creek.

6.2. Mitigated or Controlled Post Development Runoff

6.2.1. Discharge Rate from Central or Controlled Areas of the Development

The mitigated post-development runoff rate from the central catchment areas of the development calculated using the OTTHYMO model after the insertion of the Route Reservoir Hydrograph command to control the runoff rate from the front yards and roadways in the storage swale is summarized in Table 6-1. This table also provides a comparison to the pre-development runoff rates.

Table 6-1: Mitigated Post-Development Runoff Rates from Central Catchment Areas

Design Storm Event		Post-Development Runoff Rate		Pre-Development Runoff Rate	Post < Pre
		Non-Coincident	Coincident		
		(m^3/s)	**(m^3/s)**	**(m^3/s)**	
Sim 1	6 hour 5 year SCS Type II	0.013	0.010	0.027	Yes
Sim 2	6 hour 100 year SCS Type II	0.084	0.072	0.096	Yes
Sim 3	12 hour 5 year SCS Type II	0.016	0.012	0.031	Yes
Sim 4	12 hour 10 year SCS Type II	0.029	0.022	0.046	Yes
Sim 5	12 hour 100 year SCS Type II	0.088	0.077	0.100	Yes
Sim 6	12 hour 2 year Chicago	0.007	0.003	0.012	Yes
Sim 7	12 hour 100 year Chicago	0.077	0.065	0.091	Yes
Sim 8	Historical Storm July 1, 1979	0.116	0.101	0.122	Yes
Sim 9	Historical Storm Aug. 4, 1988	0.080	0.066	0.098	Yes
Sim 10	25mm 4 hour Chicago	0.004	0.000	0.003	N/A
Sim 11	120% 12 hour 100 year Chicago	0.130	0.123	0.132	Yes

The runoff rates presented in the table above are for the 3.22 hectares of the central controlled areas only and are comprised of onsite catchments C9-C16 and offsite catchments CA and CB.

A review of the above table indicates that the proposed stormwater storage swale with its associated outlet structure effectively mitigates the post-development runoff rate to less that occurring during pre-development conditions for all quality control design storm events when considering the central area of the development.

6.2.2. Runoff Rate from Entire Development Area

The mitigated post-development runoff rate for the entire development area including all offsite catchments calculated using the OTTHYMO model after the insertion of the Route Reservoir Hydrograph command to control the runoff rate from the front yards and roadways in the storage swale is summarized in Table 6-2. This table also provides a comparison to the pre-development runoff rates for the entire development.

Table 6-2: Mitigated Post-Development Runoff Rates from Entire Development Area

Design Storm Event		Post-Development Runoff Rate		Pre-Development Runoff Rate	Post < Pre
		Non-Coincident	Coincident		
		(m^3/s)	(m^3/s)	(m^3/s)	
Sim 1	6 hour 5 year SCS Type II	0.103	0.096	0.092	No
Sim 2	6 hour 100 year SCS Type II	0.38	0.366	0.329	No
Sim 3	12 hour 5 year SCS Type II	0.122	0.115	0.106	No
Sim 4	12 hour 10 year SCS Type II	0.182	0.176	0.158	No
Sim 5	12 hour 100 year SCS Type II	0.422	0.41	0.348	No
Sim 6	12 hour 2 year Chicago	0.048	0.042	0.039	No
Sim 7	12 hour 100 year Chicago	0.403	0.389	0.321	No
Sim 8	Historical Storm July 1, 1979	0.535	0.517	0.429	No
Sim 9	Historical Storm Aug. 4, 1988	0.462	0.45	0.336	No
Sim 10	25mm 4 hour Chicago	0.012	0.008	0.009	No
Sim 11	120% 12 hour 100 year Chicago	0.605	0.587	0.471	No

The runoff rates presented in the table above are for the entire 10.99 hectares inclusive of all onsite and offsite contributing catchment areas.

Appendix H contains post-development OTTHYMO summary output data for both Coincident and Non-Coincident Events. Also included in Appendix H 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 post-development outflow from the proposed development including off site catchment areas.

6.2.3. Comparison of Post to Pre-Development Runoff Rates

As previously indicated, the stormwater management criteria for the site, from a quantity control and runoff rate perspective, consisted of the following:

- Post-development peak runoff rates are to be equal to or less than pre-development levels for all design storm events up to and including the 100 year storm event for the central corridor of the development for all design quantity storm events,
- The net increase in post-development runoff due to uncontrolled rear yard area is mitigated such that there is no downstream impact on the Harwood Creek,

Table 6-1 demonstrates that the post-development runoff rate from the central corridor of the development including contributing offsite areas is less than or equal to the pre-development runoff rates for all quality design storms for both coincident and non-coincident events. As such, the first of the two criteria above is met by the proposed design.

Table 6-2 indicates that the post-development runoff rate from the entire development will be greater than the pre-development runoff rate from the entire development during all storm events. Table 6-2 also indicates that the runoff rate from the site will be greater during a non-coincident event then during a coincident event. The increase in runoff in comparison to the pre-development runoff rate from the entire site is summarized in the following Table 6-3.

Table 6-3: Summary of Increase in Runoff from Pre- to Post- Development

Design Storm Event		**Increase in Runoff from Pre- to Post- Development**			
		Non-Coincident		**Coincident**	
		(m^3/s)	**(%)**	**(m^3/s)**	**(%)**
Sim 1	6 hour 5 year SCS Type II	0.011	12.0%	0.004	4.3%
Sim 2	6 hour 100 year SCS Type II	0.051	15.5%	0.037	11.2%
Sim 3	12 hour 5 year SCS Type II	0.016	15.1%	0.009	8.5%
Sim 4	12 hour 10 year SCS Type II	0.024	15.2%	0.018	11.4%
Sim 5	12 hour 100 year SCS Type II	0.074	21.3%	0.062	17.8%
Sim 6	12 hour 2 year Chicago	0.009	23.1%	0.003	7.7%
Sim 7	12 hour 100 year Chicago	0.082	25.5%	0.068	21.2%
Sim 8	Historical Storm July 1, 1979	0.106	24.7%	0.088	20.5%
Sim 9	Historical Storm Aug. 4, 1988	0.126	37.5%	0.114	33.9%
Sim 10	25mm 4 hour Chicago	0.003	33.3%	-0.001	-11.1%
Sim 11	120% 12 hour 100 year Chicago	0.134	28.5%	0.116	24.6%

The second of the two criteria above is with respect to minimizing the increase in runoff in order to have a negligible impact on Harwood Creek. The design flow rates as shown in the HEC-RAS model for the Harwood Creek for the existing conditions which predate the proposed development at the site include the pre-development runoff from the site area. Assuming the increase in runoff rate resulting from post-development conditions from the site is simply added to the flow rate in the Harwood Creek, the greatest impact would occur when the flow rate in Harwood Creek is at its peak. If the increase in flow rate for each storm event is added to the off peak flow rate for the Harwood Creek, the minor increase would not result in a total flow rate greater than the peak design flow rates for the Creek. As such the increase in runoff rate from the site will have less impact to the Harwood Creek during a Non-Coincident event than during a coincident event.

Further discussion of the impact of the increase in flow rate from pre-development conditions to post-development conditions is provided in Section 8.4 of this report.

6.3. Storage Requirements

6.3.1. Storage Swale – Non-Coincident Event

The OTTHYMO model Route Reservoir Report is provided in Appendix I1. The storage requirements for the various storm events, obtained from the route reservoir block which models the stormwater storage swale, are shown in the following Table 6-4.

Table 6-4: Storage Requirements – Non-Coincident Events

Design Storm Event		Max. Storage	Max. Ponding Elev.	Storage Drawdown Time	Peak Discharge Rate
		m^3	m	hrs	m^3/s
Sim. 1	6 hour 5 year SCS Type II	248	75.62	39.5	0.013
Sim. 2	6 hour 100 year SCS Type II	547	75.96	57	0.084
Sim. 3	12 hour 5 year SCS Type II	260	75.63	40.5	0.016
Sim. 4	12 hour 10 year SCS Type II	333	75.73	46.5	0.029
Sim. 5	12 hour 100 yr SCS Type II	560	75.97	57.5	0.088
Sim. 6	12 hour 2 year Chicago	116	75.42	16	0.007
Sim. 7	12 hour 100 year Chicago	526	75.93	56.5	0.077
Sim. 8	Historical Storm July 1, 1979	639	76.05	60	0.116
Sim. 9	Historical August 4, 1988	533	75.94	56.5	0.080
Sim. 10	25mm 4 hour Chicago	30	75.24	3	0.004
Sim 11	120% 12 hour 100 year Chicago	674	76.08	61	0.130

The invert of the V-notch outlet weir in the control structure has been set at an elevation of 75.40 meters resulting in a storage volume of 103.6 cubic metres below the outlet. There is a total available quantity storage volume of 700.7 cubic metres below the minimum freeboard elevation of 76.10 m and a total of 1067.9 cubic metres within the storage swale below an elevation of 76.40 metres.

The maximum storage requirement of 674 cubic metres occurs during the 120% stress storm event. The maximum storage requirement during a 100 year storm event is 560 cubic metres. The minimum modeled storage requirement is 30 cubic meters during a 25 mm 4 hr Chicago storm. The maximum drawdown time is equal to 61 hours during the 120% stress storm event and 57.5 hours during a 100 year storm event. The draw down time of 61 hours is less than the time required for mosquitoes to go from the egg to the pupate stage and as such there will be insufficient time for the mosquito breeding cycle.

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

6.3.2. Storage Swale – Coincident Event

The OTTHYMO model Route Reservoir Report is provided in Appendix I2. The storage requirements for the various storm events, obtained from the from the route reservoir block which models the stormwater storage swale, are shown in the following Table 6-5.

Table 6-5: Storage Requirements – Coincident Events

Design Storm Event		Max. Storage	Max. Ponding Elev.	Storage Drawdown Time	Peak Discharge Rate
		m^3	m	hrs	m^3/s
Sim. 1	6 hour 5 year SCS Type II	288	75.67	53	0.010
Sim. 2	6 hour 100 year SCS Type II	601	76.01	79	0.072
Sim. 3	12 hour 5 year SCS Type II	304	75.69	55.5	0.012
Sim. 4	12 hour 10 year SCS Type II	378	75.78	65	0.022
Sim. 5	12 hour 100 yr SCS Type II	617	76.02	79.5	0.077
Sim. 6	12 hour 2 year Chicago	207	75.57	29	0.003
Sim. 7	12 hour 100 year Chicago	575	75.98	77.5	0.065
Sim. 8	Historical Storm July 1, 1979	691	76.09	82	0.101
Sim. 9	Historical August 4, 1988	577	75.98	77.5	0.066
Sim. 10	25mm 4 hour Chicago	67	75.33	n/a	0.000
Sim 11	120% 12 hour 100 year Chicago	723	76.11	83	0.123

The invert of the V-notch outlet weir in the control structure has been set at an elevation of 74.40 meters. Tailwater conditions or surcharge of the outlet structure were assumed equal to the 100 year flood level elevation of 75.48 m in the Harwood Creek as a worst case tailwater scenario. There is a total available quantity storage volume of 700.7 cubic metres below the minimum freeboard elevation of 75.40 m and at total of 1067.9 cubic metres within the storage swale below an elevation of 76.40 metres.

The maximum storage requirement of 723 cubic metres occurs during the 120% stress storm event. The maximum storage requirement during a 100 year storm event is 617 cubic metres. The maximum drawdown time is equal to 83 hours during the 120% stress storm event and 79.5 hours during a 100 year storm event. The draw down time of 83 hours is less than the time required for mosquitoes to go from the egg to the pupate stage and as such there will be insufficient to for the mosquito breeding cycle. It is noted that the tailwater conditions from a

Flood in the Harwood Creek will continue to impact the discharge rate and drawdown time from the storage swale until the flood waters have receded.

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

7. Quantity Control – Additional Criteria and Water Balance

The stormwater management criteria from a quantity control perspective also included the following imprecisely defined criteria: Surface runoff volumes are to be minimized through infiltration techniques and incorporate low impact design techniques where possible. Common low impact design practices include: bioretention cells, permeable pavement, infiltration trenches and chambers, enhanced swales, reduced swale slopes, rainwater harvesting and green roofs. Practices such as permeable pavement, rainwater harvesting and green roofs are not practical to enforce or design within the context of privately owned rural residential lots.

A Subwatershed Study was not identified for either the Harwood Creek or Constance Creek watersheds. A review of a number of available subwatershed studies for subwatersheds within Ottawa was completed to determine common goals and objectives of the recommendations for various subwatersheds. From this review of the studies, the common goals were divided into the following categories: 1) Surface water Quantity; 2) Groundwater Quality; 3) Aquatic Resources; 4) Terrestrial Resources. Each category had its own objectives. Reviewing the objectives indicates that the majority of the objectives are centered on reducing flood risk and protecting groundwater supplies and groundwater base flow by reducing runoff, increasing infiltration and maintaining healthy aquatic and terrestrial communities.

7.1. Water Balance

The Ministry of Environment Stormwater Management Planning and Design Manual provides the following with respect to water balance: Urbanization may reduce groundwater recharge which in turn may reduce baseflow, leading to the impairment of aquatic habitats, as well as the water available for domestic, agricultural, or other uses. Therefore, it is necessary to predict the effect of urban development on the subsurface portion of the hydrologic cycle. In cases in which the available data cannot support more sophisticated approaches, water balance methods are more appropriate for predicting the changes to the hydrologic cycle that may result from urban development.

A water balance method such as that developed by Thornthwaite and Mather (1957) determines the potential and actual amounts of evapotranspiration and water surplus (or excess of precipitation over evapotranspiration). Infiltration factors are used to determine the fraction of water surplus that infiltrates into the ground and the fraction that runs off to nearby streams. Thornthwaite and Mather's method requires monthly or daily precipitation, monthly or daily temperature, latitude of the site, vegetation type, soil type, and a series of tables. The tables define a heat index,potential evapotranspiration, water holding capacity, and soil moisture retention. Soil water holding capacity is dependent upon the soil type, soil structure and the type of vegetation growing on it.

Since location and climate do not change for a particular site, the method essential uses the pre-development site characteristics including vegetation, soil type and site topography to determine the total potential infiltration for the site and the portion of the infiltration that will become base flow. The method is then repeated for the post-development site characteristics to determine the total post-development potential for infiltration. The difference between the two values becomes the net reduction in potential. In order to achieve a water balance, this difference would have to be infiltrated using SWMPs.

The following Section 7.2 describes low impact design techniques used in the proposed design which are intended to reduce the post-development runoff rate and increase the amount of infiltration during post-development conditions. The following Section 7.3 of this report compares the post-development runoff volume to the pre-development runoff volume from the subdivision development area. The discussion presented in Section 7.2 combined with the results presented in Section 7.3 demonstrates that a water balance will be achieved for the site by the proposed stormwater management design.

7.2. Incorporation of Low Impact Design Techniques

The proposed development has incorporated elements of the common low impact design practices which will result in meeting some of the common objectives of the recommendations in the subwatershed studies. These elements include the low sloped swales along the north, south and east sides of the development. The low slope increases the travel time within the swale promoting infiltration. In addition, the localized shallow ponding caused by undulations along the channel bottoms results in additional infiltration as the ponded water will either infiltrate or evaporate. The addition of the clear stone and subdrain will decrease the potential for long term surface ponding and will promote infiltration.

The stormwater storage swale has been designed, in part, as a bioretention swale and will retain stored water below the outlet to provide quality control by filtration. As discussed in Section 9.3.2.6 below, the proposed seeding within the stormwater storage swale is intended for wet meadow or storm pond applications and can withstand emergent and flooding conditions. The vegetation will consist of a mix of native species designed to promote wildlife habitat and a healthy terrestrial community.

Additional low impact design techniques to be incorporated into the development include disconnected foundation drains and disconnected downspouts. The downspouts from the proposed dwellings should be directed to the ground surface. This will allow the runoff from the roofs to be dispersed over the vegetated lawn surfaces and will promote infiltration and evaporation. The foundations drains will also be discharged by means of sump pumps to the ground surface outside of the road allowance as opposed to being directed to a storm sewer.

7.3. Reduction in Volume

Restricting the post-development flow rate to pre-development conditions controls the runoff rate to reduce the impact of the peak flow rate from the site to the receiving watercourse. This reduction in runoff rate is achieved by providing temporary storage on site, which is discharged at a restricted rate over a period of time during and following the storm event. The additional low impact design elements serve to increase the infiltration and reduce the post-development runoff volume from the site. The runoff volumes calculated using the OTTHYMO model during the various conditions of development are presented in the following Table 7-1

Table 7-1: Comparison of Pre- to Post-Development Runoff Volume

Design Storm Event	Pre-Dev. Volume		Mitigated * Post-Dev. Volume (2)		Difference Post- to Pre- (3)
	(mm) (1)	(m^3)	(mm) (1)	(m^3)	(m^3)
6 hour 5 year SCS Type II	6.78	745	8.09	889	144
6 hour 100 year SCS Type II	22.64	2487	26.15	2874	387
12 hour 5 year SCS Type II	9.18	1009	10.89	1197	188
12 hour 10 year SCS Type II	13.21	1451	15.53	1706	256
12 hour 100 yr SCS Type II	27.47	3018	31.50	3462	444
12 hour 2 year Chicago	4.33	476	5.16	567	91
12 hour 100 year Chicago	26.31	2890	30.23	3322	432
Historical Storm July 1, 1979	21.09	2317	24.42	2684	368
Historical August 4, 1988	19.38	2129	22.51	2474	346
25mm 4 hour Chicago	0.78	86	0.70	77	-8
120% 12 hour 100 year Chicago	37.16	4082	42.14	4631	549

* Mitigated post-development volume is the result of the inclusion of the storage swale and outlet swale storage within the model.

1) The runoff volume is calculated by the model in terms of mm per-unit area. The runoff volume from the development area in terms of cubic metres is determined by multiplying the runoff volume in mm by the entire catchment area used in the model which equals 10.986 hectares including uncontrolled areas.

2) The mitigated runoff volume presented in these two columns is calculated from the runoff volume determined during post-development conditions using the OTTHYMO model less the additional volume of water infiltrated in the stormwater storage swale during the extended draw down time of the volume below the invert of the outlet weir.

3) This column represents the difference between the pre-development runoff volume and the post-development runoff volume in cubic metres from the total catchment area included in the model. A negative value indicates that the post-development runoff volume will be less than the pre-development runoff volume.

The MECP LID Stormwater Management Guidance Manual indicates that the 90th percentile precipitation event for the proposed development area is the 25 to 26 mm storm event. Table 8-1 demonstrates that the proposed stormwater management design successfully reduces the post-development runoff volume such that there will be no additional runoff volume outlet to Harwood Creek as a result of the proposed development during normal rainfall (90th percentile or less) events. There will be negligible additional runoff volume generated during minor storm events such as the 2 year and 5 year design storm events.

The greatest increase in runoff volume occurring during a 12 hour 100 year design storm is 368 m^3. This runoff volume corresponds to a flow rate of 0.011 m^3/sec over the duration of the storm event. This flow rate when compared to the peak flow rate in the Harwood Creek of 14.1 m^3/sec at the river station in proximity to the development outlet is less than 0.08% of the 100 year flow in the Creek.

7.4. Summary

The reduced runoff volume from pre-development conditions during normal rainfall events and negligible increase during minor storm events as demonstrated by the model indicates that the proposed development successfully makes use of low impact design techniques to mitigate the results of the increased impervious area caused by the development. The reduced volume indicates that more runoff will infiltrate which will aid in achieving some of the common recommendations and objectives generally contained within most subwatershed studies. The increased infiltration will reduce flood risk and protect groundwater supplies and groundwater base flow.

8. RECEIVING WATER BODY - HARWOOD CREEK

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 proposed stormwater management facility will outlet to the Harwood Creek about 35 metres upstream of the existing box culvert under the former railway. The Harwood Creek outlets to Constance Lake about 1.2 kilometres downstream of the railway culvert. The drainage area of Harwood Creek upstream of the railway culvert was estimated from National Resources Canada Topographic Maps in combination LIDAR imagery and the Ontario Flow Assessment Tool to be about 13 square kilometers.

8.1. Flow Rate and Water Level

The Mississippi Valley Conservation Authority developed a hydraulic (HEC-RAS) model of the Harwood Creek as part of the floodplain mapping works completed for the Harwood Creek. This model was used to determine flood levels at various stations along the Creek. The floodplain mapping shows that the railway culvert is located between River Stations 1023 and 1002 used in the model. The proposed stormwater management facility for the site will discharge into the Harwood Creek between River Stations 1075 and 1023

Flow rates in the Harwood Creek calculated by the model were provided to Kollaard Associates by MVCA for river stations upstream and downstream of the Culvert (Included in Appendix C for Reference). These results indicate that the 100 year flow rate in the Harwood Creek at River Station 1075, upstream of the proposed discharge point for the development, is 14.1 m^3/sec. The 100 year flow rate at River Station 1023, upstream of the railway culvert, is 14.9 m^3/sec and at River Station 1002, downstream of the culvert, is 14.9 m3/sec. The HEC-RAS model was re-run with additional flows of 0.011 m^3/sec, 0.019 m^3/sec, 0.027 m^3/sec and 0.086 m^3/sec during the 2 year, 5 year, 10 year and 100 year storm events added at River Station 1023 to account for the slight increase in flow rate as a result of the proposed development. The modeled flow rate through the railway culvert during the 100 year storm event was 14.986 m^3/sec.

The modeled flow depths during the 100 year storm event were 1.38 m, 1.46 m and 1.14 m for River Station 1075, River Station 1023 and River Station 1002 respectively.

The minimum channel elevation determined at time of survey immediately upstream of the box culverts ranges from 72.92 m to 72.96 m. The creek channel information available indicates that the average channel slope through the Railroad culvert is less than 0.1 percent. Conservatively, a slope of 0.01 percent was assumed for the creek bottom which results in an invert elevation of 72. 96 m at the culvert outlet. The above flow depths and channel inverts result in a water surface elevation of 74.42 m upstream of the culvert and 74.10 m downstream of the culvert during a 100 year flow event.

The minimum channel elevation considered in the HEC-RAS Model at River Stations 1023 and 1002 is 73.7 m which is 0.7 m higher than that measured during the topographic surveying. The actual channel elevation determined at the time of survey at River Station 1075 was 73.35 m compared to 73.95 m used in the model.

8.2. Railroad Culvert Capacity

The Harwood Creek passes under the Railroad immediately east of the site between River Stations 1023 and 1002 by means of a double barrel cast-in-place concrete culvert. The existing culvert is a double barreled cast in place “box” culvert with wing walls. The side walls of the culvert are founded on bedrock. The bottom of the barrels consists of native material. 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 74.45 m. This results in an available flow depth of 1.69 m in the south Barrel and 1.49 m in the north Barrel. The centre of the railroad tracks above the culvert is at an elevation of 75.8 m.

The flow capacity of the Box culvert was modeled using the Hydroflow Express Extension of Autodesk Civil 3D. The results of the modeling are included in Appendix J. The culvert was modeled as a double barreled culvert with spans of 2.8 m and a height of 1.4 metres representing the smallest width and height combination of the actual size of the barrels. The slope of the channel bottom through the railway culvert was measured to be less than 0.1 percent. The a bottom slope of 0.01 percent was used in the Hydroflow Express Model.

The analysis was first completed assuming tailwater conditions equal to 74.10 m. The analysis was repeated assuming normal tailwater conditions and tailwater conditions equal to (dc+D)/2. A tailwater depth of (dc+D)/2 is equal to (critical flow depth plus culvert diameter (height)) divided by 2.

The analysis completed assuming tailwater conditions equal to 74.10 m results in inlet control with a headwater depth of 1.27 m and a tailwater depth of 0.9 m during a 100 year flow event.

The analysis completed assuming tailwater conditions equal to (dc+D)/2 results in inlet control with a headwater depth of 1.32 m and a tailwater depth of 1.19 m during a 100 year flow event.

These two analyses resulted in inlet control with a headwater depth of less than the height of the culvert. This matches the flow depth expectation based on the HEC-RAS Modeling. In addition, the analysis assuming a tailwater condition equal to (dc+D)/2 results in a tailwater essentially equal to that produced by the HEC-RAS Modeling. This demonstrates that the existing box culverts have sufficient capacity to accommodate the 100 year flow rate in the Harwood Creek without surcharge and the outlet from the proposed development will not be affected by flow restriction in the downstream box culverts.

The analysis completed assuming normal tailwater conditions results in outlet control with headwater and tailwater depths of 1.49 during a 100 year flow event. As these results do not match the HEC-RAS modeling it is considered that this scenario would only occur if there was an outside influence on the tailwater elevation such as downstream damming.

8.3. Risk to Proposed Development from Flood Levels in the Harwood Creek

8.3.1. Existing Conditions

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 as 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 area is also a backwater of Harwood Creek.

Flood plain mapping obtained from the MVCA indicates that the site is subject to a backwater flood plain from the Harwood Creek that has a 100 year flood plain elevation of 75.48 m. The extent of this flood plain on the site is illustrated on Kollaard Associates drawing 200977-PRE.

8.3.2. Mitigation of Flood Risk

In order to facilitate the proposed development of the two lots affected by the backwater flood plain, fill material will be placed to raise the ground surface to a minimum of 75.5 m within the area proposed for development. The proposed ground surface will slope upward from the minimum grade towards the proposed dwelling and septic area footprints resulting in elevations of 77.20 metres over the septic bed and 77.5 metres adjacent the proposed dwellings. 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.

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.

Due to the proposed fill placement and well location, there is no risk to the proposed development from flooding of the Harwood Creek.

8.4. Affect of Development on Flood Levels in Harwood Creek and Surrounding Area.

The affect of the proposed development on the Hydraulics and Flow or Flood levels of the Harwood Creek will be discussed in the following sections. Section 8.4.1 will discuss the affect of the fill placement on the hydraulic operations of Harwood Creek. Section 8.4.2 will discuss the affect of the increase in post-development runoff from pre-development conditions on the Flow Rate and Flood levels of the Harwood Creek.

8.4.1. Placement of Fill in the Flood Plain

A detailed discussion of the effects of the removal of the backwater flood plain from the Harwood Creek by means of the proposed fill placement has been discussed by JFSA in a separate report and has been included in Appendix D. As indicated in Section 4.1 above, the proposed discharge location from the development is between Harwood Creek River Stations 1075 and 1023 (Station Information is provided on the 37th page of the JFSA document). The next upstream cross section analyzed was at River Station 1214. From the analysis provided by JFSA in Tables A-1 and A-2 the results of the HEC-RAS analysis for both the existing conditions and the conditions following the proposed filling of the backwater flood plain for all three of these river stations are identical. The 100 year water surface elevations varies from 75.48 m at River Station 1214, to 75.36 m at River Station 1130 and 75.15 at River Station 1023 indicating that the 100 year water surface elevation in the Creek is a function of the hydraulic capacity of the creek and not downstream flooding. The results of the analysis indicate that the proposed filling of the backwater flood plain has no negative impact on the existing hydraulic operations of the Creek since the 100 year levels and the 100 year gradient of the creek does not change between existing and proposed conditions. This is further indicated by JSFA in their report as quoted below.

In their report, JFSA provided the following conclusions:

> *"JFSA has assessed the potential impacts of filling the area within 2050Dunrobin Road, which is currently mapped as a floodplain in MVCA's recent floodplain mapping study. Based on updated HEC-RAS modelling, which assumes these lands are filled, JFSA has demonstrated that there is no increase in peak water level. It was noted that 1D HEC-RAS models are not well suited to assessing/simulating the complexities of lateral spills, and as such the floodplain storage lost due to filling these lands was approximated using 2020 LiDAR obtained from the City of Ottawa and the MVCA's simulated 100-year water surface elevation over these lands. Based on this analysis, it was found that filling the floodplain bulge on these lands will result in an approximate reduction in storage volume by 1,131 m³ or 0.36% of the Harwood Creek 100-year floodplain. As such JFSA concludes that the proposed*

filling within the subject property will have no o impacts on the existing hydraulic operations of Harwood Creek."

Based on the modeling and calculations completed by JFSA, the placement of the fill within the backwater flood plain will have no negative impact to the Harwood Creek and surrounding properties including the existing wells and septic systems on the surrounding properties.

8.4.2. Affect of the Proposed Development on the Harwood Creek Flood Levels.

As demonstrated in Section 6.2.1 of this report, the post-development flow rates from the central portion of the site will be less than the calculated pre-development flow rates for all quantity control storm events for the same area. Section 6.2.1 however shows that the uncontrolled area of the development will result in a slight increase in total runoff for the entire development area during post-development conditions when compared to pre-development conditions.

The additional flows above pre-development conditions from the site, calculated using OTTHYMO for the non-concurrent storm event model, were provided to JFSA. JFSA added the additional flows to the HEC-RAS model, at the request of Kollaard, in order to assess the impact of the additional flow on Harwood Creek. The additional flows were as follows:

2 year - 0.011 m^3/sec,
5 year - 0.019 m^3/sec,
10 year - 0.027 m^3/sec, and
100 year - 0.086 m^3/sec

As previously discussed, the additional flows occurring during a non-concurrent event are greater than the additional flows occurring during a concurrent event. As such, this provides a conservative assessment of the impact of the additional flow as the peak flow in Harwood Creek would only be increased by the additional runoff from the site during a concurrent event.

In the existing conditions Harwood Creek model, as presented by JFSA October 25, 2022, flow data (m^3/s) is added to the creek at 8 locations. These locations consist of

Reach Main 1, River Station 1723;
Reach Main 1, River Station 716;
Reach Tributary 1, River Station 2395;
Reach Tributary 1, River Station 1454;
Reach Main, River Station 6134;
Reach Main, River Station 5304;
Reach Main, River Station 2976;

Reach Main, River Station 1023;

Since the location Reach Main, River Station 1023 is immediately downstream of the outlet from the site, the additional post development flows were added to the HEC-RAS model at this location and the flow data in the model was revised as shown in Table 8-1:

Table 8-1: Flow Data For HEC-RAS Model RS1023

Harwood Creek – Main Reach, River Station 1023				
Storm Event	2-Year	5-Year	10-Year	100-Year
	Flow Rate (m^3/s)			
Existing Conditions	2.8	5.3	7.2	14.9
Post-Conditions	2.811	5.319	7.227	14.986

Increasing the flows in the HEC-RAS model resulted in the following changes to the hydraulics of the Harwood Creek flow as summarized in Table 8-2 for the downstream stations.

Table 8-2: Affect of Increased Flow in HEC-RAS model for Harwood Creek

River Station (1)	Return Period	Change (2) in Flow Width		Change(2) in Stream Depth	Change(2) in Energy Grade Line	Change(2) in Velocity Head
		(m)	%	(m)	(m)	(m)
1023	2 year	0.26	0.8%	0.00	0.00	0.00
	5 year	0.08	0.1%	0.00	0.00	0.00
	10 year	0.28	0.4%	0.01	0.00	0.00
	100 year	0.68	0.6%	0.01	0.00	0.00
1002	2 year	0.14	0.4%	0.00	0.00	0.00
	5 year	1.27	1.9%	0.00	0.00	0.00
	10 year	0.12	0.2%	0.00	0.00	0.00
	100 year	0.18	0.2%	0.01	0.00	0.00
900	2 year	0.11	0.6%	0.00	0.00	0.00
	5 year	0.03	0.1%	0.00	0.00	0.00
	10 year	0.03	0.1%	0.00	0.00	0.00
	100 year	0.05	0.1%	0.00	0.01	0.01
787	2 year	0.01	0.1%	0.00	0.01	0.01
	5 year	0.01	0.1%	0.00	0.00	0.00
	10 year	0.02	0.2%	0.00	0.00	0.00
	100 year	0.04	0.3%	0.00	0.01	0.01
690	2 year	0.02	0.2%	0.01	0.00	0.00
	5 year	0.02	0.2%	0.00	0.00	0.00
	10 year	0.67	2.8%	0.00	0.01	0.00
	100 year	0.0	0.0%	0.00	0.00	0.00
444	2 year	0.06	0.5%	0.00	0.00	0.00
	5 year	0.18	1.0%	0.00	0.00	0.00
	10 year	0.0	0.0%	0.00	0.00	0.01

	100 year	0.60	0.5%	0.01	0.01	0.00
209	2 year	0.01	0.1%	0.00	0.00	0.00
	5 year	0.07	0.2%	0.00	0.01	0.00
	10 year	0.05	0.1%	0.00	0.00	0.00
	100 year	0.11	0.1%	0.00	0.00	0.00
100	2 year	0.01	0.0%	0.00	0.00	0.00
	5 year	0.04	0.1%	0.00	0.00	0.00
	10 year	0.01	0.0%	0.00	0.00	0.00
	100 year	0.58	1.2%	0.01	0.00	0.01
4	2 year	0	0.0%	0.00	0.00	0.00
	5 year	0	0.0%	0.00	0.00	0.00
	10 year	0	0.0%	0.00	0.00	0.00
	100 year	0	0.0%	0.00	0.01	0.01
Average all 19 Downstream Stations	2 year	0.04	0.2%	0.00	0.01	0.00
	5 year	0.07	0.1%	0.00	0.00	0.00
	10 year	0.06	0.1%	0.00	0.00	0.00
	100 year	0.13	0.1%	0.00	0.00	0.00
Range in Change all 19 Stations	2 year	0.0 to 0.26		0.0 to 0.01	0.0 to 0.01	0.0 to 0.01
	5 year	0.0 to 1.27		0.00	0.0 to 0.01	0.0 to 0.01
	10 year	0.0 to 0.67		0.0 to 0.01	0.0 to 0.01	0.0 to 0.01
	100 year	0.0 to 0.68		0.0 to 0.01	0.0 to 0.01	0.0 to 0.01

1) Since there are 19 River Stations between the outlet from the proposed development and Constance Lake, only those stations immediately downstream of the outlet and where comparatively larger changes were calculated were added to the table. The stations not shown are less affected than the stations in the table.

2) A positive change indicates an increase from existing or pre-development conditions to post-development conditions. That is, a positive change in flow depth would indicate that the increased flow due to the proposed development would increase the flow depth in the Creek.

A review of the above table indicates a range in the increase in flow width during a 100 year event of 0.0 to 0.68 m. The maximum increase in flow width occurs during a 5 year return period and is 1.27 m and occurs at river station 1002. The associated increase in flow depth during a 5 year return period at river station 1002 is 0.0 m. This simply means that the flood plain at the 5 year flood depth is essentially flat and that the change in flow does not have enough impact to effect the calculated flow depth.

A review of the change in stream depth, energy grade line and velocity head indicate that the change in flow has no significant impact to the HEC-RAS model of the Harwood Creek. The average change in these Stream flow characteristics is 0.0 and a maximum change of 0.01 metres is within the expected deviation due to differences in rounding during the calculations.

8.4.3. Summary of Affects

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 slight increase in post-proposed development flow will not affect adjacent or downstream landowners by increasing flood elevations or significantly altering the Hydraulic function of the Harwood Creek.

8.4.4. Downstream Erosion

As discussed in the previous sections, the proposed development will not have any measurable affect on the velocity in the Harwood Creek stream channel during the design storm events. The runoff rate and volume will be less during post-development conditions than current conditions for annual rainfall events. In addition, the flood plain fringes, above the normal high water level, are well vegetated with well established grasses, shrubs and other vegetation.

Since the proposed development will result in less runoff during annual rainfall events and no significant change in flow velocity, the proposed development will not increase the potential for erosion in Harwood Creek downstream of the outlet to Harwood Creek.

9. 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 recommended strategy for stormwater management quality control is to provide an integrated treatment train approach. In general, best management practices for stormwater management quality control are divided into three categories: source control, conveyance control and end-of-pipe control.

9.1. Source Control

The primary source of total suspended solids and associated runoff pollution under post-development conditions is considered to the areas of a site subject to vehicle traffic. At the proposed development, this consists of the driveways and roadways. The vegetated landscaped surfaces and dwelling roofs are typically not considered to be significant sources of suspended solids following the completion of the development and establishment of the vegetation in landscaped areas.

The application of de-icing chemicals including salts and sand can be reduced with a best management plan for the application of these products. BMPs with respect to de-icing chemicals include such measures as timing of application, targeted application, and clearing of snow cover before application.

9.2. Conveyance Control

The proposed driveways and subdivision roadway are within the controlled area of the site. In general, runoff generated from the driveways will be directed across the grass surfaced front yards to the roadside ditch in front of the lots. The runoff from the roadways will also be conveyed along the roadside ditches to the storage swale east of the cul-de-sac. The roadside ditches have been designed with a longitudinal slope of which varies from 1.1% to 0.2% (north side) and 1.1% to 0.4% (south side). The low ditch slopes, in general, occur at the cul-de-sac. Due to the low slope and the vegetation within the ditches, the roadside ditches will provide preliminary treatment removing larger suspended solids.

A Research paper completed by University of Quelph School of Engineering (Authors Dr. Ramesh P Rudra Ph.D., Dr. Hugh R Whiteley Ph.D., Dr. William T Dickinson Ph.D.) *Sediment Removal Efficiency of Vegetative Filter Strips* January 2001 indicates that vegetative filters can partially remove sediments and pollutants attached to sediment particles in runoff. Field experiments on vegetative filter strips showed average sediment removal varying from 50 to 98% as flow path length increases from 2.5 to 10 metres. The research indicates that almost all particles larger than 40 microns in diameter are captured within the first five meters of a filter strip provided the flow velocity is limited to less than 0.5 m/s during the quality control storm event. About 50% of the sediments are removed within the first 2.5 m of travel over the vegetative filter flow path. An additional 25% to 45% of sediments are removed within the next 2.5 m of the flow path depending on the flow rate and velocity. The removal efficiency of the vegetative filtration does not significantly increase with a flow path length beyond 10 m.

The MOE Manual considers the quality storm event to be the 4 hr 25 mm Chicago storm. The flow rate and flow velocity determined using the OTTHYMO model during the 4 hr 25 mm Chicago storm in the eastern sections of the proposed roadside ditch are as summarized in the following Table 9-1:

Table 9-1: Flow Rate, Velocity and Depth along Roadside Ditches.

Ditch Section	Flow Rate (m3/s)	Flow Velocity (m/s)	Flow Depth (m)

North D5	0.003	0.043	0.013
North D7	0.005	0.046	0.022
South D6	0.003	0.043	0.013
South D8	0.005	0.049	0.021

The results in the above table indicate that the flow velocity in the ditches will be well below the critical velocity of 0.5 m/s which means that the ditches will provide effective vegetative filtration.

Section 4.5.9 of the MOE Manual provides the design guidance with respect to the use of Grassed Swales to achieve quality control. The flow criteria has been summarized in the following Table 9-2. A column has been added to indicate how the proposed design conforms to the Criteria.

Table 9-2: Summary of MOE Flow Criteria for Grassed Swales and Conformance

Design Element	Design Objective	Minimum Criteria	Maximum as Designed*
SWALES – OUTLET SWALE			
Flow Criteria	Required to Achieve Quality control		
Peak Flow Velocity	Facilitate Sedimentation and vegetative filtration	< 0.5 m/s	0.49 m/s during 10 year storm
Flow Depth	Promote Vegetative Filtration	< 0.5 m	0.2 m during 10 year storm
Flow Rate	Sedimentation and prevent re-suspension	≤ 0.15 m^3/s	0.15 m^3/s during 10 year storm
DITCHES			
Flow Criteria	Required to Achieve Quality control		
Peak Flow Velocity	Facilitate Sedimentation and vegetative filtration	< 0.5 m/s	0.04 m/s during quality control storm 0.41 m/s during 2 year storm 0.53 m/s during 10 year storm 0.62 m/s during 100 year storm
Flow Depth	Promote Vegetative Filtration	< 0.5 m	0.02 m during quality control storm 0.13 m during 2 year storm 0.20 m during 10 year storm 0.27 m during 100 year storm
Flow Rate	Sedimentation and prevent re-suspension	≤ 0.15 m^3/s	0.005 m^3/s during quality control storm 0.02 m^3/s during 2 year storm 0.07 m^3/s during 10 year storm 0.14 m^3/s during 100 year storm

* It is noted that the maximum velocity, maximum depth and maximum flow rate do not occur along the same section of ditch or swale. That is, a comparatively steeper ditch section will result in higher velocity and lower depth for the same flow rate.

All of the flow criteria are less than the required flow criteria needed to achieve an enhanced level of filtration during both the quality control event and the 2 year storm events.

Table 2.3 of the Ontario Ministry of Natural Resources Technical Guide – River and Stream Systems: Erosion Hazard Limit provides a maximum allowable flow velocity to prevent scour for a bare channel in sand and silt of 0.61 m/s. The allowable flow velocity increases to 0.91 m/s with fair vegetative cover.

The peak velocity during a 2 year storm event is less than 0.5 m/s ensuring that sedimentation will continue to occur during a 2 year design storm event. The peak flow velocities of 0.41 m/s and 0.53 m/s during the 2 year and 10 year storm events are less than the scour velocity assuming a bear channel. The peak flow of 0.62 m/s during a 100 year storm is less than 0.91 m/s ensuring scour will not occur once vegetation is established.

Since the flow velocity during a 2 year design storm is less than the scour velocity of a bare channel there will be no scour or re-suspension of sediment during a normal rainfall event. It is assumed that the vegetation will have a chance to grow through the sediment prior to successive 10 and 100 year storm events resulting in at least a fair vegetative condition in the ditches preventing resuspension of sediment.

9.3. End-of-Pipe Control – Stormwater Storage Swale

Final treatment and Quality Control will be provided by temporary detention of the entire quality control volume, generated from the surfaces in the controlled area, within the storage swale to be discharged by filtration only. The quality storage swale has been designed to outlet the quality storage volume vertically through an amended topsoil layer into subdrains complete with clear stone below the storage swale.

The 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 provides guidance on design for stormwater quality control using infiltration basins in Section 4.6.6 and using filtration in Section 4.6.7.

It is noted that the proposed stormwater storage swale does not meet all of the criteria for an infiltration or filtration basin as the stormwater storage swale is also used for quantity control and does not have a bypass for major storm events. Notwithstanding these discrepancies, guidance with respect to the design of the stormwater storage swale was taken from the MOE Manual Sections 4.6.6 and 4.6.7.

9.3.1. Summary of Design Guidance

Sections 4.6.7 and 4.6.6 of the MOE Manual provides the design guidance with respect to the use of filters and infiltration. The design guidance is summarized in Table 9-3 below. A design conformance and a comment column have been added to indicate if the design conforms to the Criteria and to provide comment. Since subdrains have been added below the filtration layer, the storm water storage swale no longer relies on infiltration. However, infiltration remains an objective to reduce the total runoff volume from the development and to assist in maintaining the water balance as required by the MECP guidelines.

Table 9-3: Filtration and Infiltration Basin Design Summary Table

Design Element	Design Objective	Minimum Criteria	Design Conformance	Comment
Drainage Area	Infiltration	< 5 hectares	Yes	3.22 hectares
Treatment Volume	Provision of appropriate Level of protection (see Section 3.3)	Table 3.2 21.4 m^3/ha x 3.22 = 68.9 m^3	Yes 9.3.2.1	103.55 m^3
Percolation Rate	Infiltration	≥ 60 mm/hr	9.3.2.2	Amended Topsoil Soil over a clear stone drainage layer complete with subdrains. Amended topsoil has a percolation rate of 60 to 75 mm/hr
Depth to Water Table	Infiltration	> 1m	N/A	>0.7 m SWM Design no longer depends on infiltration. However Infiltration remains a beneficial part of the SWM
Depth to Bedrock	Infiltration	> 1m	N/A	greater than 1.1 m
Length to Width Ratio	Spread Inflow	3:1 or greater	Yes	18:1
Storage Depth	Avoid Filter Compaction	< 0.6 m	9.3.2.3	0.87 m during a 100 year storm event for a duration of less than 11 hrs. 0.53 m during a 10 year storm event.
Pre-treatment	Longevity Groundwater protection	Required	9.3.2.4	Best management practices and Pre-treatment by vegetated filtration along ditch bottom, and side slopes

Filter Media Depth	Filtering	Organic / BioRetention 1.0 to 1.2 m	9.3.2.5	Amended Topsoil overlying sand fill and/or native soils.
By-Pass	Winter / spring Operation	Required	9.3.2.6	By-Pass by overflow weir.
Under-Drain	Discharge	Required	9.3.2.7	150 mm perforated pipes in Clearstone
Maintenance Access	Access for light discing equipment	Provided to approval of municipality	Yes	Maintenance Rd along length of Swale
Landscaping Plan	Enhanced Infiltration Increase porosity	Grasses, deep rooted legumes	9.3.2.7	Grasses, deep rooted legumes as well as other native vegetation

9.3.2. Conformance of Storage Swale

9.3.2.1. Treatment Volume

The water quality storage volume requirement to achieve an enhanced level of treatment using both infiltration and filtration is determined from the MOE Manual Table 3.2 under infiltration. The impervious ratio for the controlled area of the site is 22.7%. The storage requirement was extrapolated from Table 3.2, considering a 22.7% impervious ratio at an enhanced level of treatment, to be 21.93 m^3/ha.

The total controlled area is 3.22ha. 3.22 ha x 21.93 m^3/ha gives a quality storage requirement of 70.6 m^3. An additional criterion with respect to treatment volume provided in the MOE Manual when considering the use of filtration for treatment is that there is no by-pass of the filter during a 4 hour 15 mm design storm. The 4 hour 15 mm design storm was not included in the OTTHYMO model. In order to ensure that by-pass would not occur below a 4 hr 15 mm design event, the runoff volume calculated for the 4 hr 25 mm quality design storm was considered. The runoff volume generated across the combined primary controlled area of 3.218 ha contributing runoff to the storage swale is 2.1 mm during a 4 hr 25 mm design storm.

A 4hr 25 mm quality storm event will result in a runoff volume of (3.218 ha x 2.1 mm) 67.6 m^3. This volume is less than the quality storage requirement calculated using Table 3.2. As such the maximum quality storage requirement of was determined to be 70.6 m^3 using Table 3.2. There is a total volume of 103.55 m^3 below the lower outlet invert. As such a minimum of 103.55 m^3 will outlet by filtration 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 15 mm storm event.

9.3.2.2. Percolation Rate

The native and imported soils below the bottom structure are expected to have a percolation rate ranging from 30 to 75 mm/hr. The clear stone subdrains will distribute the infiltration to areas with a greater infiltration rate and will reduce the potential for surficial long term ponding.

Permeability testing completed in the footprint of the proposed swale indicates that the permeability of the native soils is 1.64 x 10-7 m/s. This corresponds to an infiltration rate of 30 mm/hr. The City of Ottawa's guidelines with respect to LID practice make it clear that LIDs can be used when the infiltration rate is over 15 mm/hr. It is noted that infiltration is no longer the primary outlet for water as is makes its way through the filter. Infiltration remains a priority and all water below the sub drains will infiltrate.

Section 3.5.1 of the City of Ottawa Low Impact Development Technical Guidance Report February 2021 indicates the following:

> *"The 2003 Stormwater Manual contains guidance for a number of lot level and conveyance controls but specifies that the application of a number of management practices may not be suitable if the native soil has a percolation rate less than 15 mm/hr (see for example Pg. 4-6: Table 4.1: Physical Constraints for SWMP Types - infiltration trenches, reduced lot grading, soakaway pits, rear yard ponding, and pervious pipes)."*
>
> *This has contributed to the limited application of these measures as many of the soils within Ontario do not meet this criterion. The infiltration rate has an obvious effect on the speed with which a facility will be emptied between rainfall events. Thus, LID facilities should be sized for optimum control of water quantity. Area-wide quantity criteria may be achieved through the use of multiple smaller LID facilities distributed over a large area.*
>
> *For example, stormwater management practices such as bioretention and biofiltration use multiple treatment mechanisms including retention, filtration, evaporation and transpiration as well as infiltration. If the lot level and conveyance facilities can be sized such that they empty between events, or will be installed in areas where quantity control is not a primary concern (areas draining directly to a large surface water body like Lake Ontario, for example), LID facilities can be used where the infiltration rate is less than 15 mm/hr to achieve water balance and water quality (including thermal impacts) through retention, filtration, evaporation and transpiration. Thus, the soil infiltration capacity guidance in the manual should not be interpreted as a prohibition. Rather, it should be interpreted as a caution that controls relying primarily on infiltration may not be as*

> *effective on soils with low infiltration rates as they would be on soils with higher rates of infiltration."*

9.3.2.3. Storage Depth

It is noted that the MEO Manual in section 4.6.6 under the heading Storage Configuration/ Depth provides the following:

> *"In an infiltration basin, surface storage is used to retain water for infiltration. In monitoring studies (Galli, 1990), one of the causal factors of failure was noted to be the depth of water retained in the basin. The weight of the water is thought to compact the basin decreasing its infiltration potential. The depth of storage should be limited to a maximum of 0.6 metres in order to minimize the compaction of the basin."*

In section 4.6.7 of the MOE manual, the maximum storage depth to prevent compaction of a sand filter is increased to 1.0 metres.

The maximum ponding depth in the proposed storage swale during a 100 year design storm event is 0.87 m. Using the rainfall data from the historical rainfall event of July 1, 1979, the maximum ponding depth would be 0.95 m. It is noted that the draw down time from a maximum ponding depth of 0.87 m to a depth of 0.6 m is about 11 hours. The maximum ponding depth during a 10 year storm event is 0.63 m. This means that the storage swale will only be subjected to ponding depths in excess of 0.6 m during infrequent events for a short duration. Since the excessive ponding depth will be of limited duration and infrequent in occurrence, it is considered that the excessive ponding depth will have minimal effect on the compaction of the soils below the storage swale. In addition, the proposed planting are intended to have a root structure which will aid in reducing the compaction of the soils.

9.3.2.4. Pre-Treatment

The majority of the pre-treatment for the storage swale will take the form of source control and conveyance control as described in sections 9.1 and 9.2 above. In addition to these, the first 25 metres of the bottom of the storage swale is sloped downward at 6.9 percent prior to encountering the level swale bottom. This first 25 metres will provide additional vegetative filtration prior to the runoff encountering the remainder of the swale. These measures will ensure that the coarse sediment is removed from the runoff prior to the main filtration portion of the storage swale.

9.3.2.5. Filter Media Depth

The MECP design guidance indicates a minimum sand filter thickness of 0.5 metres and a minimum bioretention thick of 1.0 to 1.2 metres of planting soils. The MECP design guidance indicates that filters are most commonly constructed with impermeable liners or within concrete structures to ensure that native material does not enter the filter and clog pore spaces, and to prevent the filtered water from infiltrating into the native soil. As such, the bioretention thickness of 1.0 to 1.2 metres is a requirement for sufficient soil depth to promote plant growth rather than to achieve filtration. Three subdrains complete with a clear stone surround will be spaced across the width of the storage swale under the topsoil filter layer. Other than at these subdrain locations, the filter will be underlain by native soils which will provide soil depth for plant growth. Since infiltration remains an important part of the design, an impermeable liner will not be used.

The average flow path for water through the filter will be greater than 0.4 metres ensuring sufficient travel distance through the amended topsoil to remove suspended particles in order to achieve 80 percent total suspended particle removal.

9.3.2.6. By Pass

Since the storage swale is being used for quality control purposes, there is no proposed low level by-pass for major storm events. By-pass of the outlet structure will be by means overflow above the V-notch of the weir through the rectangular portion of the weir.

9.3.2.7. Under Drain

As stated above, three subdrains complete with a clear stone surround will be spaced across the width of the storage swale under the topsoil filter layer. The subdrains will consist of 150 mm diameter single wall hdpe pipe. Each pipe will be placed in 400 mm wide by 400 mm high trench and will be surrounded by clearstone. The invert of the pipe should be 100 mm above the bottom of the clearstone. The clearstone should be surrounded by a non-woven 4 ounce per square yard geotextile fabric. The clearstone should meet the grading specification for septic stone as specified in Part 8 of the Ontario Building Code.

9.3.2.8. Landscaping Plan

The MOE Manual provides the following:

> *"The vegetation in an infiltration basin should be able to withstand periods of ponding and maintain or enhance the pore space in the underlying soils. There is much literature to suggest that deep rooted legumes increase porosity and enhance infiltration compared to*

other ground covers (e.g., rotation of oat and corn crops with alfalfa) (Bryant et al., 1986; Minnesota Pollution Control Agency, 1989). As such, the planting strategy should include grasses and deep rooted legumes."

The bottom of the proposed storage swale should be lightly seeded with sweet clover in combination with a mix such as Wet meadow or storm pond seed such as QS Wet Meadow Mixture as supplied by Quality Seeds or Stormpond Native Seed Mixture or Creek Bank Native Seed Mixtures supplied by OSC Seeds.. The sides slopes of the storage swale should be seeded with a meadow mix such as QS Meadow Mixture as supplied by Quality Seeds. The seed mixes should be sowed at the rates recommended by the supplier. The seed mixes should be sowed in combination with a nurse crop of annual rye or oats which is sowed at a rate of 22-25 kg/ha.

9.3.2.9. Detention Time

The normal recommended detention time for stormwater management facilities ranges from a minimum of 24 hours (12 hrs if in conflict with minimum orifice size) to a preferred time of 48 hours. The proposed storage swale will have a total drawdown time of about 58 hours following the completion of a 100 year storm event. The draw down time following the completion of a 5 year storm event and a 10 year storm event is about 41 hours and 47 hours respectively.

The amount of time for the entire storage volume below the lowest outlet invert to infiltrate will be about 14 hours.

9.3.2.10. Flow velocity

Due to the outlet restriction, the discharge rate during the various design storms will be limited to for the 5 year, 10 year and 100 year storm events. Based on a bottom width of 5 metres, these flow rates would result in flow depths and flow velocities in the storm pond assuming no backwater conditions as shown in the following Table 9-4:

Table 9-4: Flow Velocity and Depth in Storage Swale

Storm Event	Flow Rate (m^3/sec)	Section of Filter	Flow Depth (m)	Flow Velocity (m/sec)
5 year	0.096	First 25 m	0.05	0.38
		Remainder	0.17	0.10
10 year	0.135	First 25 m	0.06	0.43
		Remainder	0.21	0.11
100 year	0.265	First 25 m	0.09	0.56
		Remainder	0.31	0.14

The above flow velocities and flow depths represent the theoretical velocity that would occur without the outlet restriction. The ponding caused by the outlet restriction will increase the ponding depth and reduce the flow velocity. The velocity across the steeper first 25 m of the storage swale remains below 0.5 m/s for all storm events with a return period of 10 years or less ensuring that vegetative removal of sediment will be effect through the first 25 metres of the swale. Since the flow velocity is much lower than 0.5 m/s during all storm events in the majority of the swale, the proposed vegetation in the storage swale will effectively provide vegetative filtration and remove sediment. The minimal velocity will also prevent re-suspension and scour of fine sediment.

9.3.3. Summary

The proposed storage swale design meets the majority of the design criteria for an infiltration basin and for filtration as illustrated above. The swale meets the critical criteria with respect to storage volume and detention time necessary to infiltrate the entire quality control volume. Further, due to the outflow restriction, the flow velocity is minimized such that vegetative filtration will be effective and scour and re-suspension of sediment is unlikely.

Based on the above, the proposed stormwater storage swale will ensure that an enhanced level of treatment will be attained for the proposed development.

10. Driveway Culverts

Table 6-4 above provides the maximum flow rates in the roadside ditches during the 10 year and 100 year design storm events. Table 6-4 also provides the minimum available ditch depth for each section considered.

The driveway culverts are specified as 500 mm diameter 1.6 mm thick (16 gauge) plain galvanized corrugated steel pipe with a 68 x 13 mm helical profile.

The headwater depth for each driveway culvert required to meet the flow demand for each respective ditch section was calculated using the Hydroflow Express extension for Autodesk AutoCAD Civil 3D. The results of the calculations are presented in Table 10-1 below. Summary reports are including in Appendix J.

Table 10-1: Culvert Flow Demand and Capacity

Culvert Number	Culvert Diameter / Embedment (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)
Lot 1 & 2	0.5 / 0.05	0.19	0.02	0.13	0.05	0.21
Lot 3 & 4			0.04	0.16	0.07	0.25
Lot 5 & 6			0.05	0.21	0.10	0.32
Lot 7 & 8			0.07	0.26	0.14	0.39

From the above analyses, there is sufficient capacity to convey the maximum flow rate generated during a 100 year design storm in the roadside ditches through the driveway culverts without exceeding the minimum available ditch depth and without surcharging the culverts. It is noted that the purpose of the analysis with the results provided in Table 10-1 above is to demonstrate that the culverts have adequate capacity to convey the flow demand under normal conditions. If the tailwater becomes elevated due to outflow restrictions in the downstream storage swale, any flow restriction is no longer a function of the size of the culvert.

11. 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. It is expected that the City of Ottawa will not be providing final acceptance of the subdivision and associated stormwater management works until the stormwater management works have become established. Once the subdivision is accepted by the City of Ottawa, the operation and maintenance of the portion of the stormwater management facility within publicly owned or publically controlled property in the subdivision is the responsibility of the City of Ottawa. The short term and intermediate term maintenance requirements will be the responsibility of the owner/developer.

11.1. Grassed Swales and Roadside Ditches

Short Term

The swales and roadside ditches should be inspected on a weekly basis and after any rain fall event after construction until vegetation is well established. Bare areas should be reseeded as required. Any areas of erosion should be repaired and reseeded as soon as possible. Once the vegetation is well established and during the first year of operation, the swales and roadside ditches should be visually inspected on a bi-monthly basis and following a 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.

Long term

The grassed swales and ditches proposed for the development will require occasional maintenance. Periodic trimming along the drainage swales and ditches to remove excess vegetation represents the bulk of the maintenance required. It is noted that the specified grass and vegetation varieties can be allowed to naturalize without cutting.

Should excavation be required during maintenance, re-vegetation of disturbed areas should be completed after maintenance operations have been completed. Temporary straw bale check dams should be used to trap the debris and sediment disrupted during ditch cleaning operations.

11.1.1. Subdrains

The subdrains within the stormwater management swales consist of 150 mm perforated HDPE pipe surrounded by clearstone within a 600 mm wide by 400 mm deep trench. The subdrain will have geotextile fabric on the bottom and sides. The clearstone surface will be exposed. If ponding above the surface of the clearstone occurs or other evidence of clogging within the subdrain is observed, the section of subdrain of concern could be readily exposed by hand or mechanical excavation. Once the section of subdrain of concern is exposed, it could inspected and then either be removed and replaced or cleaned depending on its condition. Once the deficiency with respect to the section of subdrain has been addressed, the clearstone could be put back in place.

11.2. Stormwater Management Swale

11.2.1. Vegetation and Enhanced Topsoil

Short Term

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.

Intermediate (First Year)

Cut the vegetation within the stormwater storage swale to a height of 20 cm twice during the first growing season and once early in the second growing season. Hand remove pockets of aggressive weeds during the establishment period. The specified native seed mixes are intended to grow without maintenance following their establishment in order to provide wildlife habitat.

Long Term

The seed mixtures are intended to be low maintenance and the resulting vegetation is intended to be left in its natural state.

If patches of noxious weeds occur following the establishment of the seed mixture, the patch could be mechanically removed by excavator. The topsoil removed should be replaced with an amended topsoil mix and the area should be reseeded.

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 vegetation growth within the storage swale and/or the drainage patterns along the bottom. If the drawdown time becomes significantly extended, the topsoil layer should be tilled or cultivated to reduce the compaction. Additional amending material can also be added at that time.

Following tilling or cultivation, the bottom should be reseeded with the specified seed mixtures. The inspection schedule will be reset to short term following tilling or cultivation and reseeding.

11.2.2. Subdrains

Short Term and Intermediate

The subdrain should also be inspected during each inspection of the stormwater management swale. During inspections immediately following a significant rainfall event, it is expected that visually clear water will be flowing from each subdrain.

If the no flow is observed or the flow is cloudy, it is possible that the subdrain has become obstructed or partially obstructed by sediment. In this case the inspection port covers could be removed and the subdrains could be inspected with a small diameter CCTV sewer camera.

Long Term

As previously indicated, during inspections immediately following a significant rainfall event, it is expected that visually clear water will be flowing from each subdrain. If this is not observed, it is likely that the subdrain has become obstructed. In addition, if the periodic inspections of the stormwater management swale indicate areas of long term standing water, it is possible that one or more of the subdrains have been compromised.

Should there be any indication that the subdrains have become compromised or obstructed, the subdrains can be inspected by means of a small diameter sewer CCTV camera. The CCTV video will indicate if the obstruction is due to sediment, roots or crushed or otherwise compromised pipe.

Cleaning and / or repairing

Minor amounts of sediment could be removed by flushing during a dry period. The volume of water used to flush the subdrain will not be sufficient to convey the flow to Harwood Creek and any sediment in the flush water will be removed by vegetative filtration.

Significant amounts of sediment removal may require flushing in conjunction with a vacuum truck at the discharge end of the subdrain.

The bottom of the subdrain pipe will be located approximately 0.5 metres below the bottom of the stormwater management swale. If the CCTV video indicates that the subdrain has become compromised by roots or by damage, the section of subdrain in question could be readily exposed using a mini excavator or by hand excavation:

- The amended topsoil should be removed exposing the subdrain. The soil should be stockpiled for replacement following completion of repairs;
- The geotextile fabric covering the subdrain clearstone could be cut and the clearstone removed exposing the pipe section in question;
- The section of pipe can be repaired or replaced;
- The clearstone will be replaced around the subdrain pipe, the edge of the cut fabric will be pulled together and a new piece of fabric can be placed over the joint with 0.5 m of overlap on each side of the joint;
- The amended topsoil could be replaced and re-seeded as discussed in section 11.2.1 above.

11.3. Outlet Structure

Short Term

The maintenance manhole comprising the outlet control structure of the storage swale should be cleaned following completion of the construction on the storage swale and following establishment of the vegetation in the storage swale.

The grate covering the inlet to the outlet control structure should be observed during each inspection of the storage swale and cleared of debris as necessary.

Long Term

The grate covering the inlet to the outlet control structure should be inspected during any site visit to inspect the remainder of the swale and any debris or obstructions should be removed.

The interior of the control structure should be inspected on a bi-annual basis to verify that sediment and fine debris in the structure remains at least 0.15 m below the level of the weir invert.

12. Mitigation Measures for Construction and Development

The following Mitigation Measures should be incorporated during the construction and development of the site to minimize the impact of the proposed development on the adjacent undeveloped areas:

1) To prevent the introduction and spread of invasive plant species into the study area, equipment utilized during construction should be inspected and cleaned in accordance with the *Clean Equipment Protocol for Industry*
   a) Inspect the vehicle thoroughly inside and out for where dirt, plant material and seeds may be lodged or adhering to interior and exterior surfaces prior to mobilizing equipment onto the site.
   b) Remove any guards, covers or plates that are easy to remove.
   c) Attention should be paid to the underside of the vehicle, radiators, spare tires, foot wells and bumper bars.
   d) If clods of dirt, seed or other plant material are found, removal should take place immediately, using the techniques outlined in the Clean Equipment Protocol For Industry.
2) Except as required to construct the outlet, a minimum of 30 m setback from Harwood Creek should be maintained where no development or clearing should occur.
3) In accordance with the City's of Ottawa's *Protocol for Wildlife Protection during Construction to* reduce potential wildlife usage of the Forb Meadow habitat by mowing/clearing outside of the breeding season (i.e., before April 15), then maintain as mowed grass until on-site work begins.
4) No clearing of any vegetation should occur between April 1 and September 15 of any year, unless a qualified biologist has determined that no bird nesting is occurring within five days of the vegetation clearing event.
5) Should any SAR be discovered during the project works, and/or should any SAR or their habitat be potentially impacted by on-site activities, the MECP shall be contacted immediately and operations modified to avoid any negative impacts to SAR or their habitat, until further direction is provided by the MECP;
6) Any excavation or heavy equipment use in the floodplain or near Harwood Creek within the study area, conducted between May 1 and September 15, has the potential to harm travelling Blanding's Turtles and other SAR turtles that utilize the watercourse. As such, mitigation measures should be employed to protect SAR and their habitat during construction and to maintain compliance with the ESA. Some common mitigations would include working outside the known timing window for active turtle movement from May 1 to September 15 of any year, unless the area has been cleared of turtles by a qualified

biologist; as well as temporary turtle exclusion barriers should be installed by May 1, prior to the turtle nesting season surrounding the impacted watercourse or proposed works.

13. SEQUENCING OF DEVELOPMENT AND EROSION AND SEDIMENT CONTROL

13.1. Sequencing of Development and Construction Activities

It is anticipated that the development and construction activities at the site will occur in the following order. There is only one proposed Phase.

1) Construction of Roadway:
    a) Install sediment and erosion control measures;
    b) Strip topsoil and prepare subgrade;
    c) Place roadway granular subbase and base;
    d) Shape ditches and back slope to property lines;
    e) Topsoil and seed ditches;
    f) Construct "Cow path" to support truck traffic;
    g) Following placement of fill in flood plain, remove "Cow path and finish shaping roadway;
2) Place Fill in Flood Plain within the Storm Block:
    a) Install sediment and erosion control measures
    b) All of the fill required to raise the flood plain to the proposed grades should be placed within the proposed storm block.
    c) Construct the maintenance road along the stormwater storage swale;
3) Construct the Stormwater Management Facility and Outlet Swales:
    a) Install sediment and erosion control measures;
    b) Construct the stormwater management swale;
    c) Seed the specified vegetation within the stormwater management swale;
4) Construct the peripheral swales:
    a) Install sediment and erosion control measures;
    b) construct swales by excavation;
    c) cut material to be used as fill and to be placed within the confines of the sediment and erosion control measures;
5) Finish the placement of fill within the flood plain:
    a) Install sediment and erosion control measures

6) Complete individual lot development:
   a) Install sediment and erosion control measures

13.2. Sediment and Erosion Control Measures

The following Sediment and Erosion Control measures are recommended during the various stages of development of the proposed subdivision. Heavy-duty silt fence (OPSD 219.130) is to be used where area flow is directed to the watercourse. Light-duty silt fence (OPSD 219.110) may be used elsewhere.

1) Prior to Start of Construction:
   a) Install silt fence, straw bale check dams and mud mat in location shown;
   b) Inspect measures immediately after installation.
2) In General:
   a) Do not locate topsoil piles or fill piles within 2.5 m from any paved or gravel surface area;
   b) Control dust off site by seeding topsoil and soil piles and other disturbed areas watering as necessary if they are to remain unfinished longer than 30 days;
   c) City Roadway to be cleaned of all sediment from vehicular tracking as required;
   d) Provide mud mat where ever vehicular traffic leaves the site from an unpaved egress point;
   e) All erosion control measures should be inspected within 24 hours of a storm event and should be cleaned / repaired / replaced as necessary;

3) During Construction of the Roadway:
   a) Minimize the extend of the disturbed areas outside of the area immediately affected by the road construction;
   b) Install silt fence at the perimeter of the disturbed area;
   c) Ensure straw bale check dams are in place at the discharge point from the Cul-de-Sac;
   d) Equipment used should be sufficient in size and quantity to ensure the construction time is minimized;
   e) Any excess soil material excavated during the construction should be stockpiled on the proposed lots outside of vulnerable areas and outside of the road allowance. The soil should be leveled to rough grade and should be stabilized by seeding;
   f) Cover disturbed areas with minimum 100 mm of topsoil then seed and mulch or hydro seed. The topsoil placement and seeding and mulching / hydro seeding should be completed within 30 days of start of the construction of the roadway;
4) During Placement of the Fill within the Flood Plain Area:
   a) Minimize the extend of the disturbed areas outside of the area immediately affected by the fill placement;

b) Plan the placement of the fill to reduce the duration of exposure either by ensuring sufficient equipment or by placing the fill in stages;
c) Install silt fence at the perimeter of the disturbed area or around the perimeter of each phase if not completing the fill placement all at once;
d) Level the fill to finished grade immediately after placement;
e) Cover fill with minimum 100 mm of topsoil then seed and mulch or hydro seed. The placement of the fill should be completed in a manner that will allow the placement of the topsoil and seeding and mulching / hydro seeding within 30 days of start of fill placement;
f) Inspect silt fence within 24 hours of a storm event and clean / repair as necessary;

5) During Construction of the Storm water Management Facility.
   a) Minimize the extend of the disturbed areas outside of the area immediately affected by storm water management facility;
   b) Install silt fence at the perimeter of the disturbed area;
   c) Ensure straw bale check dams are in place downstream of the facility;
   d) Equipment used should be sufficient in size and quantity to ensure the construction time is minimized;
   e) Any excess soil material excavated during the construction should be stockpiled on the proposed lots outside of vulnerable areas and outside of the road allowance. The soil should be leveled to rough grade and should be stabilized by seeding;
   f) Cover disturbed areas with minimum 100 mm of topsoil then seed and mulch or hydro seed. The topsoil placement and seeding and mulching / hydro seeding should be completed within 30 days of start of the construction of the facilities;
6) During Development of Individual Lots
   a) Install silt fence at the perimeter of the disturbed area;
   b) Control dust off site by seeding topsoil and other disturbed areas watering as necessary if they are to remain unfinished longer than 30 days;
   c) Repair any erosion channels as they occur and redirect surface runoff with the use of berms to promote sheet flow;
   d) Cover disturbed areas with minimum 100 mm of topsoil then seed and mulch or hydro seed as soon as possible;

14. STORMWATER MANAGEMENT CONCLUSIONS

- The proposed Dunrobin subdivision covers a total of about 9 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.

- Development of the Site and associated filling of the backwater flood plain will have no impact on the adjacent upstream or downstream properties including their wells and septic systems. The elimination of a portion of the backwater flood plain will have no effect on the flow regime in the Harwood Creek.

- 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 rate does not exceed the pre-development runoff rate for the central developed portion of the site for all storm events. The runoff rate will be managed for the entire development area such that the additional post-development runoff from the uncontrolled areas has no negative impact to the receiving water body and downstream properties.

- The proposed stormwater management facility will ensure that the development does not increase the runoff volume during normal rainfall events and only negligibly increases the runoff volume during minor storm events ensuring the development will have no measurable effect on the Hardwood Creek flow and flood elevations.

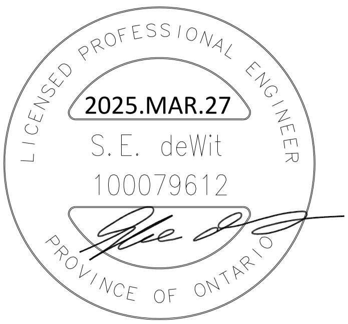
- The proposed stormwater management facility will promote infiltration and promote aquatic and terrain habitat on and adjacent to the site.

- 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.

- Mitigation measures will reduce the impact of the proposed development to adjacent undeveloped areas.

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.



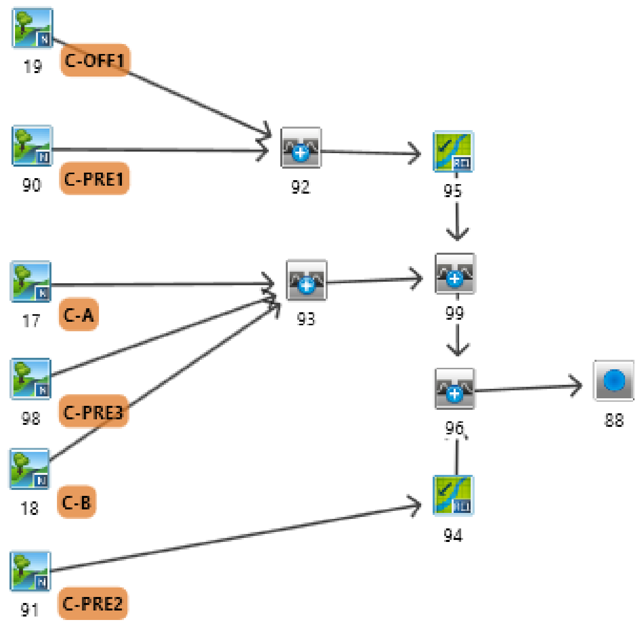
Steven deWit, P.Eng.

APPENDIX A: STORM ANALYSIS MODEL SCHEMATIC AND PARAMETERS

Pre-development OTTHYMO model Schematic and Summary Table

Post-development OTTHYMO model Schematic and Summary Table

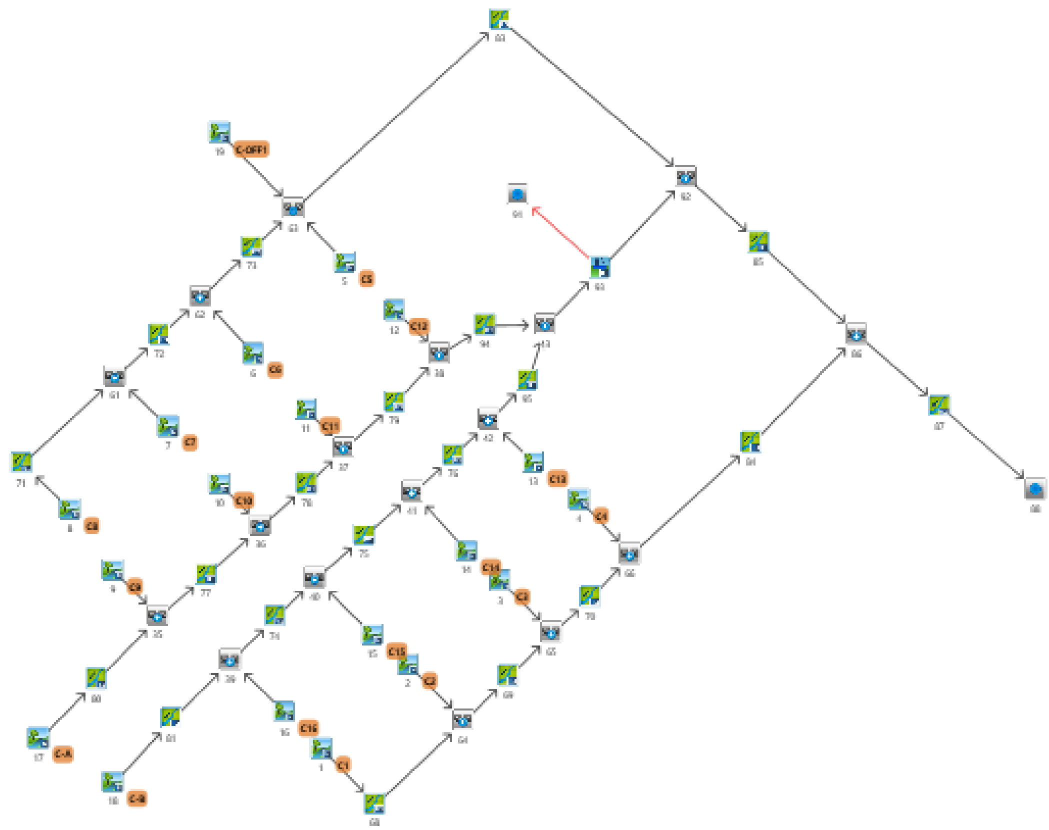
Model Variables for Each Catchment



Pre-Development OTTHYMO model Schematic Summary Table

Hydrograph No.	Model Type	Item Represented	Comment
90	NASHYD	Sub-Catchment C-PRE1	Catchment represents area of site north of the central section.
91	NASHYD	Sub-Catchment C-PRE2	Catchment represents south half of site
98	NASHYD	Sub-Catchment C-PRE3	Catchment represents area of site south of the central section
17	NASHYD	Sub-Catchment C-A	Catchment includes west side of Lot 1 and east half of Dunrobin Road adjacent Lot 1
18	NASHYD	Sub-Catchment C-B	Catchment includes west side of Lot 2 and east half of Dunrobin Road adjacent Lot 2
19	NASHYD	Sub-Catchment C-OFF1	Catchment includes offsite area north of the proposed development
94,95	Route Channel	Open Channel Flow along grassed swale	Models the open channel flow component of the runoff during pre-development conditions along the north and south sides of the site
88	Node	Ends the Model	Ends the Model
30,31,33-46,49,50,93,96,99	NASHYD	Add Hydrograph	Used to add two or more hydrographs in the routing

Post-Development OTTHYMO model Schematic



Post-Development OTTHYMO model 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	NASHYD	Sub-Catchment C5	Catchment represents rear yard of Lot 7. Uncontrolled.

6	NASHYD	Sub-Catchment C6	Catchment represents rear yard of Lot 5. Uncontrolled.
7	NASHYD	Sub-Catchment C7	Catchment represents rear yard of Lot 3. Uncontrolled.
8	NASHYD	Sub-Catchment C8	Catchment represents rear yard of Lot 1. Uncontrolled.
9	NASHYD	Sub-Catchment C9	Catchment includes front yard of Lot 1 and contains dwelling, driveway and half of road. Controlled
10	NASHYD	Sub-Catchment C10	Catchment includes front yard of Lot 3 and contains dwelling, driveway and half of road. Controlled
11	NASHYD	Sub-Catchment C11	Catchment includes front yard of Lot 5 and contains dwelling, driveway and half of road. Controlled
12	NASHYD	Sub-Catchment C12	Catchment includes front yard of Lot 7 and contains dwelling, driveway and half of road. Controlled
13	NASHYD	Sub-Catchment C13	Catchment includes front yard of Lot 8 and contains dwelling, driveway and half of road. Controlled
14	NASHYD	Sub-Catchment C14	Catchment includes front yard of Lot 6 and contains dwelling, driveway and half of road. Controlled
15	NASHYD	Sub-Catchment C15	Catchment includes front yard of Lot 4 and contains dwelling, driveway and half of road. Controlled
16	NASHYD	Sub-Catchment C16	Catchment includes front yard of Lot 2 and contains dwelling, driveway and half of road. Controlled
17	NASHYD	Sub-Catchment C-A	Catchment includes northwest side of Lot 1 and southeast half of Dunrobin Road Controlled
18	NASHYD	Sub-Catchment C-B	Catchment includes southwest side of Lot 2 and southeast half of Dunrobin Road Controlled
19	NASHYD	Sub-Catchment C-OFF1	Catchment includes offsite area northwest of the proposed development Uncontrolled
71, 72, 73, 83	Route Channel	Open Channel Flow along grassed swale	Models the open channel flow component of the runoff during post-dev. conditions along the north side of the development and along the east side of Lot 7

68, 69, 70, 84,	Route Channel	Open Channel Flow along grassed swale	Models the open channel flow component of the runoff during post-dev. conditions along the south side of the development
77, 78, 79, 94	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, 5 and 7 respectively.
74, 75, 76, 95	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 2, 4, 6 and 8 respectively.
80, 81	Route Channel	Open Channel Flow, Road side ditches	Models the open channel flow component of the runoff in the ditches along Dunrobin Road.
85, 87	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
93	Route Reservoir	The stormwater management swale	Provides a model of the stormwater storage swale storage and release.
35-43, 61-66, 86, 92	NASHYD	Add Hydrograph	Used to add two hydrographs in the routing

Catchment Areas and Model Parameters

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

OTTHYMO NASHYD PARAMETERS												
NHYD #	NAME	OUTLET NHYD#	DT [min]	AREA [ha]	DWF [m³/s]	CN	IA [mm]	N	TP [hr]	STORM INDEX	RAIN [mm/hr]	Impervious Ratio [%]
1	C1	68	5	0.496	0	62.5	12.2	3	0.17	1	0	6%
2	C2	64	5	0.503	0	62.4	12.2	3	0.26	1	0	6%
3	C3	65	5	0.510	0	62.4	12.2	3	0.24	1	0	6%
4	C4	66	5	1.676	0	62.4	12.3	3	0.41	1	0	2%
5	C5	63	5	1.408	0	63.5	11.7	3	0.34	1	0	2%
6	C6	62	5	0.501	0	62.5	12.2	3	0.29	1	0	6%
7	C7	61	5	0.501	0	62.4	12.2	3	0.27	1	0	6%
8	C8	71	5	0.493	0	62.5	12.2	3	0.17	1	0	6%
9	C9	35	5	0.359	0	68.5	9.3	3	0.27	1	0	20%
10	C10	36	5	0.376	0	68.4	9.4	3	0.27	1	0	20%
11	C11	37	5	0.377	0	68.4	9.4	3	0.27	1	0	20%
12	C12	38	5	0.296	0	75.0	8.5	3	0.22	1	0	28%
13	C13	42	5	0.340	0	76.5	7.8	3	0.24	1	0	23%
14	C14	41	5	0.363	0	68.4	9.4	3	0.27	1	0	20%
15	C15	40	5	0.376	0	68.4	9.4	3	0.27	1	0	20%
16	C16	39	5	0.387	0	68.3	9.4	3	0.27	1	0	20%
17	C-A	93	5	0.173	0	73.9	9.0	3	0.17	1	0	35%
18	C-B	93	5	0.172	0	73.9	9.0	3	0.17	1	0	35%
19	C-OFF1	92	5	1.680	0	59.5	13.8	3	0.41	1	0	2%
90	C-PRE1	92	5	2.9030	0	60.0	13.5	3	0.58	1	0	0%
91	C-PRE2	94	5	3.1840	0	60.1	13.5	3	0.71	1	0	0%
98	C-PRE3	93	5	2.8740	0	60.0	13.5	3	0.67	1	0	0%

NASHYD CATCHMENT AREAS

	NHYD #	NAME	TOTAL AREA m^2	Soil Group B: OPEN SPACE (GOOD) 61	Soil Group B: UNMAINTAINED HEAR YARD / WOOD (FAIR) 60	Soil Group B: WOODS (GOOD) 77	Soil Group D: OPEN SPACE (GOOD) 80	Soil Group D: UNMAINTAINED HEAR YARD / WOOD (FAIR) 79	Soil Group D: WOODS (GOOD) 77	IMPERVIOUS (ROOFS ROADS) 98	Weighted Average CN	POTENTIAL STORAGE mm	TC min
POST	1	**C1**	4955	800	3855	0	0	0	0	300	62.5	152.65	14.57
POST	2	**C2**	5032	800	3932	0	0	0	0	300	62.4	152.89	23.78
POST	3	**C3**	5095	800	3995	0	0	0	0	300	62.4	153.09	21.33
POST	4	**C4**	16758	6027	6608	2063	353	969	437	300	62.4	153.13	36.84
POST	5	**C5**	14079	5632	4436	1636	749	1104	222	300	63.5	146.31	31.01
POST	6	**C6**	5011	1200	3511	0	0	0	0	300	62.5	152.31	25.82
POST	7	**C7**	5007	800	3907	0	0	0	0	300	62.4	152.81	24.48
POST	8	**C8**	4934	800	3834	0	0	0	0	300	62.5	152.58	15.30
POST	9	**C9**	3590	2860	0	0	0	0	0	730	68.5	116.67	23.91
POST	10	**C10**	3763	3013	0	0	0	0	0	750	68.4	117.48	23.91
POST	11	**C11**	3767	3017	0	0	0	0	0	750	68.4	117.53	23.91
POST	12	**C12**	2955	1571	0	0	554	0	0	830	75.0	84.87	19.97
POST	13	**C13**	3400	1371	0	0	1239	0	0	790	76.5	77.94	21.30
POST	14	**C14**	3628	2898	0	0	0	0	0	730	68.4	117.10	23.91
POST	15	**C15**	3756	3006	0	0	0	0	0	750	68.4	117.41	23.91
POST	16	**C16**	3872	3112	0	0	0	0	0	760	68.3	118.09	23.91
PRE/POST	17	**C-A**	1726	1126	0	0	0	0	0	600	73.9	89.88	0.21
PRE/POST	18	**C B**	1723	1123	0	0	0	0	0	600	73.9	89.78	0.21
PRE/POST	19	**C-OFF1**	16811	0	8045	3757	0	0	0	356	59.5	173.10	36.82
PRE	90	**C-PRE1**	29030	9677	9677.0	7916.8	0	0	1759.2	0.0	60.0	169.33	52.54
PRE	91	**C-PRE2**	31840	10613	10613.0	8539.4	0	0	2074.6	0.0	60.1	168.63	63.47
PRE	98	**C PRE3**	28740	9580	9580.0	7787.0	0	0	1793.0	0.0	60.0	169.06	60.60

APPENDIX B: TIME OF CONCENTRATION AND TIME TO PEAK CALCULATION

Calculation Table

USDA Chapter 15 – Figure 15-4 and Table 15-3

Sheet Flow						Shallow Concentrated Flow					
NAME	Mannings n	length Sheet Flow (m)	2 yr 24 Hr Rainfall (mm)	Slope (m/m)	Time of Sheet Flow (hrs)	Flow Length to Major Channel	Average Slope (m/m)	Velocity (m/s)	Time of Shallow Concentrated Flow	TC min	TP [hr]
C1	0.4	16	48	0.09	0.15	58	0.024	0.18	0.09	15	0.17
C2	0.4	27	48	0.057	0.28	58	0.014	0.14	0.12	24	0.26
C3	0.4	24	48	0.067	0.24	58	0.014	0.14	0.12	21	0.24
C4	0.4	30	48	0.027	0.41	54	0.004	0.07	0.21	37	0.41
C5	0.4	30	48	0.041	0.35	45	0.004	0.07	0.17	31	0.34
C6	0.4	25	48	0.038	0.31	58	0.013	0.13	0.12	26	0.29
C7	0.4	30	48	0.066	0.29	58	0.013	0.13	0.12	24	0.27
C8	0.4	18	48	0.1	0.16	58	0.022	0.17	0.09	15	0.17
C9	0.4	30	48	0.03	0.39	10	0.03	0.37	0.01	24	0.27
C10	0.4	30	48	0.03	0.39	10	0.03	0.37	0.01	24	0.27
C11	0.4	30	48	0.03	0.39	10	0.03	0.37	0.01	24	0.27
C12	0.4	30	48	0.047	0.33	10	0.047	0.46	0.01	20	0.22
C13	0.4	30	48	0.04	0.35	10	0.04	0.42	0.01	21	0.24
C14	0.4	30	48	0.03	0.39	10	0.03	0.37	0.01	24	0.27
C15	0.4	30	48	0.03	0.39	10	0.03	0.37	0.01	24	0.27
C16	0.4	30	48	0.03	0.39	10	0.03	0.37	0.01	24	0.27
C-A	0.011	3	48	0.03	0.00					0	0.17
C-B	0.011	3	48	0.03	0.00					0	0.17
C-OFF1	0.35	30	48	0.01	0.55	30	0.013	0.12	0.07	37	0.41
C-PRE1	0.24	30	48	0.01	0.40	147	0.009	0.09	0.47	53	0.58
C-PRE2	0.24	30	48	0.01	0.40	210	0.006	0.09	0.65	63	0.71
C-PRE3	0.24	30	48	0.01	0.40	178	0.008	0.08	0.61	61	0.67

Figure 15–4 Velocity versus slope for shallow concentrated flow

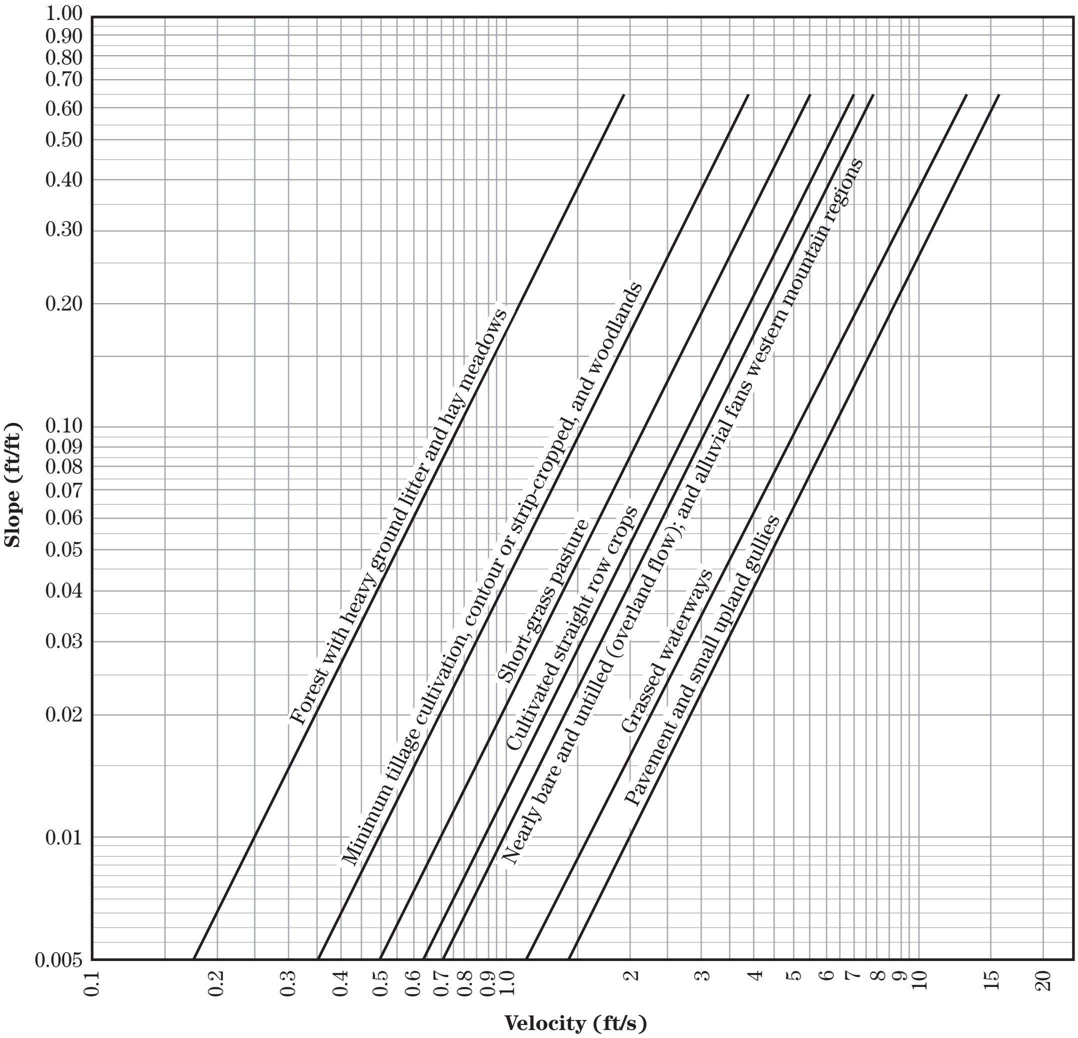


Table 15–3 Equations and assumptions developed from figure 15–4

Flow type	Depth (ft)	Manning's *n*	Velocity equation (ft/s)
Pavement and small upland gullies	0.2	0.025	$V = 20.328(s)^{0.5}$
Grassed waterways	0.4	0.050	$V=16.135(s)^{0.5}$
Nearly bare and untilled (overland flow); and alluvial fans in western mountain regions	0.2	0.051	$V=9.965(s)^{0.5}$
Cultivated straight row crops	0.2	0.058	$V=8.762(s)^{0.5}$
Short-grass pasture	0.2	0.073	$V=6.962(s)^{0.5}$
Minimum tillage cultivation, contour or strip-cropped, and woodlands	0.2	0.101	$V=5.032(s)^{0.5}$
Forest with heavy ground litter and hay meadows	0.2	0.202	$V=2.516(s)^{0.5}$

Table 3-5 Estimates of Manning's roughness coefficient for overland flow

Source	Ground Cover	n	Range
Crawford and Linsley (1966)[a]	Smooth asphalt	0.01	
	Asphalt of concrete paving	0.014	
	Packed clay	0.03	
	Light turf	0.20	
	Dense turf	0.35	
	Dense shrubbery and forest litter	0.4	
Engman (1986)[b]	Concrete or asphalt	0.011	0.010-0.013
	Bare sand	0.010	0.01-0.016
	Graveled surface	0.02	0.012-0.03
	Bare clay-loam (eroded)	0.02	0.012-0.033
	Range (natural)	0.13	0.01-0.32
	Bluegrass sod	0.45	0.39-0.63
	Short grass prairie	0.15	0.10-0.20
	Bermuda grass	0.41	0.30-0.48
Yen (2001)[c]	Smooth asphalt pavement	0.012	0.010-0.015
	Smooth impervious surface	0.013	0.011-0.015
	Tar and sand pavement	0.014	0.012-0.016
	Concrete pavement	0.017	0.014-0.020
	Rough impervious surface	0.019	0.015-0.023
	Smooth bare packed soil	0.021	0.017-0.025
	Moderate bare packed soil	0.030	0.025-0.035
	Rough bare packed soil	0.038	0.032-0.045
	Gravel soil	0.032	0.025-0.045
	Mowed poor grass	0.038	0.030-0.045
	Average grass, closely clipped sod	0.050	0.040-0.060
	Pasture	0.055	0.040-0.070
	Timberland	0.090	0.060-0.120
	Dense grass	0.090	0.060-0.120
	Shrubs and bushes	0.120	0.080-0.180
	Business land use	0.022	0.014-0.035
	Semi-business land use	0.035	0.022-0.050
	Industrial land use	0.035	0.020-0.050
	Dense residential land use	0.040	0.025-0.060
	Suburban residential land use	0.055	0.030-0.080
	Parks and lawns	0.075	0.040-0.120

[a]Obtained by calibration of Stanford Watershed Model.
[b]Computed by Engman (1986) by kinematic wave and storage analysis of measured rainfall-runoff data.
[c]Computed on basis of kinematic wave analysis.

APPENDIX C: HARWOOD CREEK FLOOD LEVEL AND FLOW RATES

Reach	River Sta	Return Period (Yrs)	Q Total (m3/s)	W.S. Elev (m)	E.G. Elev (m)	Vel Left (m/s)	Vel Chnl (m/s)	Vel Right (m/s)
Main	1214	2	2.7	74.89	74.9	0.2	0.83	0.17
Main	1214	5	5.1	75.08	75.09	0.21	0.93	0.14
Main	1214	10	7	75.19	75.2	0.22	0.94	0.13
Main	1214	25	9.7	75.29	75.3	0.24	1.02	0.13
Main	1214	50	11.8	75.39	75.4	0.22	1.02	0.13
Main	1214	100	14.1	75.48	75.49	0.22	0.96	0.14
Main	1130	2	2.7	74.75	74.77	0.16	0.95	0.21
Main	1130	5	5.1	74.93	74.96	0.23	1.24	0.22
Main	1130	10	7	75.04	75.07	0.27	1.39	0.22
Main	1130	25	9.7	75.12	75.17	0.33	1.66	0.24
Main	1130	50	11.8	75.23	75.28	0.33	1.73	0.22
Main	1130	100	14.1	75.36	75.4	0.31	1.62	0.22
Main	1075	2	2.7	74.44	74.6	0.34	1.98	0.31
Main	1075	5	5.1	74.64	74.78	0.37	2.07	0.35
Main	1075	10	7	74.75	74.89	0.36	2.18	0.34
Main	1075	25	9.7	75	75.04	0.28	1.47	0.17
Main	1075	50	11.8	75.17	75.19	0.2	1.14	0.16
Main	1075	100	14.1	75.33	75.34	0.17	0.93	0.14
Main	1023	2	2.8	74.23	74.26	0.22	0.84	0.13
Main	1023	5	5.3	74.48	74.53	0.29	1.04	0.22
Main	1023	10	7.2	74.63	74.7	0.33	1.17	0.27
Main	1023	25	10.2	74.85	74.93	0.39	1.32	0.33
Main	1023	50	12.5	75	75.09	0.42	1.43	0.37
Main	1023	100	14.9	75.15	75.26	0.45	1.51	0.4
Main	1013		Culvert					
Main	1002	2	2.8	74.18	74.22	0.2	0.91	0.18
Main	1002	5	5.3	74.39	74.45	0.29	1.16	0.28
Main	1002	10	7.2	74.5	74.59	0.35	1.34	0.34
Main	1002	25	10.2	74.66	74.78	0.43	1.58	0.41
Main	1002	50	12.5	74.75	74.9	0.48	1.76	0.47
Main	1002	100	14.9	74.83	75.01	0.54	1.94	0.52
Main	900	2	2.8	74.04	74.06	0.15	0.72	0.1
Main	900	5	5.3	74.24	74.28	0.13	0.95	0.17
Main	900	10	7.2	74.36	74.4	0.17	1.06	0.2
Main	900	25	10.2	74.5	74.56	0.21	1.24	0.18
Main	900	50	12.5	74.6	74.66	0.24	1.32	0.21
Main	900	100	14.9	74.69	74.75	0.26	1.39	0.23

APPENDIX D: JFSA – 2050 DUNROBIN ROAD FLOODPLAIN ANALYSIS

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October 25, 2022 Project Number: 2363-22

Kollaard Associates Inc.
210 Prescot Street, Unit 1,
P.O. Box 189
Kemptville, ON
K0G 1J0

Attention: **William Kollaard, P.Eng.**

Subject: **2050 Dunrobin Road, City of Ottawa – Floodplain Analysis**

Overview

J.F. Sabourin and Associates Inc. (JFSA) has been retained by Kollaard Associates Inc. (Kollaard) to investigate the current floodplain extents on a site located at 2050 Dunrobin Road (hereon referred to as "the subject property"), adjacent to Harwood Creek. Based on the current floodplain mapping of Harwood Creek provided by the Mississippi Valley Conservation Authority (MVCA), as well as the information submitted by MVCA on their review of the Application for Zoning By-law Amendment on June 17, 2022, the subject property is partially located within the floodplain and regulation limit of Harwood Creek. Under proposed conditions, the development area of 8 rural residential lots will de raised to ensure there is no floodplain encroachment on any part of the residential envelope. Additionally, the floodplain is considered a backwater area that does not contribute to the effective conveyance of flows on Harwood Creek. **Figure 1** shows the extent of the floodplain within the subject property for the existing conditions. The following memo assesses the potential flooding on these lands and quantifies the impacts of raising the grades in this location to ensure no encroachment on the residential development envelopes.

Hydraulic Analysis

To support this analysis, JFSA has purchased a copy of the hydraulic (HEC-RAS) model of Harwood Creek developed by MVCA as part of the floodplain mapping works recently undertaken on this watercourse. In addition to this, LiDAR has been obtained from the City of Ottawa which was flown in 2020. **Figure 2** provides an overview of both the HEC-RAS model and the LiDAR obtained for this project.

From the topographic mapping underlaid in **Figure 2**, it is seen that the floodplain bulges out on this site as the product of a lateral spill from Harwood Creek located between model cross-sections (XS) **1130** and **1214**. As the flooding potential on these lands would occur due to lateral spill/backwater conditions, this area provides no benefit to flow conveyance and in turn, cannot impact the conveyance of flows along Harwood Creek. This concept is also proven by comparing the results of the pre- and post-development floodplain analysis, which demonstrates that there are no changes to the inundation boundary along Harwood Creek despite the reduction of the inundated area within the subject lands due to the proposed site alteration. **Figure 3** shows the floodplain overview under proposed conditions and **Figure 4** shows a comparison/overlay between the existing and proposed floodplain conditions, identifying the floodplain removal within the subject lands and showing that there are no changes to the existing floodplain limits along Harwood Creek. Note that from **Figure 3,** none of the proposed units are at risk of flooding.

JFSA has updated the HEC-RAS model with the 2020 LiDAR obtained from the City of Ottawa and the inclusion of the proposed development as per the detailed grading design provided by Kollaard, see **Figure 5** for the proposed details grading plan for this site. **Attachment A** provides a full summary of existing and proposed results, which shows that the filling of these lands has no impact and that the peak water level results are identical. Additionally, by comparing the 100-year water surface elevation of **75.48 m** on Harwood Creek at **XS 1214** with the proposed underside of footing elevation (USF) of **75.80 m** at **Unit 8**, it can be concluded that the USF is above the 100-year water level on Harwood Creek, with a freeboard of **0.32 m**.

It should be noted that 1D HEC-RAS models, although capable of simulating lateral spills, are not well suited to capture the complex hydraulic phenomenon under such situations. As a secondary check, the floodplain storage loss caused by filling these lands has been assessed using simple GIS tools and data available.

Floodplain Storage Volume

Based on MVCA's HEC-RAS modelling, the 100-year water surface elevation on Harwood Creek at **XS 1214** is **75.48 m**. Overlaying this water surface elevation onto the City of Ottawa LiDAR within the subject property and summing up the total depth of flooding in each cell (1.0m x 1.0m cell) determined that the total existing floodplain storage volume at this location is approximately **3,008 m^3**. By doing the same process for the proposed condition where a portion of the development is filled, the floodplain storage volume within the subject property is approximately **1,877 m^3**. As such, filling this land would reduce the total floodplain storage volume to Harwood Creek by approximately **1,131 m^3**. To provide some context, based on MVCA's HEC-RAS model, the total floodplain storage volume within the Harwood Creek for the 100-year event is **312,000 m^3**, therefore the floodplain storage volume loss due to the filling within the subject property at 2050 Dunrobin Road equates to a **0.36%** reduction in total floodplain storage within Harwood Creek. As such, it is determined that filling these lands will have no impact on the hydraulic operations of this watercourse.

Conclusion

Based on the above, JFSA has assessed the potential impacts of filling the area within 2050 Dunrobin Road, which is currently mapped as a floodplain in MVCA's recent floodplain mapping study. Based on updated HEC-RAS modelling, which assumes these lands are filled, JFSA has demonstrated that there is no increase in peak water level. It was noted that 1D HEC-RAS models are not well suited to assessing/simulating the complexities of lateral spills, and as such the floodplain storage lost due to filling these lands was approximated using 2020 LiDAR obtained from the City of Ottawa and the MVCA's simulated 100-year water surface elevation over these lands. Based on this analysis, it was found that filling the floodplain bulge on these lands will result in an approximate reduction in storage volume by **1,131 m^3** or **0.36%** of the Harwood Creek 100-year floodplain. As such JFSA concludes that the proposed filling within the subject property will have no adverse impacts on the existing hydraulic operations of Harwood Creek.

Yours truly,
J.F Sabourin and Associates Inc.

Jonathon Burnet, B.Eng, P.Eng
Water Resource Engineer

LICENSED PROFESSIONAL ENGINEER
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PROVINCE OF ONTARIO

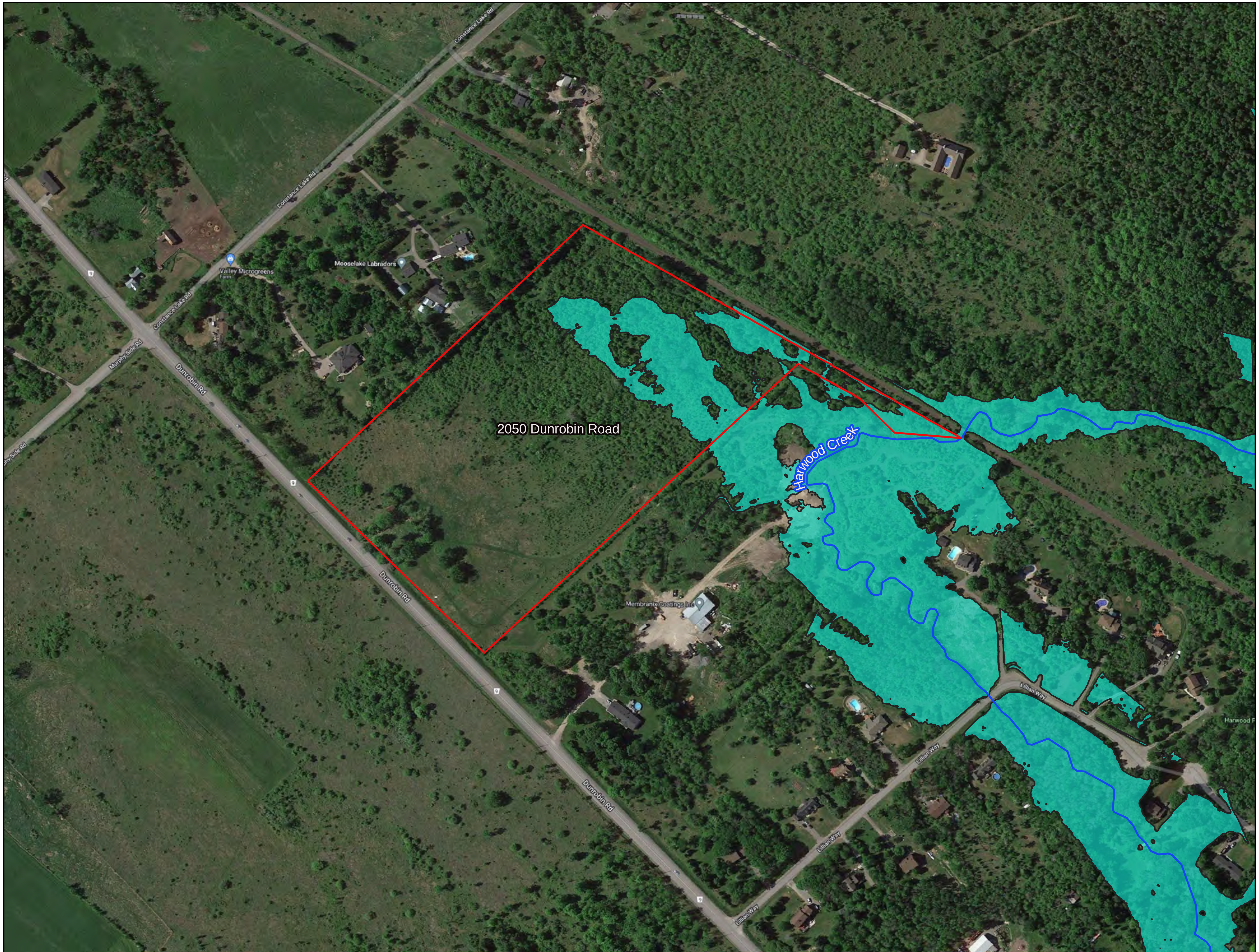
cc: J.F Sabourin, M.Eng, P.Eng
Director of Water Resources Projects

Figures

Figure 1: Existing Conditions 100-Year Floodplain Overview
Figure 2: HEC-RAS Model Overview
Figure 3: Proposed Conditions 100-Year Floodplain Overview
Figure 4: Existing & Proposed Conditions 100-Year Floodplain Comparison
Figure 5: Preliminary Grading Plan for Fill Placement (Kollaard, March 2022)

Attachments

Attachment A: Harwood Creek HEC-RAS Model Results



N

Legend

- Site Boundary
- Watercourse
- Existing Floodplain
  City of Ottawa Lidar (NRCan)

SCALE: 1:3500

0 100 200 m

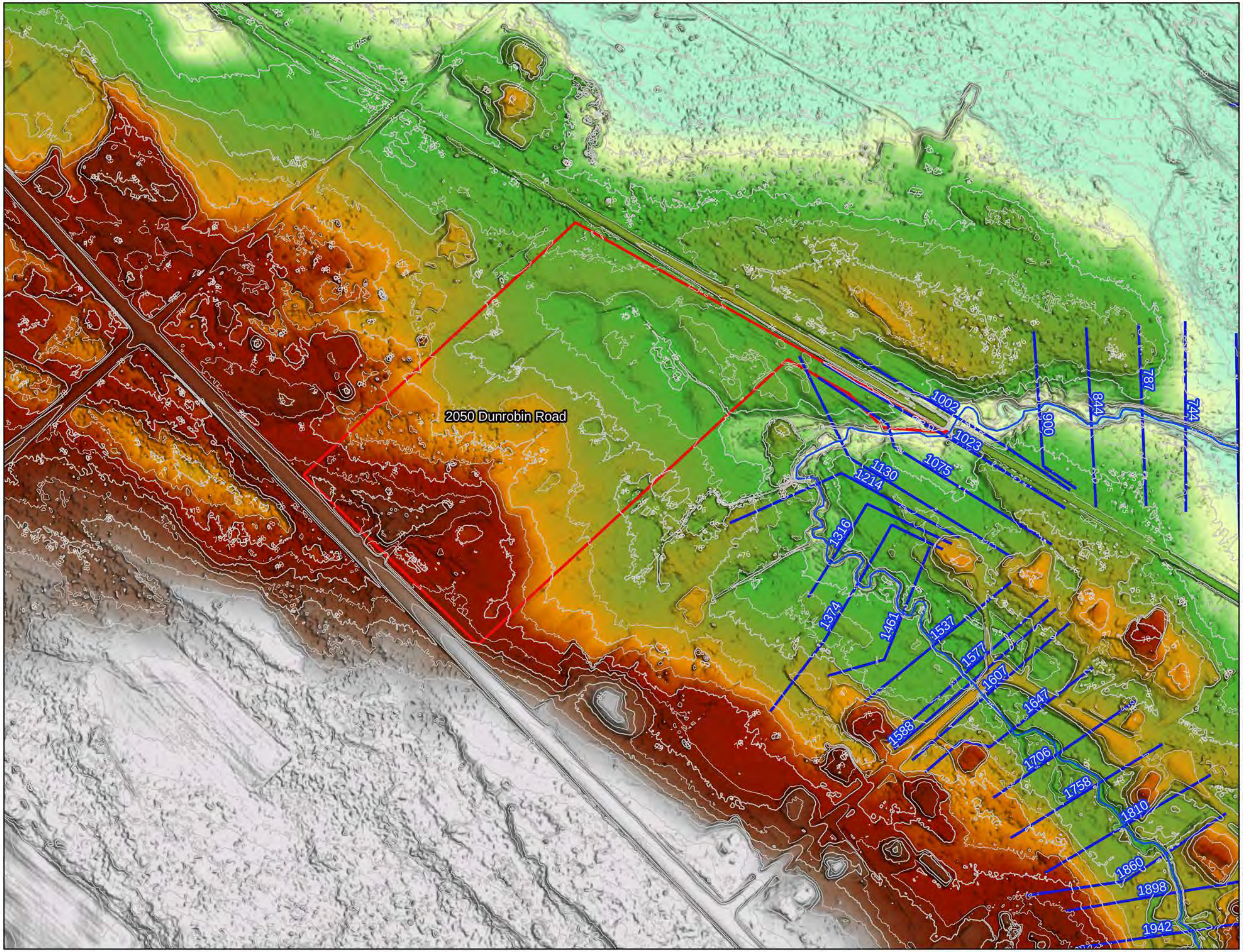
J.F. Sabourin and Associates Inc.
WATER RESOURCES AND ENVIRONMENTAL CONSULTANTS
52 Springbrook Drive
Ottawa, ON, K2S 1B9
(613) 836-3884
www.jfsa.com

Kollaard Associates
Engineers

2050 Dunrobin Road
Harwood Creek
Floodplain Analysis

Figure 1: Existing Conditions
100-Year Floodplain Overview

PROJECT	2363-22
DRAWN	PP
DATE	October 2022



Legend

N

- Minor Contours (0.5m)
- Major Contours (1.0m)
- HEC-RAS XS
- Site Boundary
- Watercourse

Lidar (m)

- 73
- 74
- 75
- 76
- 77
- 78
- 79
- 80
- 81
- 82

SCALE: 1:3500

0 100 200 m

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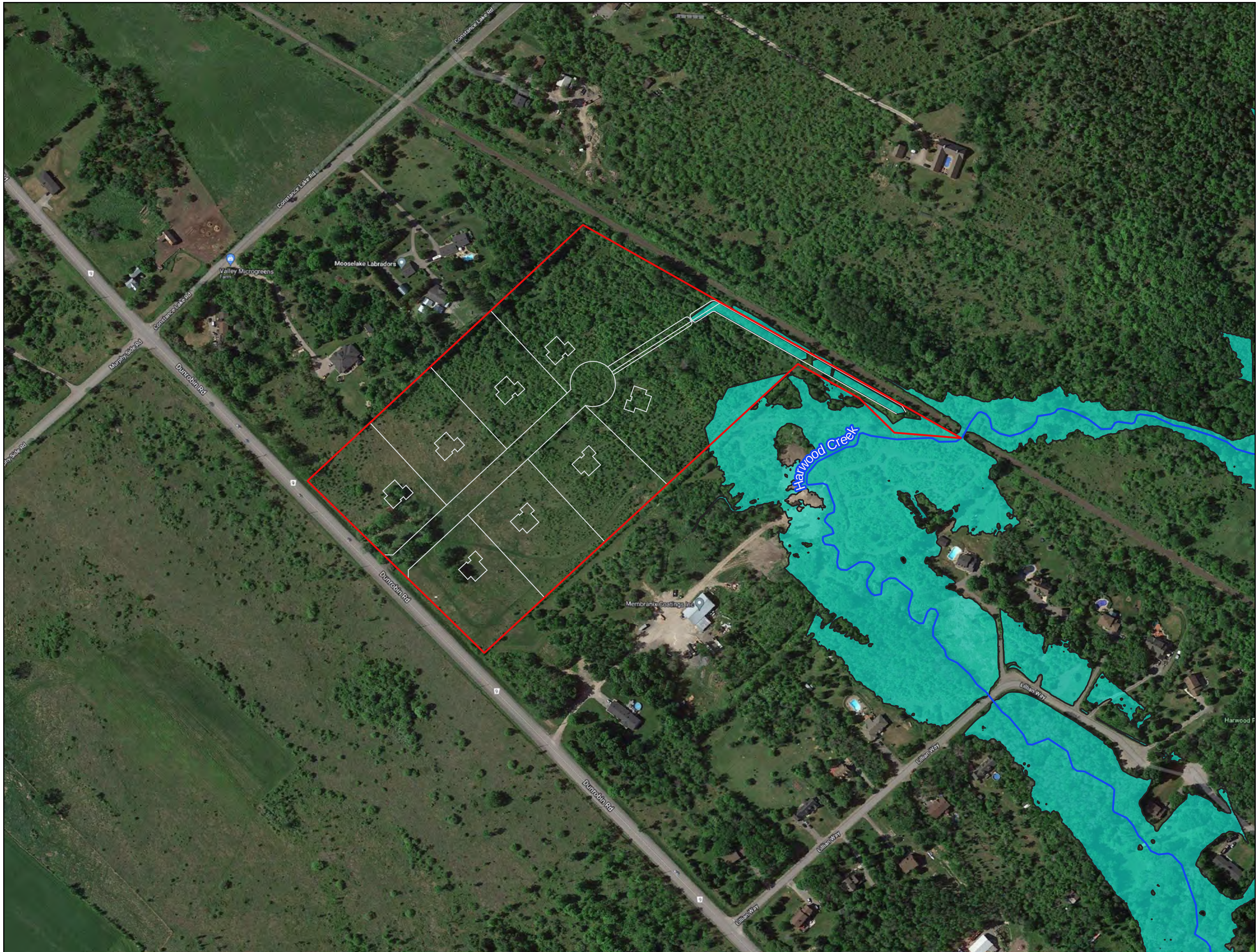
Figure 2: HEC-RAS Model Overview

PROJECT	2363-22
DRAWN	PP
DATE	October 2022

C:\OneDrive\J.F. Sabourin and Associates Inc\JFSA-OTTAWA-SERVER - Documents\PROJ\2363-22\Design\GIS\20221018 - Report Figures



Legend

- Site Boundary
- SitePlan
- Watercourse
- 100-Year Floodplain

SCALE: 1:3500

0 100 200 m

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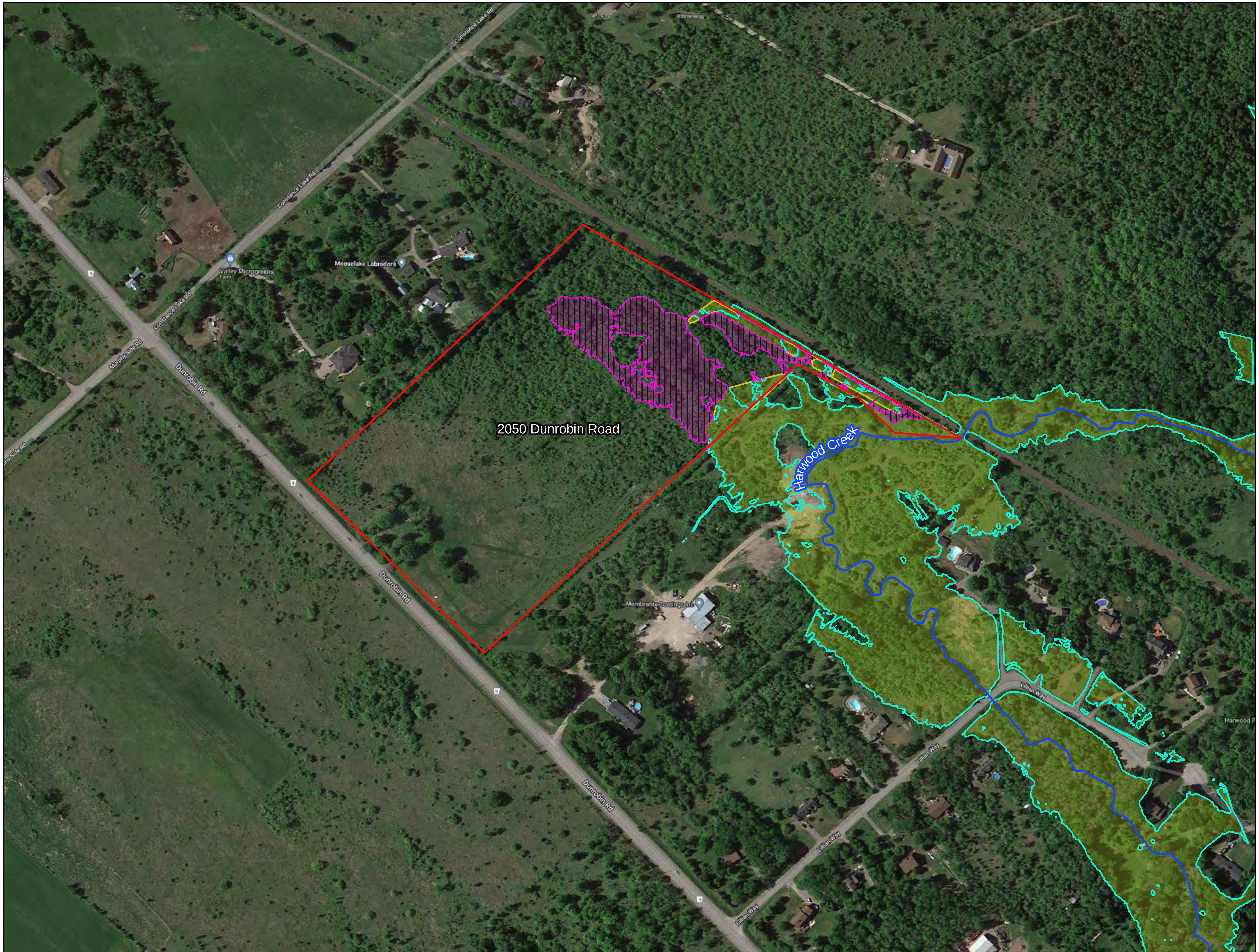
Floodplain Analysis

Figure 3: Proposed Conditions
100-Year Floodplain Overview

PROJECT	2363-22
DRAWN	PP
DATE	October 2022

C:\OneDrive\J.F. Sabourin and Associates Inc\JFSA-OTTAWA-SERVER - Documents\PROJ\2363-22\Design\GIS\20221018 - Report Figures



N

Legend

- Site Boundary
- Watercourse
- Floodplain Removal
- Existing Condition Floodplain
- Proposed Condition Floodplain

SCALE: 1:3500

0 100 200 m

J.F. Sabourin and Associates Inc.
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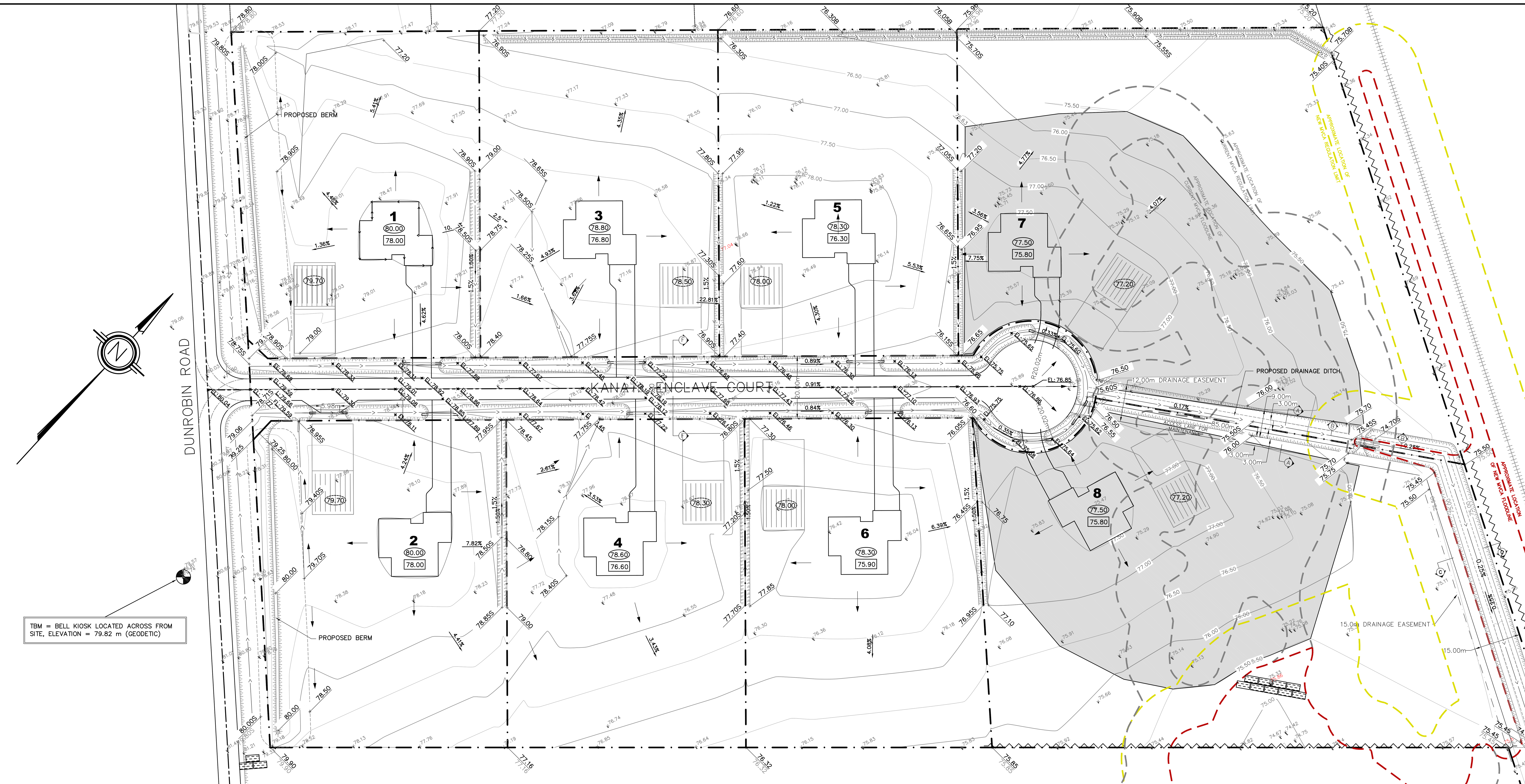
Harwood Creek
Floodplain Analysis

Figure 4: Existing & Proposed Conditions
100-Year Floodplain Comparison

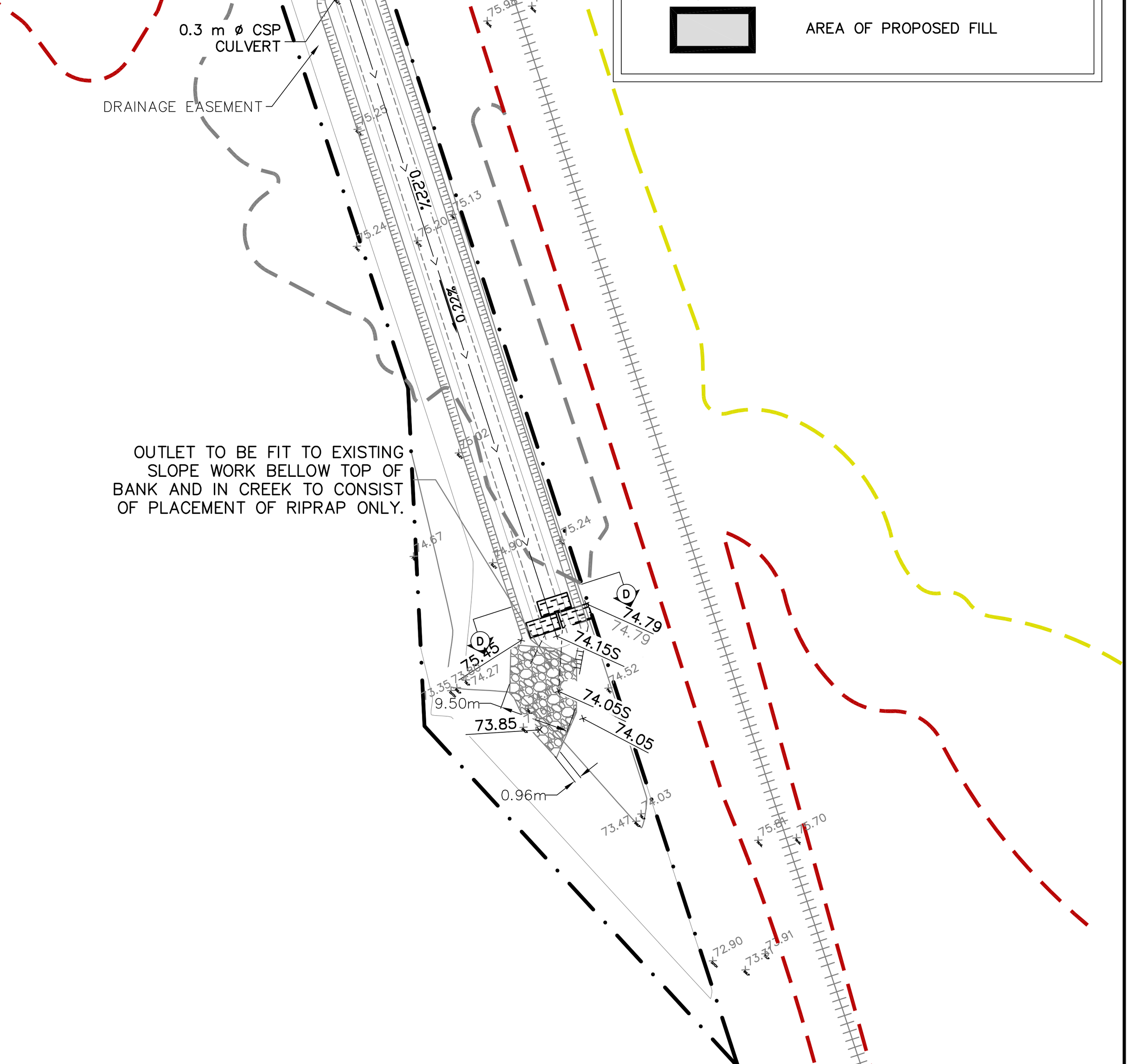
PROJECT	2363-22
DRAWN	PP
DATE	October 2022

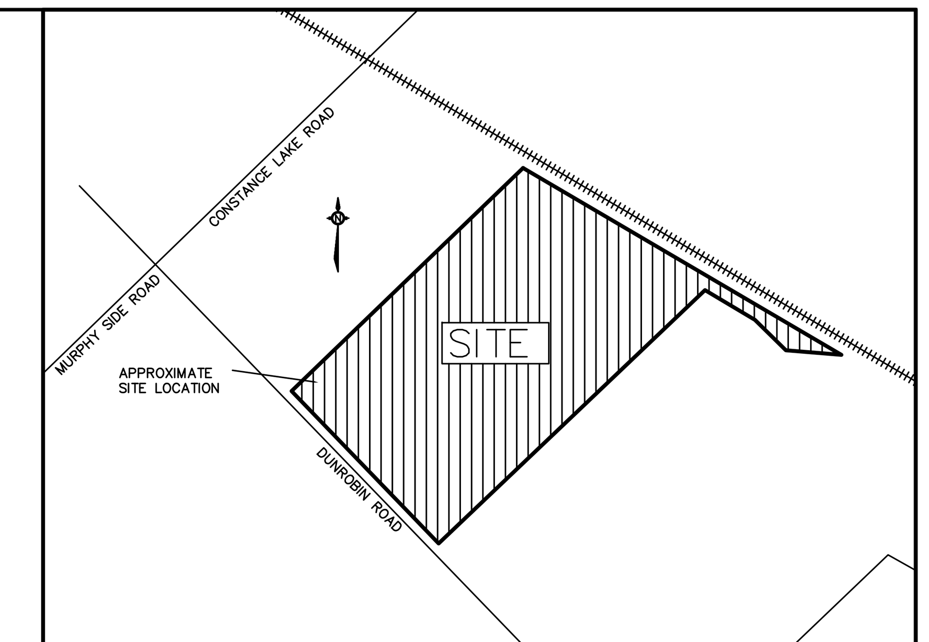
C:\OneDrive\J.F. Sabourin and Associates Inc\JFSA-OTTAWA-SERVER - Documents\PROJ\2363-22\Design\GIS\20221018 - Report Figures



PRELIMINARY GRADING PLAN FOR FILL PLACEMENT

SCALE = 1:750





KEY PLAN

NOT TO SCALE

GENERAL LEGEND

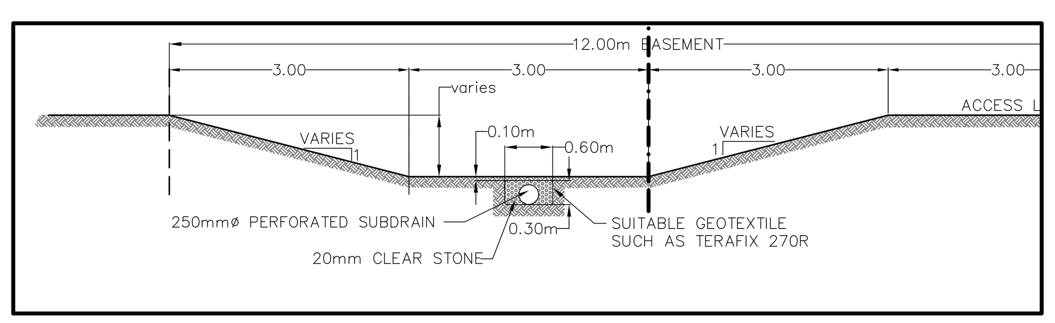
- EXISTING SPOT ELEVATION
- PROPOSED ELEVATION
- EXISTING ELEVATION
- PROPOSED DITCH ELEVATION
- GRADE AREA TO PROMOTE SURFACE RUNOFF
- PROPOSED TERRACING ELEVATION AROUND DWELLING
- PROPOSED UNDERSIDE OF FOOTING ELEVATION
- PROPOSED TOP OF SEPTIC LEACHING BED
- POTENTIAL WELL LOCATION
- NO-DEVELOPMENT AREA
- FENCELINE
- PROPERTY LINES
- PROPERTY SETBACKS
- EDGE OF ROAD
- POTENTIAL DWELLING LOCATION
- POTENTIAL SEPTIC BED LOCATION
- DIRECTION OF FLOW
- TOP OF TERRACING

LEGEND – EROSION & SEDIMENT

- PROPERTY LINES
- TOP OF TERRACING
- EDGE OF ROAD
- LIGHT DUTY SILT FENCE AS PER OPSD 219.110
- STRAWBALE FLOW BARRIER AS PER OPSD 219.180

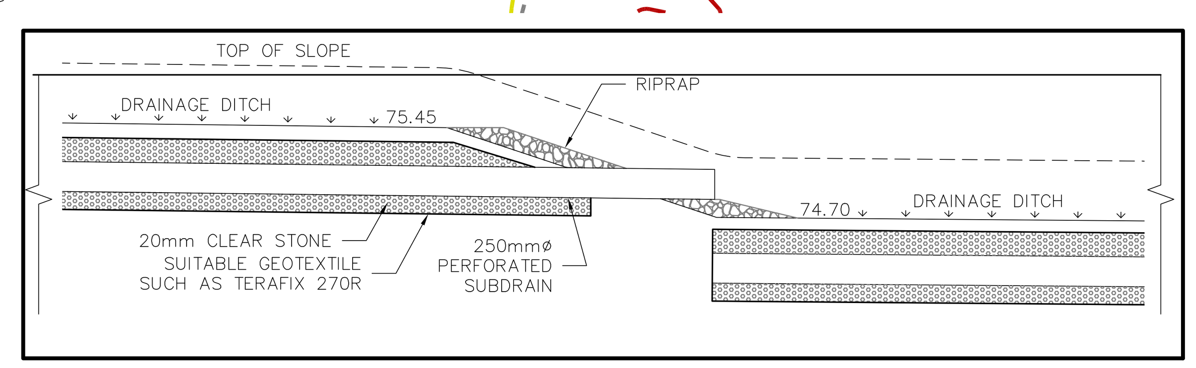
LEGEND – FILL PLACEMENT

- MVCA FLOODLINE
- MVCA REGULATION LIMIT
- PROPOSED GRADE ELEVATION
- AREA OF PROPOSED FILL



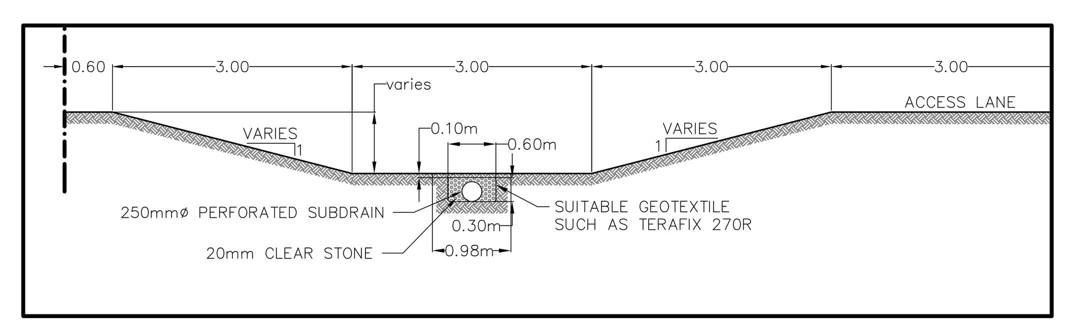
"A–A" PROPOSED DRAINAGE DITCH SECTION

NOT TO SCALE



"B–B" PROPOSED DRAINAGE DITCH PROFILE

NOT TO SCALE

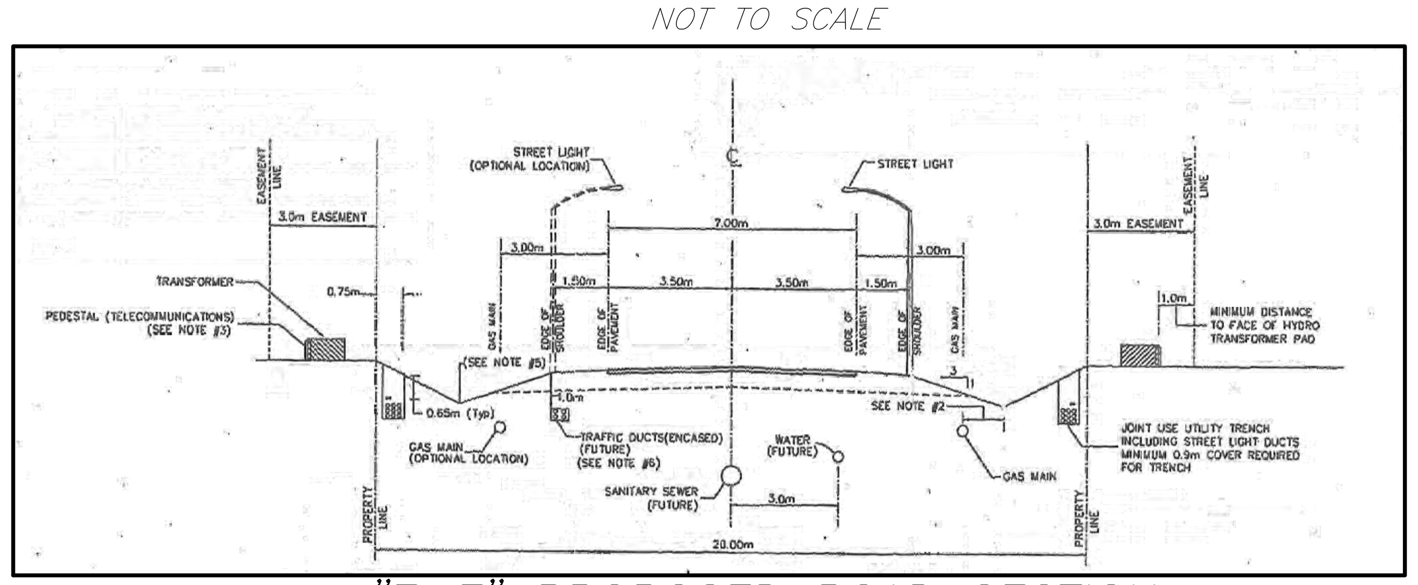


"C–C" PROPOSED DRAINAGE DITCH SECTION

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.



"F–F" PROPOSED ROAD 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
1	ISSUED FOR MVCA PERMIT	MAY.06.2021	ML
0	ISSUED FOR CITY AND MVCA REVIEW	MAR.09.2021	ML

Kollaard Associates Engineers
BOX 189
210 PRESCOTT STREET
KEMPTVILLE, ONTARIO
K0G 1J0
FACSIMILE (613) 258-0475
(613) 860-0923

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	PRELIMARY GRADING PLAN FOR FILL PLACEMENT
PROJECT No.	200977
DRAWING No.	200977–GRF
DATE	MARCH 09, 2021
SHEET SET	FIGURE 5

APPENDIX E: PRE-DEVELOPMENT OTTHYMO MODEL RESULTS

Pre-development Summary Output

Detailed Output from Last Link

Analysis results from December 10, 2024 have been reinserted in this appendix without alteration as the revisions made to the report and drawings did not result in changes to the stormwater management model.

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

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

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

  ************************************************
  ** SIMULATION : 1. SCS II 6hr 5yr Ottawa      **
  ************************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                30.0
    [ Ptot= 50.41 mm ]
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*
 ** CALIB NASHYD         0017  1  5.0    0.17    0.01  3.08  13.03 0.26   0.000
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*
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    remark: SCS II 6hr 5yr Ottawa
*
 ** CALIB NASHYD         0018  1  5.0    0.17    0.01  3.08  13.03 0.26   0.000
    [CN=73.9         ]
    [ N = 3.0:Tp 0.17]
*
    READ STORM                30.0
    [ Ptot= 50.41 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\5220502e-449b-4593-a1b2-
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*
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*
    ADD [  0093+  0098]  0093  1  5.0    3.22    0.03  3.67   7.29  n/a   0.000
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    [ Ptot= 50.41 mm ]
```

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    remark: SCS II 6hr 5yr Ottawa
*
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    ADD [  0019+  0090]  0092  3  5.0    4.58    0.04  3.67   6.53  n/a   0.000
*
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*
    ADD [  0093+  0095]  0099  3  5.0    7.80    0.07  3.75   6.84  n/a   0.000
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*
    ADD [  0094+  0099]  0096  3  5.0   10.99    0.09  3.83   6.78  n/a   0.000
*
===============================================================================

  ************************************************
  ** SIMULATION : 10. 25mm4hrChicago            **
  ************************************************

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

      START @  0.00 hrs
      --------------------
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    [ Ptot= 25.00 mm ]
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    [ N = 3.0:Tp 0.17]
*
    READ STORM                 10.0
```

```
    [ Ptot= 25.00 mm ]
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    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD         0018  1  5.0    0.17    0.00  1.75   2.41 0.10   0.000
    [CN=73.9         ]
    [ N = 3.0:Tp 0.17]
*
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    [ Ptot= 25.00 mm ]
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*
 ** CALIB NASHYD         0098  1  5.0    2.87    0.00  3.67   0.73 0.03   0.000
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*
    ADD [  0017+  0018]  0093  3  5.0    0.34    0.00  1.75   2.41  n/a   0.000
*
    ADD [  0093+  0098]  0093  1  5.0    3.22    0.00  3.42   0.91  n/a   0.000
*
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*
 ** CALIB NASHYD         0019  1  5.0    1.68    0.00  3.00   0.68 0.03   0.000
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    [ N = 3.0:Tp 0.41]
*
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    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD         0090  1  5.0    2.90    0.00  3.42   0.73 0.03   0.000
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*
    ADD [  0019+  0090]  0092  3  5.0    4.58    0.00  3.25   0.71  n/a   0.000
*
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    ADD [  0093+  0095]  0099  3  5.0    7.80    0.01  3.50   0.79  n/a   0.000
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    READ STORM                 10.0
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    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD         0091  1  5.0    3.18    0.00  3.75   0.73 0.03   0.000
    [CN=60.1         ]
    [ N = 3.0:Tp 0.71]
*
    CHANNEL[ 2:  0091]   0094  1  5.0    3.18    0.00  4.00   0.73  n/a   0.000
*
```

```
    ADD [  0094+  0099]  0096  3  5.0   10.99    0.01  3.67   0.78  n/a   0.000
*
===============================================================================

  ************************************************
  ** SIMULATION : 100 year 12 hr Chi 120 percen **
  ************************************************

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

      START @  0.00 hrs
      ---------------------
    CHIC STORM                    5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD         0017  1  5.0    0.17    0.03  4.17  55.39 0.49   0.000
    [CN=73.9          ]
    [ N = 3.0:Tp 0.17]
*
    CHIC STORM                    5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD         0018  1  5.0    0.17    0.03  4.17  55.39 0.49   0.000
    [CN=73.9          ]
    [ N = 3.0:Tp 0.17]
*
    CHIC STORM                    5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD         0098  1  5.0    2.87    0.12  4.83  36.63 0.33   0.000
    [CN=60.0          ]
    [ N = 3.0:Tp 0.67]
*
    ADD [  0017+  0018]  0093  3  5.0    0.34    0.06  4.17  55.39  n/a   0.000
*
    ADD [  0093+  0098]  0093  1  5.0    3.22    0.13  4.75  38.64  n/a   0.000
*
    CHIC STORM                    5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD         0019  1  5.0    1.68    0.10  4.50  35.97 0.32   0.000
    [CN=59.5          ]
    [ N = 3.0:Tp 0.41]
*
    CHIC STORM                    5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD         0090  1  5.0    2.90    0.13  4.75  36.63 0.33   0.000
    [CN=60.0          ]
    [ N = 3.0:Tp 0.58]
*
    ADD [  0019+  0090]  0092  3  5.0    4.58    0.22  4.58  36.39  n/a   0.000
*
    CHANNEL[ 2:  0092]   0095  1  5.0    4.58    0.22  4.67  36.39  n/a   0.000
*
    ADD [  0093+  0095]  0099  3  5.0    7.80    0.35  4.67  37.32  n/a   0.000
*
    CHIC STORM                    5.0
    [ Ptot=112.68 mm ]
```

```
*
 ** CALIB NASHYD         0091  1  5.0    3.18    0.13  4.92  36.73 0.33   0.000
    [CN=60.1         ]
    [ N = 3.0:Tp 0.71]
*
    CHANNEL[ 2:  0091]   0094  1  5.0    3.18    0.13  5.00  36.73  n/a   0.000
*
    ADD [  0094+  0099]  0096  3  5.0   10.99    0.47  4.75  37.15  n/a   0.000
*
 FINISH

===============================================================================
  ***********************************************
  ** SIMULATION : 2. SCS II 6hr 100yr Ottawa    **
  ***********************************************

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

      START @  0.00 hrs
      --------------------
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    [ Ptot= 87.00 mm ]
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    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD         0017  1  5.0    0.17    0.02  3.00  36.15 0.42   0.000
    [CN=73.9         ]
    [ N = 3.0:Tp 0.17]
*
    READ STORM                30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\5220502e-449b-4593-a1b2-
ebbd0b2a9ad3\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD         0018  1  5.0    0.17    0.02  3.00  36.15 0.42   0.000
    [CN=73.9         ]
    [ N = 3.0:Tp 0.17]
*
    READ STORM                30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\5220502e-449b-4593-a1b2-
ebbd0b2a9ad3\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD         0098  1  5.0    2.87    0.08  3.75  22.25 0.26   0.000
    [CN=60.0         ]
    [ N = 3.0:Tp 0.67]
*
    ADD [  0017+  0018]  0093  3  5.0    0.34    0.03  3.00  36.15  n/a   0.000
*
    ADD [  0093+  0098]  0093  1  5.0    3.22    0.10  3.58  23.74  n/a   0.000
*
    READ STORM                30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\5220502e-449b-4593-a1b2-
ebbd0b2a9ad3\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
```

```
*
 ** CALIB NASHYD         0019  1  5.0    1.68    0.06  3.42  21.77 0.25   0.000
    [CN=59.5          ]
    [ N = 3.0:Tp 0.41]
*
    READ STORM                30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\5220502e-449b-4593-a1b2-
ebbd0b2a9ad3\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD         0090  1  5.0    2.90    0.09  3.67  22.25 0.26   0.000
    [CN=60.0          ]
    [ N = 3.0:Tp 0.58]
*
    ADD [  0019+  0090]  0092  3  5.0    4.58    0.15  3.58  22.07  n/a   0.000
*
    CHANNEL[ 2:  0092]   0095  1  5.0    4.58    0.15  3.67  22.07  n/a   0.000
*
    ADD [  0093+  0095]  0099  3  5.0    7.80    0.25  3.67  22.76  n/a   0.000
*
    READ STORM                30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\5220502e-449b-4593-a1b2-
ebbd0b2a9ad3\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD         0091  1  5.0    3.18    0.09  3.83  22.31 0.26   0.000
    [CN=60.1          ]
    [ N = 3.0:Tp 0.71]
*
    CHANNEL[ 2:  0091]   0094  1  5.0    3.18    0.09  3.92  22.31  n/a   0.000
*
    ADD [  0094+  0099]  0096  3  5.0   10.99    0.33  3.67  22.63  n/a   0.000
*
```

```
  ***********************************************
  ** SIMULATION : 3. SCS II 12hr 5yr Ottawa     **
  ***********************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\5220502e-449b-4593-a1b2-
ebbd0b2a9ad3\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD         0017  1  5.0    0.17    0.01  6.00  16.78 0.29   0.000
    [CN=73.9          ]
    [ N = 3.0:Tp 0.17]
*
    READ STORM                30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\5220502e-449b-4593-a1b2-
ebbd0b2a9ad3\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
```

```
*
 ** CALIB NASHYD         0018  1  5.0    0.17    0.01  6.00  16.78 0.29   0.000
    [CN=73.9         ]
    [ N = 3.0:Tp 0.17]
*
    READ STORM                30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\5220502e-449b-4593-a1b2-
ebbd0b2a9ad3\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD         0098  1  5.0    2.87    0.03  6.75   8.96 0.16   0.000
    [CN=60.0         ]
    [ N = 3.0:Tp 0.67]
*
    ADD [  0017+  0018]  0093  3  5.0    0.34    0.01  6.00  16.78  n/a   0.000
*
    ADD [  0093+  0098]  0093  1  5.0    3.22    0.03  6.58   9.80  n/a   0.000
*
    READ STORM                30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\5220502e-449b-4593-a1b2-
ebbd0b2a9ad3\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD         0019  1  5.0    1.68    0.02  6.42   8.71 0.15   0.000
    [CN=59.5         ]
    [ N = 3.0:Tp 0.41]
*
    READ STORM                30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\5220502e-449b-4593-a1b2-
ebbd0b2a9ad3\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD         0090  1  5.0    2.90    0.03  6.67   8.96 0.16   0.000
    [CN=60.0         ]
    [ N = 3.0:Tp 0.58]
*
    ADD [  0019+  0090]  0092  3  5.0    4.58    0.05  6.58   8.87  n/a   0.000
*
    CHANNEL[ 2:  0092]   0095  1  5.0    4.58    0.05  6.67   8.87  n/a   0.000
*
    ADD [  0093+  0095]  0099  3  5.0    7.80    0.08  6.67   9.25  n/a   0.000
*
    READ STORM                30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\5220502e-449b-4593-a1b2-
ebbd0b2a9ad3\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD         0091  1  5.0    3.18    0.03  6.83   8.99 0.16   0.000
    [CN=60.1         ]
    [ N = 3.0:Tp 0.71]
*
    CHANNEL[ 2:  0091]   0094  1  5.0    3.18    0.03  6.92   8.99  n/a   0.000
*
    ADD [  0094+  0099]  0096  3  5.0   10.99    0.11  6.67   9.18  n/a   0.000
*
```

```
  ************************************************
  ** SIMULATION : 4. SCS II 12hr 10yr Ottawa    **
  ************************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                 30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\5220502e-449b-4593-a1b2-
ebbd0b2a9ad3\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0017  1  5.0    0.17    0.01  6.00  22.82 0.34   0.000
    [CN=73.9          ]
    [ N = 3.0:Tp 0.17]
*
    READ STORM                 30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\5220502e-449b-4593-a1b2-
ebbd0b2a9ad3\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0018  1  5.0    0.17    0.01  6.00  22.82 0.34   0.000
    [CN=73.9          ]
    [ N = 3.0:Tp 0.17]
*
    READ STORM                 30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\5220502e-449b-4593-a1b2-
ebbd0b2a9ad3\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0098  1  5.0    2.87    0.04  6.75  12.93 0.19   0.000
    [CN=60.0          ]
    [ N = 3.0:Tp 0.67]
*
    ADD [  0017+  0018]  0093  3  5.0    0.34    0.02  6.00  22.82  n/a   0.000
*
    ADD [  0093+  0098]  0093  1  5.0    3.22    0.05  6.58  13.99  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\5220502e-449b-4593-a1b2-
ebbd0b2a9ad3\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0019  1  5.0    1.68    0.03  6.33  12.60 0.19   0.000
    [CN=59.5          ]
    [ N = 3.0:Tp 0.41]
*
    READ STORM                 30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\5220502e-449b-4593-a1b2-
ebbd0b2a9ad3\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0090  1  5.0    2.90    0.04  6.58  12.93 0.19   0.000
```

```
    [CN=60.0         ]
    [ N = 3.0:Tp 0.58]
*
    ADD [  0019+  0090]  0092  3  5.0    4.58    0.07  6.50  12.81  n/a   0.000
*
    CHANNEL[ 2:  0092]   0095  1  5.0    4.58    0.07  6.58  12.81  n/a   0.000
*
    ADD [  0093+  0095]  0099  3  5.0    7.80    0.12  6.58  13.29  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\5220502e-449b-4593-a1b2-
ebbd0b2a9ad3\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0091  1  5.0    3.18    0.04  6.75  12.97 0.19   0.000
    [CN=60.1         ]
    [ N = 3.0:Tp 0.71]
*
    CHANNEL[ 2:  0091]   0094  1  5.0    3.18    0.04  6.92  12.97  n/a   0.000
*
    ADD [  0094+  0099]  0096  3  5.0   10.99    0.16  6.67  13.20  n/a   0.000
*
```

```
  ************************************************
  ** SIMULATION : 5. SCS II 12hr 100yr correct  **
  ************************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                 30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\5220502e-449b-4593-a1b2-
ebbd0b2a9ad3\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD         0017  1  5.0    0.17    0.02  6.00  42.68 0.44   0.000
    [CN=73.9         ]
    [ N = 3.0:Tp 0.17]
*
    READ STORM                 30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\5220502e-449b-4593-a1b2-
ebbd0b2a9ad3\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD         0018  1  5.0    0.17    0.02  6.00  42.68 0.44   0.000
    [CN=73.9         ]
    [ N = 3.0:Tp 0.17]
*
    READ STORM                 30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\5220502e-449b-4593-a1b2-
ebbd0b2a9ad3\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD         0098  1  5.0    2.87    0.09  6.67  27.03 0.28   0.000
```

```
    [CN=60.0         ]
    [ N = 3.0:Tp 0.67]
*
    ADD [  0017+  0018]  0093  3  5.0    0.34    0.04  6.00  42.68  n/a   0.000
*
    ADD [  0093+  0098]  0093  1  5.0    3.22    0.10  6.58  28.70  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\5220502e-449b-4593-a1b2-
ebbd0b2a9ad3\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD         0019  1  5.0    1.68    0.07  6.33  26.48 0.28   0.000
    [CN=59.5         ]
    [ N = 3.0:Tp 0.41]
*
    READ STORM                 30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\5220502e-449b-4593-a1b2-
ebbd0b2a9ad3\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD         0090  1  5.0    2.90    0.10  6.58  27.03 0.28   0.000
    [CN=60.0         ]
    [ N = 3.0:Tp 0.58]
*
    ADD [  0019+  0090]  0092  3  5.0    4.58    0.16  6.42  26.83  n/a   0.000
*
    CHANNEL[ 2:  0092]   0095  1  5.0    4.58    0.16  6.50  26.83  n/a   0.000
*
    ADD [  0093+  0095]  0099  3  5.0    7.80    0.26  6.58  27.60  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\5220502e-449b-4593-a1b2-
ebbd0b2a9ad3\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD         0091  1  5.0    3.18    0.09  6.75  27.10 0.28   0.000
    [CN=60.1         ]
    [ N = 3.0:Tp 0.71]
*
    CHANNEL[ 2:  0091]   0094  1  5.0    3.18    0.09  6.83  27.10  n/a   0.000
*
    ADD [  0094+  0099]  0096  3  5.0   10.99    0.35  6.58  27.46  n/a   0.000
*
```

```
  ************************************************
  ** SIMULATION : 6. Chi 12hr 2yr              **
  ************************************************

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

      START @  0.00 hrs
      --------------------
    CHIC STORM                 10.0
    [ Ptot= 42.34 mm ]
*
```

```
 ** CALIB NASHYD         0017  1  5.0    0.17    0.00  4.17   9.00 0.21   0.000
    [CN=73.9          ]
    [ N = 3.0:Tp 0.17]
*
    CHIC STORM                 10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD         0018  1  5.0    0.17    0.00  4.17   9.00 0.21   0.000
    [CN=73.9          ]
    [ N = 3.0:Tp 0.17]
*
    CHIC STORM                 10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD         0098  1  5.0    2.87    0.01  5.00   4.20 0.10   0.000
    [CN=60.0          ]
    [ N = 3.0:Tp 0.67]
*
    ADD [  0017+  0018]  0093  3  5.0    0.34    0.01  4.17   9.00  n/a   0.000
*
    ADD [  0093+  0098]  0093  1  5.0    3.22    0.01  4.92   4.71  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD         0019  1  5.0    1.68    0.01  4.58   4.04 0.10   0.000
    [CN=59.5          ]
    [ N = 3.0:Tp 0.41]
*
    CHIC STORM                 10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD         0090  1  5.0    2.90    0.01  4.92   4.20 0.10   0.000
    [CN=60.0          ]
    [ N = 3.0:Tp 0.58]
*
    ADD [  0019+  0090]  0092  3  5.0    4.58    0.02  4.75   4.14  n/a   0.000
*
    CHANNEL[ 2:  0092]   0095  1  5.0    4.58    0.02  4.92   4.14  n/a   0.000
*
    ADD [  0093+  0095]  0099  3  5.0    7.80    0.03  4.92   4.38  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD         0091  1  5.0    3.18    0.01  5.08   4.21 0.10   0.000
    [CN=60.1          ]
    [ N = 3.0:Tp 0.71]
*
    CHANNEL[ 2:  0091]   0094  1  5.0    3.18    0.01  5.25   4.21  n/a   0.000
*
    ADD [  0094+  0099]  0096  3  5.0   10.99    0.04  5.00   4.33  n/a   0.000
*
```

```
  ************************************************
  ** SIMULATION : 7. Chi 12hr 100yr            **
  ************************************************

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

      START @  0.00 hrs
      --------------------
    CHIC STORM                 10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0017  1  5.0    0.17    0.02  4.08  41.13 0.44   0.000
    [CN=73.9         ]
    [ N = 3.0:Tp 0.17]
*
    CHIC STORM                 10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0018  1  5.0    0.17    0.02  4.08  41.13 0.44   0.000
    [CN=73.9         ]
    [ N = 3.0:Tp 0.17]
*
    CHIC STORM                 10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0098  1  5.0    2.87    0.08  4.83  25.88 0.28   0.000
    [CN=60.0         ]
    [ N = 3.0:Tp 0.67]
*
    ADD [  0017+  0018]  0093  3  5.0    0.34    0.04  4.08  41.13  n/a   0.000
*
    ADD [  0093+  0098]  0093  1  5.0    3.22    0.09  4.75  27.52  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0019  1  5.0    1.68    0.06  4.50  25.36 0.27   0.000
    [CN=59.5         ]
    [ N = 3.0:Tp 0.41]
*
    CHIC STORM                 10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0090  1  5.0    2.90    0.09  4.67  25.88 0.28   0.000
    [CN=60.0         ]
    [ N = 3.0:Tp 0.58]
*
    ADD [  0019+  0090]  0092  3  5.0    4.58    0.15  4.58  25.69  n/a   0.000
*
    CHANNEL[ 2:  0092]   0095  1  5.0    4.58    0.15  4.67  25.69  n/a   0.000
*
    ADD [  0093+  0095]  0099  3  5.0    7.80    0.24  4.67  26.44  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0091  1  5.0    3.18    0.09  4.83  25.96 0.28   0.000
    [CN=60.1         ]
    [ N = 3.0:Tp 0.71]
```

```
*
    CHANNEL[ 2:  0091]   0094  1  5.0    3.18    0.09  4.92  25.96  n/a   0.000
*
    ADD [  0094+  0099]  0096  3  5.0   10.99    0.32  4.75  26.30  n/a   0.000
*
```

```
  ***********************************************
  ** SIMULATION : 8. Historical July 1 1979     **
  ***********************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                  5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\5220502e-449b-4593-a1b2-
ebbd0b2a9ad3\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0017  1  5.0    0.17    0.02  1.67  34.02 0.41   0.000
    [CN=73.9         ]
    [ N = 3.0:Tp 0.17]
*
    READ STORM                  5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\5220502e-449b-4593-a1b2-
ebbd0b2a9ad3\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0018  1  5.0    0.17    0.02  1.67  34.02 0.41   0.000
    [CN=73.9         ]
    [ N = 3.0:Tp 0.17]
*
    READ STORM                  5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\5220502e-449b-4593-a1b2-
ebbd0b2a9ad3\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0098  1  5.0    2.87    0.11  2.25  20.72 0.25   0.000
    [CN=60.0         ]
    [ N = 3.0:Tp 0.67]
*
    ADD [  0017+  0018]  0093  3  5.0    0.34    0.04  1.67  34.02  n/a   0.000
*
    ADD [  0093+  0098]  0093  1  5.0    3.22    0.12  2.08  22.14  n/a   0.000
*
    READ STORM                  5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\5220502e-449b-4593-a1b2-
ebbd0b2a9ad3\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0019  1  5.0    1.68    0.09  2.00  20.26 0.24   0.000
    [CN=59.5         ]
    [ N = 3.0:Tp 0.41]
*
    READ STORM                  5.0
```

```
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\5220502e-449b-4593-a1b2-
ebbd0b2a9ad3\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0090  1  5.0    2.90    0.12  2.17  20.72 0.25   0.000
    [CN=60.0          ]
    [ N = 3.0:Tp 0.58]
*
    ADD [  0019+  0090]  0092  3  5.0    4.58    0.20  2.08  20.55  n/a   0.000
*
    CHANNEL[ 2:  0092]   0095  1  5.0    4.58    0.20  2.17  20.55  n/a   0.000
*
    ADD [  0093+  0095]  0099  3  5.0    7.80    0.32  2.17  21.21  n/a   0.000
*
    READ STORM                    5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\5220502e-449b-4593-a1b2-
ebbd0b2a9ad3\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0091  1  5.0    3.18    0.12  2.25  20.78 0.25   0.000
    [CN=60.1          ]
    [ N = 3.0:Tp 0.71]
*
    CHANNEL[ 2:  0091]   0094  1  5.0    3.18    0.11  2.33  20.78  n/a   0.000
*
    ADD [  0094+  0099]  0096  3  5.0   10.99    0.43  2.17  21.08  n/a   0.000
*
```

```
  ************************************************
  ** SIMULATION : 9. Historical Aug 4 1988      **
  ************************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                    5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\5220502e-449b-4593-a1b2-
ebbd0b2a9ad3\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0017  1  5.0    0.17    0.02  2.08  31.64 0.39   0.000
    [CN=73.9          ]
    [ N = 3.0:Tp 0.17]
*
    READ STORM                    5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\5220502e-449b-4593-a1b2-
ebbd0b2a9ad3\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0018  1  5.0    0.17    0.02  2.08  31.64 0.39   0.000
    [CN=73.9          ]
    [ N = 3.0:Tp 0.17]
*
    READ STORM                    5.0
```

```
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\5220502e-449b-4593-a1b2-
ebbd0b2a9ad3\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0098  1  5.0    2.87    0.08  2.50  19.03 0.24   0.000
    [CN=60.0         ]
    [ N = 3.0:Tp 0.67]
*
    ADD [  0017+  0018]  0093  3  5.0    0.34    0.04  2.08  31.64  n/a   0.000
*
    ADD [  0093+  0098]  0093  1  5.0    3.22    0.10  2.17  20.38  n/a   0.000
*
    READ STORM                  5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\5220502e-449b-4593-a1b2-
ebbd0b2a9ad3\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0019  1  5.0    1.68    0.07  2.25  18.60 0.23   0.000
    [CN=59.5         ]
    [ N = 3.0:Tp 0.41]
*
    READ STORM                  5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\5220502e-449b-4593-a1b2-
ebbd0b2a9ad3\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0090  1  5.0    2.90    0.10  2.42  19.03 0.24   0.000
    [CN=60.0         ]
    [ N = 3.0:Tp 0.58]
*
    ADD [  0019+  0090]  0092  3  5.0    4.58    0.17  2.33  18.87  n/a   0.000
*
    CHANNEL[ 2:  0092]   0095  1  5.0    4.58    0.16  2.42  18.87  n/a   0.000
*
    ADD [  0093+  0095]  0099  3  5.0    7.80    0.25  2.33  19.49  n/a   0.000
*
    READ STORM                  5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\5220502e-449b-4593-a1b2-
ebbd0b2a9ad3\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0091  1  5.0    3.18    0.09  2.50  19.08 0.24   0.000
    [CN=60.1         ]
    [ N = 3.0:Tp 0.71]
*
    CHANNEL[ 2:  0091]   0094  1  5.0    3.18    0.09  2.58  19.08  n/a   0.000
*
    ADD [  0094+  0099]  0096  3  5.0   10.99    0.34  2.42  19.37  n/a   0.000
```

```
*****************************************
** SIMULATION:1. SCS II 6hr 5yr Ottawa **
*****************************************

--------------------
| ADD HYD  (  0096)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0094):      3.18   0.025     4.00     6.63
      + ID2= 2 (  0099):      7.80   0.069     3.75     6.84
        ===================================================
        ID = 3 (  0096):     10.99   0.092     3.83     6.78

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
***********************************
** SIMULATION:10. 25mm4hrChicago **
***********************************

--------------------
| ADD HYD  (  0096)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0094):      3.18   0.002     4.00     0.73
      + ID2= 2 (  0099):      7.80   0.006     3.50     0.79
        ===================================================
        ID = 3 (  0096):     10.99   0.009     3.67     0.78

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
***********************************************
** SIMULATION:100 year 12 hr Chi 120 percent **
***********************************************

--------------------
| ADD HYD  (  0096)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0094):      3.18   0.126     5.00    36.73
      + ID2= 2 (  0099):      7.80   0.352     4.67    37.32
        ===================================================
        ID = 3 (  0096):     10.99   0.471     4.75    37.15

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
*******************************************
** SIMULATION:2. SCS II 6hr 100yr Ottawa **
*******************************************

--------------------
| ADD HYD  (  0096)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0094):      3.18   0.089     3.92    22.31
      + ID2= 2 (  0099):      7.80   0.246     3.67    22.76
        ===================================================
        ID = 3 (  0096):     10.99   0.329     3.67    22.63

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

```
******************************************
** SIMULATION:3. SCS II 12hr 5yr Ottawa **
******************************************

--------------------
| ADD HYD  (  0096)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0094):     3.18   0.029     6.92     8.99
      + ID2= 2 (  0099):     7.80   0.079     6.67     9.25
        ===================================================
        ID = 3 (  0096):    10.99   0.106     6.67     9.18

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
*******************************************
** SIMULATION:4. SCS II 12hr 10yr Ottawa **
*******************************************

--------------------
| ADD HYD  (  0096)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0094):     3.18   0.043     6.92    12.97
      + ID2= 2 (  0099):     7.80   0.118     6.58    13.29
        ===================================================
        ID = 3 (  0096):    10.99   0.158     6.67    13.20

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
*********************************************
** SIMULATION:5. SCS II 12hr 100yr correct **
*********************************************

--------------------
| ADD HYD  (  0096)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0094):     3.18   0.094     6.83    27.10
      + ID2= 2 (  0099):     7.80   0.260     6.58    27.60
        ===================================================
        ID = 3 (  0096):    10.99   0.348     6.58    27.46

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
************************************
** SIMULATION:6. Chi 12hr 2yr     **
************************************

--------------------
| ADD HYD  (  0096)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0094):     3.18   0.011     5.25     4.21
      + ID2= 2 (  0099):     7.80   0.029     4.92     4.38
        ===================================================
        ID = 3 (  0096):    10.99   0.039     5.00     4.33

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

```
************************************
** SIMULATION:7. Chi 12hr 100yr   **
************************************

--------------------
| ADD HYD  (  0096)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0094):      3.18   0.086     4.92    25.96
      + ID2= 2 (  0099):      7.80   0.241     4.67    26.44
        ====================================================
        ID = 3 (  0096):     10.99   0.321     4.75    26.30

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
******************************************
** SIMULATION:8. Historical July 1 1979 **
******************************************

--------------------
| ADD HYD  (  0096)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0094):      3.18   0.114     2.33    20.78
      + ID2= 2 (  0099):      7.80   0.322     2.17    21.21
        ====================================================
        ID = 3 (  0096):     10.99   0.429     2.17    21.08

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
*****************************************
** SIMULATION:9. Historical Aug 4 1988 **
*****************************************

--------------------
| ADD HYD  (  0096)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0094):      3.18   0.089     2.58    19.08
      + ID2= 2 (  0099):      7.80   0.254     2.33    19.49
        ====================================================
        ID = 3 (  0096):     10.99   0.336     2.42    19.37

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

APPENDIX F: PERMEABILITY TEST RESULTS

SoilMoisture
Soil Hydrology Instruments for Research Since 1965

Guelph Permeameter

Input

Result

Test #1

Reservoir Cross-sectional area in cm^2

(enter "35.22" for Combined and "2.16" for Inner reservoir): **35.22**

Enter water Head Height ("H" in cm): **15**

Enter the Borehole Radius ("a" in cm): **6**

Enter the soil texture-structure category (enter one of the below numbers): **2**

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): **0.1000**

Res Type	35.22
H	15
a	6
H/a	2.5
a*	0.04
C0.01	1.033
C0.04	1.085
C0.12	1.063
C0.36	1.063
C	1.085
R	0.100
Q	0.059
pi	3.142

α^* = 0.04 cm^{-1}

C = 1.08468

Q = 0.0587

K_{fs} = 1.64E-05 cm/sec; 9.81E-04 cm/min; 1.64E-07 m/sec; 3.86E-04 inch/min; 6.44E-06 inch/sec

Φ_m = 4.09E-04 cm^2/min

Test #2

Reservoir Cross-sectional area in cm^2

(enter "35.22" for Combined and "2.16" for Inner reservoir): **35.22**

Enter water Head Height ("H" in cm): **5**

Enter the Borehole Radius ("a" in cm): **6**

Enter the soil texture-structure category (enter one of the below numbers): **2**

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): **0.3000**

Res Type	35.22
H	5
a	6
H/a	0.83333
a*	0.04
C0.01	0.52372
C0.04	0.53755
C0.12	0.48911
C0.36	0.48911
C	0.53755
R	0.300
Q	0.1761
pi	3.1415

α^* = 0.04 cm^{-1}

C = 0.53755

Q = 0.1761

K_{fs} = 9.44E-05 cm/sec; 5.66E-03 cm/min; 9.44E-07 m/ses; 2.23E-03 inch/min; 3.71E-05 inch/sec

Φ_m = 2.36E-03 cm^2/min

Test #3

Reservoir Cross-sectional area in cm^2

(enter "35.22" for Combined and "2.16" for Inner reservoir): **35.22**

Enter water Head Height ("H" in cm): **5**

Enter the Borehole Radius ("a" in cm): **6**

Enter the soil texture-structure category (enter one of the below numbers): **2**

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): **0.4000**

Res Type	3.52E+01
H	5
a	6
H/a	0.833333333
a*	0.04
C0.01	0.523723554
C0.04	0.537554004
C0.12	0.489114302
C0.36	0.489114302
C	0.537554004
R	0.400
Q	2.35E-01
pi	3.1415

α^* = 0.04 cm^{-1}

C = 0.53755

Q = 2.35E-01

K_{fs} = 0.00013 cm/sec; 7.55E-03 cm/min; 1.26E-06 m/ses; 2.97E-03 inch/min; 4.95E-05 inch/sec

Φ_m = 3.15E-03 cm^2/min

Calculation formulas related to shape factor (C). Where H_1 is the first water head height (cm), H_2 is the second water head height (cm), a is borehole radius (cm) and α^* is microscopic capillary length factor which is decided according to the soil texture-structure category. For one-head method, only C_1 needs to be calculated while for two-head method, C_1 and C_2 are calculated (Zang et al., 1998).

Soil Texture-Structure Category	$\alpha^*(cm^{-1})$	Shape Factor
Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.	0.01	$C_1 = \left(\frac{H_2/a}{2.081 + 0.121(H_2/a)}\right)^{0.672}$
Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.	0.04	$C_1 = \left(\frac{H_1/a}{1.992 + 0.091(H_1/a)}\right)^{0.683}$ $C_2 = \left(\frac{H_2/a}{1.992 + 0.091(H_2/a)}\right)^{0.683}$
Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.	0.12	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093(H_1/a)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093(H_2/a)}\right)^{0.754}$
Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macro pores, etc.	0.36	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093(H_1/a)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093(H_2/a)}\right)^{0.754}$

Calculation formulas related to one-head and two-head methods. Where R is steady-state rate of fall of water in reservoir (cm/s), K_{fs} is Soil saturated hydraulic conductivity (cm/s), Φ_m is Soil matric flux potential (cm²/s), α^* is Macroscopic capillary length parameter (from Table 2), a is Borehole radius (cm), H_1 is the first head of water established in borehole (cm), H_2 is the second head of water established in borehole (cm) and C is Shape factor (from Table 2).

One Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$	$K_{fs} = \frac{C_1 \times Q_1}{2\pi H_1^2 + \pi a^2 C_1 + 2\pi\left(\frac{H_1}{\alpha^*}\right)}$ $\Phi_m = \frac{C_1 \times Q_1}{(2\pi H_1^2 + \pi a^2 C_1)\alpha^* + 2\pi H_1}$
One Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$	
Two Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$ $Q_2 = \bar{R}_2 \times 35.22$	$G_1 = \frac{H_2 C_1}{\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $G_2 = \frac{H_1 C_2}{\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $K_{fs} = G_2Q_2 - G_1Q_1$ $G_3 = \frac{(2H_2^2 + a^2C_2)C_1}{2\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $G_4 = \frac{(2H_1^2 + a^2C_1)C_2}{2\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $\Phi_m = G_3Q_1 - G_4Q_2$
Two Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$ $Q_2 = \bar{R}_2 \times 2.16$	

APPENDIX G1: STAGE STORAGE WORKSHEET – STORAGE SWALE – NON-COINCIDENT OR NORMAL

Analysis results from December 10, 2024 have been reinserted in this appendix without alteration as the revisions made to the report and drawings did not result in changes to the stormwater management model.

APPENDIX G1: STORMWATER STORAGE SWALE - NON-COINCIDENT

Stage Storage Discharge Worksheet

Client: Hauderowicz, Zbigniew and Teresa
Job No.: 200977
Location: 2050 Dunrobin Road
Date: December 10, 2024

V Notch Weir	
Weir Invert	75.4
Notch Angle	25
Cw	0.59

Subdrain	
Dia (m):	0.150
Area (m2.):	0.0050
Orifice Coeff, C_d:	0.60
Orifice Top (m):	74.78
Orifice Cen (m):	74.74
Orifice Inv (m):	74.70

Rectangular Weir	
Weir Invert	76.1
Weir Length	4
Cw	0.62

Stage, WSE Elev (m)	Comment	Layer Thickness [m]	Incremental [m^3]	Cunulative [m^3]	V-notch Weir			Subdrain Flow			Rectancular Weir Flow		Total Outflow (m^3/sec)	Storage (Ha.m)
					Flow Depth (m)	Head Feet (ft)	Weir Flow (m^3/sec)	Head (m)	n	Flow (m^3/sec)	Flow Depth (m)	Weir Flow (m^3/sec)		
76.40		0.05	65.70	1067.90	1.000	3.288	0.3107	1.300	16.25	0.015	0.300	0.414	0.739	0.1068
76.35		0.05	63.90	1002.20	0.950	3.124	0.2734	1.250	15.62	0.014	0.250	0.314	0.602	0.1002
76.30		0.05	62.10	938.30	0.900	2.960	0.2389	1.200	15.00	0.014	0.200	0.224	0.477	0.0938
76.25		0.05	60.30	876.20	0.850	2.796	0.2072	1.150	14.38	0.014	0.150	0.145	0.366	0.0876
76.20		0.05	58.50	815.90	0.800	2.632	0.1781	1.100	13.75	0.014	0.100	0.079	0.270	0.0816
76.15		0.05	56.70	757.40	0.750	2.468	0.1516	1.050	13.13	0.013	0.050	0.028	0.193	0.0757
76.10		0.05	54.90	700.70	0.700	2.304	0.1277	1.000	12.50	0.013	0.000	0.000	0.141	0.0701
76.05		0.05	53.10	645.80	0.650	2.140	0.1061	0.950	11.87	0.013			0.119	0.0646
76.00		0.05	51.30	592.70	0.600	1.976	0.0870	0.900	11.25	0.012			0.099	0.0593
75.95		0.05	49.50	541.40	0.550	1.811	0.0700	0.850	10.63	0.012			0.082	0.0541
75.90		0.05	47.70	491.90	0.500	1.647	0.0552	0.800	10.00	0.011			0.067	0.0492
75.85		0.05	45.90	444.20	0.450	1.483	0.0425	0.750	9.37	0.011			0.054	0.0444
75.80		0.05	44.10	398.30	0.400	1.319	0.0317	0.700	8.75	0.011			0.042	0.0398
75.75		0.05	42.30	354.20	0.350	1.155	0.0227	0.650	8.12	0.010			0.033	0.0354
75.70		0.05	40.50	311.90	0.300	0.991	0.0155	0.600	7.50	0.010			0.025	0.0312
75.65		0.05	38.70	271.40	0.250	0.827	0.0099	0.550	6.88	0.009			0.019	0.0271
75.60		0.05	36.90	232.70	0.200	0.663	0.0003	0.500	6.25	0.009			0.009	0.0233
75.55		0.05	33.54	195.80	0.150	0.492	0.0001	0.450	5.62	0.008			0.009	0.0196
75.50		0.05	30.71	162.26	0.100	0.328	0.0001	0.400	5.00	0.008			0.008	0.0162
75.45		0.05	28.00	131.55	0.050	0.164	0.0000	0.350	4.38	0.007			0.007	0.0132
75.40		0.05	25.41	103.55	0.000	0.000	0.0000	0.300	3.75	0.007			0.007	0.0104
75.35		0.05	22.94	78.14				0.250	3.12	0.006			0.006	0.0078
75.30		0.05	20.59	55.20				0.200	2.50	0.005			0.005	0.0055
75.25		0.05	18.36	34.61				0.150	1.87	0.005			0.005	0.0035
75.20		0.05	16.25	16.25				0.100	1.25	0.003			0.003	0.0016
75.15		0.00	0.00	0.00				0.050	0.63	0.001			0.001	0.0000
													0.000	0.0000

APPENDIX G2: STAGE STORAGE WORKSHEET – STORAGE SWALE – COINCIDENT OR SURCHARGED

Analysis results from December 10, 2024 have been reinserted in this appendix without alteration as the revisions made to the report and drawings did not result in changes to the stormwater management model.

APPENDIX G2: STORMWATER STORAGE SWALE - COINCIDENT

Stage Storage Discharge Worksheet

Client: Hauderowicz, Zbigniew and Teresa
Job No.: 200977
Location: 2050 Dunrobin Road
Date: December 10, 2024

V Notch Weir	
Weir Invert	75.4
Notch Angle	25
Cw	0.59

Subdrain	
Dia (m):	0.150
Area (m2.):	0.0050
Orifice Coeff, C_d:	0.60
Orifice Top (m):	74.78
Orifice Cen (m):	74.74
Orifice Inv (m):	74.70

Rectangular Weir	
Weir Invert	76.1
Weir Length	4
Cw	0.62

100 year flood Level at River Station 1214 75.48

Stage, WSE Elev (m)	Comment	Layer Thickness [m]	Incremental [m^3]	Cunulative [m^3]	V-notch Weir Flow Depth (m)	V-notch Weir Head Feet (ft)	V-notch Weir Weir Flow (m^3/sec)	Subdrain Flow Head (m)	Subdrain Flow n	Subdrain Flow Flow (m^3/sec)	Rectancular Weir Flow Flow Depth (m)	Rectancular Weir Flow Weir Flow (m^3/sec)	Total Outflow (m^3/sec)	Storage (Ha.m)
76.40		0.05	65.70	1067.90	0.920	3.025	0.2524	0.920	11.50	0.012	0.300	0.414	0.678	0.1068
76.35		0.05	63.90	1002.20	0.870	2.861	0.2195	0.870	10.87	0.012	0.250	0.314	0.545	0.1002
76.30		0.05	62.10	938.30	0.820	2.697	0.1894	0.820	10.25	0.012	0.200	0.224	0.425	0.0938
76.25		0.05	60.30	876.20	0.770	2.533	0.1619	0.770	9.62	0.011	0.150	0.145	0.318	0.0876
76.20		0.05	58.50	815.90	0.720	2.369	0.1370	0.720	9.00	0.011	0.100	0.079	0.227	0.0816
76.15		0.05	56.70	757.40	0.670	2.205	0.1145	0.670	8.38	0.010	0.050	0.028	0.153	0.0757
76.10		0.05	54.90	700.70	0.620	2.041	0.0944	0.620	7.75	0.010	0.000	0.000	0.104	0.0701
76.05		0.05	53.10	645.80	0.570	1.877	0.0765	0.570	7.12	0.010			0.086	0.0646
76.00		0.05	51.30	592.70	0.520	1.713	0.0609	0.520	6.50	0.009			0.070	0.0593
75.95		0.05	49.50	541.40	0.470	1.549	0.0473	0.470	5.88	0.009			0.056	0.0541
75.90		0.05	47.70	491.90	0.420	1.385	0.0358	0.420	5.25	0.008			0.044	0.0492
75.85		0.05	45.90	444.20	0.370	1.221	0.0261	0.370	4.62	0.008			0.034	0.0444
75.80		0.05	44.10	398.30	0.320	1.057	0.0182	0.320	4.00	0.007			0.025	0.0398
75.75		0.05	42.30	354.20	0.270	0.893	0.0119	0.270	3.37	0.006			0.018	0.0354
75.70		0.05	40.50	311.90	0.220	0.729	0.0072	0.220	2.75	0.006			0.013	0.0312
75.65		0.05	38.70	271.40	0.170	0.565	0.0038	0.170	2.13	0.005			0.009	0.0271
75.60		0.05	36.90	232.70	0.120	0.401	0.0001	0.120	1.50	0.004			0.004	0.0233
75.55		0.05	33.54	195.80	0.070	0.230	0.0000	0.070	0.87	0.002			0.002	0.0196
75.50		0.05	30.71	162.26	0.020	0.066	0.0000	0.020	0.25	0.000			0.000	0.0162
75.45		0.05	28.00	131.55									0.000	0.0132
75.40		0.05	25.41	103.55									0.000	0.0104
75.35		0.05	22.94	78.14									0.000	0.0078
75.30		0.05	20.59	55.20									0.000	0.0055
75.25		0.05	18.36	34.61									0.000	0.0035
75.20		0.05	16.25	16.25									0.000	0.0016
75.15		0.00	0.00	0.00									0.000	0.0000

APPENDIX H: POST-DEVELOPMENT OTTHYMO MODEL RESULTS

Analysis results from December 10, 2024 have been reinserted in this appendix without alteration as the revisions made to the report and drawings did not result in changes to the stormwater management model.

Post-Development OTTHYMO summary output file – Non-coincident or Normal

Post-Development Detailed Output file Last Link before Harwood Creek – Non-coincident or Normal

Post-Development OTTHYMO summary output file – Coincident or Surcharged

Post-Development Detailed Output file Last Link before Harwood Creek – Coincident or Surcharged

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

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


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

  ************************************************
  ** SIMULATION : 1. SCS II 6hr 5yr Ottawa      **
  ************************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                 30.0
    [ Ptot= 50.41 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\efd79b53-4367-4bd5-a2ba-ef6554
    remark: SCS II 6hr 5yr Ottawa
*
 ** CALIB NASHYD         0001  1  5.0    0.50    0.01  3.08   7.63 0.15   0.000
    [CN=62.5         ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0001]   0068  1  5.0    0.50    0.01  3.08   7.63  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 50.41 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\efd79b53-4367-4bd5-a2ba-ef6554
    remark: SCS II 6hr 5yr Ottawa
*
 ** CALIB NASHYD         0002  1  5.0    0.50    0.01  3.17   7.63 0.15   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.26]
*
    ADD [  0002+  0068]  0064  3  5.0    1.00    0.02  3.17   7.63  n/a   0.000
*
    CHANNEL[ 2:  0064]   0069  1  5.0    1.00    0.02  3.17   7.63  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 50.41 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\efd79b53-4367-4bd5-a2ba-ef6554
    remark: SCS II 6hr 5yr Ottawa
*
 ** CALIB NASHYD         0003  1  5.0    0.51    0.01  3.17   7.63 0.15   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.24]
*
```

```
    ADD [  0003+  0069]  0065  3  5.0    1.51    0.02  3.17    7.63  n/a   0.000
*
    CHANNEL[ 2:  0065]   0070  1  5.0    1.51    0.02  3.25    7.62  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 50.41 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\efd79b53-4367-4bd5-a2ba-ef6554
    remark: SCS II 6hr 5yr Ottawa
*
 ** CALIB NASHYD         0004  1  5.0    1.68    0.02  3.50    7.60 0.15   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0004+  0070]  0066  3  5.0    3.18    0.04  3.33    7.61  n/a   0.000
*
    CHANNEL[ 2:  0066]   0084  1  5.0    3.18    0.04  3.50    7.61  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 50.41 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\efd79b53-4367-4bd5-a2ba-ef6554
    remark: SCS II 6hr 5yr Ottawa
*
 ** CALIB NASHYD         0005  1  5.0    1.41    0.02  3.33    8.11 0.16   0.000
    [CN=63.5         ]
    [ N = 3.0:Tp 0.34]
*
    READ STORM                 30.0
    [ Ptot= 50.41 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\efd79b53-4367-4bd5-a2ba-ef6554
    remark: SCS II 6hr 5yr Ottawa
*
 ** CALIB NASHYD         0006  1  5.0    0.50    0.01  3.25    7.66 0.15   0.000
    [CN=62.5         ]
    [ N = 3.0:Tp 0.29]
*
    READ STORM                 30.0
    [ Ptot= 50.41 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\efd79b53-4367-4bd5-a2ba-ef6554
    remark: SCS II 6hr 5yr Ottawa
*
 ** CALIB NASHYD         0007  1  5.0    0.50    0.01  3.25    7.63 0.15   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                 30.0
    [ Ptot= 50.41 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\efd79b53-4367-4bd5-a2ba-ef6554
    remark: SCS II 6hr 5yr Ottawa
*
 ** CALIB NASHYD         0008  1  5.0    0.49    0.01  3.08    7.63 0.15   0.000
    [CN=62.5         ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0008]   0071  1  5.0    0.49    0.01  3.08    7.63  n/a   0.000
*
    ADD [  0007+  0071]  0061  3  5.0    0.99    0.02  3.17    7.63  n/a   0.000
*
```

```
    CHANNEL[ 2:  0061]   0072  1  5.0    0.99    0.02  3.17   7.63  n/a   0.000
*
    ADD [  0006+  0072]  0062  3  5.0    1.49    0.02  3.17   7.64  n/a   0.000
*
    CHANNEL[ 2:  0062]   0073  1  5.0    1.49    0.02  3.25   7.64  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 50.41 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\efd79b53-4367-4bd5-a2ba-ef6554
    remark: SCS II 6hr 5yr Ottawa
*
 ** CALIB NASHYD         0019  1  5.0    1.68    0.02  3.58   6.40 0.13   0.000
    [CN=59.5        ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0019+  0005]  0063  3  5.0    3.09    0.04  3.50   7.18  n/a   0.000
*
    ADD [  0063+  0073]  0063  1  5.0    4.58    0.06  3.33   7.33  n/a   0.000
*
    CHANNEL[ 2:  0063]   0083  1  5.0    4.58    0.05  3.58   7.32  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 50.41 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\efd79b53-4367-4bd5-a2ba-ef6554
    remark: SCS II 6hr 5yr Ottawa
*
 ** CALIB NASHYD         0009  1  5.0    0.36    0.01  3.17  10.69 0.21   0.000
    [CN=68.5        ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                 30.0
    [ Ptot= 50.41 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\efd79b53-4367-4bd5-a2ba-ef6554
    remark: SCS II 6hr 5yr Ottawa
*
 ** CALIB NASHYD         0017  1  5.0    0.17    0.01  3.08  13.03 0.26   0.000
    [CN=73.9        ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0017]   0080  1  5.0    0.17    0.01  3.17  13.02  n/a   0.000
*
    ADD [  0080+  0009]  0035  3  5.0    0.53    0.01  3.17  11.45  n/a   0.000
*
    CHANNEL[ 2:  0035]   0077  1  5.0    0.53    0.01  3.17  11.45  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 50.41 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\efd79b53-4367-4bd5-a2ba-ef6554
    remark: SCS II 6hr 5yr Ottawa
*
 ** CALIB NASHYD         0010  1  5.0    0.38    0.01  3.17  10.61 0.21   0.000
    [CN=68.4        ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0010+  0077]  0036  3  5.0    0.91    0.02  3.17  11.10  n/a   0.000
*
    CHANNEL[ 2:  0036]   0078  1  5.0    0.91    0.02  3.25  11.10  n/a   0.000
*
```

```
    READ STORM                  30.0
    [ Ptot= 50.41 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\efd79b53-4367-4bd5-a2ba-ef6554
    remark: SCS II 6hr 5yr Ottawa
*
 ** CALIB NASHYD         0011  1  5.0    0.38    0.01  3.17  10.61 0.21   0.000
    [CN=68.4          ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0011+  0078]  0037  3  5.0    1.28    0.03  3.25  10.96  n/a   0.000
*
    CHANNEL[ 2:  0037]   0079  1  5.0    1.28    0.03  3.25  10.96  n/a   0.000
*
    READ STORM                  30.0
    [ Ptot= 50.41 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\efd79b53-4367-4bd5-a2ba-ef6554
    remark: SCS II 6hr 5yr Ottawa
*
 ** CALIB NASHYD         0012  1  5.0    0.29    0.01  3.08  13.86 0.27   0.000
    [CN=75.0          ]
    [ N = 3.0:Tp 0.22]
*
    ADD [  0012+  0079]  0038  3  5.0    1.58    0.04  3.25  11.50  n/a   0.000
*
    CHANNEL[ 2:  0038]   0094  1  5.0    1.58    0.04  3.25  11.49  n/a   0.000
*
    READ STORM                  30.0
    [ Ptot= 50.41 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\efd79b53-4367-4bd5-a2ba-ef6554
    remark: SCS II 6hr 5yr Ottawa
*
 ** CALIB NASHYD         0013  1  5.0    0.34    0.01  3.08  15.03 0.30   0.000
    [CN=76.5          ]
    [ N = 3.0:Tp 0.24]
*
    READ STORM                  30.0
    [ Ptot= 50.41 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\efd79b53-4367-4bd5-a2ba-ef6554
    remark: SCS II 6hr 5yr Ottawa
*
 ** CALIB NASHYD         0014  1  5.0    0.36    0.01  3.17  10.61 0.21   0.000
    [CN=68.4          ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                  30.0
    [ Ptot= 50.41 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\efd79b53-4367-4bd5-a2ba-ef6554
    remark: SCS II 6hr 5yr Ottawa
*
 ** CALIB NASHYD         0015  1  5.0    0.38    0.01  3.17  10.61 0.21   0.000
    [CN=68.4          ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                  30.0
    [ Ptot= 50.41 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\efd79b53-4367-4bd5-a2ba-ef6554
```

```
    remark: SCS II 6hr 5yr Ottawa
*
 ** CALIB NASHYD         0016  1  5.0    0.39    0.01  3.17  10.58 0.21   0.000
    [CN=68.3         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                 30.0
    [ Ptot= 50.41 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\efd79b53-4367-4bd5-a2ba-ef6554
    remark: SCS II 6hr 5yr Ottawa
*
 ** CALIB NASHYD         0018  1  5.0    0.17    0.01  3.08  13.03 0.26   0.000
    [CN=73.9         ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0018]   0081  1  5.0    0.17    0.01  3.08  13.03  n/a   0.000
*
    ADD [  0016+  0081]  0039  3  5.0    0.56    0.01  3.17  11.33  n/a   0.000
*
    CHANNEL[ 2:  0039]   0074  1  5.0    0.56    0.01  3.17  11.33  n/a   0.000
*
    ADD [  0015+  0074]  0040  3  5.0    0.94    0.02  3.17  11.04  n/a   0.000
*
    CHANNEL[ 2:  0040]   0075  1  5.0    0.94    0.02  3.17  11.04  n/a   0.000
*
    ADD [  0014+  0075]  0041  3  5.0    1.30    0.03  3.17  10.92  n/a   0.000
*
    CHANNEL[ 2:  0041]   0076  1  5.0    1.30    0.03  3.25  10.92  n/a   0.000
*
    ADD [  0013+  0076]  0042  3  5.0    1.64    0.04  3.17  11.77  n/a   0.000
*
    CHANNEL[ 2:  0042]   0095  1  5.0    1.64    0.04  3.25  11.77  n/a   0.000
*
    ADD [  0094+  0095]  0043  3  5.0    3.22    0.08  3.25  11.64  n/a   0.000
*
 ** Reservoir
    OUTFLOW:             0093  1  5.0    3.22    0.01  5.08  11.64  n/a   0.000
*
    ADD [  0083+  0093]  0092  3  5.0    7.80    0.06  3.58   9.10  n/a   0.000
*
    CHANNEL[ 2:  0092]   0085  1  5.0    7.80    0.06  3.58   9.10  n/a   0.000
*
    ADD [  0084+  0085]  0086  3  5.0   10.99    0.10  3.58   8.67  n/a   0.000
*
    CHANNEL[ 2:  0086]   0087  1  5.0   10.99    0.10  3.58   8.67  n/a   0.000
*
```

```
  ************************************************
  ** SIMULATION : 10. 25mm4hrChicago            **
  ************************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                 10.0
    [ Ptot= 25.00 mm ]
```

```
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\f1a0f5d7-8021-40d9-8279-55016d
    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD         0001  1  5.0    0.50    0.00  2.00   0.99 0.04   0.000
    [CN=62.5         ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0001]   0068  1  5.0    0.50    0.00  2.08   0.99  n/a   0.000
*
    READ STORM                 10.0
    [ Ptot= 25.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\f1a0f5d7-8021-40d9-8279-55016d
    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD         0002  1  5.0    0.50    0.00  2.25   0.98 0.04   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.26]
*
    ADD [  0002+  0068]  0064  3  5.0    1.00    0.00  2.17   0.99  n/a   0.000
*
    CHANNEL[ 2:  0064]   0069  1  5.0    1.00    0.00  2.25   0.99  n/a   0.000
*
    READ STORM                 10.0
    [ Ptot= 25.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\f1a0f5d7-8021-40d9-8279-55016d
    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD         0003  1  5.0    0.51    0.00  2.17   0.99 0.04   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.24]
*
    ADD [  0003+  0069]  0065  3  5.0    1.51    0.00  2.25   0.99  n/a   0.000
*
    CHANNEL[ 2:  0065]   0070  1  5.0    1.51    0.00  2.42   0.98  n/a   0.000
*
    READ STORM                 10.0
    [ Ptot= 25.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\f1a0f5d7-8021-40d9-8279-55016d
    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD         0004  1  5.0    1.68    0.00  2.67   0.97 0.04   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0004+  0070]  0066  3  5.0    3.18    0.00  2.50   0.98  n/a   0.000
*
    CHANNEL[ 2:  0066]   0084  1  5.0    3.18    0.00  2.83   0.98  n/a   0.000
*
    READ STORM                 10.0
    [ Ptot= 25.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\f1a0f5d7-8021-40d9-8279-55016d
    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD         0005  1  5.0    1.41    0.00  2.42   1.11 0.04   0.000
    [CN=63.5         ]
    [ N = 3.0:Tp 0.34]
*
```

```
    READ STORM                  10.0
    [ Ptot= 25.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\f1a0f5d7-8021-40d9-8279-55016d
    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD         0006  1  5.0    0.50    0.00  2.33   0.99 0.04   0.000
    [CN=62.5         ]
    [ N = 3.0:Tp 0.29]
*
    READ STORM                  10.0
    [ Ptot= 25.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\f1a0f5d7-8021-40d9-8279-55016d
    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD         0007  1  5.0    0.50    0.00  2.33   0.99 0.04   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                  10.0
    [ Ptot= 25.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\f1a0f5d7-8021-40d9-8279-55016d
    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD         0008  1  5.0    0.49    0.00  2.00   0.99 0.04   0.000
    [CN=62.5         ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0008]   0071  1  5.0    0.49    0.00  2.08   0.99  n/a   0.000
*
    ADD [  0007+  0071]  0061  3  5.0    0.99    0.00  2.17   0.99  n/a   0.000
*
    CHANNEL[ 2:  0061]   0072  1  5.0    0.99    0.00  2.25   0.99  n/a   0.000
*
    ADD [  0006+  0072]  0062  3  5.0    1.49    0.00  2.25   0.99  n/a   0.000
*
    CHANNEL[ 2:  0062]   0073  1  5.0    1.49    0.00  2.33   0.99  n/a   0.000
*
    READ STORM                  10.0
    [ Ptot= 25.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\f1a0f5d7-8021-40d9-8279-55016d
    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD         0019  1  5.0    1.68    0.00  3.00   0.68 0.03   0.000
    [CN=59.5         ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0019+  0005]  0063  3  5.0    3.09    0.00  2.67   0.88  n/a   0.000
*
    ADD [  0063+  0073]  0063  1  5.0    4.58    0.00  2.50   0.91  n/a   0.000
*
    CHANNEL[ 2:  0063]   0083  1  5.0    4.58    0.00  3.08   0.91  n/a   0.000
*
    READ STORM                  10.0
    [ Ptot= 25.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\f1a0f5d7-8021-40d9-8279-55016d
    remark: twentyfive mm 4 hr chicago storm
*
```

```
 ** CALIB NASHYD         0009  1  5.0    0.36    0.00  2.00   1.86 0.07   0.000
    [CN=68.5         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                 10.0
    [ Ptot= 25.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\f1a0f5d7-8021-40d9-8279-55016d
    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD         0017  1  5.0    0.17    0.00  1.75   2.41 0.10   0.000
    [CN=73.9         ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0017]   0080  1  5.0    0.17    0.00  1.92   2.40  n/a   0.000
*
    ADD [  0080+  0009]  0035  3  5.0    0.53    0.00  1.92   2.03  n/a   0.000
*
    CHANNEL[ 2:  0035]   0077  1  5.0    0.53    0.00  2.00   2.03  n/a   0.000
*
    READ STORM                 10.0
    [ Ptot= 25.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\f1a0f5d7-8021-40d9-8279-55016d
    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD         0010  1  5.0    0.38    0.00  2.00   1.83 0.07   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0010+  0077]  0036  3  5.0    0.91    0.00  2.00   1.95  n/a   0.000
*
    CHANNEL[ 2:  0036]   0078  1  5.0    0.91    0.00  2.08   1.95  n/a   0.000
*
    READ STORM                 10.0
    [ Ptot= 25.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\f1a0f5d7-8021-40d9-8279-55016d
    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD         0011  1  5.0    0.38    0.00  2.00   1.83 0.07   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0011+  0078]  0037  3  5.0    1.28    0.00  2.08   1.91  n/a   0.000
*
    CHANNEL[ 2:  0037]   0079  1  5.0    1.28    0.00  2.17   1.91  n/a   0.000
*
    READ STORM                 10.0
    [ Ptot= 25.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\f1a0f5d7-8021-40d9-8279-55016d
    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD         0012  1  5.0    0.29    0.00  1.83   2.68 0.11   0.000
    [CN=75.0         ]
    [ N = 3.0:Tp 0.22]
*
    ADD [  0012+  0079]  0038  3  5.0    1.58    0.00  2.08   2.05  n/a   0.000
*
    CHANNEL[ 2:  0038]   0094  1  5.0    1.58    0.00  2.17   2.05  n/a   0.000
*
```

```
    READ STORM                  10.0
    [ Ptot= 25.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\f1a0f5d7-8021-40d9-8279-55016d
    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD         0013  1  5.0    0.34    0.00  1.83   3.10 0.12   0.000
    [CN=76.5         ]
    [ N = 3.0:Tp 0.24]
*
    READ STORM                  10.0
    [ Ptot= 25.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\f1a0f5d7-8021-40d9-8279-55016d
    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD         0014  1  5.0    0.36    0.00  2.00   1.83 0.07   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                  10.0
    [ Ptot= 25.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\f1a0f5d7-8021-40d9-8279-55016d
    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD         0015  1  5.0    0.38    0.00  2.00   1.83 0.07   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                  10.0
    [ Ptot= 25.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\f1a0f5d7-8021-40d9-8279-55016d
    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD         0016  1  5.0    0.39    0.00  2.00   1.82 0.07   0.000
    [CN=68.3         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                  10.0
    [ Ptot= 25.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\f1a0f5d7-8021-40d9-8279-55016d
    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD         0018  1  5.0    0.17    0.00  1.75   2.41 0.10   0.000
    [CN=73.9         ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0018]   0081  1  5.0    0.17    0.00  1.83   2.41  n/a   0.000
*
    ADD [  0016+  0081]  0039  3  5.0    0.56    0.00  1.92   2.00  n/a   0.000
*
    CHANNEL[ 2:  0039]   0074  1  5.0    0.56    0.00  2.00   2.00  n/a   0.000
*
    ADD [  0015+  0074]  0040  3  5.0    0.94    0.00  2.00   1.93  n/a   0.000
*
    CHANNEL[ 2:  0040]   0075  1  5.0    0.94    0.00  2.08   1.93  n/a   0.000
*
    ADD [  0014+  0075]  0041  3  5.0    1.30    0.00  2.08   1.90  n/a   0.000
*
```

```
    CHANNEL[ 2:  0041]   0076  1  5.0     1.30     0.00  2.17    1.90  n/a    0.000
*
    ADD [  0013+  0076]  0042  3  5.0     1.64     0.01  2.08    2.15  n/a    0.000
*
    CHANNEL[ 2:  0042]   0095  1  5.0     1.64     0.01  2.08    2.15  n/a    0.000
*
    ADD [  0094+  0095]  0043  3  5.0     3.22     0.01  2.17    2.10  n/a    0.000
*
 ** Reservoir
    OUTFLOW:             0093  1  5.0     3.22     0.00  4.25    2.10  n/a    0.000
*
    ADD [  0083+  0093]  0092  3  5.0     7.80     0.01  3.42    1.40  n/a    0.000
*
    CHANNEL[ 2:  0092]   0085  1  5.0     7.80     0.01  3.42    1.40  n/a    0.000
*
    ADD [  0084+  0085]  0086  3  5.0    10.99     0.01  3.17    1.28  n/a    0.000
*
    CHANNEL[ 2:  0086]   0087  1  5.0    10.99     0.01  3.33    1.27  n/a    0.000
*
```

```
  ************************************************
  ** SIMULATION : 100 year 12 hr Chi 120 percen **
  ************************************************

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

      START @  0.00 hrs
      --------------------
    CHIC STORM                  5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD         0001  1  5.0     0.50     0.06  4.17   39.78 0.35    0.000
    [CN=62.5          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0001]   0068  1  5.0     0.50     0.06  4.17   39.78  n/a    0.000
*
    CHIC STORM                  5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD         0002  1  5.0     0.50     0.04  4.33   39.80 0.35    0.000
    [CN=62.4          ]
    [ N = 3.0:Tp 0.26]
*
    ADD [  0002+  0068]  0064  3  5.0     1.00     0.10  4.25   39.79  n/a    0.000
*
    CHANNEL[ 2:  0064]   0069  1  5.0     1.00     0.10  4.25   39.79  n/a    0.000
*
    CHIC STORM                  5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD         0003  1  5.0     0.51     0.05  4.25   39.79 0.35    0.000
    [CN=62.4          ]
    [ N = 3.0:Tp 0.24]
*
    ADD [  0003+  0069]  0065  3  5.0     1.51     0.15  4.25   39.79  n/a    0.000
*
    CHANNEL[ 2:  0065]   0070  1  5.0     1.51     0.14  4.25   39.78  n/a    0.000
*
```

```
    CHIC STORM                    5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD         0004  1  5.0    1.68    0.11  4.50  39.76 0.35   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0004+  0070]  0066  3  5.0    3.18    0.24  4.33  39.77  n/a   0.000
*
    CHANNEL[ 2:  0066]   0084  1  5.0    3.18    0.24  4.42  39.77  n/a   0.000
*
    CHIC STORM                    5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD         0005  1  5.0    1.41    0.11  4.42  41.28 0.37   0.000
    [CN=63.5         ]
    [ N = 3.0:Tp 0.34]
*
    CHIC STORM                    5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD         0006  1  5.0    0.50    0.04  4.33  39.91 0.35   0.000
    [CN=62.5         ]
    [ N = 3.0:Tp 0.29]
*
    CHIC STORM                    5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD         0007  1  5.0    0.50    0.04  4.33  39.80 0.35   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.27]
*
    CHIC STORM                    5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD         0008  1  5.0    0.49    0.06  4.17  39.78 0.35   0.000
    [CN=62.5         ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0008]   0071  1  5.0    0.49    0.06  4.17  39.78  n/a   0.000
*
    ADD [  0007+  0071]  0061  3  5.0    0.99    0.10  4.25  39.79  n/a   0.000
*
    CHANNEL[ 2:  0061]   0072  1  5.0    0.99    0.10  4.25  39.79  n/a   0.000
*
    ADD [  0006+  0072]  0062  3  5.0    1.49    0.14  4.25  39.83  n/a   0.000
*
    CHANNEL[ 2:  0062]   0073  1  5.0    1.49    0.14  4.25  39.83  n/a   0.000
*
    CHIC STORM                    5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD         0019  1  5.0    1.68    0.10  4.50  35.97 0.32   0.000
    [CN=59.5         ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0019+  0005]  0063  3  5.0    3.09    0.20  4.42  38.39  n/a   0.000
*
    ADD [  0063+  0073]  0063  1  5.0    4.58    0.33  4.33  38.86  n/a   0.000
*
    CHANNEL[ 2:  0063]   0083  1  5.0    4.58    0.31  4.50  38.85  n/a   0.000
*
```

```
    CHIC STORM                   5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD          0009  1  5.0    0.36    0.04  4.33  48.51 0.43   0.000
    [CN=68.5          ]
    [ N = 3.0:Tp 0.27]
*
    CHIC STORM                   5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD          0017  1  5.0    0.17    0.03  4.17  55.39 0.49   0.000
    [CN=73.9          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0017]    0080  1  5.0    0.17    0.03  4.25  55.38  n/a   0.000
*
    ADD [  0080+  0009]   0035  3  5.0    0.53    0.07  4.25  50.74  n/a   0.000
*
    CHANNEL[ 2:  0035]    0077  1  5.0    0.53    0.07  4.25  50.74  n/a   0.000
*
    CHIC STORM                   5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD          0010  1  5.0    0.38    0.04  4.33  48.32 0.43   0.000
    [CN=68.4          ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0010+  0077]   0036  3  5.0    0.91    0.11  4.25  49.74  n/a   0.000
*
    CHANNEL[ 2:  0036]    0078  1  5.0    0.91    0.11  4.25  49.74  n/a   0.000
*
    CHIC STORM                   5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD          0011  1  5.0    0.38    0.04  4.33  48.32 0.43   0.000
    [CN=68.4          ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0011+  0078]   0037  3  5.0    1.28    0.15  4.25  49.32  n/a   0.000
*
    CHANNEL[ 2:  0037]    0079  1  5.0    1.28    0.15  4.33  49.32  n/a   0.000
*
    CHIC STORM                   5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD          0012  1  5.0    0.29    0.04  4.25  57.40 0.51   0.000
    [CN=75.0          ]
    [ N = 3.0:Tp 0.22]
*
    ADD [  0012+  0079]   0038  3  5.0    1.58    0.19  4.25  50.83  n/a   0.000
*
    CHANNEL[ 2:  0038]    0094  1  5.0    1.58    0.19  4.33  50.82  n/a   0.000
*
    CHIC STORM                   5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD          0013  1  5.0    0.34    0.05  4.25  60.08 0.53   0.000
    [CN=76.5          ]
    [ N = 3.0:Tp 0.24]
*
    CHIC STORM                   5.0
    [ Ptot=112.68 mm ]
```

```
*
 ** CALIB NASHYD         0014  1  5.0    0.36    0.04  4.33  48.32 0.43   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    CHIC STORM                  5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD         0015  1  5.0    0.38    0.04  4.33  48.32 0.43   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    CHIC STORM                  5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD         0016  1  5.0    0.39    0.04  4.33  48.20 0.43   0.000
    [CN=68.3         ]
    [ N = 3.0:Tp 0.27]
*
    CHIC STORM                  5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD         0018  1  5.0    0.17    0.03  4.17  55.39 0.49   0.000
    [CN=73.9         ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0018]   0081  1  5.0    0.17    0.03  4.17  55.38  n/a   0.000
*
    ADD [  0016+  0081]  0039  3  5.0    0.56    0.07  4.25  50.41  n/a   0.000
*
    CHANNEL[ 2:  0039]   0074  1  5.0    0.56    0.07  4.25  50.41  n/a   0.000
*
    ADD [  0015+  0074]  0040  3  5.0    0.94    0.11  4.25  49.57  n/a   0.000
*
    CHANNEL[ 2:  0040]   0075  1  5.0    0.94    0.11  4.25  49.57  n/a   0.000
*
    ADD [  0014+  0075]  0041  3  5.0    1.30    0.15  4.25  49.22  n/a   0.000
*
    CHANNEL[ 2:  0041]   0076  1  5.0    1.30    0.15  4.33  49.22  n/a   0.000
*
    ADD [  0013+  0076]  0042  3  5.0    1.64    0.20  4.25  51.47  n/a   0.000
*
    CHANNEL[ 2:  0042]   0095  1  5.0    1.64    0.20  4.33  51.47  n/a   0.000
*
    ADD [  0094+  0095]  0043  3  5.0    3.22    0.39  4.33  51.15  n/a   0.000
*
 ** Reservoir
    OUTFLOW:             0093  1  5.0    3.22    0.13  5.00  51.16  n/a   0.000
*
    ADD [  0083+  0093]  0092  3  5.0    7.80    0.39  4.58  43.93  n/a   0.000
*
    CHANNEL[ 2:  0092]   0085  1  5.0    7.80    0.39  4.58  43.93  n/a   0.000
*
    ADD [  0084+  0085]  0086  3  5.0   10.99    0.61  4.50  42.72  n/a   0.000
*
    CHANNEL[ 2:  0086]   0087  1  5.0   10.99    0.60  4.58  42.72  n/a   0.000
*
 FINISH

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

```
  ************************************************
  ** SIMULATION : 2. SCS II 6hr 100yr Ottawa    **
  ************************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                 30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD         0001  1  5.0    0.50    0.03  3.00  24.54 0.28   0.000
    [CN=62.5          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0001]   0068  1  5.0    0.50    0.03  3.08  24.54  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD         0002  1  5.0    0.50    0.03  3.17  24.54 0.28   0.000
    [CN=62.4          ]
    [ N = 3.0:Tp 0.26]
*
    ADD [  0002+  0068]  0064  3  5.0    1.00    0.06  3.08  24.54  n/a   0.000
*
    CHANNEL[ 2:  0064]   0069  1  5.0    1.00    0.06  3.08  24.54  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD         0003  1  5.0    0.51    0.03  3.08  24.53 0.28   0.000
    [CN=62.4          ]
    [ N = 3.0:Tp 0.24]
*
    ADD [  0003+  0069]  0065  3  5.0    1.51    0.09  3.08  24.54  n/a   0.000
*
    CHANNEL[ 2:  0065]   0070  1  5.0    1.51    0.09  3.17  24.53  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD         0004  1  5.0    1.68    0.07  3.42  24.50 0.28   0.000
    [CN=62.4          ]
    [ N = 3.0:Tp 0.41]
```

```
*
    ADD [  0004+  0070]  0066  3  5.0    3.18    0.15  3.25  24.51  n/a   0.000
*
    CHANNEL[ 2:  0066]   0084  1  5.0    3.18    0.15  3.33  24.51  n/a   0.000
*
    READ STORM                  30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD         0005  1  5.0    1.41    0.07  3.25  25.62 0.29   0.000
    [CN=63.5         ]
    [ N = 3.0:Tp 0.34]
*
    READ STORM                  30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD         0006  1  5.0    0.50    0.03  3.17  24.61 0.28   0.000
    [CN=62.5         ]
    [ N = 3.0:Tp 0.29]
*
    READ STORM                  30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD         0007  1  5.0    0.50    0.03  3.17  24.54 0.28   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                  30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD         0008  1  5.0    0.49    0.03  3.00  24.54 0.28   0.000
    [CN=62.5         ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0008]   0071  1  5.0    0.49    0.03  3.08  24.54  n/a   0.000
*
    ADD [  0007+  0071]  0061  3  5.0    0.99    0.06  3.08  24.54  n/a   0.000
*
    CHANNEL[ 2:  0061]   0072  1  5.0    0.99    0.06  3.17  24.54  n/a   0.000
*
    ADD [  0006+  0072]  0062  3  5.0    1.49    0.08  3.17  24.56  n/a   0.000
*
    CHANNEL[ 2:  0062]   0073  1  5.0    1.49    0.08  3.17  24.56  n/a   0.000
*
    READ STORM                  30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD         0019  1  5.0    1.68    0.06  3.42  21.77 0.25   0.000
```

```
    [CN=59.5          ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0019+  0005]  0063  3  5.0    3.09    0.13  3.33  23.52  n/a   0.000
*
    ADD [  0063+  0073]  0063  1  5.0    4.58    0.21  3.25  23.86  n/a   0.000
*
    CHANNEL[ 2:  0063]   0083  1  5.0    4.58    0.20  3.33  23.85  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD         0009  1  5.0    0.36    0.02  3.17  31.02 0.36   0.000
    [CN=68.5          ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                 30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD         0017  1  5.0    0.17    0.02  3.00  36.15 0.42   0.000
    [CN=73.9          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0017]   0080  1  5.0    0.17    0.02  3.08  36.13  n/a   0.000
*
    ADD [  0080+  0009]  0035  3  5.0    0.53    0.04  3.08  32.68  n/a   0.000
*
    CHANNEL[ 2:  0035]   0077  1  5.0    0.53    0.04  3.17  32.68  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD         0010  1  5.0    0.38    0.03  3.17  30.87 0.35   0.000
    [CN=68.4          ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0010+  0077]  0036  3  5.0    0.91    0.07  3.17  31.93  n/a   0.000
*
    CHANNEL[ 2:  0036]   0078  1  5.0    0.91    0.07  3.17  31.93  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD         0011  1  5.0    0.38    0.03  3.17  30.87 0.35   0.000
    [CN=68.4          ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0011+  0078]  0037  3  5.0    1.28    0.09  3.17  31.62  n/a   0.000
*
    CHANNEL[ 2:  0037]   0079  1  5.0    1.28    0.09  3.17  31.62  n/a   0.000
```

```
*
    READ STORM                  30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD          0012  1  5.0    0.29    0.03  3.08  37.72 0.43   0.000
    [CN=75.0          ]
    [ N = 3.0:Tp 0.22]
*
    ADD [  0012+  0079]  0038  3  5.0    1.58    0.12  3.17  32.76  n/a   0.000
*
    CHANNEL[ 2:  0038]   0094  1  5.0    1.58    0.12  3.17  32.75  n/a   0.000
*
    READ STORM                  30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD          0013  1  5.0    0.34    0.03  3.08  39.86 0.46   0.000
    [CN=76.5          ]
    [ N = 3.0:Tp 0.24]
*
    READ STORM                  30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD          0014  1  5.0    0.36    0.02  3.17  30.87 0.35   0.000
    [CN=68.4          ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                  30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD          0015  1  5.0    0.38    0.03  3.17  30.87 0.35   0.000
    [CN=68.4          ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                  30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD          0016  1  5.0    0.39    0.03  3.17  30.78 0.35   0.000
    [CN=68.3          ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                  30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD          0018  1  5.0    0.17    0.02  3.00  36.15 0.42   0.000
```

```
    [CN=73.9          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0018]   0081  1  5.0    0.17    0.02  3.08  36.14  n/a   0.000
*
    ADD [  0016+  0081]  0039  3  5.0    0.56    0.04  3.08  32.43  n/a   0.000
*
    CHANNEL[ 2:  0039]   0074  1  5.0    0.56    0.04  3.08  32.43  n/a   0.000
*
    ADD [  0015+  0074]  0040  3  5.0    0.94    0.07  3.17  31.80  n/a   0.000
*
    CHANNEL[ 2:  0040]   0075  1  5.0    0.94    0.07  3.17  31.80  n/a   0.000
*
    ADD [  0014+  0075]  0041  3  5.0    1.30    0.09  3.17  31.54  n/a   0.000
*
    CHANNEL[ 2:  0041]   0076  1  5.0    1.30    0.09  3.17  31.54  n/a   0.000
*
    ADD [  0013+  0076]  0042  3  5.0    1.64    0.12  3.17  33.27  n/a   0.000
*
    CHANNEL[ 2:  0042]   0095  1  5.0    1.64    0.12  3.17  33.26  n/a   0.000
*
    ADD [  0094+  0095]  0043  3  5.0    3.22    0.24  3.17  33.01  n/a   0.000
*
 ** Reservoir
    OUTFLOW:             0093  1  5.0    3.22    0.08  4.00  33.01  n/a   0.000
*
    ADD [  0083+  0093]  0092  3  5.0    7.80    0.25  3.58  27.63  n/a   0.000
*
    CHANNEL[ 2:  0092]   0085  1  5.0    7.80    0.25  3.58  27.63  n/a   0.000
*
    ADD [  0084+  0085]  0086  3  5.0   10.99    0.38  3.50  26.73  n/a   0.000
*
    CHANNEL[ 2:  0086]   0087  1  5.0   10.99    0.38  3.50  26.73  n/a   0.000
*
```

```
  ************************************************
  ** SIMULATION : 3. SCS II 12hr 5yr Ottawa     **
  ************************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                 30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD         0001  1  5.0    0.50    0.01  6.00  10.22 0.18   0.000
    [CN=62.5          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0001]   0068  1  5.0    0.50    0.01  6.08  10.22  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\00e1f214-ae56-47d3-be2b-e27864
```

```
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD          0002  1  5.0    0.50    0.01  6.17  10.22 0.18   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.26]
*
    ADD [  0002+  0068]  0064  3  5.0    1.00    0.02  6.08  10.22  n/a   0.000
*
    CHANNEL[ 2:  0064]   0069  1  5.0    1.00    0.02  6.17  10.22  n/a   0.000
*
    READ STORM                  30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD          0003  1  5.0    0.51    0.01  6.08  10.21 0.18   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.24]
*
    ADD [  0003+  0069]  0065  3  5.0    1.51    0.03  6.17  10.22  n/a   0.000
*
    CHANNEL[ 2:  0065]   0070  1  5.0    1.51    0.03  6.17  10.21  n/a   0.000
*
    READ STORM                  30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD          0004  1  5.0    1.68    0.02  6.33  10.18 0.18   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0004+  0070]  0066  3  5.0    3.18    0.05  6.25  10.20  n/a   0.000
*
    CHANNEL[ 2:  0066]   0084  1  5.0    3.18    0.05  6.33  10.20  n/a   0.000
*
    READ STORM                  30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD          0005  1  5.0    1.41    0.02  6.25  10.81 0.19   0.000
    [CN=63.5         ]
    [ N = 3.0:Tp 0.34]
*
    READ STORM                  30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD          0006  1  5.0    0.50    0.01  6.17  10.25 0.18   0.000
    [CN=62.5         ]
    [ N = 3.0:Tp 0.29]
*
    READ STORM                  30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\00e1f214-ae56-47d3-be2b-e27864
```

```
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD         0007  1  5.0    0.50    0.01  6.17  10.22 0.18   0.000
    [CN=62.4          ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                 30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD         0008  1  5.0    0.49    0.01  6.00  10.22 0.18   0.000
    [CN=62.5          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0008]   0071  1  5.0    0.49    0.01  6.08  10.22  n/a   0.000
*
    ADD [  0007+  0071]  0061  3  5.0    0.99    0.02  6.08  10.22  n/a   0.000
*
    CHANNEL[ 2:  0061]   0072  1  5.0    0.99    0.02  6.17  10.22  n/a   0.000
*
    ADD [  0006+  0072]  0062  3  5.0    1.49    0.03  6.17  10.23  n/a   0.000
*
    CHANNEL[ 2:  0062]   0073  1  5.0    1.49    0.03  6.17  10.23  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD         0019  1  5.0    1.68    0.02  6.42   8.71 0.15   0.000
    [CN=59.5          ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0019+  0005]  0063  3  5.0    3.09    0.04  6.33   9.66  n/a   0.000
*
    ADD [  0063+  0073]  0063  1  5.0    4.58    0.07  6.25   9.85  n/a   0.000
*
    CHANNEL[ 2:  0063]   0083  1  5.0    4.58    0.07  6.42   9.84  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD         0009  1  5.0    0.36    0.01  6.17  13.92 0.24   0.000
    [CN=68.5          ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                 30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD         0017  1  5.0    0.17    0.01  6.00  16.78 0.29   0.000
    [CN=73.9          ]
    [ N = 3.0:Tp 0.17]
*
```

```
    CHANNEL[ 2:  0017]   0080  1  5.0    0.17    0.01  6.08  16.77  n/a    0.000
*
    ADD [  0080+  0009]  0035  3  5.0    0.53    0.02  6.08  14.85  n/a    0.000
*
    CHANNEL[ 2:  0035]   0077  1  5.0    0.53    0.02  6.17  14.85  n/a    0.000
*
    READ STORM                 30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD         0010  1  5.0    0.38    0.01  6.17  13.83 0.24    0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0010+  0077]  0036  3  5.0    0.91    0.03  6.17  14.42  n/a    0.000
*
    CHANNEL[ 2:  0036]   0078  1  5.0    0.91    0.03  6.17  14.42  n/a    0.000
*
    READ STORM                 30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD         0011  1  5.0    0.38    0.01  6.17  13.83 0.24    0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0011+  0078]  0037  3  5.0    1.28    0.04  6.17  14.25  n/a    0.000
*
    CHANNEL[ 2:  0037]   0079  1  5.0    1.28    0.04  6.17  14.25  n/a    0.000
*
    READ STORM                 30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD         0012  1  5.0    0.29    0.01  6.08  17.76 0.31    0.000
    [CN=75.0         ]
    [ N = 3.0:Tp 0.22]
*
    ADD [  0012+  0079]  0038  3  5.0    1.58    0.05  6.17  14.90  n/a    0.000
*
    CHANNEL[ 2:  0038]   0094  1  5.0    1.58    0.05  6.17  14.90  n/a    0.000
*
    READ STORM                 30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD         0013  1  5.0    0.34    0.01  6.08  19.13 0.33    0.000
    [CN=76.5         ]
    [ N = 3.0:Tp 0.24]
*
    READ STORM                 30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\00e1f214-ae56-47d3-be2b-e27864
```

```
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD         0014  1  5.0    0.36    0.01  6.17  13.83 0.24   0.000
    [CN=68.4          ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                 30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD         0015  1  5.0    0.38    0.01  6.17  13.83 0.24   0.000
    [CN=68.4          ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                 30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD         0016  1  5.0    0.39    0.01  6.17  13.78 0.24   0.000
    [CN=68.3          ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                 30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD         0018  1  5.0    0.17    0.01  6.00  16.78 0.29   0.000
    [CN=73.9          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0018]   0081  1  5.0    0.17    0.01  6.08  16.78  n/a   0.000
*
    ADD [  0016+  0081]  0039  3  5.0    0.56    0.02  6.08  14.70  n/a   0.000
*
    CHANNEL[ 2:  0039]   0074  1  5.0    0.56    0.02  6.17  14.70  n/a   0.000
*
    ADD [  0015+  0074]  0040  3  5.0    0.94    0.03  6.17  14.35  n/a   0.000
*
    CHANNEL[ 2:  0040]   0075  1  5.0    0.94    0.03  6.17  14.35  n/a   0.000
*
    ADD [  0014+  0075]  0041  3  5.0    1.30    0.04  6.17  14.20  n/a   0.000
*
    CHANNEL[ 2:  0041]   0076  1  5.0    1.30    0.04  6.17  14.20  n/a   0.000
*
    ADD [  0013+  0076]  0042  3  5.0    1.64    0.05  6.17  15.22  n/a   0.000
*
    CHANNEL[ 2:  0042]   0095  1  5.0    1.64    0.05  6.17  15.22  n/a   0.000
*
    ADD [  0094+  0095]  0043  3  5.0    3.22    0.10  6.17  15.06  n/a   0.000
*
 ** Reservoir
    OUTFLOW:             0093  1  5.0    3.22    0.02  7.67  15.06  n/a   0.000
*
    ADD [  0083+  0093]  0092  3  5.0    7.80    0.07  6.42  12.00  n/a   0.000
*
    CHANNEL[ 2:  0092]   0085  1  5.0    7.80    0.07  6.42  12.00  n/a   0.000
```

```
*
    ADD [  0084+  0085]  0086  3  5.0   10.99    0.12  6.42  11.47  n/a   0.000
*
    CHANNEL[ 2:  0086]   0087  1  5.0   10.99    0.12  6.42  11.47  n/a   0.000
*
```

```
  ************************************************
  ** SIMULATION : 4. SCS II 12hr 10yr Ottawa    **
  ************************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                 30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0001  1  5.0    0.50    0.02  6.00  14.53 0.22   0.000
    [CN=62.5         ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0001]   0068  1  5.0    0.50    0.02  6.08  14.53  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0002  1  5.0    0.50    0.01  6.08  14.53 0.22   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.26]
*
    ADD [  0002+  0068]  0064  3  5.0    1.00    0.03  6.08  14.53  n/a   0.000
*
    CHANNEL[ 2:  0064]   0069  1  5.0    1.00    0.03  6.17  14.53  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0003  1  5.0    0.51    0.01  6.08  14.53 0.22   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.24]
*
    ADD [  0003+  0069]  0065  3  5.0    1.51    0.04  6.17  14.53  n/a   0.000
*
    CHANNEL[ 2:  0065]   0070  1  5.0    1.51    0.04  6.17  14.52  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
```

```
*
 ** CALIB NASHYD         0004  1  5.0    1.68    0.04  6.33  14.49 0.22   0.000
    [CN=62.4          ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0004+  0070]  0066  3  5.0    3.18    0.08  6.17  14.51  n/a   0.000
*
    CHANNEL[ 2:  0066]   0084  1  5.0    3.18    0.08  6.33  14.51  n/a   0.000
*
    READ STORM                  30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0005  1  5.0    1.41    0.04  6.25  15.28 0.23   0.000
    [CN=63.5          ]
    [ N = 3.0:Tp 0.34]
*
    READ STORM                  30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0006  1  5.0    0.50    0.01  6.17  14.58 0.22   0.000
    [CN=62.5          ]
    [ N = 3.0:Tp 0.29]
*
    READ STORM                  30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0007  1  5.0    0.50    0.01  6.17  14.53 0.22   0.000
    [CN=62.4          ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                  30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0008  1  5.0    0.49    0.02  6.00  14.53 0.22   0.000
    [CN=62.5          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0008]   0071  1  5.0    0.49    0.02  6.08  14.53  n/a   0.000
*
    ADD [  0007+  0071]  0061  3  5.0    0.99    0.03  6.08  14.53  n/a   0.000
*
    CHANNEL[ 2:  0061]   0072  1  5.0    0.99    0.03  6.17  14.53  n/a   0.000
*
    ADD [  0006+  0072]  0062  3  5.0    1.49    0.04  6.17  14.55  n/a   0.000
*
    CHANNEL[ 2:  0062]   0073  1  5.0    1.49    0.04  6.17  14.55  n/a   0.000
*
    READ STORM                  30.0
    [ Ptot= 67.20 mm ]
```

```
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0019  1  5.0    1.68    0.03  6.33  12.60 0.19   0.000
    [CN=59.5         ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0019+  0005]  0063  3  5.0    3.09    0.07  6.25  13.82  n/a   0.000
*
    ADD [  0063+  0073]  0063  1  5.0    4.58    0.11  6.25  14.06  n/a   0.000
*
    CHANNEL[ 2:  0063]   0083  1  5.0    4.58    0.10  6.33  14.05  n/a   0.000
*
    READ STORM                  30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0009  1  5.0    0.36    0.01  6.08  19.18 0.29   0.000
    [CN=68.5         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                  30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0017  1  5.0    0.17    0.01  6.00  22.82 0.34   0.000
    [CN=73.9         ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0017]   0080  1  5.0    0.17    0.01  6.08  22.80  n/a   0.000
*
    ADD [  0080+  0009]  0035  3  5.0    0.53    0.02  6.08  20.36  n/a   0.000
*
    CHANNEL[ 2:  0035]   0077  1  5.0    0.53    0.02  6.17  20.36  n/a   0.000
*
    READ STORM                  30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0010  1  5.0    0.38    0.01  6.08  19.06 0.28   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0010+  0077]  0036  3  5.0    0.91    0.04  6.17  19.82  n/a   0.000
*
    CHANNEL[ 2:  0036]   0078  1  5.0    0.91    0.04  6.17  19.82  n/a   0.000
*
    READ STORM                  30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0011  1  5.0    0.38    0.01  6.08  19.06 0.28   0.000
    [CN=68.4         ]
```

```
    [ N = 3.0:Tp 0.27]
*
    ADD [  0011+  0078]  0037  3  5.0    1.28    0.05  6.17  19.60  n/a   0.000
*
    CHANNEL[ 2:  0037]   0079  1  5.0    1.28    0.05  6.17  19.60  n/a   0.000
*
    READ STORM                30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0012  1  5.0    0.29    0.02  6.08  24.00 0.36   0.000
    [CN=75.0         ]
    [ N = 3.0:Tp 0.22]
*
    ADD [  0012+  0079]  0038  3  5.0    1.58    0.07  6.17  20.42  n/a   0.000
*
    CHANNEL[ 2:  0038]   0094  1  5.0    1.58    0.07  6.17  20.41  n/a   0.000
*
    READ STORM                30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0013  1  5.0    0.34    0.02  6.08  25.65 0.38   0.000
    [CN=76.5         ]
    [ N = 3.0:Tp 0.24]
*
    READ STORM                30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0014  1  5.0    0.36    0.01  6.08  19.06 0.28   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0015  1  5.0    0.38    0.01  6.08  19.06 0.28   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0016  1  5.0    0.39    0.01  6.08  19.00 0.28   0.000
    [CN=68.3         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                30.0
    [ Ptot= 67.20 mm ]
```

```
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0018  1  5.0    0.17    0.01  6.00  22.82 0.34   0.000
    [CN=73.9          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0018]   0081  1  5.0    0.17    0.01  6.08  22.81  n/a   0.000
*
    ADD [  0016+  0081]  0039  3  5.0    0.56    0.02  6.08  20.17  n/a   0.000
*
    CHANNEL[ 2:  0039]   0074  1  5.0    0.56    0.02  6.17  20.17  n/a   0.000
*
    ADD [  0015+  0074]  0040  3  5.0    0.94    0.04  6.17  19.73  n/a   0.000
*
    CHANNEL[ 2:  0040]   0075  1  5.0    0.94    0.04  6.17  19.73  n/a   0.000
*
    ADD [  0014+  0075]  0041  3  5.0    1.30    0.05  6.17  19.54  n/a   0.000
*
    CHANNEL[ 2:  0041]   0076  1  5.0    1.30    0.05  6.17  19.54  n/a   0.000
*
    ADD [  0013+  0076]  0042  3  5.0    1.64    0.07  6.17  20.81  n/a   0.000
*
    CHANNEL[ 2:  0042]   0095  1  5.0    1.64    0.07  6.17  20.81  n/a   0.000
*
    ADD [  0094+  0095]  0043  3  5.0    3.22    0.13  6.17  20.61  n/a   0.000
*
 ** Reservoir
    OUTFLOW:             0093  1  5.0    3.22    0.03  7.25  20.62  n/a   0.000
*
    ADD [  0083+  0093]  0092  3  5.0    7.80    0.11  6.58  16.76  n/a   0.000
*
    CHANNEL[ 2:  0092]   0085  1  5.0    7.80    0.11  6.58  16.76  n/a   0.000
*
    ADD [  0084+  0085]  0086  3  5.0   10.99    0.18  6.33  16.11  n/a   0.000
*
    CHANNEL[ 2:  0086]   0087  1  5.0   10.99    0.18  6.42  16.11  n/a   0.000
*
```

```
  ************************************************
  ** SIMULATION : 5. SCS II 12hr 100yr correct  **
  ************************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD         0001  1  5.0    0.50    0.04  6.00  29.62 0.31   0.000
    [CN=62.5          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0001]   0068  1  5.0    0.50    0.04  6.08  29.62  n/a   0.000
```

```
*
    READ STORM                  30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD          0002  1  5.0    0.50    0.03  6.08  29.63 0.31   0.000
    [CN=62.4          ]
    [ N = 3.0:Tp 0.26]
*
    ADD [  0002+  0068]  0064  3  5.0    1.00    0.07  6.08  29.63  n/a   0.000
*
    CHANNEL[ 2:  0064]   0069  1  5.0    1.00    0.07  6.08  29.63  n/a   0.000
*
    READ STORM                  30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD          0003  1  5.0    0.51    0.03  6.08  29.62 0.31   0.000
    [CN=62.4          ]
    [ N = 3.0:Tp 0.24]
*
    ADD [  0003+  0069]  0065  3  5.0    1.51    0.10  6.08  29.62  n/a   0.000
*
    CHANNEL[ 2:  0065]   0070  1  5.0    1.51    0.10  6.17  29.62  n/a   0.000
*
    READ STORM                  30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD          0004  1  5.0    1.68    0.08  6.33  29.59 0.31   0.000
    [CN=62.4          ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0004+  0070]  0066  3  5.0    3.18    0.17  6.17  29.60  n/a   0.000
*
    CHANNEL[ 2:  0066]   0084  1  5.0    3.18    0.16  6.25  29.60  n/a   0.000
*
    READ STORM                  30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD          0005  1  5.0    1.41    0.08  6.17  30.85 0.32   0.000
    [CN=63.5          ]
    [ N = 3.0:Tp 0.34]
*
    READ STORM                  30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD          0006  1  5.0    0.50    0.03  6.17  29.72 0.31   0.000
    [CN=62.5          ]
    [ N = 3.0:Tp 0.29]
```

```
*
    READ STORM                  30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD          0007  1  5.0    0.50    0.03  6.08  29.63 0.31   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                  30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD          0008  1  5.0    0.49    0.04  6.00  29.62 0.31   0.000
    [CN=62.5         ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0008]    0071  1  5.0    0.49    0.04  6.08  29.62  n/a   0.000
*
    ADD [  0007+  0071]   0061  3  5.0    0.99    0.06  6.08  29.63  n/a   0.000
*
    CHANNEL[ 2:  0061]    0072  1  5.0    0.99    0.07  6.08  29.63  n/a   0.000
*
    ADD [  0006+  0072]   0062  3  5.0    1.49    0.09  6.08  29.66  n/a   0.000
*
    CHANNEL[ 2:  0062]    0073  1  5.0    1.49    0.09  6.17  29.66  n/a   0.000
*
    READ STORM                  30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD          0019  1  5.0    1.68    0.07  6.33  26.48 0.28   0.000
    [CN=59.5         ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0019+  0005]   0063  3  5.0    3.09    0.14  6.25  28.47  n/a   0.000
*
    ADD [  0063+  0073]   0063  1  5.0    4.58    0.23  6.17  28.86  n/a   0.000
*
    CHANNEL[ 2:  0063]    0083  1  5.0    4.58    0.22  6.25  28.85  n/a   0.000
*
    READ STORM                  30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD          0009  1  5.0    0.36    0.03  6.08  36.91 0.38   0.000
    [CN=68.5         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                  30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
```

```
*
 ** CALIB NASHYD         0017  1  5.0    0.17    0.02  6.00  42.68 0.44   0.000
    [CN=73.9          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0017]   0080  1  5.0    0.17    0.02  6.08  42.67  n/a   0.000
*
    ADD [  0080+  0009]  0035  3  5.0    0.53    0.05  6.08  38.78  n/a   0.000
*
    CHANNEL[ 2:  0035]   0077  1  5.0    0.53    0.04  6.08  38.78  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD         0010  1  5.0    0.38    0.03  6.08  36.75 0.38   0.000
    [CN=68.4          ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0010+  0077]  0036  3  5.0    0.91    0.07  6.08  37.94  n/a   0.000
*
    CHANNEL[ 2:  0036]   0078  1  5.0    0.91    0.07  6.17  37.94  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD         0011  1  5.0    0.38    0.03  6.08  36.75 0.38   0.000
    [CN=68.4          ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0011+  0078]  0037  3  5.0    1.28    0.10  6.17  37.59  n/a   0.000
*
    CHANNEL[ 2:  0037]   0079  1  5.0    1.28    0.10  6.17  37.59  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD         0012  1  5.0    0.29    0.03  6.08  44.41 0.46   0.000
    [CN=75.0          ]
    [ N = 3.0:Tp 0.22]
*
    ADD [  0012+  0079]  0038  3  5.0    1.58    0.13  6.17  38.86  n/a   0.000
*
    CHANNEL[ 2:  0038]   0094  1  5.0    1.58    0.13  6.17  38.86  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD         0013  1  5.0    0.34    0.04  6.08  46.75 0.49   0.000
    [CN=76.5          ]
    [ N = 3.0:Tp 0.24]
```

```
*
    READ STORM                  30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD         0014  1  5.0    0.36    0.03  6.08  36.75 0.38   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                  30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD         0015  1  5.0    0.38    0.03  6.08  36.75 0.38   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                  30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD         0016  1  5.0    0.39    0.03  6.08  36.65 0.38   0.000
    [CN=68.3         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                  30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD         0018  1  5.0    0.17    0.02  6.00  42.68 0.44   0.000
    [CN=73.9         ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0018]   0081  1  5.0    0.17    0.02  6.08  42.67  n/a   0.000
*
    ADD [  0016+  0081]  0039  3  5.0    0.56    0.05  6.08  38.50  n/a   0.000
*
    CHANNEL[ 2:  0039]   0074  1  5.0    0.56    0.05  6.08  38.50  n/a   0.000
*
    ADD [  0015+  0074]  0040  3  5.0    0.94    0.08  6.08  37.80  n/a   0.000
*
    CHANNEL[ 2:  0040]   0075  1  5.0    0.94    0.07  6.17  37.80  n/a   0.000
*
    ADD [  0014+  0075]  0041  3  5.0    1.30    0.10  6.08  37.50  n/a   0.000
*
    CHANNEL[ 2:  0041]   0076  1  5.0    1.30    0.10  6.17  37.50  n/a   0.000
*
    ADD [  0013+  0076]  0042  3  5.0    1.64    0.14  6.17  39.42  n/a   0.000
*
    CHANNEL[ 2:  0042]   0095  1  5.0    1.64    0.14  6.17  39.42  n/a   0.000
*
    ADD [  0094+  0095]  0043  3  5.0    3.22    0.27  6.17  39.14  n/a   0.000
*
 ** Reservoir
```

```
    OUTFLOW:              0093  1  5.0     3.22    0.09  6.92  39.15  n/a    0.000
*
    ADD [  0083+  0093]   0092  3  5.0     7.80    0.27  6.42  33.10  n/a    0.000
*
    CHANNEL[ 2:  0092]    0085  1  5.0     7.80    0.27  6.42  33.10  n/a    0.000
*
    ADD [  0084+  0085]   0086  3  5.0    10.99    0.42  6.33  32.08  n/a    0.000
*
    CHANNEL[ 2:  0086]    0087  1  5.0    10.99    0.42  6.33  32.08  n/a    0.000
*
```

```
  ************************************************
  ** SIMULATION : 6. Chi 12hr 2yr                **
  ************************************************

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

      START @  0.00 hrs
      --------------------
    CHIC STORM                 10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD          0001  1  5.0     0.50    0.00  4.17   4.96 0.12   0.000
    [CN=62.5          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0001]    0068  1  5.0     0.50    0.00  4.25   4.96  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD          0002  1  5.0     0.50    0.00  4.33   4.96 0.12   0.000
    [CN=62.4          ]
    [ N = 3.0:Tp 0.26]
*
    ADD [  0002+  0068]   0064  3  5.0     1.00    0.01  4.25   4.96  n/a   0.000
*
    CHANNEL[ 2:  0064]    0069  1  5.0     1.00    0.01  4.33   4.96  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD          0003  1  5.0     0.51    0.00  4.33   4.95 0.12   0.000
    [CN=62.4          ]
    [ N = 3.0:Tp 0.24]
*
    ADD [  0003+  0069]   0065  3  5.0     1.51    0.01  4.33   4.96  n/a   0.000
*
    CHANNEL[ 2:  0065]    0070  1  5.0     1.51    0.01  4.42   4.95  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD          0004  1  5.0     1.68    0.01  4.58   4.93 0.12   0.000
    [CN=62.4          ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0004+  0070]   0066  3  5.0     3.18    0.02  4.50   4.94  n/a   0.000
*
```

```
    CHANNEL[ 2:  0066]   0084  1  5.0    3.18    0.02  4.67    4.94  n/a    0.000
*
    CHIC STORM                 10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD         0005  1  5.0    1.41    0.01  4.50    5.31 0.13    0.000
    [CN=63.5          ]
    [ N = 3.0:Tp 0.34]
*
    CHIC STORM                 10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD         0006  1  5.0    0.50    0.00  4.42    4.97 0.12    0.000
    [CN=62.5          ]
    [ N = 3.0:Tp 0.29]
*
    CHIC STORM                 10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD         0007  1  5.0    0.50    0.00  4.33    4.96 0.12    0.000
    [CN=62.4          ]
    [ N = 3.0:Tp 0.27]
*
    CHIC STORM                 10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD         0008  1  5.0    0.49    0.00  4.17    4.96 0.12    0.000
    [CN=62.5          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0008]   0071  1  5.0    0.49    0.00  4.25    4.96  n/a    0.000
*
    ADD [  0007+  0071]  0061  3  5.0    0.99    0.01  4.25    4.96  n/a    0.000
*
    CHANNEL[ 2:  0061]   0072  1  5.0    0.99    0.01  4.33    4.96  n/a    0.000
*
    ADD [  0006+  0072]  0062  3  5.0    1.49    0.01  4.33    4.96  n/a    0.000
*
    CHANNEL[ 2:  0062]   0073  1  5.0    1.49    0.01  4.42    4.96  n/a    0.000
*
    CHIC STORM                 10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD         0019  1  5.0    1.68    0.01  4.58    4.04 0.10    0.000
    [CN=59.5          ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0019+  0005]  0063  3  5.0    3.09    0.02  4.50    4.62  n/a    0.000
*
    ADD [  0063+  0073]  0063  1  5.0    4.58    0.03  4.50    4.73  n/a    0.000
*
    CHANNEL[ 2:  0063]   0083  1  5.0    4.58    0.02  4.67    4.73  n/a    0.000
*
    CHIC STORM                 10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD         0009  1  5.0    0.36    0.00  4.33    7.28 0.17    0.000
    [CN=68.5          ]
    [ N = 3.0:Tp 0.27]
*
    CHIC STORM                 10.0
    [ Ptot= 42.34 mm ]
```

```
*
 ** CALIB NASHYD          0017  1  5.0    0.17    0.00  4.17   9.00 0.21   0.000
    [CN=73.9         ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0017]    0080  1  5.0    0.17    0.00  4.25   8.99  n/a   0.000
*
    ADD [  0080+  0009]   0035  3  5.0    0.53    0.01  4.33   7.84  n/a   0.000
*
    CHANNEL[ 2:  0035]    0077  1  5.0    0.53    0.01  4.33   7.84  n/a   0.000
*
    CHIC STORM                  10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD          0010  1  5.0    0.38    0.00  4.33   7.22 0.17   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0010+  0077]   0036  3  5.0    0.91    0.01  4.33   7.58  n/a   0.000
*
    CHANNEL[ 2:  0036]    0078  1  5.0    0.91    0.01  4.33   7.58  n/a   0.000
*
    CHIC STORM                  10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD          0011  1  5.0    0.38    0.00  4.33   7.22 0.17   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0011+  0078]   0037  3  5.0    1.28    0.02  4.33   7.47  n/a   0.000
*
    CHANNEL[ 2:  0037]    0079  1  5.0    1.28    0.02  4.42   7.47  n/a   0.000
*
    CHIC STORM                  10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD          0012  1  5.0    0.29    0.01  4.25   9.65 0.23   0.000
    [CN=75.0         ]
    [ N = 3.0:Tp 0.22]
*
    ADD [  0012+  0079]   0038  3  5.0    1.58    0.02  4.33   7.88  n/a   0.000
*
    CHANNEL[ 2:  0038]    0094  1  5.0    1.58    0.02  4.42   7.87  n/a   0.000
*
    CHIC STORM                  10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD          0013  1  5.0    0.34    0.01  4.25  10.59 0.25   0.000
    [CN=76.5         ]
    [ N = 3.0:Tp 0.24]
*
    CHIC STORM                  10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD          0014  1  5.0    0.36    0.00  4.33   7.22 0.17   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    CHIC STORM                  10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD          0015  1  5.0    0.38    0.00  4.33   7.22 0.17   0.000
```

```
    [CN=68.4          ]
    [ N = 3.0:Tp 0.27]
*
    CHIC STORM                 10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD         0016  1  5.0    0.39    0.00  4.33   7.19 0.17   0.000
    [CN=68.3          ]
    [ N = 3.0:Tp 0.27]
*
    CHIC STORM                 10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD         0018  1  5.0    0.17    0.00  4.17   9.00 0.21   0.000
    [CN=73.9          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0018]   0081  1  5.0    0.17    0.00  4.25   9.00  n/a   0.000
*
    ADD [  0016+  0081]  0039  3  5.0    0.56    0.01  4.25   7.75  n/a   0.000
*
    CHANNEL[ 2:  0039]   0074  1  5.0    0.56    0.01  4.33   7.75  n/a   0.000
*
    ADD [  0015+  0074]  0040  3  5.0    0.94    0.01  4.33   7.53  n/a   0.000
*
    CHANNEL[ 2:  0040]   0075  1  5.0    0.94    0.01  4.33   7.53  n/a   0.000
*
    ADD [  0014+  0075]  0041  3  5.0    1.30    0.02  4.33   7.44  n/a   0.000
*
    CHANNEL[ 2:  0041]   0076  1  5.0    1.30    0.02  4.42   7.44  n/a   0.000
*
    ADD [  0013+  0076]  0042  3  5.0    1.64    0.02  4.33   8.09  n/a   0.000
*
    CHANNEL[ 2:  0042]   0095  1  5.0    1.64    0.02  4.42   8.09  n/a   0.000
*
    ADD [  0094+  0095]  0043  3  5.0    3.22    0.04  4.42   7.99  n/a   0.000
*
 ** Reservoir
    OUTFLOW:             0093  1  5.0    3.22    0.01  6.50   7.99  n/a   0.000
*
    ADD [  0083+  0093]  0092  3  5.0    7.80    0.03  4.75   6.07  n/a   0.000
*
    CHANNEL[ 2:  0092]   0085  1  5.0    7.80    0.03  4.75   6.07  n/a   0.000
*
    ADD [  0084+  0085]  0086  3  5.0   10.99    0.05  4.75   5.75  n/a   0.000
*
    CHANNEL[ 2:  0086]   0087  1  5.0   10.99    0.05  4.83   5.74  n/a   0.000
*
```

```
  ************************************************
  ** SIMULATION : 7. Chi 12hr 100yr             **
  ************************************************

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

      START @  0.00 hrs
      --------------------
    CHIC STORM                 10.0
    [ Ptot= 93.90 mm ]
```

```
*
 ** CALIB NASHYD         0001  1  5.0    0.50    0.04  4.17  28.41 0.30   0.000
    [CN=62.5          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0001]   0068  1  5.0    0.50    0.04  4.17  28.41  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0002  1  5.0    0.50    0.03  4.25  28.41 0.30   0.000
    [CN=62.4          ]
    [ N = 3.0:Tp 0.26]
*
    ADD [  0002+  0068]  0064  3  5.0    1.00    0.07  4.17  28.41  n/a   0.000
*
    CHANNEL[ 2:  0064]   0069  1  5.0    1.00    0.07  4.25  28.41  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0003  1  5.0    0.51    0.03  4.25  28.41 0.30   0.000
    [CN=62.4          ]
    [ N = 3.0:Tp 0.24]
*
    ADD [  0003+  0069]  0065  3  5.0    1.51    0.10  4.25  28.41  n/a   0.000
*
    CHANNEL[ 2:  0065]   0070  1  5.0    1.51    0.10  4.25  28.40  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0004  1  5.0    1.68    0.07  4.50  28.37 0.30   0.000
    [CN=62.4          ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0004+  0070]  0066  3  5.0    3.18    0.16  4.33  28.39  n/a   0.000
*
    CHANNEL[ 2:  0066]   0084  1  5.0    3.18    0.16  4.42  28.39  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0005  1  5.0    1.41    0.07  4.33  29.60 0.32   0.000
    [CN=63.5          ]
    [ N = 3.0:Tp 0.34]
*
    CHIC STORM                 10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0006  1  5.0    0.50    0.03  4.33  28.50 0.30   0.000
    [CN=62.5          ]
    [ N = 3.0:Tp 0.29]
*
    CHIC STORM                 10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0007  1  5.0    0.50    0.03  4.25  28.42 0.30   0.000
    [CN=62.4          ]
    [ N = 3.0:Tp 0.27]
*
    CHIC STORM                 10.0
```

```
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0008  1  5.0    0.49    0.04  4.17  28.41 0.30   0.000
    [CN=62.5          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0008]   0071  1  5.0    0.49    0.04  4.17  28.41  n/a   0.000
*
    ADD [  0007+  0071]  0061  3  5.0    0.99    0.06  4.17  28.41  n/a   0.000
*
    CHANNEL[ 2:  0061]   0072  1  5.0    0.99    0.07  4.25  28.41  n/a   0.000
*
    ADD [  0006+  0072]  0062  3  5.0    1.49    0.09  4.25  28.44  n/a   0.000
*
    CHANNEL[ 2:  0062]   0073  1  5.0    1.49    0.09  4.25  28.44  n/a   0.000
*
    CHIC STORM                  10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0019  1  5.0    1.68    0.06  4.50  25.36 0.27   0.000
    [CN=59.5          ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0019+  0005]  0063  3  5.0    3.09    0.14  4.42  27.29  n/a   0.000
*
    ADD [  0063+  0073]  0063  1  5.0    4.58    0.22  4.33  27.67  n/a   0.000
*
    CHANNEL[ 2:  0063]   0083  1  5.0    4.58    0.21  4.50  27.66  n/a   0.000
*
    CHIC STORM                  10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0009  1  5.0    0.36    0.03  4.25  35.51 0.38   0.000
    [CN=68.5          ]
    [ N = 3.0:Tp 0.27]
*
    CHIC STORM                  10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0017  1  5.0    0.17    0.02  4.08  41.13 0.44   0.000
    [CN=73.9          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0017]   0080  1  5.0    0.17    0.02  4.17  41.12  n/a   0.000
*
    ADD [  0080+  0009]  0035  3  5.0    0.53    0.05  4.25  37.34  n/a   0.000
*
    CHANNEL[ 2:  0035]   0077  1  5.0    0.53    0.05  4.25  37.34  n/a   0.000
*
    CHIC STORM                  10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0010  1  5.0    0.38    0.03  4.25  35.35 0.38   0.000
    [CN=68.4          ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0010+  0077]  0036  3  5.0    0.91    0.08  4.25  36.52  n/a   0.000
*
    CHANNEL[ 2:  0036]   0078  1  5.0    0.91    0.08  4.25  36.51  n/a   0.000
*
    CHIC STORM                  10.0
    [ Ptot= 93.90 mm ]
```

```
*
 ** CALIB NASHYD         0011  1  5.0    0.38    0.03  4.25  35.35 0.38   0.000
    [CN=68.4          ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0011+  0078]  0037  3  5.0    1.28    0.11  4.25  36.17  n/a   0.000
*
    CHANNEL[ 2:  0037]   0079  1  5.0    1.28    0.11  4.25  36.17  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0012  1  5.0    0.29    0.03  4.17  42.83 0.46   0.000
    [CN=75.0          ]
    [ N = 3.0:Tp 0.22]
*
    ADD [  0012+  0079]  0038  3  5.0    1.58    0.14  4.25  37.41  n/a   0.000
*
    CHANNEL[ 2:  0038]   0094  1  5.0    1.58    0.13  4.25  37.41  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0013  1  5.0    0.34    0.04  4.17  45.12 0.48   0.000
    [CN=76.5          ]
    [ N = 3.0:Tp 0.24]
*
    CHIC STORM                 10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0014  1  5.0    0.36    0.03  4.25  35.35 0.38   0.000
    [CN=68.4          ]
    [ N = 3.0:Tp 0.27]
*
    CHIC STORM                 10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0015  1  5.0    0.38    0.03  4.25  35.35 0.38   0.000
    [CN=68.4          ]
    [ N = 3.0:Tp 0.27]
*
    CHIC STORM                 10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0016  1  5.0    0.39    0.03  4.25  35.26 0.38   0.000
    [CN=68.3          ]
    [ N = 3.0:Tp 0.27]
*
    CHIC STORM                 10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0018  1  5.0    0.17    0.02  4.08  41.13 0.44   0.000
    [CN=73.9          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0018]   0081  1  5.0    0.17    0.02  4.17  41.13  n/a   0.000
*
    ADD [  0016+  0081]  0039  3  5.0    0.56    0.05  4.17  37.06  n/a   0.000
*
    CHANNEL[ 2:  0039]   0074  1  5.0    0.56    0.05  4.25  37.06  n/a   0.000
*
    ADD [  0015+  0074]  0040  3  5.0    0.94    0.08  4.25  36.38  n/a   0.000
```

```
*
    CHANNEL[ 2:  0040]   0075  1  5.0    0.94    0.08  4.25  36.38  n/a   0.000
*
    ADD [  0014+  0075]  0041  3  5.0    1.30    0.11  4.25  36.09  n/a   0.000
*
    CHANNEL[ 2:  0041]   0076  1  5.0    1.30    0.11  4.25  36.09  n/a   0.000
*
    ADD [  0013+  0076]  0042  3  5.0    1.64    0.14  4.25  37.96  n/a   0.000
*
    CHANNEL[ 2:  0042]   0095  1  5.0    1.64    0.14  4.25  37.96  n/a   0.000
*
    ADD [  0094+  0095]  0043  3  5.0    3.22    0.28  4.25  37.69  n/a   0.000
*
 ** Reservoir
    OUTFLOW:             0093  1  5.0    3.22    0.08  5.08  37.70  n/a   0.000
*
    ADD [  0083+  0093]  0092  3  5.0    7.80    0.25  4.58  31.80  n/a   0.000
*
    CHANNEL[ 2:  0092]   0085  1  5.0    7.80    0.25  4.58  31.80  n/a   0.000
*
    ADD [  0084+  0085]  0086  3  5.0   10.99    0.40  4.50  30.81  n/a   0.000
*
    CHANNEL[ 2:  0086]   0087  1  5.0   10.99    0.40  4.50  30.81  n/a   0.000
*
```

```
  ************************************************
  ** SIMULATION : 8. Historical July 1 1979     **
  ************************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                  5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0001  1  5.0    0.50    0.04  1.67  22.90 0.27   0.000
    [CN=62.5         ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0001]   0068  1  5.0    0.50    0.04  1.67  22.90  n/a   0.000
*
    READ STORM                  5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0002  1  5.0    0.50    0.04  1.75  22.90 0.27   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.26]
*
    ADD [  0002+  0068]  0064  3  5.0    1.00    0.08  1.75  22.90  n/a   0.000
*
    CHANNEL[ 2:  0064]   0069  1  5.0    1.00    0.08  1.75  22.90  n/a   0.000
*
```

```
    READ STORM                   5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0003  1  5.0    0.51    0.04  1.75  22.90 0.27   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.24]
*
    ADD [  0003+  0069]  0065  3  5.0    1.51    0.11  1.75  22.90  n/a   0.000
*
    CHANNEL[ 2:  0065]   0070  1  5.0    1.51    0.11  1.75  22.90  n/a   0.000
*
    READ STORM                   5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0004  1  5.0    1.68    0.10  2.00  22.86 0.27   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0004+  0070]  0066  3  5.0    3.18    0.20  1.83  22.88  n/a   0.000
*
    CHANNEL[ 2:  0066]   0084  1  5.0    3.18    0.20  1.92  22.88  n/a   0.000
*
    READ STORM                   5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0005  1  5.0    1.41    0.09  1.83  23.93 0.28   0.000
    [CN=63.5         ]
    [ N = 3.0:Tp 0.34]
*
    READ STORM                   5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0006  1  5.0    0.50    0.03  1.83  22.98 0.27   0.000
    [CN=62.5         ]
    [ N = 3.0:Tp 0.29]
*
    READ STORM                   5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0007  1  5.0    0.50    0.04  1.75  22.91 0.27   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                   5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\d7f4048b-1af6-49f3-b4b8-e4e455
```

```
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0008  1  5.0    0.49    0.04  1.67  22.90 0.27   0.000
    [CN=62.5         ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0008]   0071  1  5.0    0.49    0.04  1.67  22.90  n/a   0.000
*
    ADD [  0007+  0071]  0061  3  5.0    0.99    0.08  1.75  22.91  n/a   0.000
*
    CHANNEL[ 2:  0061]   0072  1  5.0    0.99    0.08  1.75  22.91  n/a   0.000
*
    ADD [  0006+  0072]  0062  3  5.0    1.49    0.11  1.75  22.93  n/a   0.000
*
    CHANNEL[ 2:  0062]   0073  1  5.0    1.49    0.11  1.75  22.93  n/a   0.000
*
    READ STORM                    5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0019  1  5.0    1.68    0.09  2.00  20.26 0.24   0.000
    [CN=59.5         ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0019+  0005]  0063  3  5.0    3.09    0.18  1.92  21.94  n/a   0.000
*
    ADD [  0063+  0073]  0063  1  5.0    4.58    0.28  1.83  22.26  n/a   0.000
*
    CHANNEL[ 2:  0063]   0083  1  5.0    4.58    0.27  1.92  22.25  n/a   0.000
*
    READ STORM                    5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0009  1  5.0    0.36    0.03  1.75  29.11 0.35   0.000
    [CN=68.5         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                    5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0017  1  5.0    0.17    0.02  1.67  34.02 0.41   0.000
    [CN=73.9         ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0017]   0080  1  5.0    0.17    0.02  1.67  34.01  n/a   0.000
*
    ADD [  0080+  0009]  0035  3  5.0    0.53    0.05  1.75  30.70  n/a   0.000
*
    CHANNEL[ 2:  0035]   0077  1  5.0    0.53    0.05  1.75  30.70  n/a   0.000
*
    READ STORM                    5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\d7f4048b-1af6-49f3-b4b8-e4e455
```

```
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0010  1  5.0    0.38    0.03  1.75  28.97 0.34   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0010+  0077]  0036  3  5.0    0.91    0.09  1.75  29.98  n/a   0.000
*
    CHANNEL[ 2:  0036]   0078  1  5.0    0.91    0.09  1.75  29.98  n/a   0.000
*
    READ STORM                  5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0011  1  5.0    0.38    0.03  1.75  28.97 0.34   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0011+  0078]  0037  3  5.0    1.28    0.12  1.75  29.68  n/a   0.000
*
    CHANNEL[ 2:  0037]   0079  1  5.0    1.28    0.12  1.83  29.68  n/a   0.000
*
    READ STORM                  5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0012  1  5.0    0.29    0.03  1.67  35.53 0.42   0.000
    [CN=75.0         ]
    [ N = 3.0:Tp 0.22]
*
    ADD [  0012+  0079]  0038  3  5.0    1.58    0.15  1.75  30.77  n/a   0.000
*
    CHANNEL[ 2:  0038]   0094  1  5.0    1.58    0.15  1.83  30.77  n/a   0.000
*
    READ STORM                  5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0013  1  5.0    0.34    0.04  1.75  37.60 0.45   0.000
    [CN=76.5         ]
    [ N = 3.0:Tp 0.24]
*
    READ STORM                  5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0014  1  5.0    0.36    0.03  1.75  28.97 0.34   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                  5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\d7f4048b-1af6-49f3-b4b8-e4e455
```

```
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0015  1  5.0    0.38    0.03  1.75  28.97 0.34   0.000
    [CN=68.4          ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                  5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0016  1  5.0    0.39    0.03  1.75  28.89 0.34   0.000
    [CN=68.3          ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                  5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0018  1  5.0    0.17    0.02  1.67  34.02 0.41   0.000
    [CN=73.9          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0018]   0081  1  5.0    0.17    0.02  1.67  34.02  n/a   0.000
*
    ADD [  0016+  0081]  0039  3  5.0    0.56    0.05  1.75  30.46  n/a   0.000
*
    CHANNEL[ 2:  0039]   0074  1  5.0    0.56    0.05  1.75  30.46  n/a   0.000
*
    ADD [  0015+  0074]  0040  3  5.0    0.94    0.09  1.75  29.86  n/a   0.000
*
    CHANNEL[ 2:  0040]   0075  1  5.0    0.94    0.09  1.75  29.86  n/a   0.000
*
    ADD [  0014+  0075]  0041  3  5.0    1.30    0.12  1.75  29.61  n/a   0.000
*
    CHANNEL[ 2:  0041]   0076  1  5.0    1.30    0.12  1.75  29.61  n/a   0.000
*
    ADD [  0013+  0076]  0042  3  5.0    1.64    0.16  1.75  31.27  n/a   0.000
*
    CHANNEL[ 2:  0042]   0095  1  5.0    1.64    0.16  1.75  31.27  n/a   0.000
*
    ADD [  0094+  0095]  0043  3  5.0    3.22    0.31  1.83  31.02  n/a   0.000
*
 ** Reservoir
    OUTFLOW:             0093  1  5.0    3.22    0.12  2.33  31.03  n/a   0.000
*
    ADD [  0083+  0093]  0092  3  5.0    7.80    0.35  2.08  25.87  n/a   0.000
*
    CHANNEL[ 2:  0092]   0085  1  5.0    7.80    0.35  2.08  25.87  n/a   0.000
*
    ADD [  0084+  0085]  0086  3  5.0   10.99    0.54  2.00  25.00  n/a   0.000
*
    CHANNEL[ 2:  0086]   0087  1  5.0   10.99    0.53  2.08  25.00  n/a   0.000
*
```

```
  ************************************************
  ** SIMULATION : 9. Historical Aug 4 1988      **
  ************************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                  5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0001  1  5.0    0.50    0.04  2.08  21.10 0.26   0.000
    [CN=62.5         ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0001]   0068  1  5.0    0.50    0.04  2.08  21.10  n/a   0.000
*
    READ STORM                  5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0002  1  5.0    0.50    0.03  2.08  21.09 0.26   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.26]
*
    ADD [  0002+  0068]  0064  3  5.0    1.00    0.08  2.08  21.09  n/a   0.000
*
    CHANNEL[ 2:  0064]   0069  1  5.0    1.00    0.07  2.17  21.09  n/a   0.000
*
    READ STORM                  5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0003  1  5.0    0.51    0.04  2.08  21.09 0.26   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.24]
*
    ADD [  0003+  0069]  0065  3  5.0    1.51    0.11  2.08  21.09  n/a   0.000
*
    CHANNEL[ 2:  0065]   0070  1  5.0    1.51    0.11  2.17  21.09  n/a   0.000
*
    READ STORM                  5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0004  1  5.0    1.68    0.08  2.25  21.05 0.26   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0004+  0070]  0066  3  5.0    3.18    0.19  2.17  21.07  n/a   0.000
*
```

```
    CHANNEL[ 2:  0066]   0084  1  5.0    3.18    0.18  2.25  21.07  n/a   0.000
*
    READ STORM                   5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0005  1  5.0    1.41    0.08  2.17  22.07 0.27   0.000
    [CN=63.5         ]
    [ N = 3.0:Tp 0.34]
*
    READ STORM                   5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0006  1  5.0    0.50    0.03  2.17  21.16 0.26   0.000
    [CN=62.5         ]
    [ N = 3.0:Tp 0.29]
*
    READ STORM                   5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0007  1  5.0    0.50    0.03  2.08  21.10 0.26   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                   5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0008  1  5.0    0.49    0.04  2.08  21.10 0.26   0.000
    [CN=62.5         ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0008]   0071  1  5.0    0.49    0.04  2.08  21.10  n/a   0.000
*
    ADD [  0007+  0071]  0061  3  5.0    0.99    0.07  2.08  21.10  n/a   0.000
*
    CHANNEL[ 2:  0061]   0072  1  5.0    0.99    0.07  2.17  21.10  n/a   0.000
*
    ADD [  0006+  0072]  0062  3  5.0    1.49    0.10  2.17  21.12  n/a   0.000
*
    CHANNEL[ 2:  0062]   0073  1  5.0    1.49    0.11  2.17  21.12  n/a   0.000
*
    READ STORM                   5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0019  1  5.0    1.68    0.07  2.25  18.60 0.23   0.000
    [CN=59.5         ]
    [ N = 3.0:Tp 0.41]
*
```

```
    ADD [  0019+  0005]  0063  3  5.0    3.09    0.15  2.17  20.18  n/a   0.000
*
    ADD [  0063+  0073]  0063  1  5.0    4.58    0.26  2.17  20.49  n/a   0.000
*
    CHANNEL[ 2:  0063]   0083  1  5.0    4.58    0.24  2.25  20.48  n/a   0.000
*
    READ STORM                  5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0009  1  5.0    0.36    0.03  2.08  26.99 0.33   0.000
    [CN=68.5         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                  5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0017  1  5.0    0.17    0.02  2.08  31.64 0.39   0.000
    [CN=73.9         ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0017]   0080  1  5.0    0.17    0.02  2.08  31.63  n/a   0.000
*
    ADD [  0080+  0009]  0035  3  5.0    0.53    0.05  2.08  28.50  n/a   0.000
*
    CHANNEL[ 2:  0035]   0077  1  5.0    0.53    0.05  2.17  28.50  n/a   0.000
*
    READ STORM                  5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0010  1  5.0    0.38    0.03  2.08  26.85 0.33   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0010+  0077]  0036  3  5.0    0.91    0.08  2.17  27.81  n/a   0.000
*
    CHANNEL[ 2:  0036]   0078  1  5.0    0.91    0.08  2.17  27.81  n/a   0.000
*
    READ STORM                  5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0011  1  5.0    0.38    0.03  2.08  26.85 0.33   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0011+  0078]  0037  3  5.0    1.28    0.11  2.17  27.53  n/a   0.000
*
    CHANNEL[ 2:  0037]   0079  1  5.0    1.28    0.11  2.17  27.53  n/a   0.000
*
    READ STORM                  5.0
    [ Ptot= 80.57 mm ]
```

```
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0012  1  5.0    0.29    0.03  2.08  33.09 0.41   0.000
    [CN=75.0          ]
    [ N = 3.0:Tp 0.22]
*
    ADD [  0012+  0079]  0038  3  5.0    1.58    0.14  2.17  28.57  n/a   0.000
*
    CHANNEL[ 2:  0038]   0094  1  5.0    1.58    0.14  2.17  28.56  n/a   0.000
*
    READ STORM                    5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0013  1  5.0    0.34    0.04  2.08  35.08 0.44   0.000
    [CN=76.5          ]
    [ N = 3.0:Tp 0.24]
*
    READ STORM                    5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0014  1  5.0    0.36    0.03  2.08  26.85 0.33   0.000
    [CN=68.4          ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                    5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0015  1  5.0    0.38    0.03  2.08  26.85 0.33   0.000
    [CN=68.4          ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                    5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0016  1  5.0    0.39    0.03  2.08  26.77 0.33   0.000
    [CN=68.3          ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                    5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\7d28006c-2085-4ba7-a58e-
8f382e95f013\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0018  1  5.0    0.17    0.02  2.08  31.64 0.39   0.000
    [CN=73.9          ]
    [ N = 3.0:Tp 0.17]
*
```

```
    CHANNEL[ 2:  0018]   0081  1  5.0    0.17     0.02  2.08  31.64  n/a    0.000
*
    ADD [  0016+  0081]  0039  3  5.0    0.56     0.05  2.08  28.27  n/a    0.000
*
    CHANNEL[ 2:  0039]   0074  1  5.0    0.56     0.05  2.17  28.27  n/a    0.000
*
    ADD [  0015+  0074]  0040  3  5.0    0.94     0.08  2.17  27.70  n/a    0.000
*
    CHANNEL[ 2:  0040]   0075  1  5.0    0.94     0.08  2.17  27.70  n/a    0.000
*
    ADD [  0014+  0075]  0041  3  5.0    1.30     0.11  2.17  27.46  n/a    0.000
*
    CHANNEL[ 2:  0041]   0076  1  5.0    1.30     0.11  2.17  27.46  n/a    0.000
*
    ADD [  0013+  0076]  0042  3  5.0    1.64     0.15  2.17  29.04  n/a    0.000
*
    CHANNEL[ 2:  0042]   0095  1  5.0    1.64     0.15  2.17  29.04  n/a    0.000
*
    ADD [  0094+  0095]  0043  3  5.0    3.22     0.29  2.17  28.80  n/a    0.000
*
 ** Reservoir
    OUTFLOW:             0093  1  5.0    3.22     0.08  2.58  28.80  n/a    0.000
*
    ADD [  0083+  0093]  0092  3  5.0    7.80     0.29  2.33  23.91  n/a    0.000
*
    CHANNEL[ 2:  0092]   0085  1  5.0    7.80     0.29  2.33  23.91  n/a    0.000
*
    ADD [  0084+  0085]  0086  3  5.0   10.99     0.46  2.25  23.09  n/a    0.000
*
    CHANNEL[ 2:  0086]   0087  1  5.0   10.99     0.46  2.33  23.09  n/a    0.000
*
```

```
*****************************************
** SIMULATION:1. SCS II 6hr 5yr Ottawa **
*****************************************

--------------------
| ADD HYD  (  0086)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0084):     3.18   0.041     3.50     7.61
      + ID2= 2 (  0085):     7.80   0.063     3.58     9.10
        ===================================================
        ID = 3 (  0086):    10.99   0.103     3.58     8.67

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
***********************************
** SIMULATION:10. 25mm4hrChicago **
***********************************

--------------------
| ADD HYD  (  0086)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0084):     3.18   0.004     2.83     0.98
      + ID2= 2 (  0085):     7.80   0.008     3.42     1.40
        ===================================================
        ID = 3 (  0086):    10.99   0.012     3.17     1.28

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
***********************************************
** SIMULATION:100 year 12 hr Chi 120 percent **
***********************************************

--------------------
| ADD HYD  (  0086)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0084):     3.18   0.235     4.42    39.77
      + ID2= 2 (  0085):     7.80   0.390     4.58    43.93
        ===================================================
        ID = 3 (  0086):    10.99   0.605     4.50    42.72

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
*******************************************
** SIMULATION:2. SCS II 6hr 100yr Ottawa **
*******************************************

--------------------
| ADD HYD  (  0086)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0084):     3.18   0.146     3.33    24.51
      + ID2= 2 (  0085):     7.80   0.248     3.58    27.63
        ===================================================
        ID = 3 (  0086):    10.99   0.380     3.50    26.73

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

```
******************************************
** SIMULATION:3. SCS II 12hr 5yr Ottawa **
******************************************

--------------------
| ADD HYD  (  0086)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0084):     3.18   0.050     6.33    10.20
      + ID2= 2 (  0085):     7.80   0.073     6.42    12.00
        ===================================================
        ID = 3 (  0086):    10.99   0.122     6.42    11.47

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
*******************************************
** SIMULATION:4. SCS II 12hr 10yr Ottawa **
*******************************************

--------------------
| ADD HYD  (  0086)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0084):     3.18   0.075     6.33    14.51
      + ID2= 2 (  0085):     7.80   0.109     6.58    16.76
        ===================================================
        ID = 3 (  0086):    10.99   0.182     6.33    16.11

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
*********************************************
** SIMULATION:5. SCS II 12hr 100yr correct **
*********************************************

--------------------
| ADD HYD  (  0086)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0084):     3.18   0.164     6.25    29.60
      + ID2= 2 (  0085):     7.80   0.268     6.42    33.10
        ===================================================
        ID = 3 (  0086):    10.99   0.422     6.33    32.08

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
************************************
** SIMULATION:6. Chi 12hr 2yr     **
************************************

--------------------
| ADD HYD  (  0086)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0084):     3.18   0.018     4.67     4.94
      + ID2= 2 (  0085):     7.80   0.030     4.75     6.07
        ===================================================
        ID = 3 (  0086):    10.99   0.048     4.75     5.75

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

```
************************************
** SIMULATION:7. Chi 12hr 100yr    **
************************************

--------------------
| ADD HYD  (  0086)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0084):      3.18   0.160     4.42    28.39
      + ID2= 2 (  0085):      7.80   0.252     4.58    31.80
        ====================================================
        ID = 3 (  0086):     10.99   0.403     4.50    30.81

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
******************************************
** SIMULATION:8. Historical July 1 1979 **
******************************************

--------------------
| ADD HYD  (  0086)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0084):      3.18   0.199     1.92    22.88
      + ID2= 2 (  0085):      7.80   0.350     2.08    25.87
        ====================================================
        ID = 3 (  0086):     10.99   0.535     2.00    25.00

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
*****************************************
** SIMULATION:9. Historical Aug 4 1988 **
*****************************************

--------------------
| ADD HYD  (  0086)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0084):      3.18   0.181     2.25    21.07
      + ID2= 2 (  0085):      7.80   0.289     2.33    23.91
        ====================================================
        ID = 3 (  0086):     10.99   0.462     2.25    23.09

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

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

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

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

  ************************************************
  ** SIMULATION : 1. SCS II 6hr 5yr Ottawa      **
  ************************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                  30.0
    [ Ptot= 50.41 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\efd79b53-4367-4bd5-a2ba-ef6554
    remark: SCS II 6hr 5yr Ottawa
*
 ** CALIB NASHYD         0001  1  5.0    0.50    0.01  3.08   7.63 0.15   0.000
    [CN=62.5         ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0001]   0068  1  5.0    0.50    0.01  3.08   7.63  n/a   0.000
*
    READ STORM                  30.0
    [ Ptot= 50.41 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\efd79b53-4367-4bd5-a2ba-ef6554
    remark: SCS II 6hr 5yr Ottawa
*
 ** CALIB NASHYD         0002  1  5.0    0.50    0.01  3.17   7.63 0.15   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.26]
*
    ADD [  0002+  0068]  0064  3  5.0    1.00    0.02  3.17   7.63  n/a   0.000
*
    CHANNEL[ 2:  0064]   0069  1  5.0    1.00    0.02  3.17   7.63  n/a   0.000
*
    READ STORM                  30.0
    [ Ptot= 50.41 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\efd79b53-4367-4bd5-a2ba-ef6554
    remark: SCS II 6hr 5yr Ottawa
*
 ** CALIB NASHYD         0003  1  5.0    0.51    0.01  3.17   7.63 0.15   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.24]
*
    ADD [  0003+  0069]  0065  3  5.0    1.51    0.02  3.17   7.63  n/a   0.000
```

```
*
    CHANNEL[ 2:  0065]   0070  1  5.0    1.51    0.02  3.25    7.62  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 50.41 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\efd79b53-4367-4bd5-a2ba-ef6554
    remark: SCS II 6hr 5yr Ottawa
*
 ** CALIB NASHYD         0004  1  5.0    1.68    0.02  3.50    7.60 0.15   0.000
    [CN=62.4          ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0004+  0070]  0066  3  5.0    3.18    0.04  3.33    7.61  n/a   0.000
*
    CHANNEL[ 2:  0066]   0084  1  5.0    3.18    0.04  3.50    7.61  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 50.41 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\efd79b53-4367-4bd5-a2ba-ef6554
    remark: SCS II 6hr 5yr Ottawa
*
 ** CALIB NASHYD         0005  1  5.0    1.41    0.02  3.33    8.11 0.16   0.000
    [CN=63.5          ]
    [ N = 3.0:Tp 0.34]
*
    READ STORM                 30.0
    [ Ptot= 50.41 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\efd79b53-4367-4bd5-a2ba-ef6554
    remark: SCS II 6hr 5yr Ottawa
*
 ** CALIB NASHYD         0006  1  5.0    0.50    0.01  3.25    7.66 0.15   0.000
    [CN=62.5          ]
    [ N = 3.0:Tp 0.29]
*
    READ STORM                 30.0
    [ Ptot= 50.41 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\efd79b53-4367-4bd5-a2ba-ef6554
    remark: SCS II 6hr 5yr Ottawa
*
 ** CALIB NASHYD         0007  1  5.0    0.50    0.01  3.25    7.63 0.15   0.000
    [CN=62.4          ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                 30.0
    [ Ptot= 50.41 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\efd79b53-4367-4bd5-a2ba-ef6554
    remark: SCS II 6hr 5yr Ottawa
*
 ** CALIB NASHYD         0008  1  5.0    0.49    0.01  3.08    7.63 0.15   0.000
    [CN=62.5          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0008]   0071  1  5.0    0.49    0.01  3.08    7.63  n/a   0.000
*
    ADD [  0007+  0071]  0061  3  5.0    0.99    0.02  3.17    7.63  n/a   0.000
*
    CHANNEL[ 2:  0061]   0072  1  5.0    0.99    0.02  3.17    7.63  n/a   0.000
```

```
*
    ADD [  0006+  0072]  0062  3  5.0    1.49    0.02  3.17   7.64  n/a   0.000
*
    CHANNEL[ 2:  0062]   0073  1  5.0    1.49    0.02  3.25   7.64  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 50.41 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\efd79b53-4367-4bd5-a2ba-ef6554
    remark: SCS II 6hr 5yr Ottawa
*
 ** CALIB NASHYD         0019  1  5.0    1.68    0.02  3.58   6.40 0.13   0.000
    [CN=59.5         ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0019+  0005]  0063  3  5.0    3.09    0.04  3.50   7.18  n/a   0.000
*
    ADD [  0063+  0073]  0063  1  5.0    4.58    0.06  3.33   7.33  n/a   0.000
*
    CHANNEL[ 2:  0063]   0083  1  5.0    4.58    0.05  3.58   7.32  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 50.41 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\efd79b53-4367-4bd5-a2ba-ef6554
    remark: SCS II 6hr 5yr Ottawa
*
 ** CALIB NASHYD         0009  1  5.0    0.36    0.01  3.17  10.69 0.21   0.000
    [CN=68.5         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                 30.0
    [ Ptot= 50.41 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\efd79b53-4367-4bd5-a2ba-ef6554
    remark: SCS II 6hr 5yr Ottawa
*
 ** CALIB NASHYD         0017  1  5.0    0.17    0.01  3.08  13.03 0.26   0.000
    [CN=73.9         ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0017]   0080  1  5.0    0.17    0.01  3.17  13.02  n/a   0.000
*
    ADD [  0080+  0009]  0035  3  5.0    0.53    0.01  3.17  11.45  n/a   0.000
*
    CHANNEL[ 2:  0035]   0077  1  5.0    0.53    0.01  3.17  11.45  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 50.41 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\efd79b53-4367-4bd5-a2ba-ef6554
    remark: SCS II 6hr 5yr Ottawa
*
 ** CALIB NASHYD         0010  1  5.0    0.38    0.01  3.17  10.61 0.21   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0010+  0077]  0036  3  5.0    0.91    0.02  3.17  11.10  n/a   0.000
*
    CHANNEL[ 2:  0036]   0078  1  5.0    0.91    0.02  3.25  11.10  n/a   0.000
*
    READ STORM                 30.0
```

```
    [ Ptot= 50.41 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\efd79b53-4367-4bd5-a2ba-ef6554
    remark: SCS II 6hr 5yr Ottawa
*
 ** CALIB NASHYD         0011  1  5.0    0.38    0.01  3.17  10.61 0.21   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0011+  0078]  0037  3  5.0    1.28    0.03  3.25  10.96  n/a   0.000
*
    CHANNEL[ 2:  0037]   0079  1  5.0    1.28    0.03  3.25  10.96  n/a   0.000
*
    READ STORM                  30.0
    [ Ptot= 50.41 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\efd79b53-4367-4bd5-a2ba-ef6554
    remark: SCS II 6hr 5yr Ottawa
*
 ** CALIB NASHYD         0012  1  5.0    0.29    0.01  3.08  13.86 0.27   0.000
    [CN=75.0         ]
    [ N = 3.0:Tp 0.22]
*
    ADD [  0012+  0079]  0038  3  5.0    1.58    0.04  3.25  11.50  n/a   0.000
*
    CHANNEL[ 2:  0038]   0094  1  5.0    1.58    0.04  3.25  11.49  n/a   0.000
*
    READ STORM                  30.0
    [ Ptot= 50.41 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\efd79b53-4367-4bd5-a2ba-ef6554
    remark: SCS II 6hr 5yr Ottawa
*
 ** CALIB NASHYD         0013  1  5.0    0.34    0.01  3.08  15.03 0.30   0.000
    [CN=76.5         ]
    [ N = 3.0:Tp 0.24]
*
    READ STORM                  30.0
    [ Ptot= 50.41 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\efd79b53-4367-4bd5-a2ba-ef6554
    remark: SCS II 6hr 5yr Ottawa
*
 ** CALIB NASHYD         0014  1  5.0    0.36    0.01  3.17  10.61 0.21   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                  30.0
    [ Ptot= 50.41 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\efd79b53-4367-4bd5-a2ba-ef6554
    remark: SCS II 6hr 5yr Ottawa
*
 ** CALIB NASHYD         0015  1  5.0    0.38    0.01  3.17  10.61 0.21   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                  30.0
    [ Ptot= 50.41 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\efd79b53-4367-4bd5-a2ba-ef6554
    remark: SCS II 6hr 5yr Ottawa
```

```
*
 ** CALIB NASHYD         0016  1  5.0    0.39    0.01  3.17  10.58 0.21   0.000
    [CN=68.3          ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                 30.0
    [ Ptot= 50.41 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\efd79b53-4367-4bd5-a2ba-ef6554
    remark: SCS II 6hr 5yr Ottawa
*
 ** CALIB NASHYD         0018  1  5.0    0.17    0.01  3.08  13.03 0.26   0.000
    [CN=73.9          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0018]   0081  1  5.0    0.17    0.01  3.08  13.03  n/a   0.000
*
    ADD [  0016+  0081]  0039  3  5.0    0.56    0.01  3.17  11.33  n/a   0.000
*
    CHANNEL[ 2:  0039]   0074  1  5.0    0.56    0.01  3.17  11.33  n/a   0.000
*
    ADD [  0015+  0074]  0040  3  5.0    0.94    0.02  3.17  11.04  n/a   0.000
*
    CHANNEL[ 2:  0040]   0075  1  5.0    0.94    0.02  3.17  11.04  n/a   0.000
*
    ADD [  0014+  0075]  0041  3  5.0    1.30    0.03  3.17  10.92  n/a   0.000
*
    CHANNEL[ 2:  0041]   0076  1  5.0    1.30    0.03  3.25  10.92  n/a   0.000
*
    ADD [  0013+  0076]  0042  3  5.0    1.64    0.04  3.17  11.77  n/a   0.000
*
    CHANNEL[ 2:  0042]   0095  1  5.0    1.64    0.04  3.25  11.77  n/a   0.000
*
    ADD [  0094+  0095]  0043  3  5.0    3.22    0.08  3.25  11.64  n/a   0.000
*
 ** Reservoir
    OUTFLOW:             0093  1  5.0    3.22    0.01  5.92   6.58  n/a   0.000
*
    ADD [  0083+  0093]  0092  3  5.0    7.80    0.06  3.67   7.01  n/a   0.000
*
    CHANNEL[ 2:  0092]   0085  1  5.0    7.80    0.06  3.67   7.01  n/a   0.000
*
    ADD [  0084+  0085]  0086  3  5.0   10.99    0.10  3.58   7.19  n/a   0.000
*
    CHANNEL[ 2:  0086]   0087  1  5.0   10.99    0.10  3.58   7.18  n/a   0.000
*
```

```
  ************************************************
  ** SIMULATION : 10. 25mm4hrChicago            **
  ************************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                 10.0
    [ Ptot= 25.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\f1a0f5d7-8021-40d9-8279-55016d
```

```
    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD         0001  1  5.0    0.50    0.00  2.00    0.99 0.04   0.000
    [CN=62.5         ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0001]   0068  1  5.0    0.50    0.00  2.08    0.99  n/a   0.000
*
    READ STORM                 10.0
    [ Ptot= 25.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\f1a0f5d7-8021-40d9-8279-55016d
    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD         0002  1  5.0    0.50    0.00  2.25    0.98 0.04   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.26]
*
    ADD [  0002+  0068]  0064  3  5.0    1.00    0.00  2.17    0.99  n/a   0.000
*
    CHANNEL[ 2:  0064]   0069  1  5.0    1.00    0.00  2.25    0.99  n/a   0.000
*
    READ STORM                 10.0
    [ Ptot= 25.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\f1a0f5d7-8021-40d9-8279-55016d
    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD         0003  1  5.0    0.51    0.00  2.17    0.99 0.04   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.24]
*
    ADD [  0003+  0069]  0065  3  5.0    1.51    0.00  2.25    0.99  n/a   0.000
*
    CHANNEL[ 2:  0065]   0070  1  5.0    1.51    0.00  2.42    0.98  n/a   0.000
*
    READ STORM                 10.0
    [ Ptot= 25.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\f1a0f5d7-8021-40d9-8279-55016d
    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD         0004  1  5.0    1.68    0.00  2.67    0.97 0.04   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0004+  0070]  0066  3  5.0    3.18    0.00  2.50    0.98  n/a   0.000
*
    CHANNEL[ 2:  0066]   0084  1  5.0    3.18    0.00  2.83    0.98  n/a   0.000
*
    READ STORM                 10.0
    [ Ptot= 25.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\f1a0f5d7-8021-40d9-8279-55016d
    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD         0005  1  5.0    1.41    0.00  2.42    1.11 0.04   0.000
    [CN=63.5         ]
    [ N = 3.0:Tp 0.34]
*
    READ STORM                 10.0
    [ Ptot= 25.00 mm ]
```

```
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\f1a0f5d7-8021-40d9-8279-55016d
    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD         0006  1  5.0    0.50    0.00  2.33   0.99 0.04   0.000
    [CN=62.5         ]
    [ N = 3.0:Tp 0.29]
*
    READ STORM                  10.0
    [ Ptot= 25.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\f1a0f5d7-8021-40d9-8279-55016d
    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD         0007  1  5.0    0.50    0.00  2.33   0.99 0.04   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                  10.0
    [ Ptot= 25.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\f1a0f5d7-8021-40d9-8279-55016d
    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD         0008  1  5.0    0.49    0.00  2.00   0.99 0.04   0.000
    [CN=62.5         ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0008]   0071  1  5.0    0.49    0.00  2.08   0.99  n/a   0.000
*
    ADD [  0007+  0071]  0061  3  5.0    0.99    0.00  2.17   0.99  n/a   0.000
*
    CHANNEL[ 2:  0061]   0072  1  5.0    0.99    0.00  2.25   0.99  n/a   0.000
*
    ADD [  0006+  0072]  0062  3  5.0    1.49    0.00  2.25   0.99  n/a   0.000
*
    CHANNEL[ 2:  0062]   0073  1  5.0    1.49    0.00  2.33   0.99  n/a   0.000
*
    READ STORM                  10.0
    [ Ptot= 25.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\f1a0f5d7-8021-40d9-8279-55016d
    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD         0019  1  5.0    1.68    0.00  3.00   0.68 0.03   0.000
    [CN=59.5         ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0019+  0005]  0063  3  5.0    3.09    0.00  2.67   0.88  n/a   0.000
*
    ADD [  0063+  0073]  0063  1  5.0    4.58    0.00  2.50   0.91  n/a   0.000
*
    CHANNEL[ 2:  0063]   0083  1  5.0    4.58    0.00  3.08   0.91  n/a   0.000
*
    READ STORM                  10.0
    [ Ptot= 25.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\f1a0f5d7-8021-40d9-8279-55016d
    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD         0009  1  5.0    0.36    0.00  2.00   1.86 0.07   0.000
    [CN=68.5         ]
```

```
    [ N = 3.0:Tp 0.27]
*
    READ STORM                 10.0
    [ Ptot= 25.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\f1a0f5d7-8021-40d9-8279-55016d
    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD          0017  1  5.0    0.17    0.00  1.75   2.41 0.10   0.000
    [CN=73.9         ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0017]   0080  1  5.0    0.17    0.00  1.92   2.40  n/a   0.000
*
    ADD [  0080+  0009]  0035  3  5.0    0.53    0.00  1.92   2.03  n/a   0.000
*
    CHANNEL[ 2:  0035]   0077  1  5.0    0.53    0.00  2.00   2.03  n/a   0.000
*
    READ STORM                 10.0
    [ Ptot= 25.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\f1a0f5d7-8021-40d9-8279-55016d
    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD          0010  1  5.0    0.38    0.00  2.00   1.83 0.07   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0010+  0077]  0036  3  5.0    0.91    0.00  2.00   1.95  n/a   0.000
*
    CHANNEL[ 2:  0036]   0078  1  5.0    0.91    0.00  2.08   1.95  n/a   0.000
*
    READ STORM                 10.0
    [ Ptot= 25.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\f1a0f5d7-8021-40d9-8279-55016d
    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD          0011  1  5.0    0.38    0.00  2.00   1.83 0.07   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0011+  0078]  0037  3  5.0    1.28    0.00  2.08   1.91  n/a   0.000
*
    CHANNEL[ 2:  0037]   0079  1  5.0    1.28    0.00  2.17   1.91  n/a   0.000
*
    READ STORM                 10.0
    [ Ptot= 25.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\f1a0f5d7-8021-40d9-8279-55016d
    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD          0012  1  5.0    0.29    0.00  1.83   2.68 0.11   0.000
    [CN=75.0         ]
    [ N = 3.0:Tp 0.22]
*
    ADD [  0012+  0079]  0038  3  5.0    1.58    0.00  2.08   2.05  n/a   0.000
*
    CHANNEL[ 2:  0038]   0094  1  5.0    1.58    0.00  2.17   2.05  n/a   0.000
*
    READ STORM                 10.0
    [ Ptot= 25.00 mm ]
```

```
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\f1a0f5d7-8021-40d9-8279-55016d
    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD         0013  1  5.0    0.34    0.00  1.83   3.10 0.12   0.000
    [CN=76.5         ]
    [ N = 3.0:Tp 0.24]
*
    READ STORM                 10.0
    [ Ptot= 25.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\f1a0f5d7-8021-40d9-8279-55016d
    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD         0014  1  5.0    0.36    0.00  2.00   1.83 0.07   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                 10.0
    [ Ptot= 25.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\f1a0f5d7-8021-40d9-8279-55016d
    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD         0015  1  5.0    0.38    0.00  2.00   1.83 0.07   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                 10.0
    [ Ptot= 25.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\f1a0f5d7-8021-40d9-8279-55016d
    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD         0016  1  5.0    0.39    0.00  2.00   1.82 0.07   0.000
    [CN=68.3         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                 10.0
    [ Ptot= 25.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\f1a0f5d7-8021-40d9-8279-55016d
    remark: twentyfive mm 4 hr chicago storm
*
 ** CALIB NASHYD         0018  1  5.0    0.17    0.00  1.75   2.41 0.10   0.000
    [CN=73.9         ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0018]   0081  1  5.0    0.17    0.00  1.83   2.41  n/a   0.000
*
    ADD [  0016+  0081]  0039  3  5.0    0.56    0.00  1.92   2.00  n/a   0.000
*
    CHANNEL[ 2:  0039]   0074  1  5.0    0.56    0.00  2.00   2.00  n/a   0.000
*
    ADD [  0015+  0074]  0040  3  5.0    0.94    0.00  2.00   1.93  n/a   0.000
*
    CHANNEL[ 2:  0040]   0075  1  5.0    0.94    0.00  2.08   1.93  n/a   0.000
*
    ADD [  0014+  0075]  0041  3  5.0    1.30    0.00  2.08   1.90  n/a   0.000
*
    CHANNEL[ 2:  0041]   0076  1  5.0    1.30    0.00  2.17   1.90  n/a   0.000
*
```

```
    ADD [  0013+  0076]  0042  3  5.0    1.64    0.01  2.08   2.15  n/a    0.000
*
    CHANNEL[ 2:  0042]   0095  1  5.0    1.64    0.01  2.08   2.15  n/a    0.000
*
    ADD [  0094+  0095]  0043  3  5.0    3.22    0.01  2.17   2.10  n/a    0.000
*
 ** Reservoir
    OUTFLOW:             0093  1  5.0    3.22    0.00  5.00   0.00  n/a    0.000
*
    ADD [  0083+  0093]  0092  3  5.0    7.80    0.00  3.08   0.53  n/a    0.000
*
    CHANNEL[ 2:  0092]   0085  1  5.0    7.80    0.00  3.17   0.53  n/a    0.000
*
    ADD [  0084+  0085]  0086  3  5.0   10.99    0.01  3.00   0.66  n/a    0.000
*
    CHANNEL[ 2:  0086]   0087  1  5.0   10.99    0.01  3.17   0.66  n/a    0.000
*
```

```
  ************************************************
  ** SIMULATION : 100 year 12 hr Chi 120 percen **
  ************************************************

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

      START @  0.00 hrs
      --------------------
    CHIC STORM                  5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD         0001  1  5.0    0.50    0.06  4.17  39.78 0.35   0.000
    [CN=62.5          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0001]   0068  1  5.0    0.50    0.06  4.17  39.78  n/a   0.000
*
    CHIC STORM                  5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD         0002  1  5.0    0.50    0.04  4.33  39.80 0.35   0.000
    [CN=62.4          ]
    [ N = 3.0:Tp 0.26]
*
    ADD [  0002+  0068]  0064  3  5.0    1.00    0.10  4.25  39.79  n/a   0.000
*
    CHANNEL[ 2:  0064]   0069  1  5.0    1.00    0.10  4.25  39.79  n/a   0.000
*
    CHIC STORM                  5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD         0003  1  5.0    0.51    0.05  4.25  39.79 0.35   0.000
    [CN=62.4          ]
    [ N = 3.0:Tp 0.24]
*
    ADD [  0003+  0069]  0065  3  5.0    1.51    0.15  4.25  39.79  n/a   0.000
*
    CHANNEL[ 2:  0065]   0070  1  5.0    1.51    0.14  4.25  39.78  n/a   0.000
*
    CHIC STORM                  5.0
    [ Ptot=112.68 mm ]
```

```
*
 ** CALIB NASHYD         0004  1  5.0    1.68    0.11  4.50  39.76 0.35   0.000
    [CN=62.4          ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0004+  0070]  0066  3  5.0    3.18    0.24  4.33  39.77  n/a   0.000
*
    CHANNEL[ 2:  0066]   0084  1  5.0    3.18    0.24  4.42  39.77  n/a   0.000
*
    CHIC STORM                    5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD         0005  1  5.0    1.41    0.11  4.42  41.28 0.37   0.000
    [CN=63.5          ]
    [ N = 3.0:Tp 0.34]
*
    CHIC STORM                    5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD         0006  1  5.0    0.50    0.04  4.33  39.91 0.35   0.000
    [CN=62.5          ]
    [ N = 3.0:Tp 0.29]
*
    CHIC STORM                    5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD         0007  1  5.0    0.50    0.04  4.33  39.80 0.35   0.000
    [CN=62.4          ]
    [ N = 3.0:Tp 0.27]
*
    CHIC STORM                    5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD         0008  1  5.0    0.49    0.06  4.17  39.78 0.35   0.000
    [CN=62.5          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0008]   0071  1  5.0    0.49    0.06  4.17  39.78  n/a   0.000
*
    ADD [  0007+  0071]  0061  3  5.0    0.99    0.10  4.25  39.79  n/a   0.000
*
    CHANNEL[ 2:  0061]   0072  1  5.0    0.99    0.10  4.25  39.79  n/a   0.000
*
    ADD [  0006+  0072]  0062  3  5.0    1.49    0.14  4.25  39.83  n/a   0.000
*
    CHANNEL[ 2:  0062]   0073  1  5.0    1.49    0.14  4.25  39.83  n/a   0.000
*
    CHIC STORM                    5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD         0019  1  5.0    1.68    0.10  4.50  35.97 0.32   0.000
    [CN=59.5          ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0019+  0005]  0063  3  5.0    3.09    0.20  4.42  38.39  n/a   0.000
*
    ADD [  0063+  0073]  0063  1  5.0    4.58    0.33  4.33  38.86  n/a   0.000
*
    CHANNEL[ 2:  0063]   0083  1  5.0    4.58    0.31  4.50  38.85  n/a   0.000
*
    CHIC STORM                    5.0
    [ Ptot=112.68 mm ]
```

```
*
 ** CALIB NASHYD         0009  1  5.0    0.36    0.04  4.33  48.51 0.43   0.000
    [CN=68.5          ]
    [ N = 3.0:Tp 0.27]
*
    CHIC STORM                   5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD         0017  1  5.0    0.17    0.03  4.17  55.39 0.49   0.000
    [CN=73.9          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0017]   0080  1  5.0    0.17    0.03  4.25  55.38  n/a   0.000
*
    ADD [  0080+  0009]  0035  3  5.0    0.53    0.07  4.25  50.74  n/a   0.000
*
    CHANNEL[ 2:  0035]   0077  1  5.0    0.53    0.07  4.25  50.74  n/a   0.000
*
    CHIC STORM                   5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD         0010  1  5.0    0.38    0.04  4.33  48.32 0.43   0.000
    [CN=68.4          ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0010+  0077]  0036  3  5.0    0.91    0.11  4.25  49.74  n/a   0.000
*
    CHANNEL[ 2:  0036]   0078  1  5.0    0.91    0.11  4.25  49.74  n/a   0.000
*
    CHIC STORM                   5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD         0011  1  5.0    0.38    0.04  4.33  48.32 0.43   0.000
    [CN=68.4          ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0011+  0078]  0037  3  5.0    1.28    0.15  4.25  49.32  n/a   0.000
*
    CHANNEL[ 2:  0037]   0079  1  5.0    1.28    0.15  4.33  49.32  n/a   0.000
*
    CHIC STORM                   5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD         0012  1  5.0    0.29    0.04  4.25  57.40 0.51   0.000
    [CN=75.0          ]
    [ N = 3.0:Tp 0.22]
*
    ADD [  0012+  0079]  0038  3  5.0    1.58    0.19  4.25  50.83  n/a   0.000
*
    CHANNEL[ 2:  0038]   0094  1  5.0    1.58    0.19  4.33  50.82  n/a   0.000
*
    CHIC STORM                   5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD         0013  1  5.0    0.34    0.05  4.25  60.08 0.53   0.000
    [CN=76.5          ]
    [ N = 3.0:Tp 0.24]
*
    CHIC STORM                   5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD         0014  1  5.0    0.36    0.04  4.33  48.32 0.43   0.000
```

```
    [CN=68.4          ]
    [ N = 3.0:Tp 0.27]
*
    CHIC STORM                  5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD        0015  1  5.0    0.38    0.04  4.33  48.32 0.43   0.000
    [CN=68.4          ]
    [ N = 3.0:Tp 0.27]
*
    CHIC STORM                  5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD        0016  1  5.0    0.39    0.04  4.33  48.20 0.43   0.000
    [CN=68.3          ]
    [ N = 3.0:Tp 0.27]
*
    CHIC STORM                  5.0
    [ Ptot=112.68 mm ]
*
 ** CALIB NASHYD        0018  1  5.0    0.17    0.03  4.17  55.39 0.49   0.000
    [CN=73.9          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0018]  0081  1  5.0    0.17    0.03  4.17  55.38  n/a   0.000
*
    ADD [  0016+  0081] 0039  3  5.0    0.56    0.07  4.25  50.41  n/a   0.000
*
    CHANNEL[ 2:  0039]  0074  1  5.0    0.56    0.07  4.25  50.41  n/a   0.000
*
    ADD [  0015+  0074] 0040  3  5.0    0.94    0.11  4.25  49.57  n/a   0.000
*
    CHANNEL[ 2:  0040]  0075  1  5.0    0.94    0.11  4.25  49.57  n/a   0.000
*
    ADD [  0014+  0075] 0041  3  5.0    1.30    0.15  4.25  49.22  n/a   0.000
*
    CHANNEL[ 2:  0041]  0076  1  5.0    1.30    0.15  4.33  49.22  n/a   0.000
*
    ADD [  0013+  0076] 0042  3  5.0    1.64    0.20  4.25  51.47  n/a   0.000
*
    CHANNEL[ 2:  0042]  0095  1  5.0    1.64    0.20  4.33  51.47  n/a   0.000
*
    ADD [  0094+  0095] 0043  3  5.0    3.22    0.39  4.33  51.15  n/a   0.000
*
 ** Reservoir
    OUTFLOW:            0093  1  5.0    3.22    0.12  5.00  46.09  n/a   0.000
*
    ADD [  0083+  0093] 0092  3  5.0    7.80    0.37  4.58  41.84  n/a   0.000
*
    CHANNEL[ 2:  0092]  0085  1  5.0    7.80    0.37  4.58  41.84  n/a   0.000
*
    ADD [  0084+  0085] 0086  3  5.0   10.99    0.59  4.50  41.24  n/a   0.000
*
    CHANNEL[ 2:  0086]  0087  1  5.0   10.99    0.59  4.58  41.24  n/a   0.000
*
```

```
 ************************************************
  ** SIMULATION : 2. SCS II 6hr 100yr Ottawa    **
  ************************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                 30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD          0001  1  5.0    0.50    0.03  3.00  24.54 0.28   0.000
    [CN=62.5          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0001]   0068  1  5.0    0.50    0.03  3.08  24.54  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD          0002  1  5.0    0.50    0.03  3.17  24.54 0.28   0.000
    [CN=62.4          ]
    [ N = 3.0:Tp 0.26]
*
    ADD [  0002+  0068]  0064  3  5.0    1.00    0.06  3.08  24.54  n/a   0.000
*
    CHANNEL[ 2:  0064]   0069  1  5.0    1.00    0.06  3.08  24.54  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD          0003  1  5.0    0.51    0.03  3.08  24.53 0.28   0.000
    [CN=62.4          ]
    [ N = 3.0:Tp 0.24]
*
    ADD [  0003+  0069]  0065  3  5.0    1.51    0.09  3.08  24.54  n/a   0.000
*
    CHANNEL[ 2:  0065]   0070  1  5.0    1.51    0.09  3.17  24.53  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD          0004  1  5.0    1.68    0.07  3.42  24.50 0.28   0.000
    [CN=62.4          ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0004+  0070]  0066  3  5.0    3.18    0.15  3.25  24.51  n/a   0.000
*
```

```
    CHANNEL[ 2:  0066]   0084  1  5.0    3.18    0.15  3.33  24.51  n/a   0.000
*
    READ STORM                30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD         0005  1  5.0    1.41    0.07  3.25  25.62 0.29   0.000
    [CN=63.5         ]
    [ N = 3.0:Tp 0.34]
*
    READ STORM                30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD         0006  1  5.0    0.50    0.03  3.17  24.61 0.28   0.000
    [CN=62.5         ]
    [ N = 3.0:Tp 0.29]
*
    READ STORM                30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD         0007  1  5.0    0.50    0.03  3.17  24.54 0.28   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD         0008  1  5.0    0.49    0.03  3.00  24.54 0.28   0.000
    [CN=62.5         ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0008]   0071  1  5.0    0.49    0.03  3.08  24.54  n/a   0.000
*
    ADD [  0007+  0071]  0061  3  5.0    0.99    0.06  3.08  24.54  n/a   0.000
*
    CHANNEL[ 2:  0061]   0072  1  5.0    0.99    0.06  3.17  24.54  n/a   0.000
*
    ADD [  0006+  0072]  0062  3  5.0    1.49    0.08  3.17  24.56  n/a   0.000
*
    CHANNEL[ 2:  0062]   0073  1  5.0    1.49    0.08  3.17  24.56  n/a   0.000
*
    READ STORM                30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD         0019  1  5.0    1.68    0.06  3.42  21.77 0.25   0.000
    [CN=59.5         ]
    [ N = 3.0:Tp 0.41]
*
```

```
    ADD [  0019+  0005]  0063  3  5.0    3.09    0.13  3.33  23.52  n/a   0.000
*
    ADD [  0063+  0073]  0063  1  5.0    4.58    0.21  3.25  23.86  n/a   0.000
*
    CHANNEL[ 2:  0063]   0083  1  5.0    4.58    0.20  3.33  23.85  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD         0009  1  5.0    0.36    0.02  3.17  31.02 0.36   0.000
    [CN=68.5         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                 30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD         0017  1  5.0    0.17    0.02  3.00  36.15 0.42   0.000
    [CN=73.9         ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0017]   0080  1  5.0    0.17    0.02  3.08  36.13  n/a   0.000
*
    ADD [  0080+  0009]  0035  3  5.0    0.53    0.04  3.08  32.68  n/a   0.000
*
    CHANNEL[ 2:  0035]   0077  1  5.0    0.53    0.04  3.17  32.68  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD         0010  1  5.0    0.38    0.03  3.17  30.87 0.35   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0010+  0077]  0036  3  5.0    0.91    0.07  3.17  31.93  n/a   0.000
*
    CHANNEL[ 2:  0036]   0078  1  5.0    0.91    0.07  3.17  31.93  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD         0011  1  5.0    0.38    0.03  3.17  30.87 0.35   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0011+  0078]  0037  3  5.0    1.28    0.09  3.17  31.62  n/a   0.000
*
    CHANNEL[ 2:  0037]   0079  1  5.0    1.28    0.09  3.17  31.62  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 87.00 mm ]
```

```
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD         0012  1  5.0    0.29    0.03  3.08  37.72 0.43   0.000
    [CN=75.0         ]
    [ N = 3.0:Tp 0.22]
*
    ADD [  0012+  0079]  0038  3  5.0    1.58    0.12  3.17  32.76  n/a   0.000
*
    CHANNEL[ 2:  0038]   0094  1  5.0    1.58    0.12  3.17  32.75  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD         0013  1  5.0    0.34    0.03  3.08  39.86 0.46   0.000
    [CN=76.5         ]
    [ N = 3.0:Tp 0.24]
*
    READ STORM                 30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD         0014  1  5.0    0.36    0.02  3.17  30.87 0.35   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                 30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD         0015  1  5.0    0.38    0.03  3.17  30.87 0.35   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                 30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD         0016  1  5.0    0.39    0.03  3.17  30.78 0.35   0.000
    [CN=68.3         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                 30.0
    [ Ptot= 87.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\2561705c-3809-4f45-a1ef-af05b6
    remark: SCS II 6hr 100yr Ottawa
*
 ** CALIB NASHYD         0018  1  5.0    0.17    0.02  3.00  36.15 0.42   0.000
    [CN=73.9         ]
    [ N = 3.0:Tp 0.17]
*
```

```
    CHANNEL[ 2:  0018]   0081  1  5.0     0.17    0.02  3.08  36.14  n/a    0.000
*
    ADD [  0016+  0081]  0039  3  5.0     0.56    0.04  3.08  32.43  n/a    0.000
*
    CHANNEL[ 2:  0039]   0074  1  5.0     0.56    0.04  3.08  32.43  n/a    0.000
*
    ADD [  0015+  0074]  0040  3  5.0     0.94    0.07  3.17  31.80  n/a    0.000
*
    CHANNEL[ 2:  0040]   0075  1  5.0     0.94    0.07  3.17  31.80  n/a    0.000
*
    ADD [  0014+  0075]  0041  3  5.0     1.30    0.09  3.17  31.54  n/a    0.000
*
    CHANNEL[ 2:  0041]   0076  1  5.0     1.30    0.09  3.17  31.54  n/a    0.000
*
    ADD [  0013+  0076]  0042  3  5.0     1.64    0.12  3.17  33.27  n/a    0.000
*
    CHANNEL[ 2:  0042]   0095  1  5.0     1.64    0.12  3.17  33.26  n/a    0.000
*
    ADD [  0094+  0095]  0043  3  5.0     3.22    0.24  3.17  33.01  n/a    0.000
*
 ** Reservoir
    OUTFLOW:             0093  1  5.0     3.22    0.07  4.08  27.95  n/a    0.000
*
    ADD [  0083+  0093]  0092  3  5.0     7.80    0.23  3.58  25.54  n/a    0.000
*
    CHANNEL[ 2:  0092]   0085  1  5.0     7.80    0.23  3.58  25.54  n/a    0.000
*
    ADD [  0084+  0085]  0086  3  5.0    10.99    0.37  3.42  25.24  n/a    0.000
*
    CHANNEL[ 2:  0086]   0087  1  5.0    10.99    0.37  3.50  25.24  n/a    0.000
*
```

```
  ************************************************
  ** SIMULATION : 3. SCS II 12hr 5yr Ottawa     **
  ************************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                 30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD         0001  1  5.0     0.50    0.01  6.00  10.22 0.18   0.000
    [CN=62.5          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0001]   0068  1  5.0     0.50    0.01  6.08  10.22  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD         0002  1  5.0     0.50    0.01  6.17  10.22 0.18   0.000
```

```
    [CN=62.4          ]
    [ N = 3.0:Tp 0.26]
*
    ADD [  0002+  0068]  0064  3  5.0    1.00    0.02  6.08  10.22  n/a   0.000
*
    CHANNEL[ 2:  0064]   0069  1  5.0    1.00    0.02  6.17  10.22  n/a   0.000
*
    READ STORM                30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD         0003  1  5.0    0.51    0.01  6.08  10.21 0.18   0.000
    [CN=62.4          ]
    [ N = 3.0:Tp 0.24]
*
    ADD [  0003+  0069]  0065  3  5.0    1.51    0.03  6.17  10.22  n/a   0.000
*
    CHANNEL[ 2:  0065]   0070  1  5.0    1.51    0.03  6.17  10.21  n/a   0.000
*
    READ STORM                30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD         0004  1  5.0    1.68    0.02  6.33  10.18 0.18   0.000
    [CN=62.4          ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0004+  0070]  0066  3  5.0    3.18    0.05  6.25  10.20  n/a   0.000
*
    CHANNEL[ 2:  0066]   0084  1  5.0    3.18    0.05  6.33  10.20  n/a   0.000
*
    READ STORM                30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD         0005  1  5.0    1.41    0.02  6.25  10.81 0.19   0.000
    [CN=63.5          ]
    [ N = 3.0:Tp 0.34]
*
    READ STORM                30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD         0006  1  5.0    0.50    0.01  6.17  10.25 0.18   0.000
    [CN=62.5          ]
    [ N = 3.0:Tp 0.29]
*
    READ STORM                30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD         0007  1  5.0    0.50    0.01  6.17  10.22 0.18   0.000
```

```
    [CN=62.4          ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                 30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD          0008  1  5.0    0.49    0.01  6.00  10.22 0.18   0.000
    [CN=62.5          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0008]    0071  1  5.0    0.49    0.01  6.08  10.22  n/a   0.000
*
    ADD [  0007+  0071]   0061  3  5.0    0.99    0.02  6.08  10.22  n/a   0.000
*
    CHANNEL[ 2:  0061]    0072  1  5.0    0.99    0.02  6.17  10.22  n/a   0.000
*
    ADD [  0006+  0072]   0062  3  5.0    1.49    0.03  6.17  10.23  n/a   0.000
*
    CHANNEL[ 2:  0062]    0073  1  5.0    1.49    0.03  6.17  10.23  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD          0019  1  5.0    1.68    0.02  6.42   8.71 0.15   0.000
    [CN=59.5          ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0019+  0005]   0063  3  5.0    3.09    0.04  6.33   9.66  n/a   0.000
*
    ADD [  0063+  0073]   0063  1  5.0    4.58    0.07  6.25   9.85  n/a   0.000
*
    CHANNEL[ 2:  0063]    0083  1  5.0    4.58    0.07  6.42   9.84  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD          0009  1  5.0    0.36    0.01  6.17  13.92 0.24   0.000
    [CN=68.5          ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                 30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD          0017  1  5.0    0.17    0.01  6.00  16.78 0.29   0.000
    [CN=73.9          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0017]    0080  1  5.0    0.17    0.01  6.08  16.77  n/a   0.000
*
    ADD [  0080+  0009]   0035  3  5.0    0.53    0.02  6.08  14.85  n/a   0.000
```

```
*
    CHANNEL[ 2:  0035]   0077  1  5.0    0.53    0.02  6.17  14.85  n/a   0.000
*
    READ STORM                30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD         0010  1  5.0    0.38    0.01  6.17  13.83 0.24   0.000
    [CN=68.4          ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0010+  0077]  0036  3  5.0    0.91    0.03  6.17  14.42  n/a   0.000
*
    CHANNEL[ 2:  0036]   0078  1  5.0    0.91    0.03  6.17  14.42  n/a   0.000
*
    READ STORM                30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD         0011  1  5.0    0.38    0.01  6.17  13.83 0.24   0.000
    [CN=68.4          ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0011+  0078]  0037  3  5.0    1.28    0.04  6.17  14.25  n/a   0.000
*
    CHANNEL[ 2:  0037]   0079  1  5.0    1.28    0.04  6.17  14.25  n/a   0.000
*
    READ STORM                30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD         0012  1  5.0    0.29    0.01  6.08  17.76 0.31   0.000
    [CN=75.0          ]
    [ N = 3.0:Tp 0.22]
*
    ADD [  0012+  0079]  0038  3  5.0    1.58    0.05  6.17  14.90  n/a   0.000
*
    CHANNEL[ 2:  0038]   0094  1  5.0    1.58    0.05  6.17  14.90  n/a   0.000
*
    READ STORM                30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD         0013  1  5.0    0.34    0.01  6.08  19.13 0.33   0.000
    [CN=76.5          ]
    [ N = 3.0:Tp 0.24]
*
    READ STORM                30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD         0014  1  5.0    0.36    0.01  6.17  13.83 0.24   0.000
```

```
    [CN=68.4          ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                 30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD          0015  1  5.0    0.38    0.01  6.17  13.83 0.24   0.000
    [CN=68.4          ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                 30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD          0016  1  5.0    0.39    0.01  6.17  13.78 0.24   0.000
    [CN=68.3          ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                 30.0
    [ Ptot= 57.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\00e1f214-ae56-47d3-be2b-e27864
    remark: SCS II 12hr 5yr Ottawa
*
 ** CALIB NASHYD          0018  1  5.0    0.17    0.01  6.00  16.78 0.29   0.000
    [CN=73.9          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0018]   0081  1  5.0    0.17    0.01  6.08  16.78  n/a   0.000
*
    ADD [  0016+  0081]  0039  3  5.0    0.56    0.02  6.08  14.70  n/a   0.000
*
    CHANNEL[ 2:  0039]   0074  1  5.0    0.56    0.02  6.17  14.70  n/a   0.000
*
    ADD [  0015+  0074]  0040  3  5.0    0.94    0.03  6.17  14.35  n/a   0.000
*
    CHANNEL[ 2:  0040]   0075  1  5.0    0.94    0.03  6.17  14.35  n/a   0.000
*
    ADD [  0014+  0075]  0041  3  5.0    1.30    0.04  6.17  14.20  n/a   0.000
*
    CHANNEL[ 2:  0041]   0076  1  5.0    1.30    0.04  6.17  14.20  n/a   0.000
*
    ADD [  0013+  0076]  0042  3  5.0    1.64    0.05  6.17  15.22  n/a   0.000
*
    CHANNEL[ 2:  0042]   0095  1  5.0    1.64    0.05  6.17  15.22  n/a   0.000
*
    ADD [  0094+  0095]  0043  3  5.0    3.22    0.10  6.17  15.06  n/a   0.000
*
 ** Reservoir
    OUTFLOW:             0093  1  5.0    3.22    0.01  8.50  10.00  n/a   0.000
*
    ADD [  0083+  0093]  0092  3  5.0    7.80    0.07  6.50   9.91  n/a   0.000
*
    CHANNEL[ 2:  0092]   0085  1  5.0    7.80    0.07  6.42   9.91  n/a   0.000
*
    ADD [  0084+  0085]  0086  3  5.0   10.99    0.12  6.42   9.99  n/a   0.000
*
```

```
    CHANNEL[ 2:  0086]   0087  1  5.0    10.99    0.12  6.42   9.99  n/a   0.000
*
```

```
   ************************************************
   ** SIMULATION : 4. SCS II 12hr 10yr Ottawa    **
   ************************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                  30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0001  1  5.0    0.50    0.02  6.00  14.53 0.22   0.000
    [CN=62.5         ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0001]   0068  1  5.0    0.50    0.02  6.08  14.53  n/a   0.000
*
    READ STORM                  30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0002  1  5.0    0.50    0.01  6.08  14.53 0.22   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.26]
*
    ADD [  0002+  0068]  0064  3  5.0    1.00    0.03  6.08  14.53  n/a   0.000
*
    CHANNEL[ 2:  0064]   0069  1  5.0    1.00    0.03  6.17  14.53  n/a   0.000
*
    READ STORM                  30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0003  1  5.0    0.51    0.01  6.08  14.53 0.22   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.24]
*
    ADD [  0003+  0069]  0065  3  5.0    1.51    0.04  6.17  14.53  n/a   0.000
*
    CHANNEL[ 2:  0065]   0070  1  5.0    1.51    0.04  6.17  14.52  n/a   0.000
*
    READ STORM                  30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0004  1  5.0    1.68    0.04  6.33  14.49 0.22   0.000
    [CN=62.4         ]
```

```
    [ N = 3.0:Tp 0.41]
*
    ADD [  0004+  0070]  0066  3  5.0    3.18    0.08  6.17  14.51  n/a   0.000
*
    CHANNEL[ 2:  0066]   0084  1  5.0    3.18    0.08  6.33  14.51  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0005  1  5.0    1.41    0.04  6.25  15.28 0.23   0.000
    [CN=63.5         ]
    [ N = 3.0:Tp 0.34]
*
    READ STORM                 30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0006  1  5.0    0.50    0.01  6.17  14.58 0.22   0.000
    [CN=62.5         ]
    [ N = 3.0:Tp 0.29]
*
    READ STORM                 30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0007  1  5.0    0.50    0.01  6.17  14.53 0.22   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                 30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0008  1  5.0    0.49    0.02  6.00  14.53 0.22   0.000
    [CN=62.5         ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0008]   0071  1  5.0    0.49    0.02  6.08  14.53  n/a   0.000
*
    ADD [  0007+  0071]  0061  3  5.0    0.99    0.03  6.08  14.53  n/a   0.000
*
    CHANNEL[ 2:  0061]   0072  1  5.0    0.99    0.03  6.17  14.53  n/a   0.000
*
    ADD [  0006+  0072]  0062  3  5.0    1.49    0.04  6.17  14.55  n/a   0.000
*
    CHANNEL[ 2:  0062]   0073  1  5.0    1.49    0.04  6.17  14.55  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
```

```
 ** CALIB NASHYD         0019  1  5.0    1.68    0.03  6.33  12.60 0.19   0.000
    [CN=59.5          ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0019+  0005]  0063  3  5.0    3.09    0.07  6.25  13.82  n/a   0.000
*
    ADD [  0063+  0073]  0063  1  5.0    4.58    0.11  6.25  14.06  n/a   0.000
*
    CHANNEL[ 2:  0063]   0083  1  5.0    4.58    0.10  6.33  14.05  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0009  1  5.0    0.36    0.01  6.08  19.18 0.29   0.000
    [CN=68.5          ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                 30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0017  1  5.0    0.17    0.01  6.00  22.82 0.34   0.000
    [CN=73.9          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0017]   0080  1  5.0    0.17    0.01  6.08  22.80  n/a   0.000
*
    ADD [  0080+  0009]  0035  3  5.0    0.53    0.02  6.08  20.36  n/a   0.000
*
    CHANNEL[ 2:  0035]   0077  1  5.0    0.53    0.02  6.17  20.36  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0010  1  5.0    0.38    0.01  6.08  19.06 0.28   0.000
    [CN=68.4          ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0010+  0077]  0036  3  5.0    0.91    0.04  6.17  19.82  n/a   0.000
*
    CHANNEL[ 2:  0036]   0078  1  5.0    0.91    0.04  6.17  19.82  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0011  1  5.0    0.38    0.01  6.08  19.06 0.28   0.000
    [CN=68.4          ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0011+  0078]  0037  3  5.0    1.28    0.05  6.17  19.60  n/a   0.000
*
```

```
    CHANNEL[ 2:  0037]   0079  1  5.0    1.28    0.05  6.17  19.60  n/a    0.000
*
    READ STORM                 30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0012  1  5.0    0.29    0.02  6.08  24.00 0.36   0.000
    [CN=75.0         ]
    [ N = 3.0:Tp 0.22]
*
    ADD [  0012+  0079]  0038  3  5.0    1.58    0.07  6.17  20.42  n/a    0.000
*
    CHANNEL[ 2:  0038]   0094  1  5.0    1.58    0.07  6.17  20.41  n/a    0.000
*
    READ STORM                 30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0013  1  5.0    0.34    0.02  6.08  25.65 0.38   0.000
    [CN=76.5         ]
    [ N = 3.0:Tp 0.24]
*
    READ STORM                 30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0014  1  5.0    0.36    0.01  6.08  19.06 0.28   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                 30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0015  1  5.0    0.38    0.01  6.08  19.06 0.28   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                 30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
 ** CALIB NASHYD         0016  1  5.0    0.39    0.01  6.08  19.00 0.28   0.000
    [CN=68.3         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                 30.0
    [ Ptot= 67.20 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\f6f44053-9f17-4948-819d-f46d03
    remark: SCS II 12hr 10yr Ottawa
*
```

```
 ** CALIB NASHYD         0018  1  5.0    0.17    0.01  6.00  22.82 0.34   0.000
    [CN=73.9          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0018]   0081  1  5.0    0.17    0.01  6.08  22.81  n/a   0.000
*
    ADD [  0016+  0081]  0039  3  5.0    0.56    0.02  6.08  20.17  n/a   0.000
*
    CHANNEL[ 2:  0039]   0074  1  5.0    0.56    0.02  6.17  20.17  n/a   0.000
*
    ADD [  0015+  0074]  0040  3  5.0    0.94    0.04  6.17  19.73  n/a   0.000
*
    CHANNEL[ 2:  0040]   0075  1  5.0    0.94    0.04  6.17  19.73  n/a   0.000
*
    ADD [  0014+  0075]  0041  3  5.0    1.30    0.05  6.17  19.54  n/a   0.000
*
    CHANNEL[ 2:  0041]   0076  1  5.0    1.30    0.05  6.17  19.54  n/a   0.000
*
    ADD [  0013+  0076]  0042  3  5.0    1.64    0.07  6.17  20.81  n/a   0.000
*
    CHANNEL[ 2:  0042]   0095  1  5.0    1.64    0.07  6.17  20.81  n/a   0.000
*
    ADD [  0094+  0095]  0043  3  5.0    3.22    0.13  6.17  20.61  n/a   0.000
*
 ** Reservoir
    OUTFLOW:             0093  1  5.0    3.22    0.02  7.58  15.55  n/a   0.000
*
    ADD [  0083+  0093]  0092  3  5.0    7.80    0.10  6.42  14.67  n/a   0.000
*
    CHANNEL[ 2:  0092]   0085  1  5.0    7.80    0.10  6.42  14.67  n/a   0.000
*
    ADD [  0084+  0085]  0086  3  5.0   10.99    0.18  6.33  14.62  n/a   0.000
*
    CHANNEL[ 2:  0086]   0087  1  5.0   10.99    0.18  6.42  14.62  n/a   0.000
*
```

```
  ************************************************
  ** SIMULATION : 5. SCS II 12hr 100yr correct  **
  ************************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                 30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD         0001  1  5.0    0.50    0.04  6.00  29.62 0.31   0.000
    [CN=62.5          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0001]   0068  1  5.0    0.50    0.04  6.08  29.62  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 96.00 mm ]
```

```
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD         0002  1  5.0    0.50    0.03  6.08  29.63 0.31   0.000
    [CN=62.4        ]
    [ N = 3.0:Tp 0.26]
*
    ADD [  0002+  0068]  0064  3  5.0    1.00    0.07  6.08  29.63  n/a   0.000
*
    CHANNEL[ 2:  0064]   0069  1  5.0    1.00    0.07  6.08  29.63  n/a   0.000
*
    READ STORM                  30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD         0003  1  5.0    0.51    0.03  6.08  29.62 0.31   0.000
    [CN=62.4        ]
    [ N = 3.0:Tp 0.24]
*
    ADD [  0003+  0069]  0065  3  5.0    1.51    0.10  6.08  29.62  n/a   0.000
*
    CHANNEL[ 2:  0065]   0070  1  5.0    1.51    0.10  6.17  29.62  n/a   0.000
*
    READ STORM                  30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD         0004  1  5.0    1.68    0.08  6.33  29.59 0.31   0.000
    [CN=62.4        ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0004+  0070]  0066  3  5.0    3.18    0.17  6.17  29.60  n/a   0.000
*
    CHANNEL[ 2:  0066]   0084  1  5.0    3.18    0.16  6.25  29.60  n/a   0.000
*
    READ STORM                  30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD         0005  1  5.0    1.41    0.08  6.17  30.85 0.32   0.000
    [CN=63.5        ]
    [ N = 3.0:Tp 0.34]
*
    READ STORM                  30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD         0006  1  5.0    0.50    0.03  6.17  29.72 0.31   0.000
    [CN=62.5        ]
    [ N = 3.0:Tp 0.29]
*
    READ STORM                  30.0
    [ Ptot= 96.00 mm ]
```

```
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD         0007  1  5.0    0.50    0.03  6.08  29.63 0.31   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                 30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD         0008  1  5.0    0.49    0.04  6.00  29.62 0.31   0.000
    [CN=62.5         ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0008]   0071  1  5.0    0.49    0.04  6.08  29.62  n/a   0.000
*
    ADD [  0007+  0071]  0061  3  5.0    0.99    0.06  6.08  29.63  n/a   0.000
*
    CHANNEL[ 2:  0061]   0072  1  5.0    0.99    0.07  6.08  29.63  n/a   0.000
*
    ADD [  0006+  0072]  0062  3  5.0    1.49    0.09  6.08  29.66  n/a   0.000
*
    CHANNEL[ 2:  0062]   0073  1  5.0    1.49    0.09  6.17  29.66  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD         0019  1  5.0    1.68    0.07  6.33  26.48 0.28   0.000
    [CN=59.5         ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0019+  0005]  0063  3  5.0    3.09    0.14  6.25  28.47  n/a   0.000
*
    ADD [  0063+  0073]  0063  1  5.0    4.58    0.23  6.17  28.86  n/a   0.000
*
    CHANNEL[ 2:  0063]   0083  1  5.0    4.58    0.22  6.25  28.85  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD         0009  1  5.0    0.36    0.03  6.08  36.91 0.38   0.000
    [CN=68.5         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                 30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD         0017  1  5.0    0.17    0.02  6.00  42.68 0.44   0.000
    [CN=73.9         ]
```

```
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0017]   0080  1  5.0    0.17    0.02  6.08  42.67  n/a   0.000
*
    ADD [  0080+  0009]  0035  3  5.0    0.53    0.05  6.08  38.78  n/a   0.000
*
    CHANNEL[ 2:  0035]   0077  1  5.0    0.53    0.04  6.08  38.78  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD         0010  1  5.0    0.38    0.03  6.08  36.75 0.38   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0010+  0077]  0036  3  5.0    0.91    0.07  6.08  37.94  n/a   0.000
*
    CHANNEL[ 2:  0036]   0078  1  5.0    0.91    0.07  6.17  37.94  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD         0011  1  5.0    0.38    0.03  6.08  36.75 0.38   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0011+  0078]  0037  3  5.0    1.28    0.10  6.17  37.59  n/a   0.000
*
    CHANNEL[ 2:  0037]   0079  1  5.0    1.28    0.10  6.17  37.59  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD         0012  1  5.0    0.29    0.03  6.08  44.41 0.46   0.000
    [CN=75.0         ]
    [ N = 3.0:Tp 0.22]
*
    ADD [  0012+  0079]  0038  3  5.0    1.58    0.13  6.17  38.86  n/a   0.000
*
    CHANNEL[ 2:  0038]   0094  1  5.0    1.58    0.13  6.17  38.86  n/a   0.000
*
    READ STORM                 30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD         0013  1  5.0    0.34    0.04  6.08  46.75 0.49   0.000
    [CN=76.5         ]
    [ N = 3.0:Tp 0.24]
*
    READ STORM                 30.0
    [ Ptot= 96.00 mm ]
```

```
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD         0014  1  5.0    0.36    0.03  6.08  36.75 0.38   0.000
    [CN=68.4          ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                 30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD         0015  1  5.0    0.38    0.03  6.08  36.75 0.38   0.000
    [CN=68.4          ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                 30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD         0016  1  5.0    0.39    0.03  6.08  36.65 0.38   0.000
    [CN=68.3          ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                 30.0
    [ Ptot= 96.00 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\5f0b7bb1-f676-48d3-8e28-cd9bf2
    remark: SCS II 12hr 100yr Ottawa
*
 ** CALIB NASHYD         0018  1  5.0    0.17    0.02  6.00  42.68 0.44   0.000
    [CN=73.9          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0018]   0081  1  5.0    0.17    0.02  6.08  42.67  n/a   0.000
*
    ADD [  0016+  0081]  0039  3  5.0    0.56    0.05  6.08  38.50  n/a   0.000
*
    CHANNEL[ 2:  0039]   0074  1  5.0    0.56    0.05  6.08  38.50  n/a   0.000
*
    ADD [  0015+  0074]  0040  3  5.0    0.94    0.08  6.08  37.80  n/a   0.000
*
    CHANNEL[ 2:  0040]   0075  1  5.0    0.94    0.07  6.17  37.80  n/a   0.000
*
    ADD [  0014+  0075]  0041  3  5.0    1.30    0.10  6.08  37.50  n/a   0.000
*
    CHANNEL[ 2:  0041]   0076  1  5.0    1.30    0.10  6.17  37.50  n/a   0.000
*
    ADD [  0013+  0076]  0042  3  5.0    1.64    0.14  6.17  39.42  n/a   0.000
*
    CHANNEL[ 2:  0042]   0095  1  5.0    1.64    0.14  6.17  39.42  n/a   0.000
*
    ADD [  0094+  0095]  0043  3  5.0    3.22    0.27  6.17  39.14  n/a   0.000
*
 ** Reservoir
    OUTFLOW:             0093  1  5.0    3.22    0.08  7.00  34.08  n/a   0.000
*
    ADD [  0083+  0093]  0092  3  5.0    7.80    0.25  6.42  31.01  n/a   0.000
```

```
*
    CHANNEL[ 2:  0092]   0085  1  5.0     7.80    0.25  6.42  31.01  n/a   0.000
*
    ADD [  0084+  0085]  0086  3  5.0    10.99    0.41  6.33  30.60  n/a   0.000
*
    CHANNEL[ 2:  0086]   0087  1  5.0    10.99    0.41  6.33  30.60  n/a   0.000
*
```

```
  ************************************************
  ** SIMULATION : 6. Chi 12hr 2yr               **
  ************************************************

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

      START @  0.00 hrs
      --------------------
    CHIC STORM                  10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD         0001  1  5.0     0.50    0.00  4.17   4.96 0.12   0.000
    [CN=62.5          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0001]   0068  1  5.0     0.50    0.00  4.25   4.96  n/a   0.000
*
    CHIC STORM                  10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD         0002  1  5.0     0.50    0.00  4.33   4.96 0.12   0.000
    [CN=62.4          ]
    [ N = 3.0:Tp 0.26]
*
    ADD [  0002+  0068]  0064  3  5.0     1.00    0.01  4.25   4.96  n/a   0.000
*
    CHANNEL[ 2:  0064]   0069  1  5.0     1.00    0.01  4.33   4.96  n/a   0.000
*
    CHIC STORM                  10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD         0003  1  5.0     0.51    0.00  4.33   4.95 0.12   0.000
    [CN=62.4          ]
    [ N = 3.0:Tp 0.24]
*
    ADD [  0003+  0069]  0065  3  5.0     1.51    0.01  4.33   4.96  n/a   0.000
*
    CHANNEL[ 2:  0065]   0070  1  5.0     1.51    0.01  4.42   4.95  n/a   0.000
*
    CHIC STORM                  10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD         0004  1  5.0     1.68    0.01  4.58   4.93 0.12   0.000
    [CN=62.4          ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0004+  0070]  0066  3  5.0     3.18    0.02  4.50   4.94  n/a   0.000
*
    CHANNEL[ 2:  0066]   0084  1  5.0     3.18    0.02  4.67   4.94  n/a   0.000
*
    CHIC STORM                  10.0
```

```
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD          0005  1  5.0     1.41     0.01  4.50    5.31 0.13    0.000
    [CN=63.5           ]
    [ N = 3.0:Tp 0.34]
*
    CHIC STORM                  10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD          0006  1  5.0     0.50     0.00  4.42    4.97 0.12    0.000
    [CN=62.5           ]
    [ N = 3.0:Tp 0.29]
*
    CHIC STORM                  10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD          0007  1  5.0     0.50     0.00  4.33    4.96 0.12    0.000
    [CN=62.4           ]
    [ N = 3.0:Tp 0.27]
*
    CHIC STORM                  10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD          0008  1  5.0     0.49     0.00  4.17    4.96 0.12    0.000
    [CN=62.5           ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0008]    0071  1  5.0     0.49     0.00  4.25    4.96  n/a    0.000
*
    ADD [  0007+  0071]   0061  3  5.0     0.99     0.01  4.25    4.96  n/a    0.000
*
    CHANNEL[ 2:  0061]    0072  1  5.0     0.99     0.01  4.33    4.96  n/a    0.000
*
    ADD [  0006+  0072]   0062  3  5.0     1.49     0.01  4.33    4.96  n/a    0.000
*
    CHANNEL[ 2:  0062]    0073  1  5.0     1.49     0.01  4.42    4.96  n/a    0.000
*
    CHIC STORM                  10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD          0019  1  5.0     1.68     0.01  4.58    4.04 0.10    0.000
    [CN=59.5           ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0019+  0005]   0063  3  5.0     3.09     0.02  4.50    4.62  n/a    0.000
*
    ADD [  0063+  0073]   0063  1  5.0     4.58     0.03  4.50    4.73  n/a    0.000
*
    CHANNEL[ 2:  0063]    0083  1  5.0     4.58     0.02  4.67    4.73  n/a    0.000
*
    CHIC STORM                  10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD          0009  1  5.0     0.36     0.00  4.33    7.28 0.17    0.000
    [CN=68.5           ]
    [ N = 3.0:Tp 0.27]
*
    CHIC STORM                  10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD          0017  1  5.0     0.17     0.00  4.17    9.00 0.21    0.000
    [CN=73.9           ]
```

```
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0017]   0080  1  5.0    0.17    0.00  4.25    8.99  n/a   0.000
*
    ADD [  0080+  0009]  0035  3  5.0    0.53    0.01  4.33    7.84  n/a   0.000
*
    CHANNEL[ 2:  0035]   0077  1  5.0    0.53    0.01  4.33    7.84  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD         0010  1  5.0    0.38    0.00  4.33    7.22 0.17   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0010+  0077]  0036  3  5.0    0.91    0.01  4.33    7.58  n/a   0.000
*
    CHANNEL[ 2:  0036]   0078  1  5.0    0.91    0.01  4.33    7.58  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD         0011  1  5.0    0.38    0.00  4.33    7.22 0.17   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0011+  0078]  0037  3  5.0    1.28    0.02  4.33    7.47  n/a   0.000
*
    CHANNEL[ 2:  0037]   0079  1  5.0    1.28    0.02  4.42    7.47  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD         0012  1  5.0    0.29    0.01  4.25    9.65 0.23   0.000
    [CN=75.0         ]
    [ N = 3.0:Tp 0.22]
*
    ADD [  0012+  0079]  0038  3  5.0    1.58    0.02  4.33    7.88  n/a   0.000
*
    CHANNEL[ 2:  0038]   0094  1  5.0    1.58    0.02  4.42    7.87  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD         0013  1  5.0    0.34    0.01  4.25   10.59 0.25   0.000
    [CN=76.5         ]
    [ N = 3.0:Tp 0.24]
*
    CHIC STORM                 10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD         0014  1  5.0    0.36    0.00  4.33    7.22 0.17   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    CHIC STORM                 10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD         0015  1  5.0    0.38    0.00  4.33    7.22 0.17   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
```

```
    CHIC STORM                   10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD          0016  1  5.0    0.39    0.00  4.33   7.19 0.17   0.000
    [CN=68.3         ]
    [ N = 3.0:Tp 0.27]
*
    CHIC STORM                   10.0
    [ Ptot= 42.34 mm ]
*
 ** CALIB NASHYD          0018  1  5.0    0.17    0.00  4.17   9.00 0.21   0.000
    [CN=73.9         ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0018]    0081  1  5.0    0.17    0.00  4.25   9.00  n/a   0.000
*
    ADD [  0016+  0081]   0039  3  5.0    0.56    0.01  4.25   7.75  n/a   0.000
*
    CHANNEL[ 2:  0039]    0074  1  5.0    0.56    0.01  4.33   7.75  n/a   0.000
*
    ADD [  0015+  0074]   0040  3  5.0    0.94    0.01  4.33   7.53  n/a   0.000
*
    CHANNEL[ 2:  0040]    0075  1  5.0    0.94    0.01  4.33   7.53  n/a   0.000
*
    ADD [  0014+  0075]   0041  3  5.0    1.30    0.02  4.33   7.44  n/a   0.000
*
    CHANNEL[ 2:  0041]    0076  1  5.0    1.30    0.02  4.42   7.44  n/a   0.000
*
    ADD [  0013+  0076]   0042  3  5.0    1.64    0.02  4.33   8.09  n/a   0.000
*
    CHANNEL[ 2:  0042]    0095  1  5.0    1.64    0.02  4.42   8.09  n/a   0.000
*
    ADD [  0094+  0095]   0043  3  5.0    3.22    0.04  4.42   7.99  n/a   0.000
*
 ** Reservoir
    OUTFLOW:              0093  1  5.0    3.22    0.00 12.00   2.92  n/a   0.000
*
    ADD [  0083+  0093]   0092  3  5.0    7.80    0.02  4.67   3.98  n/a   0.000
*
    CHANNEL[ 2:  0092]    0085  1  5.0    7.80    0.02  4.75   3.98  n/a   0.000
*
    ADD [  0084+  0085]   0086  3  5.0   10.99    0.04  4.67   4.26  n/a   0.000
*
    CHANNEL[ 2:  0086]    0087  1  5.0   10.99    0.04  4.83   4.26  n/a   0.000
*
```

```
  ************************************************
  ** SIMULATION : 7. Chi 12hr 100yr             **
  ************************************************

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

      START @  0.00 hrs
      --------------------
    CHIC STORM                   10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD          0001  1  5.0    0.50    0.04  4.17  28.41 0.30   0.000
    [CN=62.5         ]
```

```
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0001]   0068  1  5.0    0.50    0.04  4.17  28.41  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0002  1  5.0    0.50    0.03  4.25  28.41 0.30   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.26]
*
    ADD [  0002+  0068]  0064  3  5.0    1.00    0.07  4.17  28.41  n/a   0.000
*
    CHANNEL[ 2:  0064]   0069  1  5.0    1.00    0.07  4.25  28.41  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0003  1  5.0    0.51    0.03  4.25  28.41 0.30   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.24]
*
    ADD [  0003+  0069]  0065  3  5.0    1.51    0.10  4.25  28.41  n/a   0.000
*
    CHANNEL[ 2:  0065]   0070  1  5.0    1.51    0.10  4.25  28.40  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0004  1  5.0    1.68    0.07  4.50  28.37 0.30   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0004+  0070]  0066  3  5.0    3.18    0.16  4.33  28.39  n/a   0.000
*
    CHANNEL[ 2:  0066]   0084  1  5.0    3.18    0.16  4.42  28.39  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0005  1  5.0    1.41    0.07  4.33  29.60 0.32   0.000
    [CN=63.5         ]
    [ N = 3.0:Tp 0.34]
*
    CHIC STORM                 10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0006  1  5.0    0.50    0.03  4.33  28.50 0.30   0.000
    [CN=62.5         ]
    [ N = 3.0:Tp 0.29]
*
    CHIC STORM                 10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0007  1  5.0    0.50    0.03  4.25  28.42 0.30   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.27]
*
    CHIC STORM                 10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0008  1  5.0    0.49    0.04  4.17  28.41 0.30   0.000
```

```
    [CN=62.5          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0008]   0071  1  5.0    0.49    0.04  4.17  28.41  n/a   0.000
*
    ADD [  0007+  0071]  0061  3  5.0    0.99    0.06  4.17  28.41  n/a   0.000
*
    CHANNEL[ 2:  0061]   0072  1  5.0    0.99    0.07  4.25  28.41  n/a   0.000
*
    ADD [  0006+  0072]  0062  3  5.0    1.49    0.09  4.25  28.44  n/a   0.000
*
    CHANNEL[ 2:  0062]   0073  1  5.0    1.49    0.09  4.25  28.44  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0019  1  5.0    1.68    0.06  4.50  25.36 0.27   0.000
    [CN=59.5          ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0019+  0005]  0063  3  5.0    3.09    0.14  4.42  27.29  n/a   0.000
*
    ADD [  0063+  0073]  0063  1  5.0    4.58    0.22  4.33  27.67  n/a   0.000
*
    CHANNEL[ 2:  0063]   0083  1  5.0    4.58    0.21  4.50  27.66  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0009  1  5.0    0.36    0.03  4.25  35.51 0.38   0.000
    [CN=68.5          ]
    [ N = 3.0:Tp 0.27]
*
    CHIC STORM                 10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0017  1  5.0    0.17    0.02  4.08  41.13 0.44   0.000
    [CN=73.9          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0017]   0080  1  5.0    0.17    0.02  4.17  41.12  n/a   0.000
*
    ADD [  0080+  0009]  0035  3  5.0    0.53    0.05  4.25  37.34  n/a   0.000
*
    CHANNEL[ 2:  0035]   0077  1  5.0    0.53    0.05  4.25  37.34  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0010  1  5.0    0.38    0.03  4.25  35.35 0.38   0.000
    [CN=68.4          ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0010+  0077]  0036  3  5.0    0.91    0.08  4.25  36.52  n/a   0.000
*
    CHANNEL[ 2:  0036]   0078  1  5.0    0.91    0.08  4.25  36.51  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0011  1  5.0    0.38    0.03  4.25  35.35 0.38   0.000
    [CN=68.4          ]
```

```
    [ N = 3.0:Tp 0.27]
*
    ADD [  0011+  0078]  0037  3  5.0    1.28    0.11  4.25  36.17  n/a   0.000
*
    CHANNEL[ 2:  0037]   0079  1  5.0    1.28    0.11  4.25  36.17  n/a   0.000
*
    CHIC STORM                10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0012  1  5.0    0.29    0.03  4.17  42.83 0.46   0.000
    [CN=75.0          ]
    [ N = 3.0:Tp 0.22]
*
    ADD [  0012+  0079]  0038  3  5.0    1.58    0.14  4.25  37.41  n/a   0.000
*
    CHANNEL[ 2:  0038]   0094  1  5.0    1.58    0.13  4.25  37.41  n/a   0.000
*
    CHIC STORM                10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0013  1  5.0    0.34    0.04  4.17  45.12 0.48   0.000
    [CN=76.5          ]
    [ N = 3.0:Tp 0.24]
*
    CHIC STORM                10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0014  1  5.0    0.36    0.03  4.25  35.35 0.38   0.000
    [CN=68.4          ]
    [ N = 3.0:Tp 0.27]
*
    CHIC STORM                10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0015  1  5.0    0.38    0.03  4.25  35.35 0.38   0.000
    [CN=68.4          ]
    [ N = 3.0:Tp 0.27]
*
    CHIC STORM                10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0016  1  5.0    0.39    0.03  4.25  35.26 0.38   0.000
    [CN=68.3          ]
    [ N = 3.0:Tp 0.27]
*
    CHIC STORM                10.0
    [ Ptot= 93.90 mm ]
*
 ** CALIB NASHYD         0018  1  5.0    0.17    0.02  4.08  41.13 0.44   0.000
    [CN=73.9          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0018]   0081  1  5.0    0.17    0.02  4.17  41.13  n/a   0.000
*
    ADD [  0016+  0081]  0039  3  5.0    0.56    0.05  4.17  37.06  n/a   0.000
*
    CHANNEL[ 2:  0039]   0074  1  5.0    0.56    0.05  4.25  37.06  n/a   0.000
*
    ADD [  0015+  0074]  0040  3  5.0    0.94    0.08  4.25  36.38  n/a   0.000
*
    CHANNEL[ 2:  0040]   0075  1  5.0    0.94    0.08  4.25  36.38  n/a   0.000
*
```

```
    ADD [  0014+  0075]  0041  3  5.0     1.30    0.11  4.25  36.09  n/a    0.000
*
    CHANNEL[ 2:  0041]   0076  1  5.0     1.30    0.11  4.25  36.09  n/a    0.000
*
    ADD [  0013+  0076]  0042  3  5.0     1.64    0.14  4.25  37.96  n/a    0.000
*
    CHANNEL[ 2:  0042]   0095  1  5.0     1.64    0.14  4.25  37.96  n/a    0.000
*
    ADD [  0094+  0095]  0043  3  5.0     3.22    0.28  4.25  37.69  n/a    0.000
*
 ** Reservoir
    OUTFLOW:             0093  1  5.0     3.22    0.07  5.17  32.63  n/a    0.000
*
    ADD [  0083+  0093]  0092  3  5.0     7.80    0.24  4.58  29.71  n/a    0.000
*
    CHANNEL[ 2:  0092]   0085  1  5.0     7.80    0.24  4.58  29.71  n/a    0.000
*
    ADD [  0084+  0085]  0086  3  5.0    10.99    0.39  4.50  29.33  n/a    0.000
*
    CHANNEL[ 2:  0086]   0087  1  5.0    10.99    0.39  4.50  29.33  n/a    0.000
*
 FINISH
```

```
  ************************************************
  ** SIMULATION : 8. Historical July 1 1979     **
  ************************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                  5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0001  1  5.0     0.50    0.04  1.67  22.90 0.27   0.000
    [CN=62.5          ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0001]   0068  1  5.0     0.50    0.04  1.67  22.90  n/a   0.000
*
    READ STORM                  5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0002  1  5.0     0.50    0.04  1.75  22.90 0.27   0.000
    [CN=62.4          ]
    [ N = 3.0:Tp 0.26]
*
    ADD [  0002+  0068]  0064  3  5.0     1.00    0.08  1.75  22.90  n/a   0.000
*
    CHANNEL[ 2:  0064]   0069  1  5.0     1.00    0.08  1.75  22.90  n/a   0.000
*
    READ STORM                  5.0
```

```
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0003  1  5.0    0.51    0.04  1.75  22.90 0.27   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.24]
*
    ADD [  0003+  0069]  0065  3  5.0    1.51    0.11  1.75  22.90  n/a   0.000
*
    CHANNEL[ 2:  0065]   0070  1  5.0    1.51    0.11  1.75  22.90  n/a   0.000
*
    READ STORM                    5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0004  1  5.0    1.68    0.10  2.00  22.86 0.27   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0004+  0070]  0066  3  5.0    3.18    0.20  1.83  22.88  n/a   0.000
*
    CHANNEL[ 2:  0066]   0084  1  5.0    3.18    0.20  1.92  22.88  n/a   0.000
*
    READ STORM                    5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0005  1  5.0    1.41    0.09  1.83  23.93 0.28   0.000
    [CN=63.5         ]
    [ N = 3.0:Tp 0.34]
*
    READ STORM                    5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0006  1  5.0    0.50    0.03  1.83  22.98 0.27   0.000
    [CN=62.5         ]
    [ N = 3.0:Tp 0.29]
*
    READ STORM                    5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0007  1  5.0    0.50    0.04  1.75  22.91 0.27   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                    5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
```

```
*
 ** CALIB NASHYD         0008  1  5.0    0.49    0.04  1.67  22.90 0.27   0.000
    [CN=62.5         ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0008]   0071  1  5.0    0.49    0.04  1.67  22.90  n/a   0.000
*
    ADD [  0007+  0071]  0061  3  5.0    0.99    0.08  1.75  22.91  n/a   0.000
*
    CHANNEL[ 2:  0061]   0072  1  5.0    0.99    0.08  1.75  22.91  n/a   0.000
*
    ADD [  0006+  0072]  0062  3  5.0    1.49    0.11  1.75  22.93  n/a   0.000
*
    CHANNEL[ 2:  0062]   0073  1  5.0    1.49    0.11  1.75  22.93  n/a   0.000
*
    READ STORM                  5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0019  1  5.0    1.68    0.09  2.00  20.26 0.24   0.000
    [CN=59.5         ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0019+  0005]  0063  3  5.0    3.09    0.18  1.92  21.94  n/a   0.000
*
    ADD [  0063+  0073]  0063  1  5.0    4.58    0.28  1.83  22.26  n/a   0.000
*
    CHANNEL[ 2:  0063]   0083  1  5.0    4.58    0.27  1.92  22.25  n/a   0.000
*
    READ STORM                  5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0009  1  5.0    0.36    0.03  1.75  29.11 0.35   0.000
    [CN=68.5         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                  5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0017  1  5.0    0.17    0.02  1.67  34.02 0.41   0.000
    [CN=73.9         ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0017]   0080  1  5.0    0.17    0.02  1.67  34.01  n/a   0.000
*
    ADD [  0080+  0009]  0035  3  5.0    0.53    0.05  1.75  30.70  n/a   0.000
*
    CHANNEL[ 2:  0035]   0077  1  5.0    0.53    0.05  1.75  30.70  n/a   0.000
*
    READ STORM                  5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
```

```
*
 ** CALIB NASHYD         0010  1  5.0    0.38    0.03  1.75  28.97 0.34   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0010+  0077]  0036  3  5.0    0.91    0.09  1.75  29.98  n/a   0.000
*
    CHANNEL[ 2:  0036]   0078  1  5.0    0.91    0.09  1.75  29.98  n/a   0.000
*
    READ STORM                  5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0011  1  5.0    0.38    0.03  1.75  28.97 0.34   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0011+  0078]  0037  3  5.0    1.28    0.12  1.75  29.68  n/a   0.000
*
    CHANNEL[ 2:  0037]   0079  1  5.0    1.28    0.12  1.83  29.68  n/a   0.000
*
    READ STORM                  5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0012  1  5.0    0.29    0.03  1.67  35.53 0.42   0.000
    [CN=75.0         ]
    [ N = 3.0:Tp 0.22]
*
    ADD [  0012+  0079]  0038  3  5.0    1.58    0.15  1.75  30.77  n/a   0.000
*
    CHANNEL[ 2:  0038]   0094  1  5.0    1.58    0.15  1.83  30.77  n/a   0.000
*
    READ STORM                  5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0013  1  5.0    0.34    0.04  1.75  37.60 0.45   0.000
    [CN=76.5         ]
    [ N = 3.0:Tp 0.24]
*
    READ STORM                  5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0014  1  5.0    0.36    0.03  1.75  28.97 0.34   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                  5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
```

```
*
 ** CALIB NASHYD         0015  1  5.0    0.38    0.03  1.75  28.97 0.34   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                  5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0016  1  5.0    0.39    0.03  1.75  28.89 0.34   0.000
    [CN=68.3         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                  5.0
    [ Ptot= 83.99 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\d7f4048b-1af6-49f3-b4b8-e4e455
    remark: Ottawa July 1 1979
*
 ** CALIB NASHYD         0018  1  5.0    0.17    0.02  1.67  34.02 0.41   0.000
    [CN=73.9         ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0018]   0081  1  5.0    0.17    0.02  1.67  34.02  n/a   0.000
*
    ADD [  0016+  0081]  0039  3  5.0    0.56    0.05  1.75  30.46  n/a   0.000
*
    CHANNEL[ 2:  0039]   0074  1  5.0    0.56    0.05  1.75  30.46  n/a   0.000
*
    ADD [  0015+  0074]  0040  3  5.0    0.94    0.09  1.75  29.86  n/a   0.000
*
    CHANNEL[ 2:  0040]   0075  1  5.0    0.94    0.09  1.75  29.86  n/a   0.000
*
    ADD [  0014+  0075]  0041  3  5.0    1.30    0.12  1.75  29.61  n/a   0.000
*
    CHANNEL[ 2:  0041]   0076  1  5.0    1.30    0.12  1.75  29.61  n/a   0.000
*
    ADD [  0013+  0076]  0042  3  5.0    1.64    0.16  1.75  31.27  n/a   0.000
*
    CHANNEL[ 2:  0042]   0095  1  5.0    1.64    0.16  1.75  31.27  n/a   0.000
*
    ADD [  0094+  0095]  0043  3  5.0    3.22    0.31  1.83  31.02  n/a   0.000
*
 ** Reservoir
    OUTFLOW:             0093  1  5.0    3.22    0.10  2.42  25.96  n/a   0.000
*
    ADD [  0083+  0093]  0092  3  5.0    7.80    0.33  2.08  23.78  n/a   0.000
*
    CHANNEL[ 2:  0092]   0085  1  5.0    7.80    0.33  2.08  23.78  n/a   0.000
*
    ADD [  0084+  0085]  0086  3  5.0   10.99    0.52  2.00  23.52  n/a   0.000
*
    CHANNEL[ 2:  0086]   0087  1  5.0   10.99    0.52  2.08  23.52  n/a   0.000
*
```

```
  ***********************************************
  ** SIMULATION : 9. Historical Aug 4 1988      **
  ***********************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                  5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD          0001  1  5.0    0.50    0.04  2.08  21.10 0.26   0.000
    [CN=62.5         ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0001]   0068  1  5.0    0.50    0.04  2.08  21.10  n/a   0.000
*
    READ STORM                  5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD          0002  1  5.0    0.50    0.03  2.08  21.09 0.26   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.26]
*
    ADD [  0002+  0068]  0064  3  5.0    1.00    0.08  2.08  21.09  n/a   0.000
*
    CHANNEL[ 2:  0064]   0069  1  5.0    1.00    0.07  2.17  21.09  n/a   0.000
*
    READ STORM                  5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD          0003  1  5.0    0.51    0.04  2.08  21.09 0.26   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.24]
*
    ADD [  0003+  0069]  0065  3  5.0    1.51    0.11  2.08  21.09  n/a   0.000
*
    CHANNEL[ 2:  0065]   0070  1  5.0    1.51    0.11  2.17  21.09  n/a   0.000
*
    READ STORM                  5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD          0004  1  5.0    1.68    0.08  2.25  21.05 0.26   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0004+  0070]  0066  3  5.0    3.18    0.19  2.17  21.07  n/a   0.000
```

```
*
    CHANNEL[ 2:  0066]   0084  1  5.0    3.18    0.18  2.25  21.07  n/a   0.000
*
    READ STORM                  5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0005  1  5.0    1.41    0.08  2.17  22.07 0.27   0.000
    [CN=63.5         ]
    [ N = 3.0:Tp 0.34]
*
    READ STORM                  5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0006  1  5.0    0.50    0.03  2.17  21.16 0.26   0.000
    [CN=62.5         ]
    [ N = 3.0:Tp 0.29]
*
    READ STORM                  5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0007  1  5.0    0.50    0.03  2.08  21.10 0.26   0.000
    [CN=62.4         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                  5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0008  1  5.0    0.49    0.04  2.08  21.10 0.26   0.000
    [CN=62.5         ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0008]   0071  1  5.0    0.49    0.04  2.08  21.10  n/a   0.000
*
    ADD [  0007+  0071]  0061  3  5.0    0.99    0.07  2.08  21.10  n/a   0.000
*
    CHANNEL[ 2:  0061]   0072  1  5.0    0.99    0.07  2.17  21.10  n/a   0.000
*
    ADD [  0006+  0072]  0062  3  5.0    1.49    0.10  2.17  21.12  n/a   0.000
*
    CHANNEL[ 2:  0062]   0073  1  5.0    1.49    0.11  2.17  21.12  n/a   0.000
*
    READ STORM                  5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0019  1  5.0    1.68    0.07  2.25  18.60 0.23   0.000
    [CN=59.5         ]
    [ N = 3.0:Tp 0.41]
```

```
*
    ADD [  0019+  0005]  0063  3  5.0    3.09    0.15  2.17  20.18  n/a   0.000
*
    ADD [  0063+  0073]  0063  1  5.0    4.58    0.26  2.17  20.49  n/a   0.000
*
    CHANNEL[ 2:  0063]   0083  1  5.0    4.58    0.24  2.25  20.48  n/a   0.000
*
    READ STORM                  5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0009  1  5.0    0.36    0.03  2.08  26.99 0.33   0.000
    [CN=68.5         ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                  5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0017  1  5.0    0.17    0.02  2.08  31.64 0.39   0.000
    [CN=73.9         ]
    [ N = 3.0:Tp 0.17]
*
    CHANNEL[ 2:  0017]   0080  1  5.0    0.17    0.02  2.08  31.63  n/a   0.000
*
    ADD [  0080+  0009]  0035  3  5.0    0.53    0.05  2.08  28.50  n/a   0.000
*
    CHANNEL[ 2:  0035]   0077  1  5.0    0.53    0.05  2.17  28.50  n/a   0.000
*
    READ STORM                  5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0010  1  5.0    0.38    0.03  2.08  26.85 0.33   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0010+  0077]  0036  3  5.0    0.91    0.08  2.17  27.81  n/a   0.000
*
    CHANNEL[ 2:  0036]   0078  1  5.0    0.91    0.08  2.17  27.81  n/a   0.000
*
    READ STORM                  5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0011  1  5.0    0.38    0.03  2.08  26.85 0.33   0.000
    [CN=68.4         ]
    [ N = 3.0:Tp 0.27]
*
    ADD [  0011+  0078]  0037  3  5.0    1.28    0.11  2.17  27.53  n/a   0.000
*
    CHANNEL[ 2:  0037]   0079  1  5.0    1.28    0.11  2.17  27.53  n/a   0.000
*
    READ STORM                  5.0
```

```
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0012  1  5.0    0.29    0.03  2.08  33.09 0.41   0.000
    [CN=75.0          ]
    [ N = 3.0:Tp 0.22]
*
    ADD [  0012+  0079]  0038  3  5.0    1.58    0.14  2.17  28.57  n/a   0.000
*
    CHANNEL[ 2:  0038]   0094  1  5.0    1.58    0.14  2.17  28.56  n/a   0.000
*
    READ STORM                    5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0013  1  5.0    0.34    0.04  2.08  35.08 0.44   0.000
    [CN=76.5          ]
    [ N = 3.0:Tp 0.24]
*
    READ STORM                    5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0014  1  5.0    0.36    0.03  2.08  26.85 0.33   0.000
    [CN=68.4          ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                    5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0015  1  5.0    0.38    0.03  2.08  26.85 0.33   0.000
    [CN=68.4          ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                    5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0016  1  5.0    0.39    0.03  2.08  26.77 0.33   0.000
    [CN=68.3          ]
    [ N = 3.0:Tp 0.27]
*
    READ STORM                    5.0
    [ Ptot= 80.57 mm ]
    fname : C:\Users\hymo\AppData\Local\Temp\916ce198-0177-4899-8069-
1d7002190864\3c6051d3-683f-4b2d-95ad-68862a
    remark: Ottawa Aug 4 1988
*
 ** CALIB NASHYD         0018  1  5.0    0.17    0.02  2.08  31.64 0.39   0.000
    [CN=73.9          ]
    [ N = 3.0:Tp 0.17]
```

```
*
    CHANNEL[ 2:  0018]   0081  1  5.0    0.17    0.02  2.08  31.64  n/a   0.000
*
    ADD [  0016+  0081]  0039  3  5.0    0.56    0.05  2.08  28.27  n/a   0.000
*
    CHANNEL[ 2:  0039]   0074  1  5.0    0.56    0.05  2.17  28.27  n/a   0.000
*
    ADD [  0015+  0074]  0040  3  5.0    0.94    0.08  2.17  27.70  n/a   0.000
*
    CHANNEL[ 2:  0040]   0075  1  5.0    0.94    0.08  2.17  27.70  n/a   0.000
*
    ADD [  0014+  0075]  0041  3  5.0    1.30    0.11  2.17  27.46  n/a   0.000
*
    CHANNEL[ 2:  0041]   0076  1  5.0    1.30    0.11  2.17  27.46  n/a   0.000
*
    ADD [  0013+  0076]  0042  3  5.0    1.64    0.15  2.17  29.04  n/a   0.000
*
    CHANNEL[ 2:  0042]   0095  1  5.0    1.64    0.15  2.17  29.04  n/a   0.000
*
    ADD [  0094+  0095]  0043  3  5.0    3.22    0.29  2.17  28.80  n/a   0.000
*
 ** Reservoir
    OUTFLOW:             0093  1  5.0    3.22    0.07  2.67  23.74  n/a   0.000
*
    ADD [  0083+  0093]  0092  3  5.0    7.80    0.27  2.33  21.82  n/a   0.000
*
    CHANNEL[ 2:  0092]   0085  1  5.0    7.80    0.27  2.33  21.82  n/a   0.000
*
    ADD [  0084+  0085]  0086  3  5.0   10.99    0.45  2.25  21.61  n/a   0.000
*
    CHANNEL[ 2:  0086]   0087  1  5.0   10.99    0.45  2.33  21.60  n/a   0.000
```

```
*****************************************
** SIMULATION:1. SCS II 6hr 5yr Ottawa **
*****************************************

--------------------
| ADD HYD  (  0086)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0084):      3.18   0.041     3.50     7.61
      + ID2= 2 (  0085):      7.80   0.056     3.67     7.01
        ====================================================
        ID = 3 (  0086):     10.99   0.096     3.58     7.19

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
***********************************
** SIMULATION:10. 25mm4hrChicago **
***********************************

--------------------
| ADD HYD  (  0086)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0084):      3.18   0.004     2.83     0.98
      + ID2= 2 (  0085):      7.80   0.005     3.17     0.53
        ====================================================
        ID = 3 (  0086):     10.99   0.008     3.00     0.66

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
***********************************************
** SIMULATION:100 year 12 hr Chi 120 percent **
***********************************************

--------------------
| ADD HYD  (  0086)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0084):      3.18   0.235     4.42    39.77
      + ID2= 2 (  0085):      7.80   0.369     4.58    41.84
        ====================================================
        ID = 3 (  0086):     10.99   0.587     4.50    41.24

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
*******************************************
** SIMULATION:2. SCS II 6hr 100yr Ottawa **
*******************************************

--------------------
| ADD HYD  (  0086)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0084):      3.18   0.146     3.33    24.51
      + ID2= 2 (  0085):      7.80   0.232     3.58    25.54
        ====================================================
        ID = 3 (  0086):     10.99   0.366     3.42    25.24

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

```
*******************************************
** SIMULATION:3. SCS II 12hr 5yr Ottawa **
*******************************************

--------------------
| ADD HYD  (  0086)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0084):      3.18   0.050     6.33    10.20
      + ID2= 2 (  0085):      7.80   0.066     6.42     9.91
        =====================================================
        ID = 3 (  0086):     10.99   0.115     6.42     9.99

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
********************************************
** SIMULATION:4. SCS II 12hr 10yr Ottawa **
********************************************

--------------------
| ADD HYD  (  0086)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0084):      3.18   0.075     6.33    14.51
      + ID2= 2 (  0085):      7.80   0.103     6.42    14.67
        =====================================================
        ID = 3 (  0086):     10.99   0.176     6.33    14.62

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
**********************************************
** SIMULATION:5. SCS II 12hr 100yr correct **
**********************************************

--------------------
| ADD HYD  (  0086)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0084):      3.18   0.164     6.25    29.60
      + ID2= 2 (  0085):      7.80   0.254     6.42    31.01
        =====================================================
        ID = 3 (  0086):     10.99   0.410     6.33    30.60

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
************************************
** SIMULATION:6. Chi 12hr 2yr     **
************************************

--------------------
| ADD HYD  (  0086)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0084):      3.18   0.018     4.67     4.94
      + ID2= 2 (  0085):      7.80   0.024     4.75     3.98
        =====================================================
        ID = 3 (  0086):     10.99   0.042     4.67     4.26

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

```
************************************
** SIMULATION:7. Chi 12hr 100yr   **
************************************

--------------------
| ADD HYD  (  0086)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0084):      3.18   0.160     4.42    28.39
      + ID2= 2 (  0085):      7.80   0.237     4.58    29.71
        ====================================================
        ID = 3 (  0086):     10.99   0.389     4.50    29.33

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
******************************************
** SIMULATION:8. Historical July 1 1979 **
******************************************

--------------------
| ADD HYD  (  0086)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0084):      3.18   0.199     1.92    22.88
      + ID2= 2 (  0085):      7.80   0.331     2.08    23.78
        ====================================================
        ID = 3 (  0086):     10.99   0.517     2.00    23.52

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
*****************************************
** SIMULATION:9. Historical Aug 4 1988 **
*****************************************

--------------------
| ADD HYD  (  0086)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0084):      3.18   0.181     2.25    21.07
      + ID2= 2 (  0085):      7.80   0.274     2.33    21.82
        ====================================================
        ID = 3 (  0086):     10.99   0.450     2.25    21.61

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

APPENDIX I1: OTTHYMO MODEL ROUTE RESERVOIR REPORT – STORAGE SWALE – NON-COINCIDENT OR NORMAL

Analysis results from December 10, 2024 have been reinserted in this appendix without alteration as the revisions made to the report and drawings did not result in changes to the stormwater management model.

```
*****************************************
** SIMULATION:1. SCS II 6hr 5yr Ottawa **
*****************************************
--------------------
| RESERVOIR(  0093)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0270      0.0300
                          0.0000     0.0020   |   0.0380      0.0340
                          0.0000     0.0040   |   0.0510      0.0380
                          0.0000     0.0067   |   0.0670      0.0430
                          0.0000     0.0090   |   0.0850      0.0480
                          0.0010     0.0120   |   0.1050      0.0540
                          0.0030     0.0150   |   0.1280      0.0600
                          0.0070     0.0190   |   0.1540      0.0660
                          0.0120     0.0220   |   0.1830      0.0720
                          0.0190     0.0260   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0043)      3.218     0.079      3.25      11.56
   OUTFLOW: ID= 1 (  0093)      3.218     0.016      4.83       8.52
   OVERFLOW:ID= 3 (  0003)      0.000     0.000      0.00       0.00

                   TOTAL NUMBER OF SIMULATION OVERFLOW  =     0
                   CUMULATIVE TIME OF OVERFLOW  (HOURS) =  0.00
                   PERCENTAGE OF TIME OVERFLOWING   (%) =  0.00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 20.71
                   TIME SHIFT OF PEAK FLOW         (min)= 95.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0244

-------------------------------------------------------------------------------
*******************************************
** SIMULATION:2. SCS II 6hr 100yr Ottawa **
*******************************************
--------------------
| RESERVOIR(  0093)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0270      0.0300
                          0.0000     0.0020   |   0.0380      0.0340
                          0.0000     0.0040   |   0.0510      0.0380
                          0.0000     0.0067   |   0.0670      0.0430
                          0.0000     0.0090   |   0.0850      0.0480
                          0.0010     0.0120   |   0.1050      0.0540
                          0.0030     0.0150   |   0.1280      0.0600
                          0.0070     0.0190   |   0.1540      0.0660
                          0.0120     0.0220   |   0.1830      0.0720
                          0.0190     0.0260   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0043)      3.218     0.241      3.17      32.84
   OUTFLOW: ID= 1 (  0093)      3.218     0.096      3.92      29.81
   OVERFLOW:ID= 3 (  0003)      0.000     0.000      0.00       0.00

                   TOTAL NUMBER OF SIMULATION OVERFLOW  =     0
```

```
                   CUMULATIVE TIME OF OVERFLOW  (HOURS) =  0.00
                   PERCENTAGE OF TIME OVERFLOWING   (%) =  0.00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 40.07
                   TIME SHIFT OF PEAK FLOW         (min)= 45.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0514

--------------------------------------------------------------------------------
******************************************
** SIMULATION:3. SCS II 12hr 5yr Ottawa **
******************************************
--------------------
| RESERVOIR(  0093)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)      (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000    |   0.0270      0.0300
                          0.0000     0.0020    |   0.0380      0.0340
                          0.0000     0.0040    |   0.0510      0.0380
                          0.0000     0.0067    |   0.0670      0.0430
                          0.0000     0.0090    |   0.0850      0.0480
                          0.0010     0.0120    |   0.1050      0.0540
                          0.0030     0.0150    |   0.1280      0.0600
                          0.0070     0.0190    |   0.1540      0.0660
                          0.0120     0.0220    |   0.1830      0.0720
                          0.0190     0.0260    |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0043)      3.218      0.095      6.17      14.96
   OUTFLOW: ID= 1 (  0093)      3.218      0.019      7.50      11.93
   OVERFLOW:ID= 3 (  0003)      0.000      0.000      0.00       0.00

                   TOTAL NUMBER OF SIMULATION OVERFLOW  =     0
                   CUMULATIVE TIME OF OVERFLOW  (HOURS) =  0.00
                   PERCENTAGE OF TIME OVERFLOWING   (%) =  0.00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 19.63
                   TIME SHIFT OF PEAK FLOW         (min)= 80.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0259

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

```
******************************************
** SIMULATION:4. SCS II 12hr 10yr Ottawa **
******************************************
--------------------
| RESERVOIR(  0093)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0270      0.0300
                          0.0000     0.0020   |   0.0380      0.0340
                          0.0000     0.0040   |   0.0510      0.0380
                          0.0000     0.0067   |   0.0670      0.0430
                          0.0000     0.0090   |   0.0850      0.0480
                          0.0010     0.0120   |   0.1050      0.0540
                          0.0030     0.0150   |   0.1280      0.0600
                          0.0070     0.0190   |   0.1540      0.0660
                          0.0120     0.0220   |   0.1830      0.0720
                          0.0190     0.0260   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0043)      3.218      0.134      6.17      20.49
   OUTFLOW: ID= 1 (  0093)      3.218      0.034      7.17      17.46
   OVERFLOW:ID= 3 (  0003)      0.000      0.000      0.00       0.00

                   TOTAL NUMBER OF SIMULATION OVERFLOW  =     0
                   CUMULATIVE TIME OF OVERFLOW  (HOURS) =  0.00
                   PERCENTAGE OF TIME OVERFLOWING   (%) =  0.00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 25.74
                   TIME SHIFT OF PEAK FLOW         (min)= 60.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0327

--------------------------------------------------------------------------------
********************************************
** SIMULATION:5. SCS II 12hr 100yr correct **
********************************************
--------------------
| RESERVOIR(  0093)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0270      0.0300
                          0.0000     0.0020   |   0.0380      0.0340
                          0.0000     0.0040   |   0.0510      0.0380
                          0.0000     0.0067   |   0.0670      0.0430
                          0.0000     0.0090   |   0.0850      0.0480
                          0.0010     0.0120   |   0.1050      0.0540
                          0.0030     0.0150   |   0.1280      0.0600
                          0.0070     0.0190   |   0.1540      0.0660
                          0.0120     0.0220   |   0.1830      0.0720
                          0.0190     0.0260   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0043)      3.218      0.264      6.17      38.95
   OUTFLOW: ID= 1 (  0093)      3.218      0.102      6.83      35.92
   OVERFLOW:ID= 3 (  0003)      0.000      0.000      0.00       0.00

                   TOTAL NUMBER OF SIMULATION OVERFLOW  =     0
```

```
                   CUMULATIVE TIME OF OVERFLOW  (HOURS) =  0.00
                   PERCENTAGE OF TIME OVERFLOWING   (%) =  0.00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 38.61
                   TIME SHIFT OF PEAK FLOW         (min)= 40.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0531

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

************************************
** SIMULATION:6. Chi 12hr 2yr     **
************************************
--------------------
| RESERVOIR(  0093)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0270      0.0300
                          0.0000     0.0020   |   0.0380      0.0340
                          0.0000     0.0040   |   0.0510      0.0380
                          0.0000     0.0067   |   0.0670      0.0430
                          0.0000     0.0090   |   0.0850      0.0480
                          0.0010     0.0120   |   0.1050      0.0540
                          0.0030     0.0150   |   0.1280      0.0600
                          0.0070     0.0190   |   0.1540      0.0660
                          0.0120     0.0220   |   0.1830      0.0720
                          0.0190     0.0260   |   0.0000      0.0000

                                AREA     QPEAK      TPEAK       R.V.
                                (ha)     (cms)      (hrs)       (mm)
   INFLOW : ID= 2 (  0043)      3.218      0.044      4.42       7.92
   OUTFLOW: ID= 1 (  0093)      3.218      0.004      8.25       4.89
   OVERFLOW:ID= 3 (  0003)      0.000      0.000      0.00       0.00

                   TOTAL NUMBER OF SIMULATION OVERFLOW  =     0
                   CUMULATIVE TIME OF OVERFLOW  (HOURS) =  0.00
                   PERCENTAGE OF TIME OVERFLOWING   (%) =  0.00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 10.16
                   TIME SHIFT OF PEAK FLOW         (min)=230.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0165

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

```
************************************
** SIMULATION:7. Chi 12hr 100yr   **
************************************
--------------------
| RESERVOIR(  0093)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0270      0.0300
                          0.0000     0.0020   |   0.0380      0.0340
                          0.0000     0.0040   |   0.0510      0.0380
                          0.0000     0.0067   |   0.0670      0.0430
                          0.0000     0.0090   |   0.0850      0.0480
                          0.0010     0.0120   |   0.1050      0.0540
                          0.0030     0.0150   |   0.1280      0.0600
                          0.0070     0.0190   |   0.1540      0.0660
                          0.0120     0.0220   |   0.1830      0.0720
                          0.0190     0.0260   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0043)      3.218      0.277      4.25      37.50
   OUTFLOW: ID= 1 (  0093)      3.218      0.090      5.00      34.47
   OVERFLOW:ID= 3 (  0003)      0.000      0.000      0.00       0.00

                   TOTAL NUMBER OF SIMULATION OVERFLOW  =     0
                   CUMULATIVE TIME OF OVERFLOW  (HOURS) =  0.00
                   PERCENTAGE OF TIME OVERFLOWING   (%) =  0.00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 32.54
                   TIME SHIFT OF PEAK FLOW         (min)= 45.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0496

--------------------------------------------------------------------------------
******************************************
** SIMULATION:8. Historical July 1 1979 **
******************************************
--------------------
| RESERVOIR(  0093)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0270      0.0300
                          0.0000     0.0020   |   0.0380      0.0340
                          0.0000     0.0040   |   0.0510      0.0380
                          0.0000     0.0067   |   0.0670      0.0430
                          0.0000     0.0090   |   0.0850      0.0480
                          0.0010     0.0120   |   0.1050      0.0540
                          0.0030     0.0150   |   0.1280      0.0600
                          0.0070     0.0190   |   0.1540      0.0660
                          0.0120     0.0220   |   0.1830      0.0720
                          0.0190     0.0260   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0043)      3.218      0.306      1.83      30.86
   OUTFLOW: ID= 1 (  0093)      3.218      0.131      2.33      27.83
   OVERFLOW:ID= 3 (  0003)      0.000      0.000      0.00       0.00

                   TOTAL NUMBER OF SIMULATION OVERFLOW  =     0
```

```
                   CUMULATIVE TIME OF OVERFLOW  (HOURS) =  0.00
                   PERCENTAGE OF TIME OVERFLOWING   (%) =  0.00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 42.72
                   TIME SHIFT OF PEAK FLOW         (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0607

--------------------------------------------------------------------------------
*****************************************
** SIMULATION:9. Historical Aug 4 1988 **
*****************************************
--------------------
| RESERVOIR(  0093)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0270     0.0300
                          0.0000     0.0020   |   0.0380     0.0340
                          0.0000     0.0040   |   0.0510     0.0380
                          0.0000     0.0067   |   0.0670     0.0430
                          0.0000     0.0090   |   0.0850     0.0480
                          0.0010     0.0120   |   0.1050     0.0540
                          0.0030     0.0150   |   0.1280     0.0600
                          0.0070     0.0190   |   0.1540     0.0660
                          0.0120     0.0220   |   0.1830     0.0720
                          0.0190     0.0260   |   0.0000     0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0043)      3.218     0.287      2.17      28.65
   OUTFLOW: ID= 1 (  0093)      3.218     0.096      2.58      25.62
   OVERFLOW:ID= 3 (  0003)      0.000     0.000      0.00       0.00

                   TOTAL NUMBER OF SIMULATION OVERFLOW  =      0
                   CUMULATIVE TIME OF OVERFLOW  (HOURS) =  0.00
                   PERCENTAGE OF TIME OVERFLOWING   (%) =  0.00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 33.44
                   TIME SHIFT OF PEAK FLOW         (min)= 25.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0515
```

```
--------------------------------------------------------------------------------
***********************************
** SIMULATION:10. 25mm4hrChicago **
***********************************
--------------------
| RESERVOIR(  0093)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0270     0.0300
                          0.0000     0.0020   |   0.0380     0.0340
                          0.0000     0.0040   |   0.0510     0.0380
                          0.0000     0.0067   |   0.0670     0.0430
                          0.0000     0.0090   |   0.0850     0.0480
                          0.0010     0.0120   |   0.1050     0.0540
                          0.0030     0.0150   |   0.1280     0.0600
                          0.0070     0.0190   |   0.1540     0.0660
                          0.0120     0.0220   |   0.1830     0.0720
                          0.0190     0.0260   |   0.0000     0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0043)      3.218     0.009     2.17        2.08
   OUTFLOW: ID= 1 (  0093)      3.218     0.000     0.00        0.00
   OVERFLOW:ID= 3 (  0003)      0.000     0.000     0.00        0.00

                   TOTAL NUMBER OF SIMULATION OVERFLOW  =     0
                   CUMULATIVE TIME OF OVERFLOW  (HOURS) =  0.00
                   PERCENTAGE OF TIME OVERFLOWING   (%) =  0.00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.00
                   TIME SHIFT OF PEAK FLOW         (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0067

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

```
***********************************************
** SIMULATION:100 year 12 hr Chi 120 percent **
***********************************************
--------------------
| RESERVOIR(  0093)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0270      0.0300
                          0.0000     0.0020   |   0.0380      0.0340
                          0.0000     0.0040   |   0.0510      0.0380
                          0.0000     0.0067   |   0.0670      0.0430
                          0.0000     0.0090   |   0.0850      0.0480
                          0.0010     0.0120   |   0.1050      0.0540
                          0.0030     0.0150   |   0.1280      0.0600
                          0.0070     0.0190   |   0.1540      0.0660
                          0.0120     0.0220   |   0.1830      0.0720
                          0.0190     0.0260   |   0.0000      0.0000

                                AREA      QPEAK      TPEAK       R.V.
                                (ha)      (cms)      (hrs)       (mm)
   INFLOW : ID= 2 (  0043)      3.218       0.389       4.33       50.92
   OUTFLOW: ID= 1 (  0093)      3.218       0.144       4.92       47.89
   OVERFLOW:ID= 3 (  0003)      0.000       0.000       0.00        0.00

                   TOTAL NUMBER OF SIMULATION OVERFLOW  =     0
                   CUMULATIVE TIME OF OVERFLOW  (HOURS) =  0.00
                   PERCENTAGE OF TIME OVERFLOWING   (%) =  0.00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 37.00
                   TIME SHIFT OF PEAK FLOW         (min)= 35.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0637

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

APPENDIX I2: OTTHYMO MODEL ROUTE RESERVOIR REPORT – STORAGE SWALE – COINCIDENT OR SURCHARGED

Analysis results from December 10, 2024 have been reinserted in this appendix without alteration as the revisions made to the report and drawings did not result in changes to the stormwater management model.

```
*****************************************
** SIMULATION:1. SCS II 6hr 5yr Ottawa **
*****************************************
--------------------
| RESERVOIR(  0111)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1410     0.0160
                          0.0070     0.0000   |   0.1930     0.0250
                          0.0180     0.0010   |   0.2560     0.0360
                          0.0290     0.0020   |   0.3320     0.0510
                          0.0460     0.0040   |   0.4200     0.0700
                          0.0690     0.0060   |   0.5230     0.0930
                          0.1000     0.0100   |   0.0000     0.0000

                                AREA     QPEAK      TPEAK       R.V.
                                (ha)     (cms)      (hrs)       (mm)
   INFLOW : ID= 2 (  0086)     10.986     0.102      3.58       7.90
   OUTFLOW: ID= 1 (  0111)     10.986     0.089      3.92       7.90

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 86.81
                   TIME SHIFT OF PEAK FLOW         (min)= 20.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0086

-------------------------------------------------------------------------------
*******************************************
** SIMULATION:2. SCS II 6hr 100yr Ottawa **
*******************************************
--------------------
| RESERVOIR(  0111)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1410     0.0160
                          0.0070     0.0000   |   0.1930     0.0250
                          0.0180     0.0010   |   0.2560     0.0360
                          0.0290     0.0020   |   0.3320     0.0510
                          0.0460     0.0040   |   0.4200     0.0700
                          0.0690     0.0060   |   0.5230     0.0930
                          0.1000     0.0100   |   0.0000     0.0000

                                AREA     QPEAK      TPEAK       R.V.
                                (ha)     (cms)      (hrs)       (mm)
   INFLOW : ID= 2 (  0086)     10.986     0.402      3.50      26.10
   OUTFLOW: ID= 1 (  0111)     10.986     0.317      3.92      26.10

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 78.89
                   TIME SHIFT OF PEAK FLOW         (min)= 25.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0482

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

```
*****************************************
** SIMULATION:3. SCS II 12hr 5yr Ottawa **
*****************************************
--------------------
| RESERVOIR(  0111)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1410      0.0160
                          0.0070     0.0000   |   0.1930      0.0250
                          0.0180     0.0010   |   0.2560      0.0360
                          0.0290     0.0020   |   0.3320      0.0510
                          0.0460     0.0040   |   0.4200      0.0700
                          0.0690     0.0060   |   0.5230      0.0930
                          0.1000     0.0100   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0086)     10.986      0.122      6.42      10.73
   OUTFLOW: ID= 1 (  0111)     10.986      0.103      6.83      10.73

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 84.28
                   TIME SHIFT OF PEAK FLOW         (min)= 25.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0104

-------------------------------------------------------------------------------
******************************************
** SIMULATION:4. SCS II 12hr 10yr Ottawa **
******************************************
--------------------
| RESERVOIR(  0111)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1410      0.0160
                          0.0070     0.0000   |   0.1930      0.0250
                          0.0180     0.0010   |   0.2560      0.0360
                          0.0290     0.0020   |   0.3320      0.0510
                          0.0460     0.0040   |   0.4200      0.0700
                          0.0690     0.0060   |   0.5230      0.0930
                          0.1000     0.0100   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0086)     10.986      0.188      6.42      15.40
   OUTFLOW: ID= 1 (  0111)     10.986      0.151      6.83      15.40

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 80.57
                   TIME SHIFT OF PEAK FLOW         (min)= 25.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0178

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

```
*********************************************
** SIMULATION:5. SCS II 12hr 100yr correct **
*********************************************
--------------------
| RESERVOIR(  0111)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1410      0.0160
                          0.0070     0.0000   |   0.1930      0.0250
                          0.0180     0.0010   |   0.2560      0.0360
                          0.0290     0.0020   |   0.3320      0.0510
                          0.0460     0.0040   |   0.4200      0.0700
                          0.0690     0.0060   |   0.5230      0.0930
                          0.1000     0.0100   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0086)     10.986     0.446      6.33      31.49
   OUTFLOW: ID= 1 (  0111)     10.986     0.333      6.83      31.49

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 74.64
                   TIME SHIFT OF PEAK FLOW         (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0514

--------------------------------------------------------------------------------
************************************
** SIMULATION:6. Chi 12hr 2yr     **
************************************
--------------------
| RESERVOIR(  0111)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1410      0.0160
                          0.0070     0.0000   |   0.1930      0.0250
                          0.0180     0.0010   |   0.2560      0.0360
                          0.0290     0.0020   |   0.3320      0.0510
                          0.0460     0.0040   |   0.4200      0.0700
                          0.0690     0.0060   |   0.5230      0.0930
                          0.1000     0.0100   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0086)     10.986     0.044      4.67       4.95
   OUTFLOW: ID= 1 (  0111)     10.986     0.037      5.00       4.95

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 84.80
                   TIME SHIFT OF PEAK FLOW         (min)= 20.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0030

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

```
************************************
** SIMULATION:7. Chi 12hr 100yr   **
************************************
--------------------
| RESERVOIR(  0111)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1410     0.0160
                          0.0070     0.0000   |   0.1930     0.0250
                          0.0180     0.0010   |   0.2560     0.0360
                          0.0290     0.0020   |   0.3320     0.0510
                          0.0460     0.0040   |   0.4200     0.0700
                          0.0690     0.0060   |   0.5230     0.0930
                          0.1000     0.0100   |   0.0000     0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0086)     10.986     0.422      4.50      30.20
   OUTFLOW: ID= 1 (  0111)     10.986     0.307      5.00      30.21

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 72.74
                   TIME SHIFT OF PEAK FLOW         (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0461

-------------------------------------------------------------------------------
******************************************
** SIMULATION:8. Historical July 1 1979 **
******************************************
--------------------
| RESERVOIR(  0111)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1410     0.0160
                          0.0070     0.0000   |   0.1930     0.0250
                          0.0180     0.0010   |   0.2560     0.0360
                          0.0290     0.0020   |   0.3320     0.0510
                          0.0460     0.0040   |   0.4200     0.0700
                          0.0690     0.0060   |   0.5230     0.0930
                          0.1000     0.0100   |   0.0000     0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0086)     10.986     0.563      2.00      24.36
   OUTFLOW: ID= 1 (  0111)     10.986     0.401      2.42      24.36

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 71.32
                   TIME SHIFT OF PEAK FLOW         (min)= 25.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0660

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

```
*****************************************
** SIMULATION:9. Historical Aug 4 1988 **
*****************************************
--------------------
| RESERVOIR(  0111)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1410     0.0160
                          0.0070     0.0000   |   0.1930     0.0250
                          0.0180     0.0010   |   0.2560     0.0360
                          0.0290     0.0020   |   0.3320     0.0510
                          0.0460     0.0040   |   0.4200     0.0700
                          0.0690     0.0060   |   0.5230     0.0930
                          0.1000     0.0100   |   0.0000     0.0000

                                AREA     QPEAK     TPEAK      R.V.
                                (ha)     (cms)     (hrs)      (mm)
   INFLOW : ID= 2 (  0086)     10.986     0.486      2.25      22.43
   OUTFLOW: ID= 1 (  0111)     10.986     0.318      2.67      22.43

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 65.48
                   TIME SHIFT OF PEAK FLOW         (min)= 25.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0486
--------------------------------------------------------------------------------

***********************************
** SIMULATION:10. 25mm4hrChicago **
***********************************
--------------------
| RESERVOIR(  0111)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1410     0.0160
                          0.0070     0.0000   |   0.1930     0.0250
                          0.0180     0.0010   |   0.2560     0.0360
                          0.0290     0.0020   |   0.3320     0.0510
                          0.0460     0.0040   |   0.4200     0.0700
                          0.0690     0.0060   |   0.5230     0.0930
                          0.1000     0.0100   |   0.0000     0.0000

                                AREA     QPEAK     TPEAK      R.V.
                                (ha)     (cms)     (hrs)      (mm)
   INFLOW : ID= 2 (  0086)     10.986     0.009      2.92       0.70
   OUTFLOW: ID= 1 (  0111)     10.986     0.008      3.25       0.70

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 98.15
                   TIME SHIFT OF PEAK FLOW         (min)= 20.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0001

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

```
***********************************************
** SIMULATION:100 year 12 hr Chi 120 percent **
***********************************************
--------------------
| RESERVOIR(  0111)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1410      0.0160
                          0.0070     0.0000   |   0.1930      0.0250
                          0.0180     0.0010   |   0.2560      0.0360
                          0.0290     0.0020   |   0.3320      0.0510
                          0.0460     0.0040   |   0.4200      0.0700
                          0.0690     0.0060   |   0.5230      0.0930
                          0.1000     0.0100   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0086)     10.986     0.636      4.50      42.18
   OUTFLOW: ID= 1 (  0111)     10.986     0.440      5.00      42.19

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 69.16
                   TIME SHIFT OF PEAK FLOW         (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0746

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

APPENDIX J1: CULVERT ANALYSIS AND HYDRAFLOW EXPRESS ANALYSIS RESULTS

ROAD SIDE DITCHES

Analysis results from April 3, 2024 have been reinserted in this appendix without alteration as the revisions made to the report and stormwater management model did not measurably change the flow in the roadside ditches.

Culvert Report

Lot 1 & 2 - 10 Year

Invert Elev Dn (m)	=	78.0000
Pipe Length (m)	=	12.0000
Slope (%)	=	0.3000
Invert Elev Up (m)	=	78.0360
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

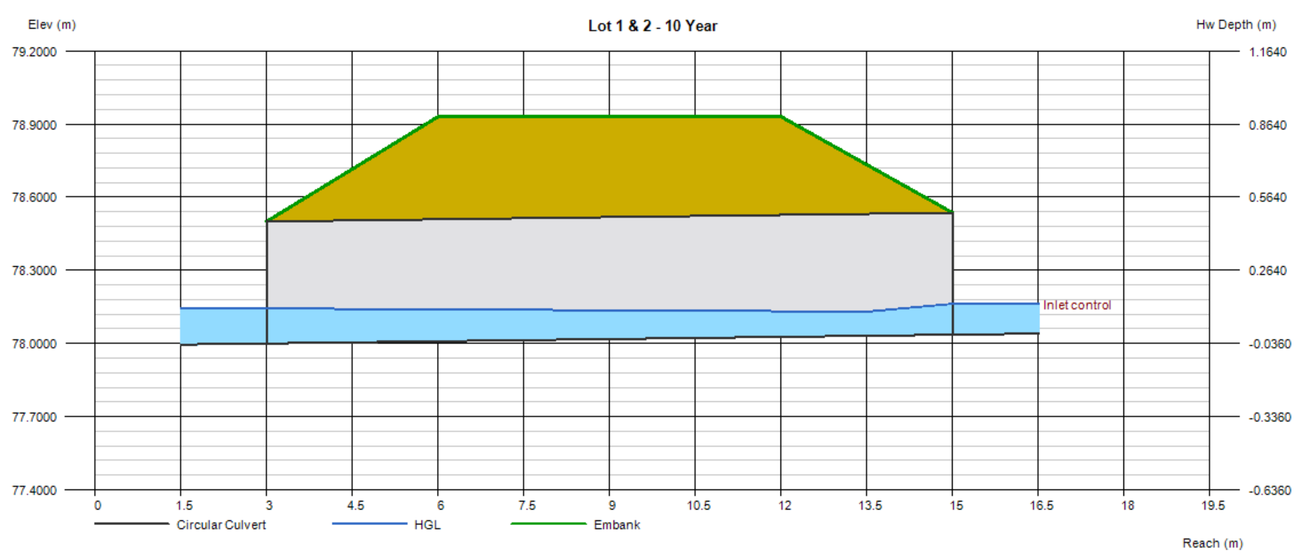
Top Elevation (m)	=	78.9300
Top Width (m)	=	6.0000
Crest Width (m)	=	3.0000

Calculations

Qmin (cms)	=	0.0200
Qmax (cms)	=	0.0200
Tailwater Elev (m)	=	Normal

Highlighted

Qtotal (cms)	=	0.0200
Qpipe (cms)	=	0.0200
Qovertop (cms)	=	0.0000
Veloc Dn (m/s)	=	0.4300
Veloc Up (m/s)	=	0.7970
HGL Dn (m)	=	78.1433
HGL Up (m)	=	78.1288
Hw Elev (m)	=	78.1627
Hw/D (m)	=	0.2533
Flow Regime	=	Inlet Control



Culvert Report

Lot 1 & 2 - 100 Year

Invert Elev Dn (m)	=	78.0000
Pipe Length (m)	=	12.0000
Slope (%)	=	0.3000
Invert Elev Up (m)	=	78.0360
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

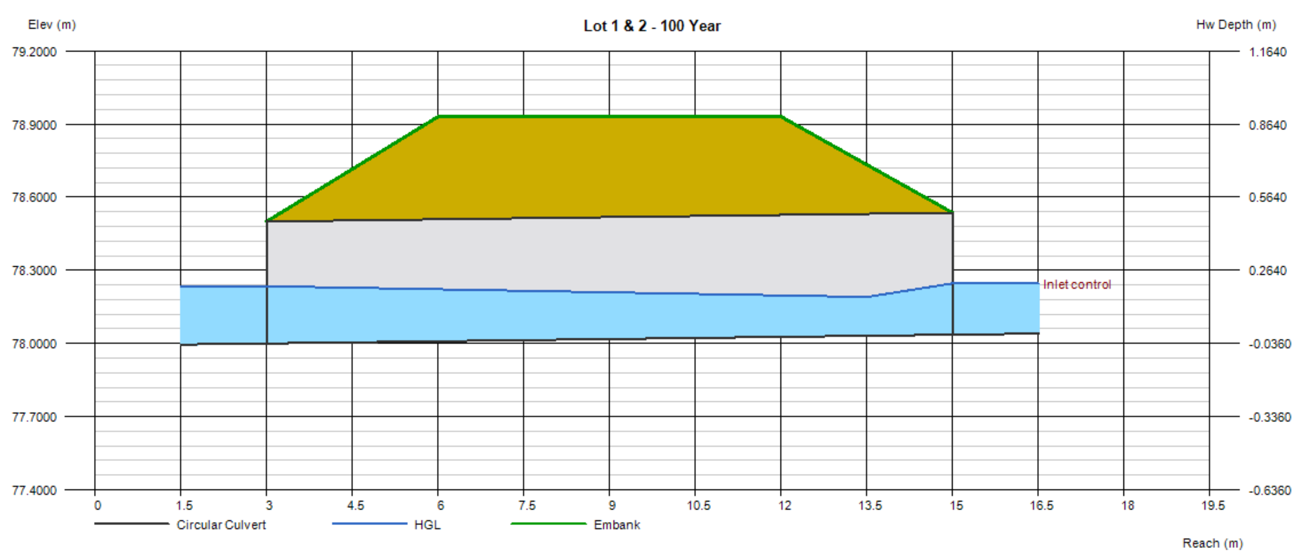
Top Elevation (m)	=	78.9300
Top Width (m)	=	6.0000
Crest Width (m)	=	3.0000

Calculations

Qmin (cms)	=	0.0500
Qmax (cms)	=	0.0500
Tailwater Elev (m)	=	Normal

Highlighted

Qtotal (cms)	=	0.0500
Qpipe (cms)	=	0.0500
Qovertop (cms)	=	0.0000
Veloc Dn (m/s)	=	0.5520
Veloc Up (m/s)	=	1.0250
HGL Dn (m)	=	78.2348
HGL Up (m)	=	78.1843
Hw Elev (m)	=	78.2461
Hw/D (m)	=	0.4202
Flow Regime	=	Inlet Control



Culvert Report

Lot 3 & 4 - 10 Year

Invert Elev Dn (m)	=	77.0000
Pipe Length (m)	=	12.0000
Slope (%)	=	1.1000
Invert Elev Up (m)	=	77.1320
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

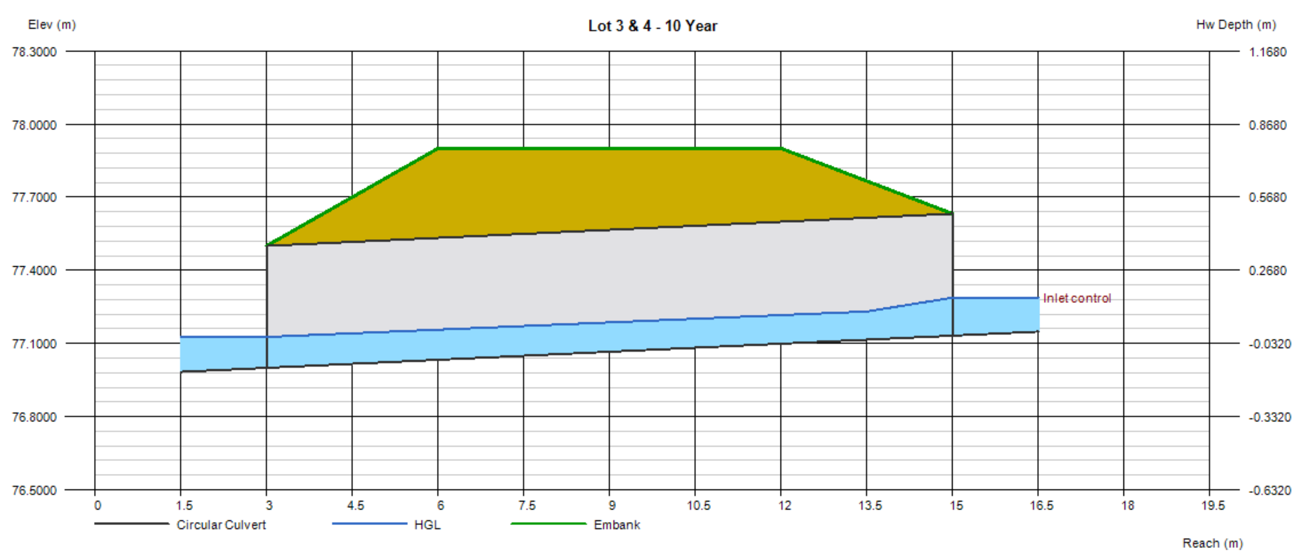
Top Elevation (m)	=	77.9000
Top Width (m)	=	6.0000
Crest Width (m)	=	3.0000

Calculations

Qmin (cms)	=	0.0300
Qmax (cms)	=	0.0300
Tailwater Elev (m)	=	Normal

Highlighted

Qtotal (cms)	=	0.0300
Qpipe (cms)	=	0.0300
Qovertop (cms)	=	0.0000
Veloc Dn (m/s)	=	0.7668
Veloc Up (m/s)	=	0.8893
HGL Dn (m)	=	77.1267
HGL Up (m)	=	77.2461
Hw Elev (m)	=	77.2879
Hw/D (m)	=	0.3117
Flow Regime	=	Inlet Control



Culvert Report

Lot 3 & 4 - 100 Year

Invert Elev Dn (m)	=	77.0000
Pipe Length (m)	=	12.0000
Slope (%)	=	1.1000
Invert Elev Up (m)	=	77.1320
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

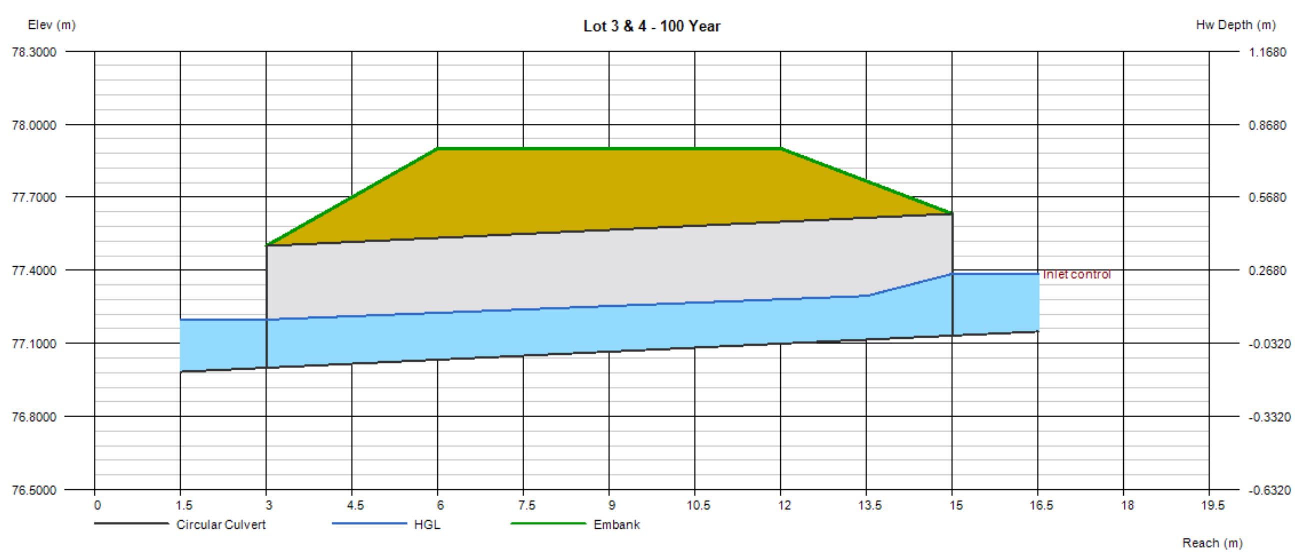
Top Elevation (m)	=	77.9000
Top Width (m)	=	6.0000
Crest Width (m)	=	3.0000

Calculations

Qmin (cms)	=	0.0700
Qmax (cms)	=	0.0700
Tailwater Elev (m)	=	Normal

Highlighted

Qtotal (cms)	=	0.0700
Qpipe (cms)	=	0.0700
Qovertop (cms)	=	0.0000
Veloc Dn (m/s)	=	0.9694
Veloc Up (m/s)	=	1.1295
HGL Dn (m)	=	77.1977
HGL Up (m)	=	77.3085
Hw Elev (m)	=	77.3857
Hw/D (m)	=	0.5074
Flow Regime	=	Inlet Control



Culvert Report

Lot 5 & 6 - 10 Year

Invert Elev Dn (m)	=	76.0000
Pipe Length (m)	=	12.0000
Slope (%)	=	0.9000
Invert Elev Up (m)	=	76.1080
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

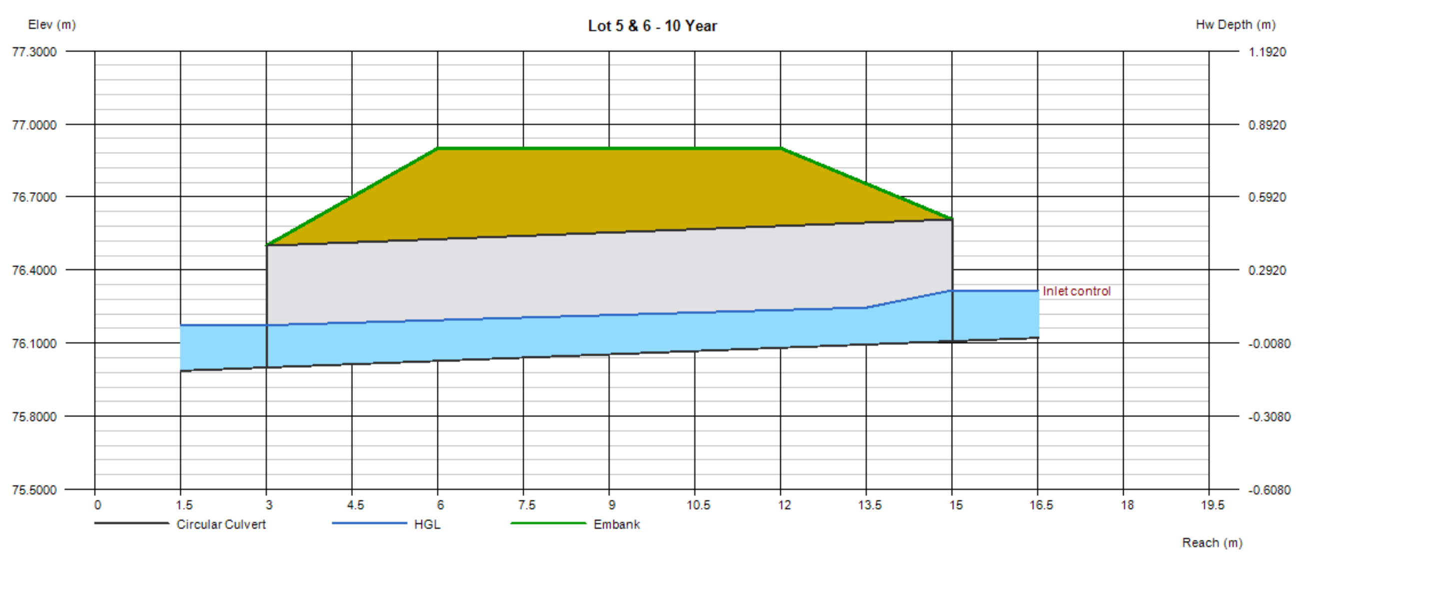
Top Elevation (m)	=	76.9000
Top Width (m)	=	6.0000
Crest Width (m)	=	3.0000

Calculations

Qmin (cms)	=	0.0500
Qmax (cms)	=	0.0500
Tailwater Elev (m)	=	Normal

Highlighted

Qtotal (cms)	=	0.0500
Qpipe (cms)	=	0.0500
Qovertop (cms)	=	0.0000
Veloc Dn (m/s)	=	0.8257
Veloc Up (m/s)	=	1.0250
HGL Dn (m)	=	76.1736
HGL Up (m)	=	76.2563
Hw Elev (m)	=	76.3166
Hw/D (m)	=	0.4173
Flow Regime	=	Inlet Control



Culvert Report

Lot 5 & 6 - 100 Year

Invert Elev Dn (m)	=	76.0000
Pipe Length (m)	=	12.0000
Slope (%)	=	0.9000
Invert Elev Up (m)	=	76.1080
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

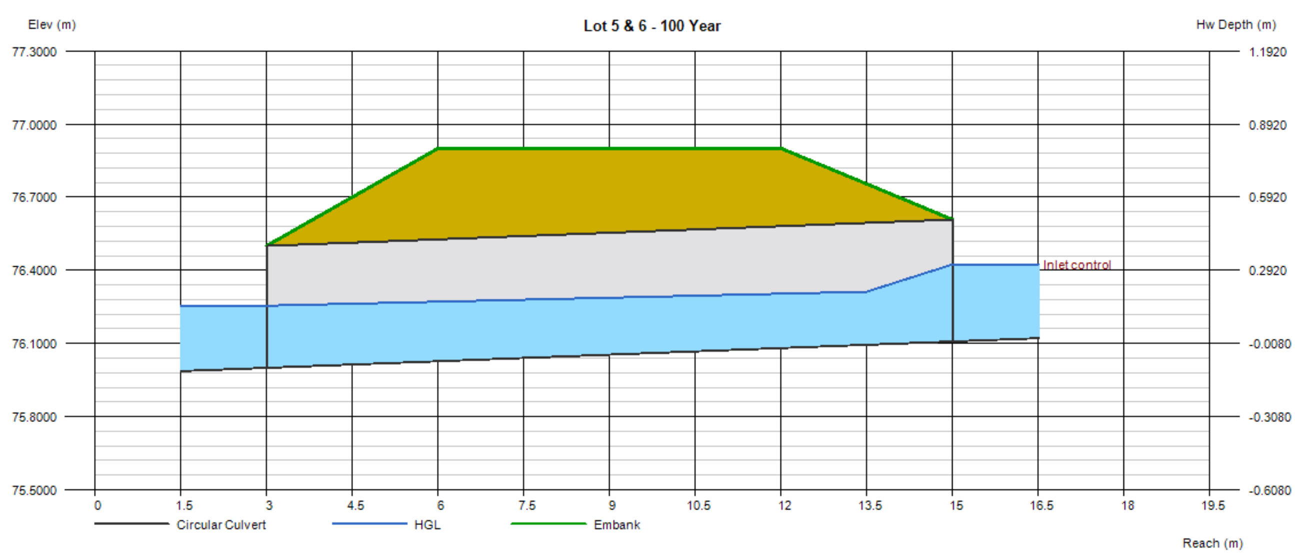
Top Elevation (m)	=	76.9000
Top Width (m)	=	6.0000
Crest Width (m)	=	3.0000

Calculations

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

Highlighted

Qtotal (cms)	=	0.1000
Qpipe (cms)	=	0.1000
Qovertop (cms)	=	0.0000
Veloc Dn (m/s)	=	0.9943
Veloc Up (m/s)	=	1.2584
HGL Dn (m)	=	76.2548
HGL Up (m)	=	76.3204
Hw Elev (m)	=	76.4243
Hw/D (m)	=	0.6326
Flow Regime	=	Inlet Control



Culvert Report

Lot 7 & 8 - 10 Year

Invert Elev Dn (m)	=	75.6000
Pipe Length (m)	=	12.0000
Slope (%)	=	0.5000
Invert Elev Up (m)	=	75.6600
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

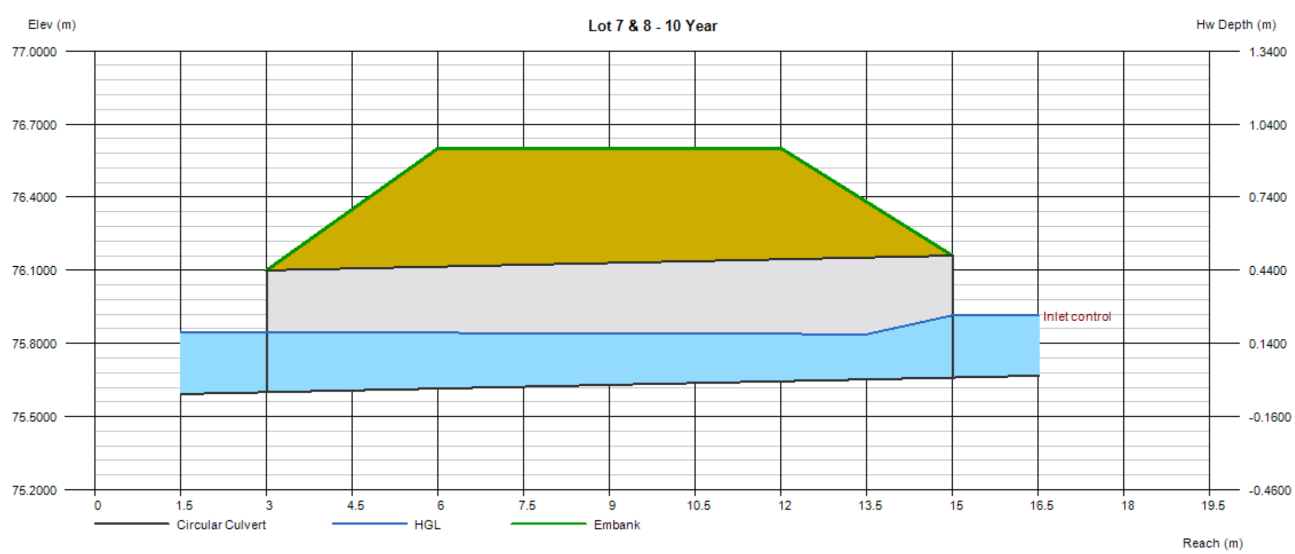
Top Elevation (m)	=	76.6000
Top Width (m)	=	6.0000
Crest Width (m)	=	3.0000

Calculations

Qmin (cms)	=	0.0700
Qmax (cms)	=	0.0700
Tailwater Elev (m)	=	Normal

Highlighted

Qtotal (cms)	=	0.0700
Qpipe (cms)	=	0.0700
Qovertop (cms)	=	0.0000
Veloc Dn (m/s)	=	0.7276
Veloc Up (m/s)	=	1.1295
HGL Dn (m)	=	75.8461
HGL Up (m)	=	75.8365
Hw Elev (m)	=	75.9152
Hw/D (m)	=	0.5104
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Apr 3 2024

Lot 7 & 8 - 100 Year

Invert Elev Dn (m)	=	75.6000
Pipe Length (m)	=	12.0000
Slope (%)	=	0.5000
Invert Elev Up (m)	=	75.6600
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

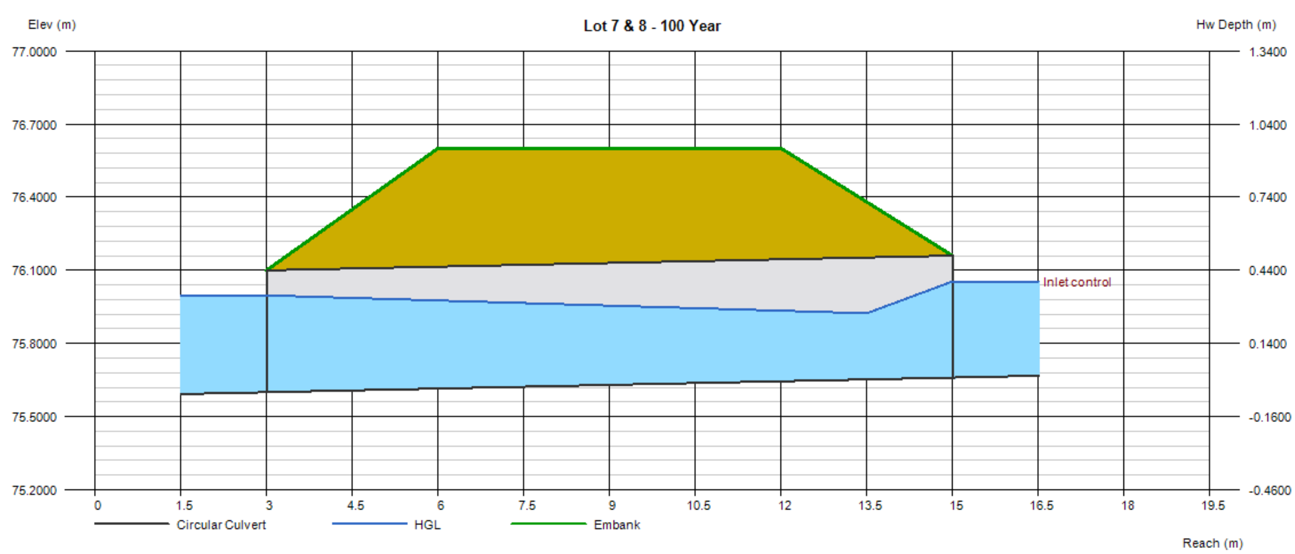
Top Elevation (m)	=	76.6000
Top Width (m)	=	6.0000
Crest Width (m)	=	3.0000

Calculations

Qmin (cms)	=	0.1400
Qmax (cms)	=	0.1400
Tailwater Elev (m)	=	Normal

Highlighted

Qtotal (cms)	=	0.1400
Qpipe (cms)	=	0.1400
Qovertop (cms)	=	0.0000
Veloc Dn (m/s)	=	0.8371
Veloc Up (m/s)	=	1.4016
HGL Dn (m)	=	75.9971
HGL Up (m)	=	75.9134
Hw Elev (m)	=	76.0543
Hw/D (m)	=	0.7887
Flow Regime	=	Inlet Control



APPENDIX J2: CULVERT ANALYSIS AND HYDRAFLOW EXPRESS ANALYSIS RESULTS

FORMER RAILWAY BOX CULVERT

Analysis results from December 10, 2024 have been reinserted in this appendix without alteration as the revisions made to the report and drawings did not result in changes to the stormwater management model or changes to the flow in the Harwood Creek.

Culvert Report

Railroad Box Culvert - Tailwater = 74.10

Invert Elev Dn (m)	=	72.9600
Pipe Length (m)	=	20.0000
Slope (%)	=	0.0100
Invert Elev Up (m)	=	72.9620
Rise (mm)	=	1490.0
Shape	=	Box
Span (mm)	=	2800.0
No. Barrels	=	2
n-Value	=	0.023
Culvert Type	=	Flared Wingwalls
Culvert Entrance	=	30D to 75D wingwall flares
Coeff. K,M,c,Y,k	=	0.026, 1, 0.0347, 0.81, 0.4

Embankment

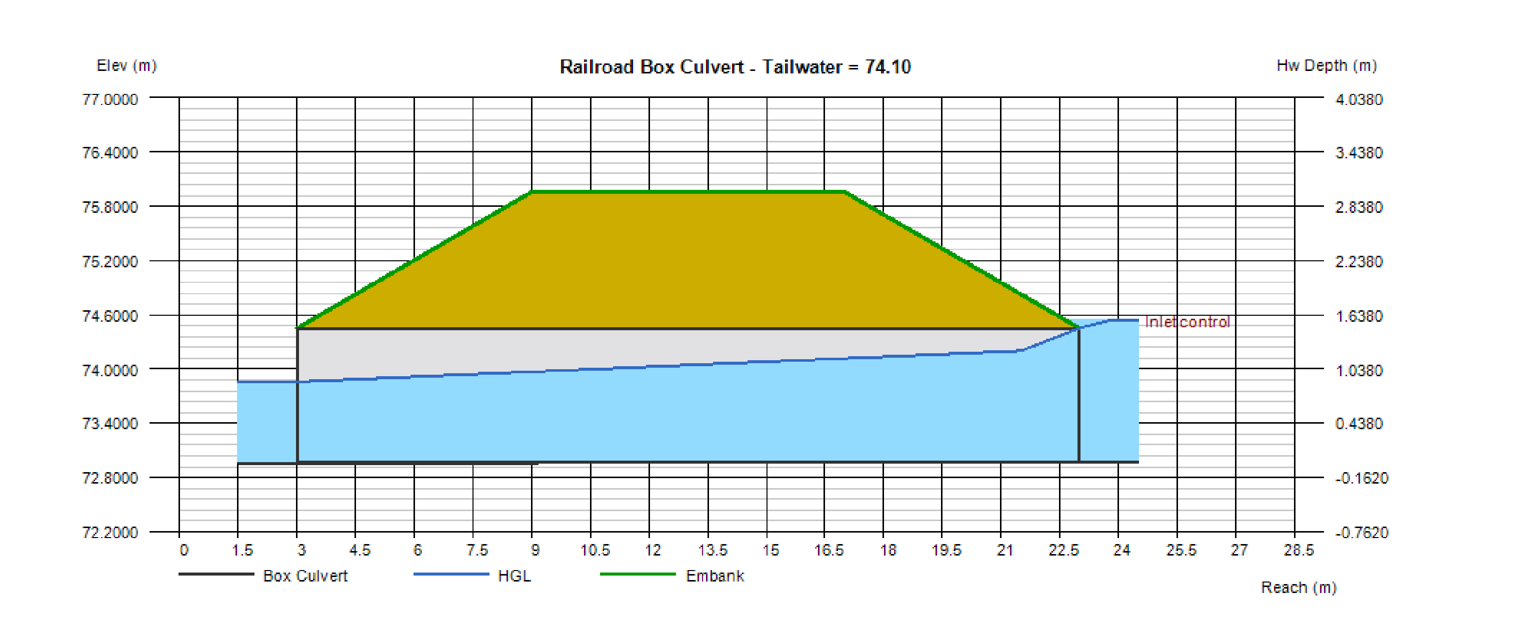
Top Elevation (m)	=	75.9600
Top Width (m)	=	8.0000
Crest Width (m)	=	10.0000

Calculations

Qmin (cms)	=	14.9860
Qmax (cms)	=	14.9860
Tailwater Elev (m)	=	74.10

Highlighted

Qtotal (cms)	=	14.9860
Qpipe (cms)	=	14.9860
Qovertop (cms)	=	0.0000
Veloc Dn (m/s)	=	2.9745
Veloc Up (m/s)	=	2.1142
HGL Dn (m)	=	73.8597
HGL Up (m)	=	74.2277
Hw Elev (m)	=	74.5361
Hw/D (m)	=	1.0564
Flow Regime	=	Inlet Control



Culvert Report

Railroad Box Culvert - Tailwater = (dc+D)/2

Invert Elev Dn (m)	=	72.9600
Pipe Length (m)	=	20.0000
Slope (%)	=	0.0100
Invert Elev Up (m)	=	72.9620
Rise (mm)	=	1490.0
Shape	=	Box
Span (mm)	=	2800.0
No. Barrels	=	2
n-Value	=	0.023
Culvert Type	=	Flared Wingwalls
Culvert Entrance	=	30D to 75D wingwall flares
Coeff. K,M,c,Y,k	=	0.026, 1, 0.0347, 0.81, 0.4

Embankment

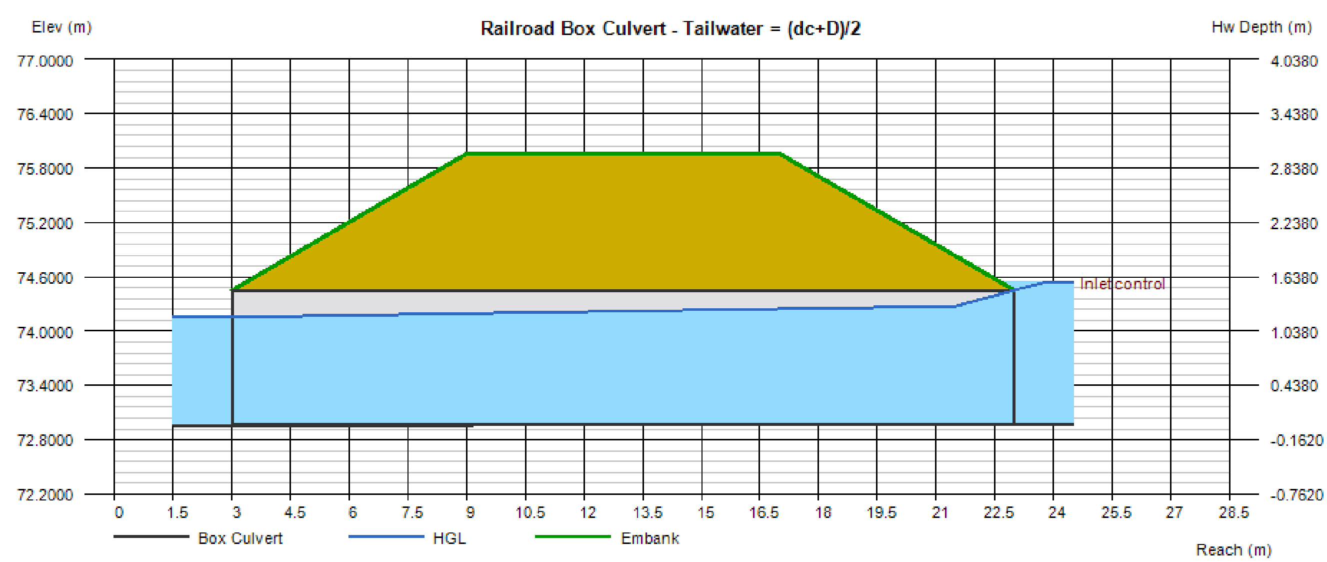
Top Elevation (m)	=	75.9600
Top Width (m)	=	8.0000
Crest Width (m)	=	10.0000

Calculations

Qmin (cms)	=	14.9860
Qmax (cms)	=	14.9860
Tailwater Elev (m)	=	(dc+D)/2

Highlighted

Qtotal (cms)	=	14.9860
Qpipe (cms)	=	14.9860
Qovertop (cms)	=	0.0000
Veloc Dn (m/s)	=	2.2397
Veloc Up (m/s)	=	2.0209
HGL Dn (m)	=	74.1548
HGL Up (m)	=	74.2862
Hw Elev (m)	=	74.5361
Hw/D (m)	=	1.0564
Flow Regime	=	Inlet Control



Culvert Report

Railroad Box Culvert - Tailwater = Normal

Invert Elev Dn (m)	=	72.9600
Pipe Length (m)	=	20.0000
Slope (%)	=	0.0100
Invert Elev Up (m)	=	72.9620
Rise (mm)	=	1490.0
Shape	=	Box
Span (mm)	=	2800.0
No. Barrels	=	2
n-Value	=	0.023
Culvert Type	=	Flared Wingwalls
Culvert Entrance	=	30D to 75D wingwall flares
Coeff. K,M,c,Y,k	=	0.026, 1, 0.0347, 0.81, 0.4

Embankment

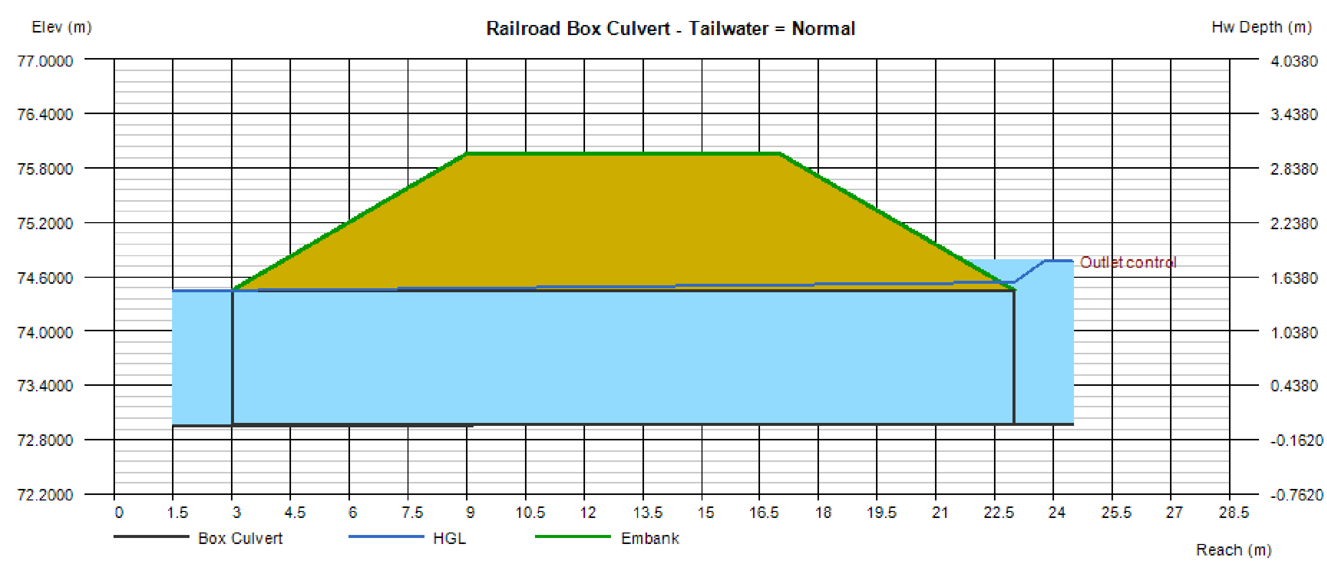
Top Elevation (m)	=	75.9600
Top Width (m)	=	8.0000
Crest Width (m)	=	10.0000

Calculations

Qmin (cms)	=	14.9860
Qmax (cms)	=	14.9860
Tailwater Elev (m)	=	Normal

Highlighted

Qtotal (cms)	=	14.9860
Qpipe (cms)	=	14.9860
Qovertop (cms)	=	0.0000
Veloc Dn (m/s)	=	1.7960
Veloc Up (m/s)	=	1.7960
HGL Dn (m)	=	74.4500
HGL Up (m)	=	74.5392
Hw Elev (m)	=	74.7696
Hw/D (m)	=	1.2131
Flow Regime	=	Outlet Control



APPENDIX K: RESPONSES TO REVIEW COMMENTS

Kollaard Associates
Engineers
210 Prescott Street, Unit 1
P.O. Box 189
Kemptville, Ontario K0G 1J0

Civil • Geotechnical •
Structural • Environmental •
Materials Testing •
(613) 860-0923
FAX: (613) 258-0475

Kollaard File # 200977
City of Ottawa File No. D02-02-22-0018
MVCA File No. PMRZA-43

March 27, 2025

ATTN: Phil Castro, MCIP, RPP
Planner III (T) | Urbaniste III (t)
Development Review - East

Re: Response to City of Ottawa 5th review Comments
2050 Dunrobin Road, City of Ottawa
Application for Zoning By-Law Amendment
Application for Subdivision Approval

The following presents a response to the review comments received in February 2025:

Major changes between submission in response to 5th review comments and previous submission:

- *Added Section 5.5 to the geotechnical report to discuss swimming pools and Section 5.6 to the geotechnical report to discuss slope stability. Section numbers adjusted accordingly.*
- *Added Section 7.1 Water balance and Section 8.4.4 Downstream Erosion to the Stormwater management report to discuss these topics. Section numbers adjusted accordingly.*
- *Additional discussion added in Sections 11.1 and 11.2 of the SWM report to discuss operation and maintenance of the subdrains.*

i. **Geotechnical Investigation,** Proposed Residential Subdivision Part 1, Plan 5R-10284 2050 Dunrobin Road West Carleton Ward City of Ottawa, Ontario prepared by Kollaard Associates Engineers, dated and sealed April 19, 2024.

Comments:

1. Section 5.3 must be revised to reference only the one weir wall for the SWM block since the design has changed.

Corrected in report

2. Provide a copy of the geotechnical report within the next submission.

Noted. The most recent version of the report is revision 4 dated March 12, 2025

The following two comments are based upon satisfying the Geotechnical condition as part of the Draft Plan of Subdivision:

3. The report must discuss design and construction provisions of swimming pools.

Discussion of swimming pools added to the report as Section 5.5

4. The report must discuss any slopes (existing or proposed) which are considered to be unstable and require a slope stability analysis. If none exist or are proposed on-site, briefly state this assertion within the report

Discussion of slope stability added to the report as Section 5.6. Numbering of the subsequent sections was adjusted accordingly.

ii. Stormwater Management Report, Proposed Residential Subdivision 2050 Dunrobin Road City of Ottawa, prepared by Kollaard Associates Engineers, dated and sealed December 10, 2024.

Comments:

1. Section 5.2.3 last paragraph, first sentence affirms there is no outlet for the rear yard subdrains, yet the civil plans and your comment response have indicated there is now an outlet. Revise the report to clarify.

Section 5.2.3 was updated and the discrepancy has been corrected.

2. Section 5.3.2 refers to "As discussed in Section 6.2.2 above." Please review and correct the section number.

Corrected

Comments from MVCA

*Please see separate document entitled "MVCA Comment Letter – 2050 Dunrobin – January 2025***:**

2. MVCA Comment (January 2025): – Please provide a cross-section from the SWM pond though the swale to the receiving watercourse, illustrating water levels for each design storm even (2- to 100-year) to confirm that positive drainage is maintained under all conditions.

Two cross sections have been generated and added to Drawing 200977 – DET(3). One cross-section provides the water levels during concurrent events and one cross-section provides the water levels during non-concurrent events.

It is noted that:

The backwater flood plain elevation has been considered to result from the 100 year flood level within the Harwood Creek at River Station 1214 and corresponds to a water surface elevation of 75.48 m.

The outlet swale which conveys runoff from the proposed development ties into the Harwood Creek at River Station 1130. The 100 year water surface elevation at River Station 1130 is 75.36 m.

The SWMM analysis to determine the affect of the Harwood Creek flooding on the stormwater storage swale was completed assuming a 100 yr flood level at the outlet structure of the stormwater management swale conforming to the established backwater flood plain elevation of 75.48 as this would have the most impact on the discharge from the swale.

3. MVCA Comment (January 2025): – No further response required at this time

4. MVCA Comment (January 2025): – Supporting documents for the MVCA permit to fill the existing floodplain should be provided at the time of the permit application.

The Floodplain Analysis, by J.F Sabourin and Associates Inc together with the Stormwater Management Report and the and civil engineering drawings prepared by Kollaard Associates Inc will be submitted in support of the permit application once the approval process for the subdivision is complete.

Comments from Asset Management concerning the SWM and modelling:

Comments were obtained from document entitled "2050 Dunrobin Road_Review Memo_2025-01-23".

Stormwater Management Design Brief

Comment 1 – No further comment
Comment 2 – No further comment
Comment 3 – No further comment
Comment 4 – No further comment
Comment 5 – No further comment
Comment 6 – No further comment
Comment 7 – No further comment
Comment 8 – No further comment
Comment 9 – No further comment
Comment 10 – No further comment
Comment 11 – No further comment
Comment 12 – No further comment however see the new comment # 15
Comment 13 – No further comment
Comment 14 – No further comment
Comment 15 – No further comment
Comment 16 – No further response required at this time
Comment 17 – No further comment

Comment 18. – Follow up Comment – The concern over water backing up into the roadside ditch from the SWM block has not been addressed. The design still shows water backing up into the ditch system. The weir invert is set at 75.60 m which is the same as the invert in the roadside drainage ditch. This means that every time there is runoff water will back up into the road sidechannel. The design should lower the storage area or raise the roadside ditch.

Kollaard Response - The final about 65 metres of the bottom of the storage swale has been lowered by 0.3 m. As a result, the ponding level of a 2 year storm event will be completely contained within the storage swale and the ponding level for a 5 year storm event will result in a maximum ponding depth of 2 to 3 cm within the roadside ditch.

Follow up Comment – It is noted that the tailwater condition from the flood in Harwood Creek will continue to affect the discharge rate and drawdown time of the storage swale until the floodwaters have receded. However, the maximum storage requirement is smaller than the total

available storage capacity, meaning there is adequate storage volume in the proposed secondary storage area.
What is meant by "secondary storage"?

This is an editing error. The wording "Outlet Swale and Secondary Storage" has been replaced with "Storage Swale".

Please show the water level depths and extent in the ditches and storage swale profiles for both scenarios: with the tailwater effect and under normal (non-coincident) conditions.
Also, refer to new comment #13.

The water levels for both scenarios have been added to the "cross-sections" included on drawing 200977-DET(3) required to address MVCA comment 2. These levels have not been added to the existing profile details in order to keep the existing profile details clear and legible.

The extent of the ponding has been added to the plan view of the storage swale for the 2 year and 100 year events for both scenarios.

Comment 19 – No further comment
Comment 20 – No further response required at this time
Comment 21 – No further comment
Comment 22 – No further comment
Comment 23 – No further comment
Comment 24 – No further comment

Comment 25 – Follow up Comment – No further comment.
Please note the highlighted portion above is not correspond to previous comment. We understood that 'the creek profile (and slope/gradient) will remain the same as in the existing conditions'. If the statement in the report read 'no negative impact on the existing hydraulic operations of the Creek since the 100 year levels and the 100 year gradient of the Creek does not change between existing and proposed conditions' (section 8.4.1) will be clear.

The wording of this section has been revised as suggested for clarity.

Comment 26 – Follow up Comment – The report stated there is not outlet for subdrains due to the elevation difference between the bottom of the perimeter swales and the receiving water course (section 5.2.3). Please review and correct.

Section 5.2.3 was updated and the discrepancy has been corrected.

Comment 27 – No further comment
Comment 28 – No further comment
Comment 29 – No further comment
Comment 30 – No further response required at this time

Comment 31 – Follow up Comment – Please review and correct units of parameters in table 9.3, percolation should be mm/hr or cm/hr (the unit given is in min/cm)

Corrected.

Comment 32 – No further response required at this time
Comment 33 – No further response required at this time
Comment 34 – No further response required at this time
Comment 35 – No further response required at this time
Comment 36 – No further response required at this time
Comment 37 – No further comment
Comment 38 – No further response required at this time
Comment 39 – No further comment

Drawings
Comment 1 – No further comment
Comment 2 – No further comment
Comment 3 – No further comment
Comment 4 – No further comment
Comment 5 – No further comment
Comment 6 – No further comment
Comment 7 – No further comment

New Comments

1. In the detailed drawing, section G-G, what is it referred to the 150mm and 100mm dimensions indicated near the third 150mm diameter subdrain?

Clarification added to detail. These measurements correspond to a thickness of 150 mm of clearstone above the subdrain and 100 mm of clearstone below the subdrain.

2. Outlet structure design details should be included in the section H-H of the detailed drawing.

Additional details have been added to section H-H

3. The report mentions that rip rap will be placed at the bottom and side slopes of the weir wall; however, the drawing does not show these details. Please clarify.

The report has been revised to clarify that "The bottom and side slopes of the outlet swale on the outside (eastside) of the weir wall should be protected with Rip-Rap and geotextile. The details have been revised to show this.

4. The subcatchment C-OFF1 (ID #19) appears to be uncontrolled based on the modeling and proposed SWM plan, yet the post-development OTTHYMO summary table indicates it is controlled. Please review and correct this inconsistency.

Corrected in report

5. It is recommended to use a heavy-duty silt fence rather than a light-duty one near any watercourse for better erosion control.

Additional area specific specifications added to the drawing. Recommendations added to the report in the Sediment and Erosion Control section. Heavy-duty silt fence (OPSD 219.130) is to be used where area flow is directed to the watercourse. Light-duty silt fence (OPSD 219.110) may be used elsewhere.

6. The report states that CN number calculations for both pre- and post-development conditions are provided in the Appendix, but only the values are included. Please add the calculations in the Appendix.

Calculations were completed using Excel. The Excel table was added to Appendix A.

7. The suggested CN number guidelines appear to be from the OTTHYMO user guide. Please provide a reference to the software manual to clarify this source.

It is assumed that this comment is in reference to section 3.3.3 Initial Abstraction and Potential Storage as the CN numbers were obtained from the City of Ottawa Guidelines and the USDA TR55 as stated in the report. Reference to the OTTHYMO user guide was added in Section 3.3.3.

8. The naming of the swale sections should be consistent in both the report and drawings. For example, in Table 5.3, the swale section outlet 7/8 is labeled South 7/8 in the Site Servicing plan.

The labels on the servicing plan have been adjusted to reflect the labeling in the report.

9. Additionally, for the contributing catchment ‘East 7 + SS’ (row - outlet 8) in Table 5.3, "SS" should be updated to "East 7 + Outlet 7/8" or "East 7 + South 7/8."

Corrected

10. Do the last columns of Table 5.4 (Min Available Depth and Min Capacity (m^3/s)") refer to the maximum values?

The following was added to the report:
The minimum available depth was determined by calculating the elevation difference between the top of the ditch slope and the bottom of the ditch slope at the location of the shallowest point along each respective section.

The minimum available capacity of each ditch section was is a function of the ditch slope and depth in each section. The minimum available capacity corresponds to the location of the lowest flow capacity within each respective section.

11. The report mentions localized ponding in the ditches during significant rainfall events, with the ponding expected to be limited. There should be no ponding in the ditches. Please provide details on ponding depth and duration for different storm events to support this statement.

This section was not properly clarified following the revision in the stormwater management strategy. This section has been revised.

12. Table 5-4 does not include capacity and flow depth details for East Swale 7 and Outlet Swale 8. Please ensure these details are included in both the report and drawings.

These swale sections have been included in Table 5-3 as they are swales. Table 5-4 includes the roadside ditches.

13. The details of the V-notch should be shown on the outlet structure drawing.

Added to the drawing.

14. Section 6.3.1 states, the invert of the V-notch outlet weir set at 75.40 m provides a storage volume of 103.6 m^3, and a total available storage volume of 700.7 m^3 below the minimum freeboard elevation of 75.40 m. The elevations for both are listed as the same, but it seems the 700.7 m^3 of storage is provided below the rectangular weir. Please review and correct this.

Corrected in report. It should have been…below the minimum freeboard elevation of 76.10 m.

15. The report needs to align with the CLI-ECA requirements. It is recommended to add sections on 'downstream erosion' and 'water balance.' These sections do not need to be complex.

Added Section 7.1 Water Balance and Section 8.4.4 Downstream Erosion to the report

Comments from Operations and Maintenance:

Response to the latest submission for 2050 Dunrobin (dwg. revision 3. dated December 10, 2024).

1. SWM Facility Subdrains:

a. Subdrains within SWM facility shall be HDPE double wall with smooth interior for camera inspection and flushing (Boss 2000). Extents of Boss 2000 pipe shown in ‘red’. Unclear whether 2 or 3 subdrains are included in the design. Whether there are 2 or 3 subdrains, the requirements for each subdrain are the same. A header pipe with one outlet is not acceptable/maintainable. Refer to comments provided in the snip, below.

The design and details have been modified to:

- *Clearly show the number of subdrains is 3.*

- *The diameter of each subdrain*
- *Each subdrain extends through the weir wall with no header.*

b. Subdrains shall be extended through the concrete structure. Removable rodent grates provided at subdrain outlets.

Subdrains have been extended through the weir wall.

c. Flushing ports and inspections ports are required, all complete with traffic rated watertight flush-mount cast iron bolt down covers. Provide t-post markers at each port location. See similar examples provided, below.

Flushing and inspection ports have been added. Since the subdrains are perforated, watertight covers have not been specified. Flush mount cast iron traffic rated bolt down grates have been specified instead.

2. Creek outlet:

a. OPSD 206.050 is for a rural ditch outlet … not a creek outlet. We have concerns with the outlet pipe becoming damaged or plugged within the creek flow path. In addition, we do not want staff working in the creek to complete maintenance at the outlet. We would prefer that the subdrain daylight before the creek bank with a short rip-rap swale to the creek. Coordination may be required with MVCA on this connection to the creek.

It is acknowledged that OPSD 206.050 is for a rural ditch. The intent of using this OPSD was to make clear the end treatment specification for the subdrain. Since the HDPE subdrain will be day lighted, it is intended that the end of the subdrain be protected with a short length of CSP pipe complete with a rodent grate. The outlet has been modified to show that the subdrain will daylight before the creek in a short swale protected by riprap.

MVCA is part of this circulation. A permit for the connection to the creek will also be obtained from MVCA once approval of the civil engineering has been obtained.

iii. Civil Plans, prepared by Kollaard Associates, dated December 10, 2024:

1. Ensure the hatch pattern for the 100-year floodplain is shown within the drawing legend for all applicable civil plans. Not addressed.

Corrected on Drawings.

2. The 100 year-floodplain hatch is missing within the area in the railway property. Please show the hatch for clarity. See screenshot below the area this comment refers to.

100 year-floodplain hatching hatch added to drawings 'Post-Development Conditions (POST)', 'Site (West) Grading Plan (GR-W)','Site (East) Grading Plan (GR-E)' and 'Floodplain Comparison (FP)'

e) Site (West) grading plan (GR-W);

1. Ditch grading (cut), at the front of the Lot #1, encroaches into private property. The public ditch shall not encroach onto private property. Not addressed. If the ditch remains as is, the encroachment must be registered on the title for Lot 1.

The grading has been altered such that the top of the ditch slope is now at the property line.

f) Site (East) grading plan (GR-E)

1. The Site (East) Grading Plan still refers to a second outlet weir. Please review and make the necessary corrections

Corrected on Drawing.

g) Site Servicing plan (SVC);

1. Provide bollards around the monitoring well. This is to be shown on all for clarity.

Bollards have been added to drawings.

2. Initial Comment: Perforated subdrains require a rear yard catch basin (RYCB) to be installed at every 120m length as per the City of Ottawa Sewer Design Guidelines. Revise the Civil plans with the RYCB and specify the type in accordance with the City Standard Details accordingly.

***Kollaard response**:*
An alternate subdrain detail is proposed as indicated in response to comment 2 above. The purpose of the rear yard catch basin is to provide inlet into the subdrain for surface water as evidenced by the subdrain detail. Since the clear stone in the proposed section is extended to the surface of the swale bottom and the proposed pipe is perforated, the rear yard catch basins would become redundant. Further there is not sufficient depth to accommodate any catch basin structure.

Follow up comment:
How will these subdrains be maintained if no catch basins are proposed? Provide clarification within the SWM report.

The subdrains within the swales consist of a 150 mm diameter perforated pipe surrounded on both sides and on top with clearstone in a 600 mm wide by 400 mm deep trench. Should a section of subdrain become clogged, it will be readily accessible from the surface of the subdrain trench for maintenance purposes.
Additional discussion has been added to Section 11.1 and 11.2 of the report.

3. Specify on the plan the size and material of subdrain within the road ditches.

Labels have been added to the drawing.

4. Specify and/or show on the servicing plan that every house within this subdivision is to be equipped with a sump pump, and refer to the detail provided on Details page.

A Sump and sump line have been added to each proposed dwelling on the servicing plan.

i) Details (DET(2))

1. Cross sectional detail K-K for the swale outlet into the creek is shown as H-H on the grading and servicing plans. There is already a detail H-H for the headwall. Revise accordingly. Ensure consistency throughout reports and drawings.

Corrected

2. Within Section K-K the outlet protection note states “OBSP” should be “OPSD”.

Corrected

iv. General Comments:

1. Provide a composite utility plan.

Included

2. Provide a lighting plan.

Outstanding

v. 2050 Dunrobin Road, City of Ottawa – Floodplain Analysis, by J.F Sabourin and Associates Inc., dated October 2022

1. P.Eng seal with date is required. Not addressed.

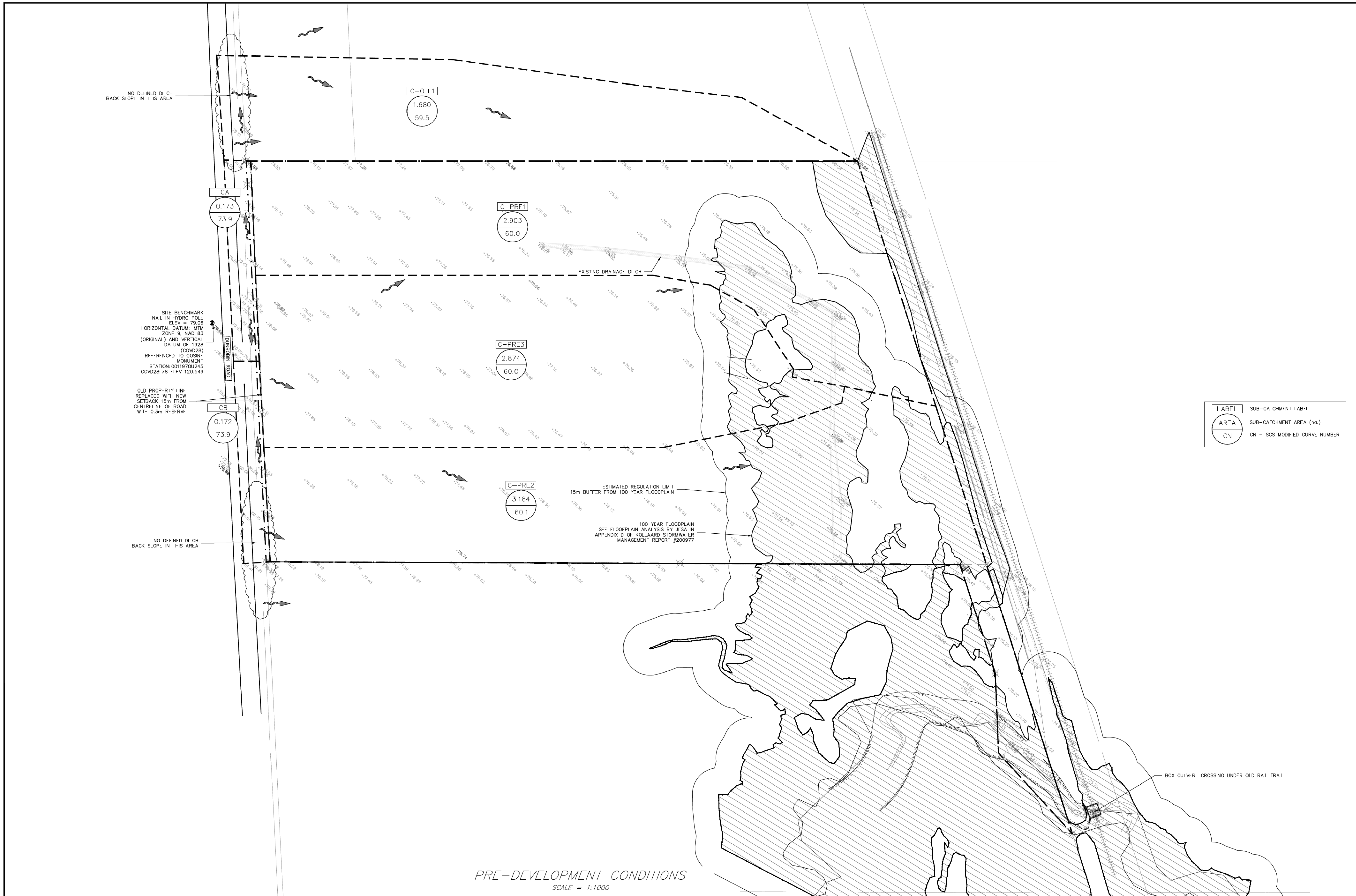
To be addressed by others.

We trust that this response provides sufficient information for your present purposes. If you have any questions concerning this response please do not hesitate to contact our office.

Sincerely,

LICENSED PROFESSIONAL ENGINEER
2025.MAR.27
S.E. deWit
100079612
PROVINCE OF ONTARIO

Steven deWit, P.Eng.
Kollaard Associates Inc



PRE–DEVELOPMENT CONDITIONS

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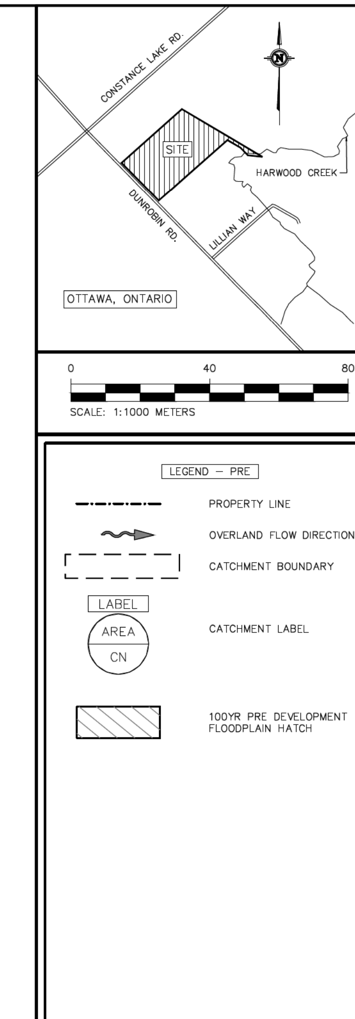

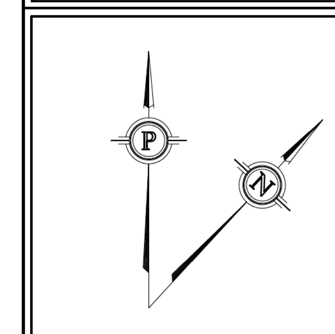

NOTES:

1. ALL DIMENSIONS ARE IN METRES, UNLESS OTHERWISE SPECIFIED; ALL ELEVATIONS ARE IN METRES.
2. THIS IS NOT A LEGAL SURVEY.
3. EXISTING SERVICES INFORMATION SHOWN ARE BASED ON BEST CURRENT INFORMATION. CONTRACTOR TO VERIFY EXACT LOCATION AND REPORT ANY DISCREPANCIES TO KOLLAARD ASSOCIATES INC.
4. CLIENT IS RESPONSIBLE FOR ACQUIRING ALL NECESSARY PERMITS.
5. CONTRACTOR TO VERIFY THAT APPROPRIATE PERMITS HAVE BEEN ACQUIRED PRIOR TO ANY CONSTRUCTION.
6. CONTRACTOR IS RESPONSIBLE FOR LOCATION AND PROTECTION OF UTILITIES.
7. ALL DIMENSIONS TO BE VERIFIED ON SITE BY CONTRACTOR PRIOR TO CONSTRUCTION.
8. THIS DRAWING IS NOT FOR CONSTRUCTION UNTIL ALL APPROVALS HAVE BEEN GRANTED.
9. INSPECTION OF ROUGH GRADE BY KOLLAARD ASSOCIATES INC. AND MUNICIPALITY MUST BE CONDUCTED PRIOR TO PLACEMENT OF TOPSOIL OR SOD.
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4.	RESPONSE TO 5TH COMMENTS	2025.MAR.27	SD
3.	RESPONSE TO 4TH COMMENTS	2024.DEC.10	SD
2.	PARTIAL RESPONSE TO 4TH COMMENTS	2024.SEP.10	SD
1.	RESPONSE TO SECOND REVIEW COMMENTS	2024.APR.19	SD

CONSULTANTS

Kollaard Associates Engineers

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K0G 1J0
FACSIMILE (613) 258–0475

(613) 860–0923

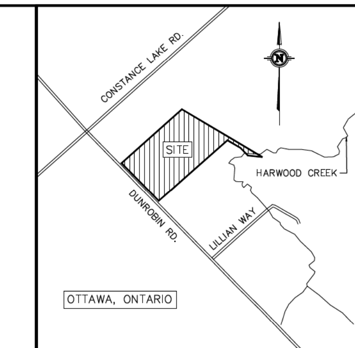
DESIGN	AJ/SD
DRAWN	AJ
CHECKED	SD
APPROVED	SD

STAMP: LICENSED PROFESSIONAL ENGINEER 2025.MAR.27 S.E. deWit 100079612 PROVINCE OF ONTARIO

CLIENT NAME	ZBIGNIEW HAUDEROWICZ	PROJECT No.	200977
PROJECT NAME	PROPOSED RESIDENTIAL SUBDIVISION	DATE	2024/12/10
PROJECT LOCATION	2050 DUNROBIN ROAD OTTAWA, ONTARIO	SCALE	1:1000
DRAWING	PRE–DEVELOPMENT CONDITIONS	DRAWING No.	PRE

D02–02–22–0018

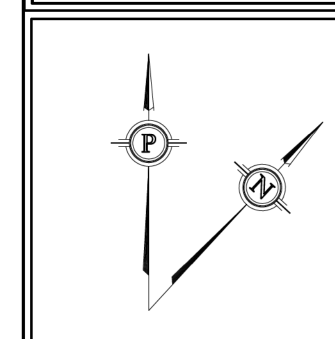
POST-DEVELOPMENT CONDITIONS
SCALE = 1:1000



0 40 80
SCALE: 1:1000 METERS

LEGEND - POST

- PROPERTY LINE
- TOP OF SLOPE
- CATCHMENT BOUNDRY
- OVERLAND FLOW DIRECTION
- CONTROLLED AREA
- UNCONTROLLED AREA
- LABEL / AREA / CN — CATCHMENT LABEL
- 100YR MVCA POST DEVELOPMENT FLOODPLAIN HATCH



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CLIENT NAME	ZBIGNIEW HAUDEROWICZ
PROJECT NAME	PROPOSED RESIDENTIAL SUBDIVISION
PROJECT LOCATION	2050 DUNROBIN ROAD OTTAWA, ONTARIO
DRAWING	POST-DEVELOPMENT CONDITIONS
PROJECT No.	200977
DATE	2024/12/10
SCALE	1:1000
DRAWING No.	POST

D02-02-22-0018

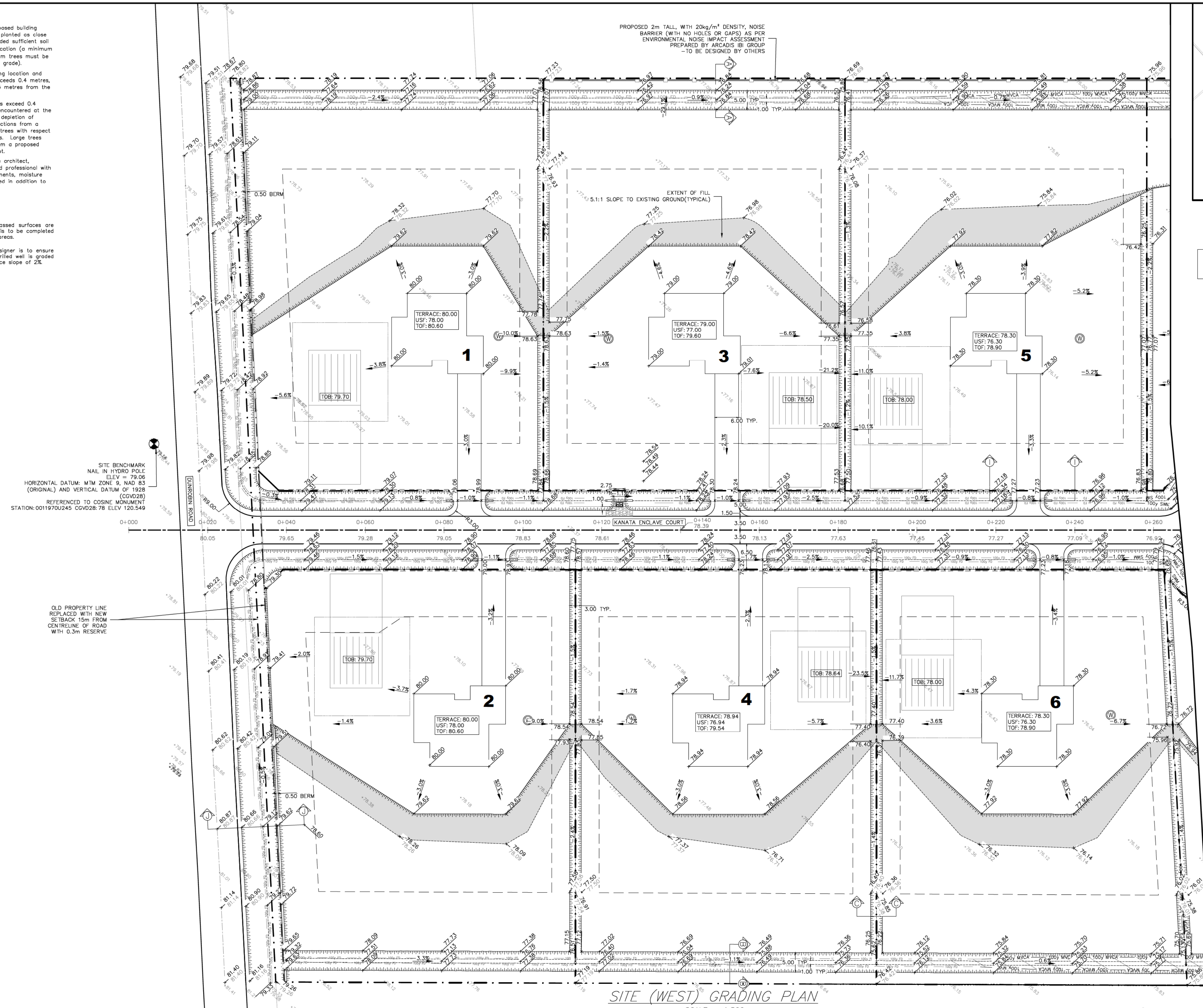
Tree planting Guidelines

1. Where silty clay soils are encountered at a proposed building location, small and medium sized trees can be planted as close as 4.5 metres from the proposed dwelling provided sufficient soil volume is available around the proposed tree location (a minimum of 25 m^3 for small trees and 30 m^3 for medium trees must be available in the upper 1.5 metres below finished grade).
2. Where silty clay is present at a proposed building location and where the thickness of the silty clay deposit exceeds 0.4 metres, large trees should be planted no closer than 15 metres from the proposed building.
3. Excluding the areas where the silty clay deposits exceed 0.4 metres, the remainder of the subsurface soils encountered at the site are not considered particularly sensitive to depletion of moisture by trees. There are no planting restrictions from a geotechnical perspective for small and medium trees with respect to planting distance from the proposed buildings. Large trees should be planted no closer than 10 metres from a proposed dwelling where no silty clay is present on the lot.
4. Tree planting guidelines provided by a landscape architect, arborist, urban forest manager or other qualified professional with respect to species, distance to building requirements, moisture requirements etc should be obtained and followed in addition to the geotechnical recommendations.

General Grading Notes:

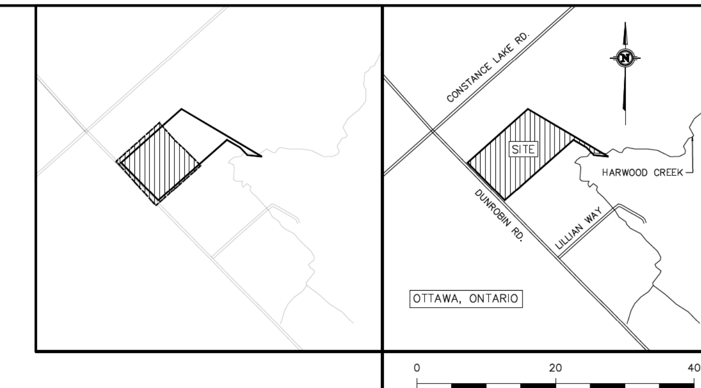
All grade elevations shown on softscaped or grassed surfaces are finished grades including topsoil. Rough grading is to be completed to allow for 100 mm of Topsoil on all disturbed areas.

During detailed grading of individual lots, the designer is to ensure that the area within 3 metres of the proposed drilled well is graded away from the well with a minimum ground surface slope of 2%.



NOTE:

ALL PRIVATE DRIVEWAY ENTRANCE CORNER RADII AS PER CoO DRAWING S26



0 20 40

SCALE: 1:500 METERS

LEGEND - GRADING

???	PROPOSED ELEVATION (PROP/EX)
???TG	PROPOSED TOP OF GRATE ELEVATION
???	PROPOSED GRADE
??.?? INV	PROPOSED ELEVATION (PROP/INVERT)
	PROPERTY LINE
	TOP OF SLOPE
	BOTTOM OF SLOPE
W	PROPOSED WELL LOCATION
100y MVCA	100YR MVCA FLOODPLAIN
100y SWM	100YR SWM FACILITY PONDING
100y FD	100YR FLOW DEPTH
	LOT RESERVE LINE
80m	80m ZONING SETBACK
2y	12HR 2YR CHICAGO PONDING
	100YR MVCA POST DEVELOPMENT FLOODPLAIN HATCH

	PROPOSED DWELLING FOOTPRINT
	- PROPOSED SEPTIC BED
	- SEPTIC BED MANTLE

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CHECKED	SD
APPROVED	SD

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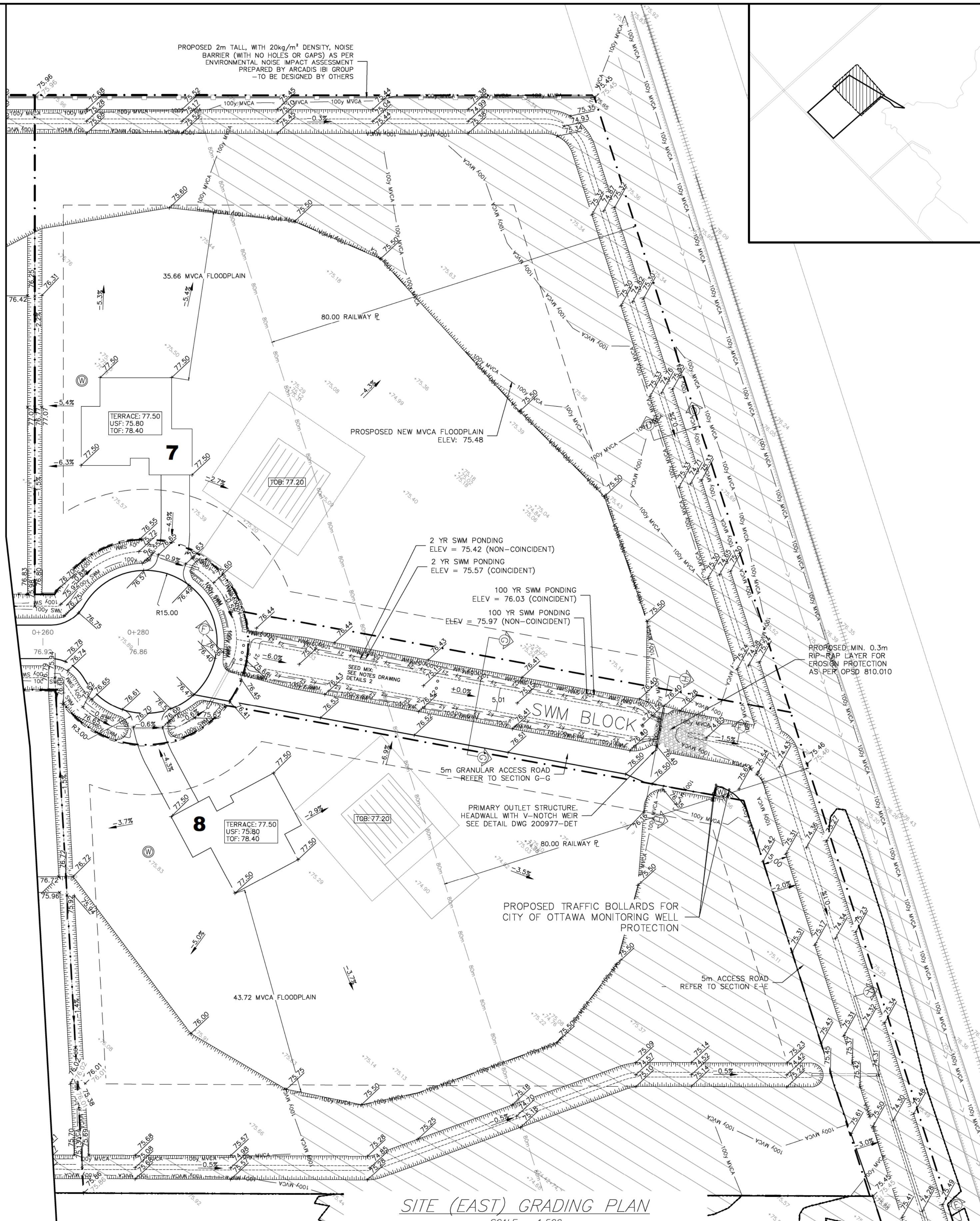
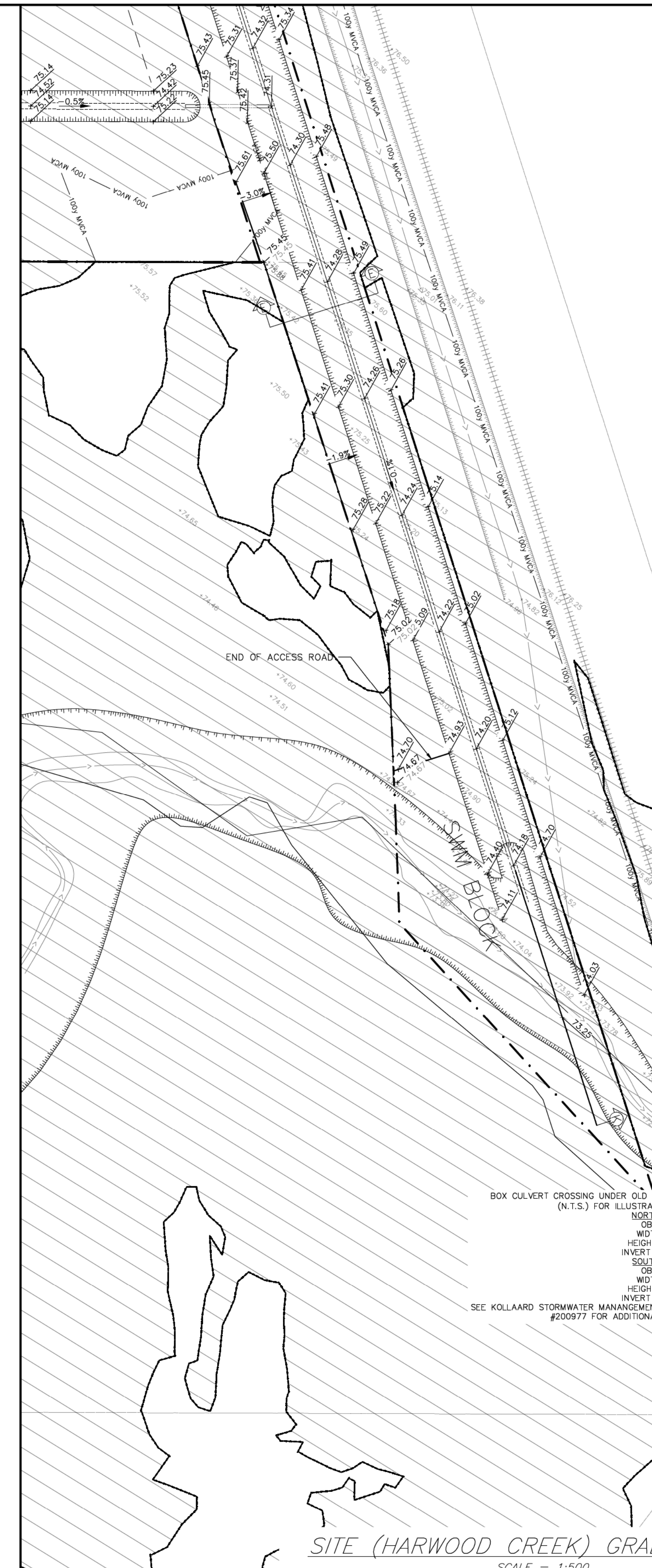
CLIENT NAME	ZBIGNIEW HAUDEROWICZ	PROJECT No.	200977
PROJECT NAME	PROPOSED RESIDENTIAL SUBDIVISION	DATE	2024/12/10
PROJECT LOCATION	2050 DUNROBIN ROAD OTTAWA, ONTARIO	SCALE	1:500
DRAWING	SITE (WEST) GRADING PLAN	DRAWING No.	GR-W

D02-02-22-0018



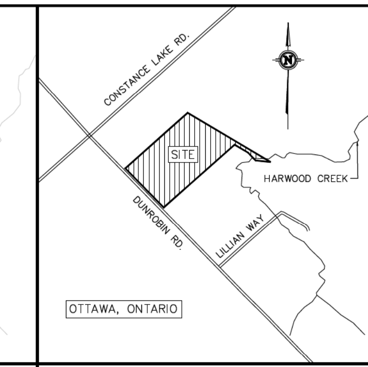
SITE (EAST) GRADING PLAN

SCALE = 1:500



SITE (HARWOOD CREEK) GRADING PLAN

SCALE = 1:500



SCALE: 1:500 METERS (0 – 20 – 40)

NOTE:

REFERENCED TO COSINE MONUMENT STATION: 0011970U245
CGVD28: 78 ELEV 120.549
HORIZONTAL DATUM: MTM ZONE 9, NAD 83 (ORIGINAL)

NOTE:

ALL PRIVATE DRIVEWAY ENTRANCE CORNER RADII AS PER CoO DRAWING S26

NOTE:

100 YEAR FLOOD LEVEL IN HARWOOD CREEK AT RIVER STATION 1214 IS 75.48m

SWM STORAGE SWALE NOTES:

- The topsoil should be removed from below the footprint of the proposed storage swale and stockpiled on the upper third (west third) of the site.
- Once the topsoil has been removed, the bottom of the storage swale is expected to be between 0.4 and 0.8 metres above the subgrade surface. The subgrade should be further excavated as required to ensure a minimum of 0.45 m of separation between the bottom of the swale and the native subgrade.
- Construction traffic on the foot print of the storage swale should be limited as much as possible to avoid compaction of the underlying soils.
- The subgrade surface should be scarified or ripped using the teeth of an excavator following removal of the topsoil.
- The subgrade should be built up to 0.45 metres below the bottom of the storage swale using a sandy material such as the native silty sand or silty sand glacial till present on site. Alternatively silty sands or sand-silt mixes identified as SM using the United Soils Classification System as illustrated in the Ontario Building Code Supplementary Standard SB-6 could be imported to raise the subgrade to the underside of the storage swale bottom soil structure.
- The storage bottom soil structure should consist of a layer of 150 mm thickness of 20mm clear stone placed on the fill materials used to raise the subgrade, topped with a 300 mm thickness of amended existing site topsoil.
- The existing site topsoil can be stripped and stock piled prior to amending. The site topsoil should be amended by mixing 1 part amendment material with 3 parts by volume of site topsoil. The amendment material shall consist of organic matter primarily leaf, yard and bark waste compost of 20 - 30% by dry weight as determined by Loss-on-ignition. No uncomposted manure should be used.
- The swale shall be seeded with deep rooted grasses and planted with vegetation that can tolerate both wet and dry soil conditions.
- Discharge from the swale below an elevation of 75.60 metres is by infiltration only.

LEGEND – GRADING

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???	PROPOSED GRADE
??.?? INV	PROPOSED ELEVATION (PROP/INVERT)
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	TOP OF SLOPE
	BOTTOM OF SLOPE
W	PROPOSED WELL LOCATION
100y MVCA	100YR MVCA FLOODPLAIN
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100y FD	100YR FLOW DEPTH
	LOT RESERVE LINE
80m	80m ZONING SETBACK
2y	12HR 2YR CHICAGO PONDING
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	PROPOSED DWELLING FOOTPRINT
	PROPOSED SEPTIC BED
	SEPTIC BED MANTLE

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DRAWN: AJ
CHECKED: SD
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CLIENT NAME	ZBIGNIEW HAUDEROWICZ
PROJECT NAME	PROPOSED RESIDENTIAL SUBDIVISION
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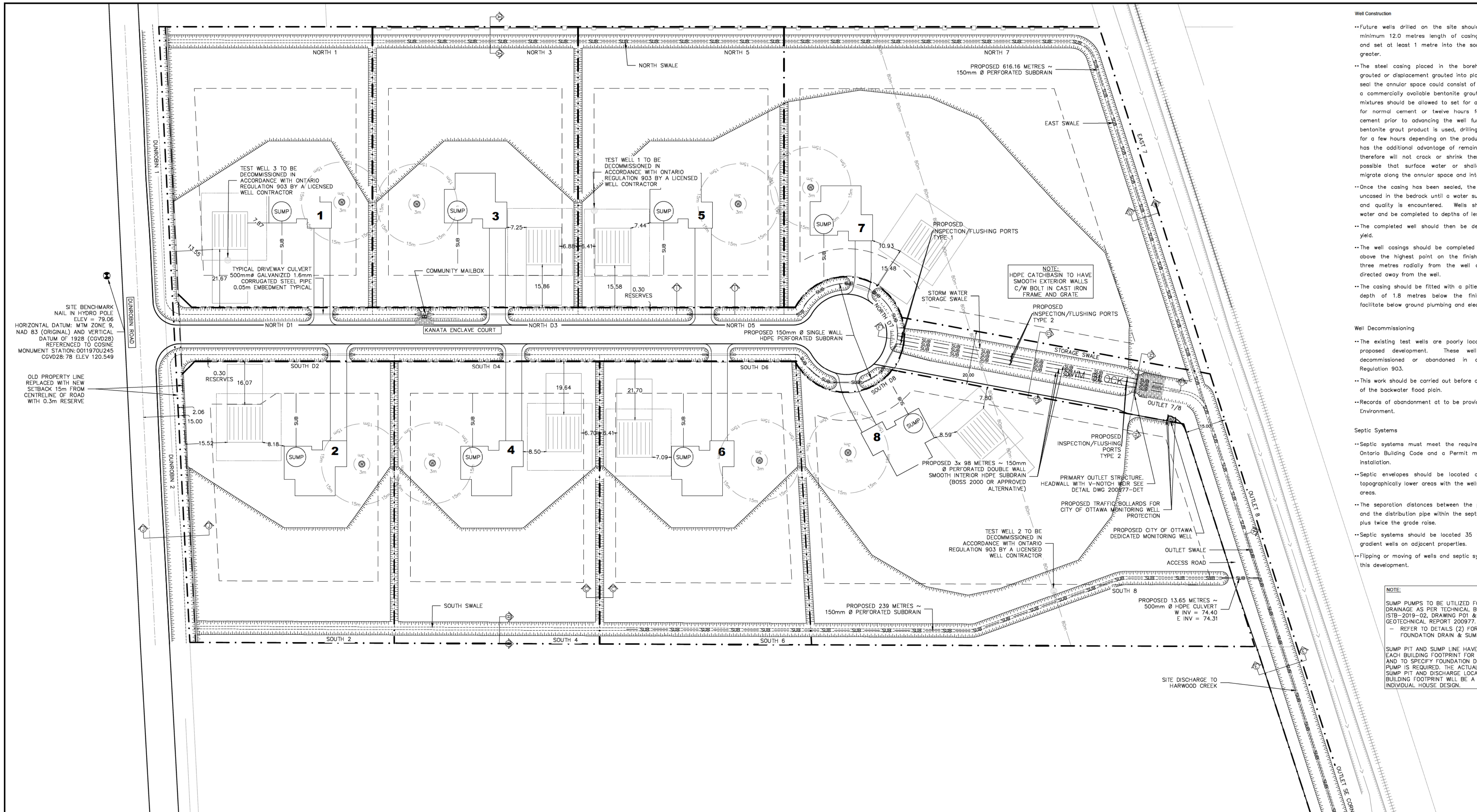
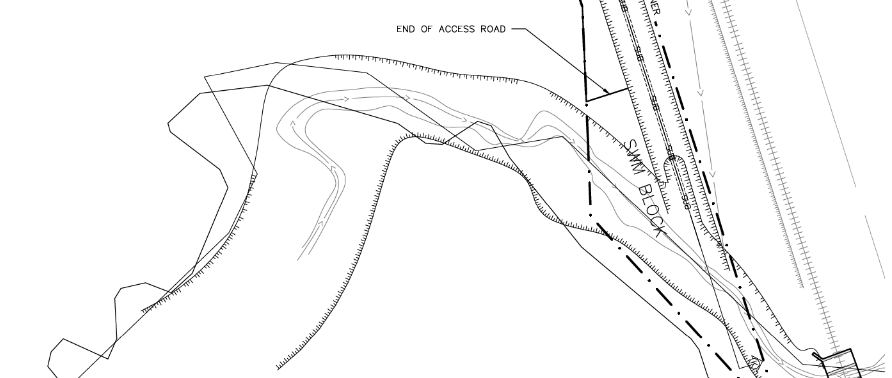
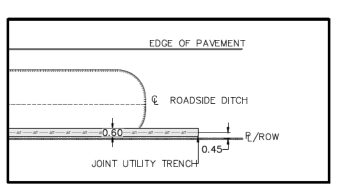
DRAWING	SITE (EAST) GRADING PLAN
PROJECT No.	200977
DATE	2024/12/10
SCALE	1:500
DRAWING No.	GR-E

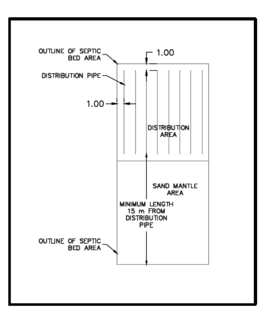
002-02-22-0018







JOINT UTILITY TRENCH
SCALE = 1:250



GENERAL SEPTIC BED LAYOUT
N.T.S.

SITE SERVICING PLAN
SCALE = 1:750

Well Construction

- Future wells drilled on the site should be constructed with a minimum 12.0 metres length of casing through the overburden and set at least 1 metre into the sound bedrock, whichever is greater.
- The steel casing placed in the boreholes should be pressure grouted or displacement grouted into place. The material used to seal the annular space could consist of either a cement grout or a commercially available bentonite grout product. Cement grout mixtures should be allowed to set for a minimum two day period for normal cement or twelve hours for a high early strength cement prior to advancing the well further into bedrock. If a bentonite grout product is used, drilling need only be suspended for a few hours depending on the product used. Bentonite grout has the additional advantage of remaining flexible when set and therefore will not crack or shrink thereby ensuring as well as possible that surface water or shallow groundwater will not migrate along the annular space and into the well bore.
- Once the casing has been sealed, the well should be advanced uncased in the bedrock until a water supply of sufficient quantity and quality is encountered. Wells should encounter sufficient water and be completed to depths of less than about 55 metres.
- The completed well should then be developed to maximize the yield.
- The well casings should be completed at least 400 millimetres above the highest point on the finished ground surface within three metres radially from the well after surface drainage is directed away from the well.
- The casing should be fitted with a pitless adapter at a minimum depth of 1.8 metres below the finished ground surface to facilitate below ground plumbing and electrical connections.

Well Decommissioning

- The existing test wells are poorly located with respect to the proposed development. These well are indicated to be decommissioned or abandoned in accordance with Ontario Regulation 903.
- This work should be carried out before any development or infilling of the backwater flood plain.
- Records of abandonment at to be provided to the Ministry of the Environment.

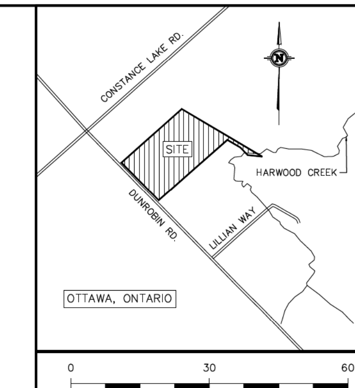
Septic Systems

- Septic systems must meet the requirements of Part 8 of the Ontario Building Code and a Permit must be obtained prior to installation.
- Septic envelopes should be located as much as possible on topographically lower areas with the wells in topographically higher areas.
- The separation distances between the properly constructed wells and the distribution pipe within the septic system should be 15 m plus twice the grade raise.
- Septic systems should be located 35 to 40 metres from down gradient wells on adjacent properties.
- Flipping or moving of wells and septic systems is not permitted in this development.

NOTE:

SUMP PUMPS TO BE UTILIZED FOR FOUNDATION DRAINAGE AS PER TECHNICAL BULLETIN ISTB-2019-02, DRAWING P01 & KOLLAARD GEOTECHNICAL REPORT 200977.
- REFER TO DETAILS (2) FOR TYPICAL FOUNDATION DRAIN & SUMP DETAIL

SUMP PIT AND SUMP LINE HAVE BEEN ADDED TO EACH BUILDING FOOTPRINT FOR ILLUSTRATION AND TO SPECIFY FOUNDATION DRAIN BY SUMP PUMP IS REQUIRED. THE ACTUAL LOCATION OF SUMP PIT AND DISCHARGE LOCATION WITHIN THE BUILDING FOOTPRINT WILL BE A FUNCTION OF THE INDIVIDUAL HOUSE DESIGN.



0 30 60
SCALE: 1:750 METERS

LEGEND – SERVICING

- PROPOSED ELEVATION (PROP/INVERT)
- PROPERTY LINE
- LOT RESERVE LINE
- TOP OF SLOPE
- BOTTOM OF SLOPE
- PROPOSED WELL LOCATION
- JOINT UTILITY TRENCH
- ZONING SETBACK FOR BUILDING
- 15 METRES SETBACK
- 3 METRES SETBACK
- 80 METRES ZONING SETBACK
- PROPOSED SUBDRAIN

- PROPOSED DWELLING FOOTPRINT
- PROPOSED SEPTIC BED
- SEPTIC BED MANTLE

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DRAWING	SITE SERVICING PLAN
PROJECT No.	200977
DATE	2024/12/10
SCALE	1:750
DRAWING No.	SVC

D02-02-22-0018

SEQUENCING OF DEVELOPMENT

1)Construction of Roadway:

a) Install sediment and erosion control measures;
b) Strip topsoil and prepare subgrade;
c) Place raodway granular subbase and base;
d) Shape ditches and back slope to property lines;
e) Topsoil and seed ditches;
f) Construct "Cow path" to support truck traffic;
g) Following placement of fill in flood plain, remove "Cow path and finish shaping roadway;

2) Place Fill in Flood Plain within the Storm Block:

a) Install sediment and erosion control measures
b) All of the fill required to raise the flood plain to the proposed grades should be placed within the proposed storm block.
c) Construct the maintenance road along the stormwater storage swale;

3) Construct the Stormwater Management Facility and Outlet Swales:

a) Install sediment and erosion control measures;
b) Construct the stormwater management swale;
c) Seed the specified vegetation within the stormwater management swale;

4) Construct the peripheral swales:

a) Install sediment and erosion control measures;
b) construct swales by excavation;
c) cut material to be used as fill and to be placed within the confines of the sediment and erosion control measures;

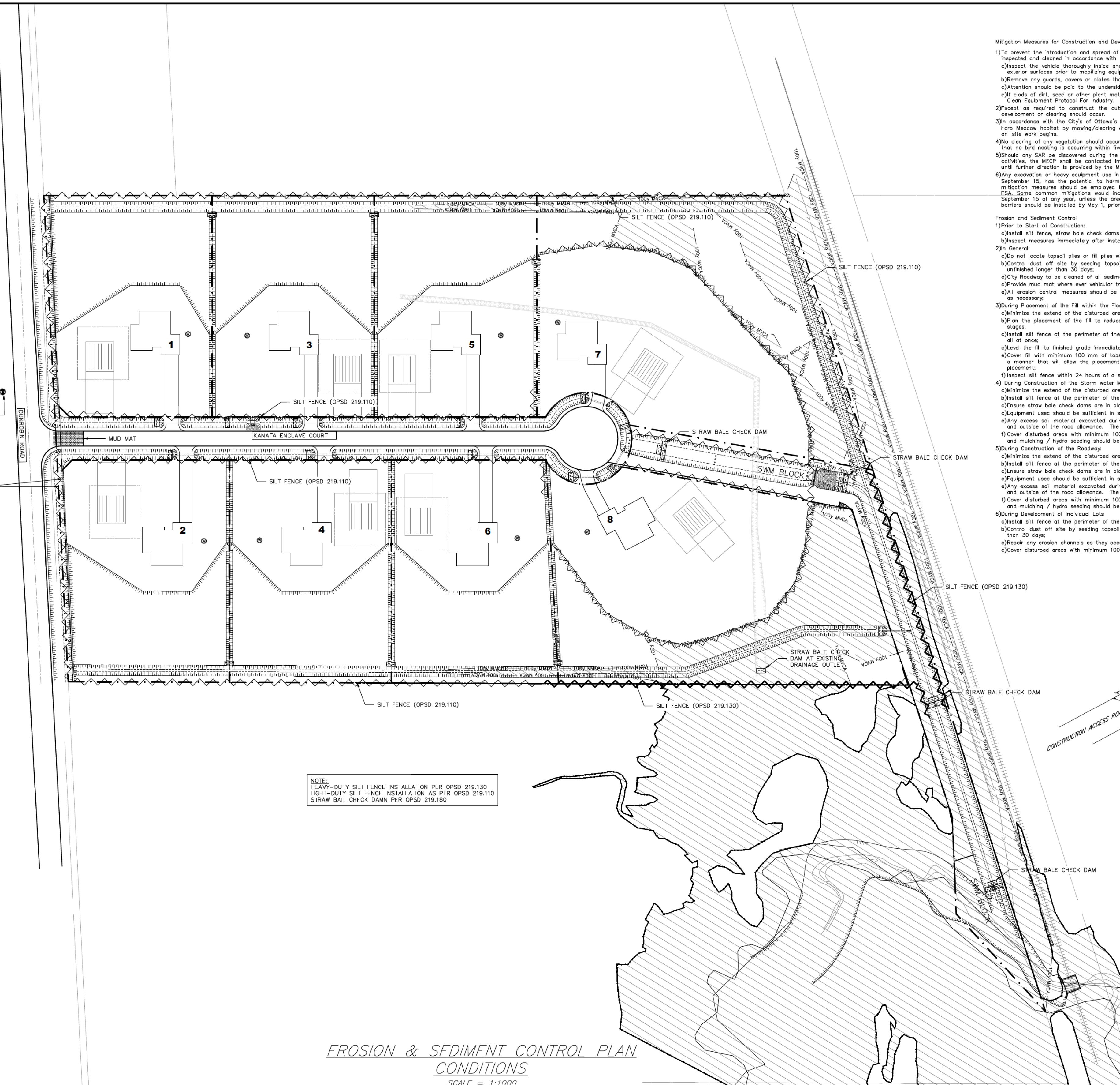
5) Finish the placement of fill within the flood plain:

a) Install sediment and erosion control measures

6) Complete individual lot development:

a) Install sediment and erosion control measures

SITE BENCHMARK
NAIL IN HYDRO POLE
ELEV = 79.06
HORIZONTAL DATUM: MTM
ZONE 9, NAD 83
(ORIGINAL) AND VERTICAL
DATUM OF 1928
(CGVD28)
REFERENCED TO COSINE
MONUMENT
STATION:0011970U245
CGVD28:78 ELEV 120.549



NOTE:
HEAVY-DUTY SILT FENCE INSTALLATION PER OPSD 219.130
LIGHT-DUTY SILT FENCE INSTALLATION AS PER OPSD 219.110
STRAW BAIL CHECK DAMN PER OPSD 219.180

EROSION & SEDIMENT CONTROL PLAN CONDITIONS

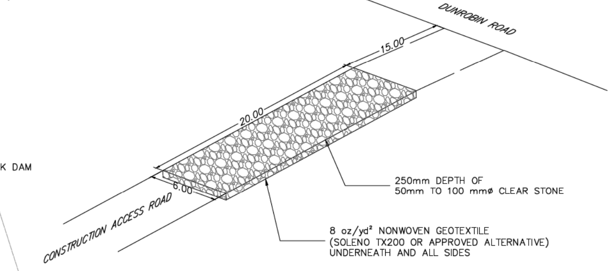
SCALE = 1:1000

Mitigation Measures for Construction and Development

1) To prevent the introduction and spread of invasive plant species into the study area, equipment utilized during construction should be inspected and cleaned in accordance with the Clean Equipment Protocol for Industry
   a) Inspect the vehicle thoroughly inside and out for where dirt, plant material and seeds may be lodged or adhering to interior and exterior surfaces prior to mobilizing equipment onto the site.
   b) Remove any guards, covers or plates that are easy to remove.
   c) Attention should be paid to the underside of the vehicle, radiators, spare tires, foot wells and bumper bars.
   d) If clods of dirt, seed or other plant material are found, removal should take place immediately, using the techniques outlined in the Clean Equipment Protocol For Industry.
2) Except as required to construct the outlet, a minimum of 30 m setback from Harwood Creek should be maintained where no development or clearing should occur.
3) In accordance with the City's of Ottawa's Protocol for Wildlife Protection during Construction to reduce potential wildlife usage of the Forb Meadow habitat by mowing/clearing outside of the breeding season (i.e., before April 15), then maintain as mowed grass until on-site work begins.
4) No clearing of any vegetation should occur between April 1 and September 15 of any year, unless a qualified biologist has determined that no bird nesting is occurring within five days of the vegetation clearing event.
5) Should any SAR be discovered during the project works, and/or should any SAR or their habitat be potentially impacted by on-site activities, the MECP shall be contacted immediately and operations modified to avoid any negative impacts to SAR or their habitat, until further direction is provided by the MECP;
6) Any excavation or heavy equipment use in the floodplain or near Harwood Creek within the study area, conducted between May 1 and September 15, has the potential to harm travelling Blanding's Turtles and other SAR turtles that utilize the watercourse. As such, mitigation measures should be employed to protect SAR and their habitat during construction and to maintain compliance with the ESA. Some common mitigations would include working outside the known timing window for active turtle movement from May 1 to September 15 of any year, unless the area has been cleared of turtles by a qualified biologist; as well as temporary turtle exclusion barriers should be installed by May 1, prior to the turtle nesting season surrounding the impacted watercourse or proposed works.

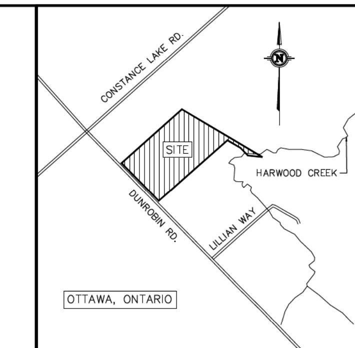
Erosion and Sediment Control

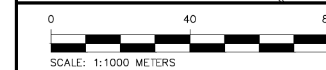
1) Prior to Start of Construction:
   a) Install silt fence, straw bale check dams and mud mat in location shown;
   b) Inspect measures immediately after installation.
2) In General:
   a) Do not locate topsoil piles or fill piles within 2.5 m from any paved or gravel surface area;
   b) Control dust off site by seeding topsoil and soil piles and other disturbed areas watering as necessary if they are to remain unfinished longer than 30 days;
   c) City Roadway to be cleaned of all sediment from vehicular tracking as required;
   d) Provide mud mat where ever vehicular traffic leaves the site from an unpaved egress point;
   e) All erosion control measures should be inspected within 24 hours of a storm event and should be cleaned / repaired / replaced as necessary;
3) During Placement of the Fill within the Flood Plain Area:
   a) Minimize the extend of the disturbed areas outside of the area immediately affected by the fill placement;
   b) Plan the placement of the fill to reduce the duration of exposure either by ensuring sufficient equipment or by placing the fill in stages;
   c) Install silt fence at the perimeter of the disturbed area or around the perimeter of each phase if not completing the fill placement all at once;
   d) Level the fill to finished grade immediately after placement;
   e) Cover fill with minimum 100 mm of topsoil then seed and mulch or hydro seed. The placement of the fill should be completed in a manner that will allow the placement of the topsoil and seeding and mulching / hydro seeding within 30 days of start of fill placement;
   f) Inspect silt fence within 24 hours of a storm event and clean / repair as necessary;
4) During Construction of the Storm water Management Facility.
   a) Minimize the extend of the disturbed areas outside of the area immediately affected by storm water management facility;
   b) Install silt fence at the perimeter of the disturbed area;
   c) Ensure straw bale check dams are in place downstream of the facility;
   d) Equipment used should be sufficient in size and quantity to ensure the construction time is minimized;
   e) Any excess soil material excavated during the construction should be stockpiled on the proposed lots outside of vulnerable areas and outside of the road allowance. The soil should be leveled to rough grade and should be stabilized by seeding;
   f) Cover disturbed areas with minimum 100 mm of topsoil then seed and mulch or hydro seed. The topsoil placement and seeding and mulching / hydro seeding should be completed within 30 days of start of the construction of the facilities;
5) During Construction of the Roadway:
   a) Minimize the extend of the disturbed areas outside of the area immediately affected by the road construction;
   b) Install silt fence at the perimeter of the disturbed area;
   c) Ensure straw bale check dams are in place at the discharge point from the Cul-de-Sac;
   d) Equipment used should be sufficient in size and quantity to ensure the construction time is minimized;
   e) Any excess soil material excavated during the construction should be stockpiled on the proposed lots outside of vulnerable areas and outside of the road allowance. The soil should be leveled to rough grade and should be stabilized by seeding;
   f) Cover disturbed areas with minimum 100 mm of topsoil then seed and mulch or hydro seed. The topsoil placement and seeding and mulching / hydro seeding should be completed within 30 days of start of the construction of the roadway;
6) During Development of Individual Lots
   a) Install silt fence at the perimeter of the disturbed area;
   b) Control dust off site by seeding topsoil and other disturbed areas watering as necessary if they are to remain unfinished longer than 30 days;
   c) Repair any erosion channels as they occur and redirect surface runoff with the use of berms to promote sheet flow;
   d) Cover disturbed areas with minimum 100 mm of topsoil then seed and mulch or hydro seed as soon as possible;



MUD MAT DETAIL

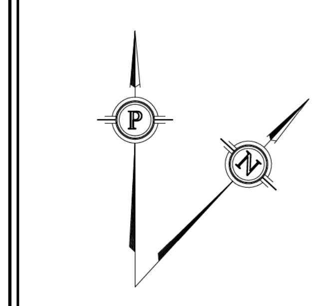
SCALE = N.T.S.





LEGEND – ESC

- PROPERTY LINE
- TOP OF SLOPE
- SILT FENCE (OPSD 219.110)
- SILT FENCE (OPSD 219.130)
- MUD MAT
- BOTTOM OF SLOPE
- STRAW BALE CHECK DAMN
- LOT RESERVE LINE
- 100YR MVCA POST DEVELOPMENT FLOODPLAIN HATCH



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1.	RESPONSE TO SECOND REVIEW COMMENTS	2024.APR.19	SD

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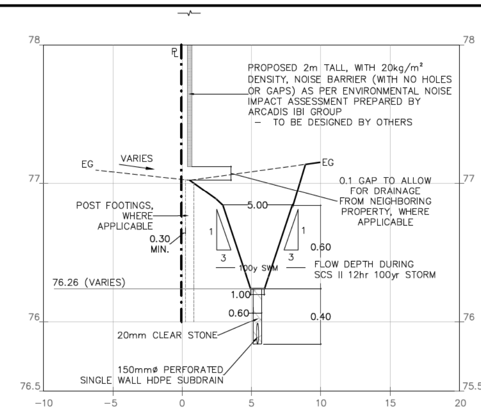
DRAWN	AJ
CHECKED	SD
APPROVED	SD

STAMP: LICENSED PROFESSIONAL ENGINEER 2025.MAR.27 S.E. deWit 100079612 PROVINCE OF ONTARIO

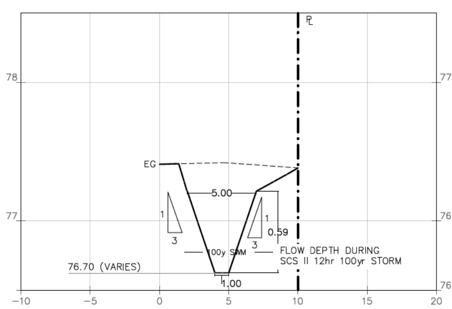
CLIENT NAME	ZBIGNIEW HAUDEROWICZ	PROJECT No.	200977
PROJECT NAME	PROPOSED RESIDENTIAL SUBDIVISION	DATE	2024/12/10
PROJECT LOCATION	2050 DUNROBIN ROAD OTTAWA, ONTARIO	SCALE	1:1000
DRAWING	EROSION & SEDIMENT CONTROL PLAN	DRAWING No.	ESC

D02–02–22–0018



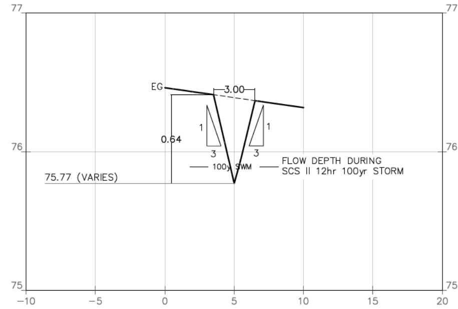
SECTION A–A (NORTH SWALE) / TYPICAL NOISE BARRIER DETAIL

SCALE = 1:250(H) 1:25(V)



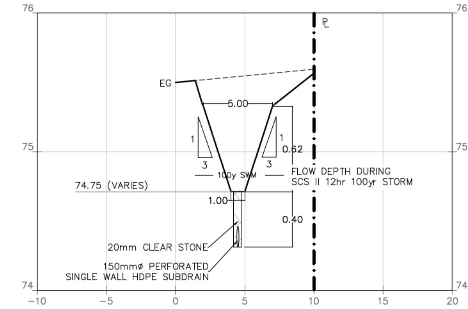
SECTION B–B (SOUTH SWALE)

SCALE = 1:250(H) 1:25(V)



SECTION C–C (SOUTH REAR SIDE YARD)

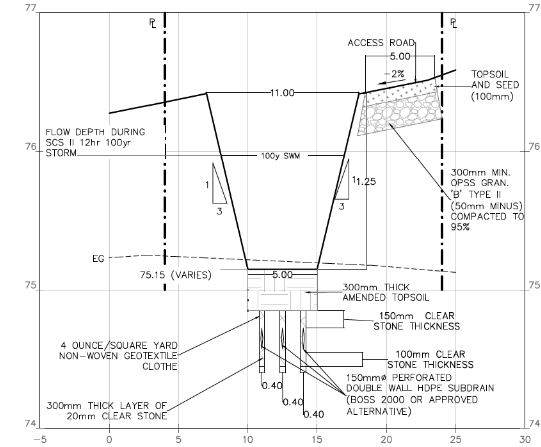
SCALE = 1:250(H) 1:25(V)



SECTION D–D (EAST SWALE)

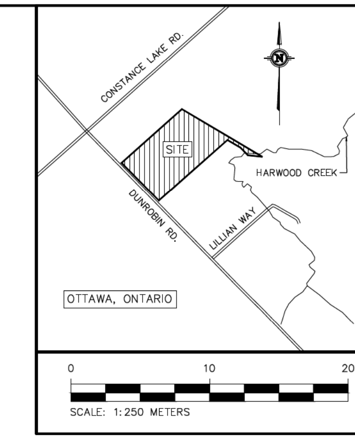
SCALE = 1:250(H) 1:25(V)

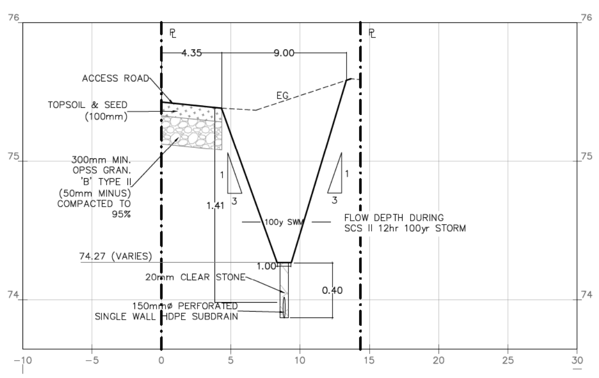
NOTE: 100YR FLOW DEPTHS/FLOOD ELEVATIONS CORRESPOND TO A NON-COINCIDENT STORM EVENT.



SECTION G–G (STORAGE)

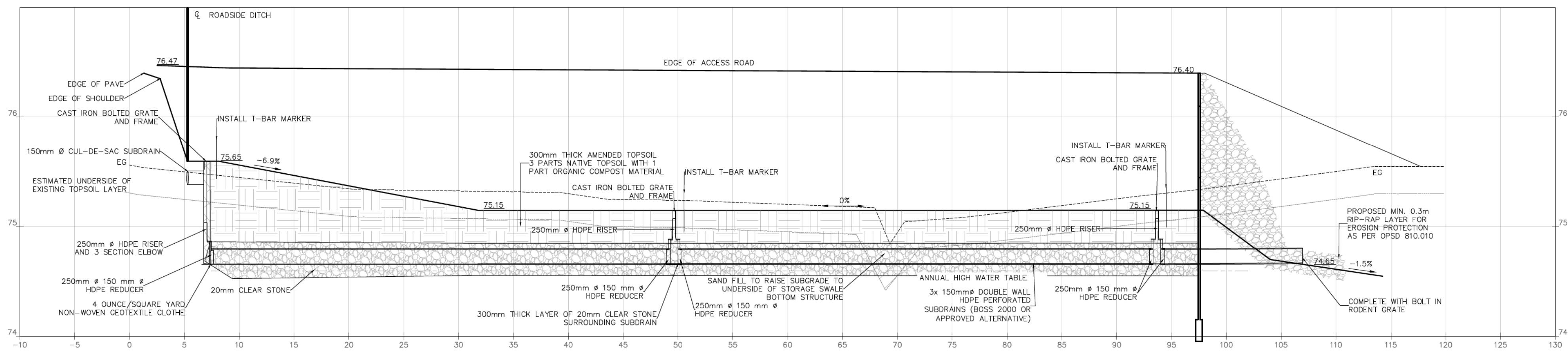
SCALE = 1:250(H) 1:25(V)





SECTION E–E (OUTLET TO HARWOOD CREEK)

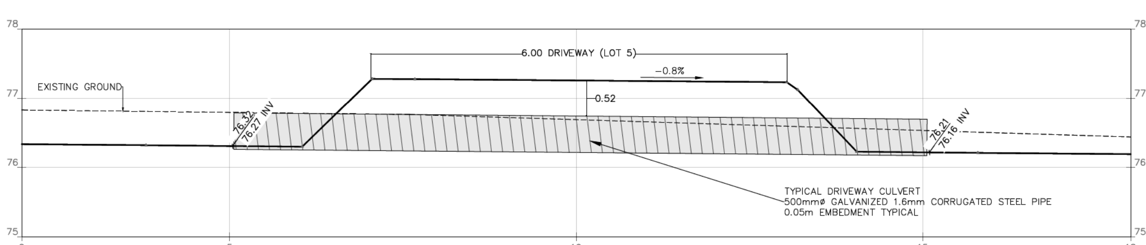
SCALE = 1:250(H) 1:25(V)



SECTION F–F (STORAGE)

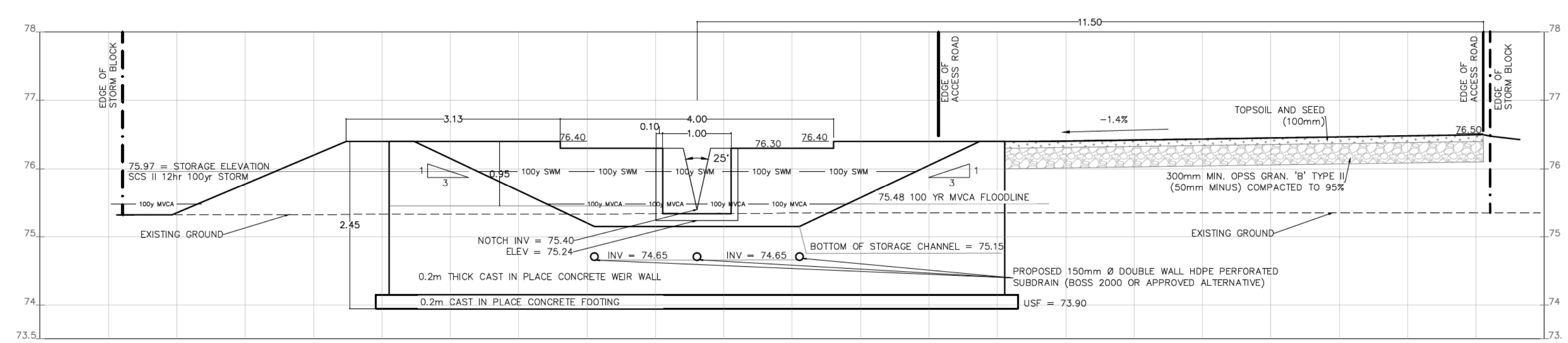
SCALE = 1:250(H) 1:25(V)

NOTE: All grade elevations shown on softscaped or grassed surfaces are finished grades including topsoil. Rough grading is to be completed to allow for 100 mm of Topsoil on all disturbed areas.



SECTION I–I (TYPICAL DRIVEWAY CULVERT)

SCALE = 1:50(H) 1:50(V)



PRIMARY OUTLET SWALE CONTROL STRUCTURE (HEADWALL)
SECTION H–H

SCALE = 1:50(H) 1:50(V)

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1.	RESPONSE TO SECOND REVIEW COMMENTS	2024.APR.19	SD

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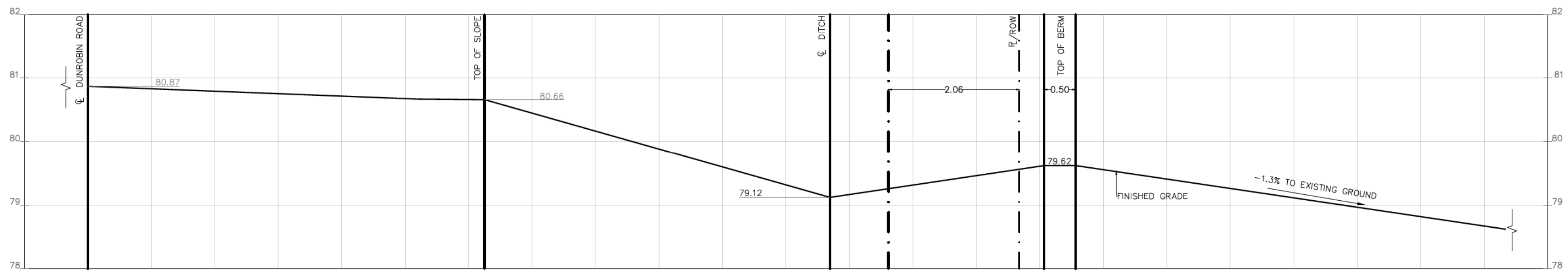
DESIGN: AJ/SD
DRAWN: AJ
CHECKED: SD
APPROVED: SD

STAMP: LICENSED PROFESSIONAL ENGINEER — 2025.MAR.27 — S.E. deWit — 100079612 — PROVINCE OF ONTARIO

CLIENT NAME	ZBIGNIEW HAUDEROWICZ
PROJECT NAME	PROPOSED RESIDENTIAL SUBDIVISION
PROJECT LOCATION	2050 DUNROBIN ROAD OTTAWA, ONTARIO
DRAWING	DETAILS
PROJECT No.	200977
DATE	2024/12/10
SCALE	AS NOTED
DRAWING No.	DET

D02-02-22-0018



SECTION J–J
N.T.S.

SEEDING – GENERAL

THE SEED MIXES BELOW SHOULD BE SOWED AT THE RATES RECOMMENDED BY THE SUPPLIER.

THE SEED MIXES SHOULD BE SOWED IN COMBINATION WITH A NURSE CROP OF ANNUAL RYE OR OATS WHICH IS SOWED AT A RATE OF 22–25 KG/HA

THE FOLLOWING SEED MIXES ARE INTENDED TO RESULT IN A VEGETATIVE COVER THAT REQUIRES NO MAINTENANCE. THE NATURALLY UN–MAINTAINED CONDITION WILL PROVIDE HEALTHY AND ADEQUATE COVER TO PROTECT THE SURFACES FROM EROSION, FACILITATE VEGETATIVE FILTRATION AND WILL PROVIDE NATURAL HABITAT FOR WILDLIFE.

STORAGE SWALE SEEDING

THE BOTTOM OF THE PROPOSED STORAGE SWALE SHOULD BE LIGHTLY SEEDED WITH SWEET CLOVER IN COMBINATION WITH A MIX SUCH AS WET MEADOW OR STORM POND SEED SUCH AS QS WET MEADOW MIXTURE AS SUPPLIED BY QUALITY SEEDS OR STORMPOND NATIVE SEED MIXTURE OR CREEK BANK NATIVE SEED MIXTURES SUPPLIED BY OSC SEEDS.

THE SIDES SLOPES OF THE STORAGE SWALE SHOULD BE SEEDED WITH A MEADOW MIX SUCH AS QS MEADOW MIXTURE AS SUPPLIED BY QUALITY SEEDS.

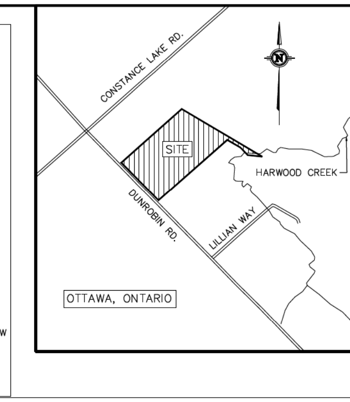
PERIMETER AND OUTLET SWALE SEEDING

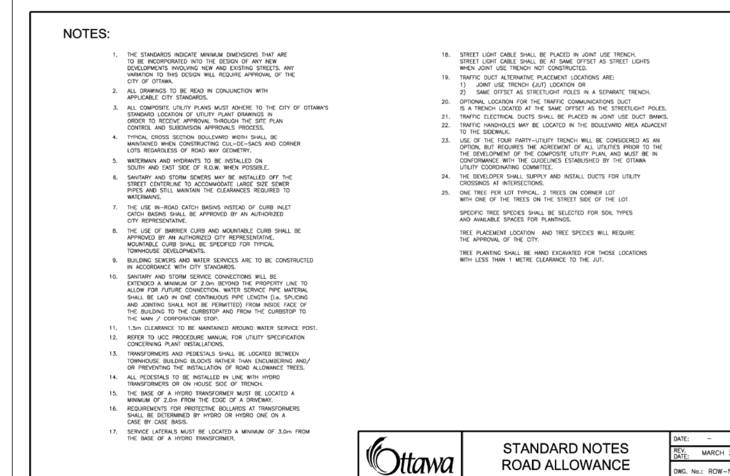
WHERE THE PROPOSED LONGITUDINAL SLOPE OF THE PERIMETER SWALES IS A MINIMUM OF 0.6 PERCENT, BOTH THE SIDES AND BOTTOM OF THE THE PERIMETER SWALES SHOULD BE SEEDED WITH A NATIVE MEADOW MIX SUCH AS QS MEADOW MIXTURE AS SUPPLIED BY QUALITY SEEDS.

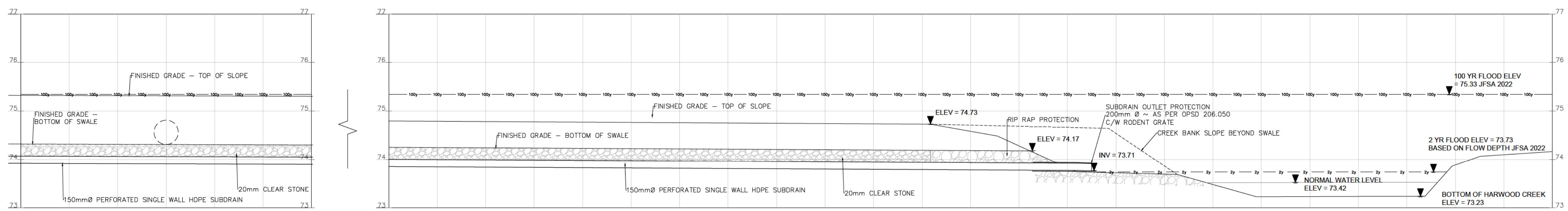
WHERE THE PROPOSED LONGITUDINAL SLOPE OF THE PERIMETER AND OUTLET SWALES IS LESS THAN 0.6 PERCENT, THE BOTTOMS OF THE PERIMETER SWALES SHOULD BE SEEDED WITH A NATIVE MIX SUCH AS WET MEADOW OR STORM POND SEED SUCH AS QS WET MEADOW MIXTURE AS SUPPLIED BY QUALITY SEEDS

DISTURBED AND UNMAINTAINED REAR YARD AREAS

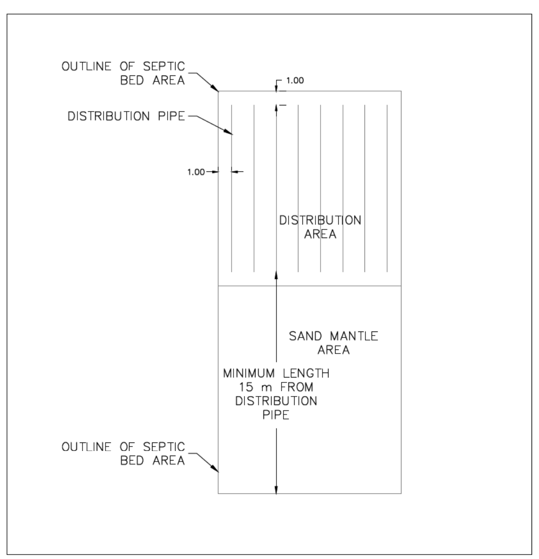
THE DISTURBED AND PROPOSED UNMAINTAINED AREAS IN THE REAR YARDS SHOULD BE LEVELED AND SEEDED WITH A NATIVE MEADOW MIX SUCH AS QS MEADOW MIXTURE AS SUPPLIED BY QUALITY SEEDS.



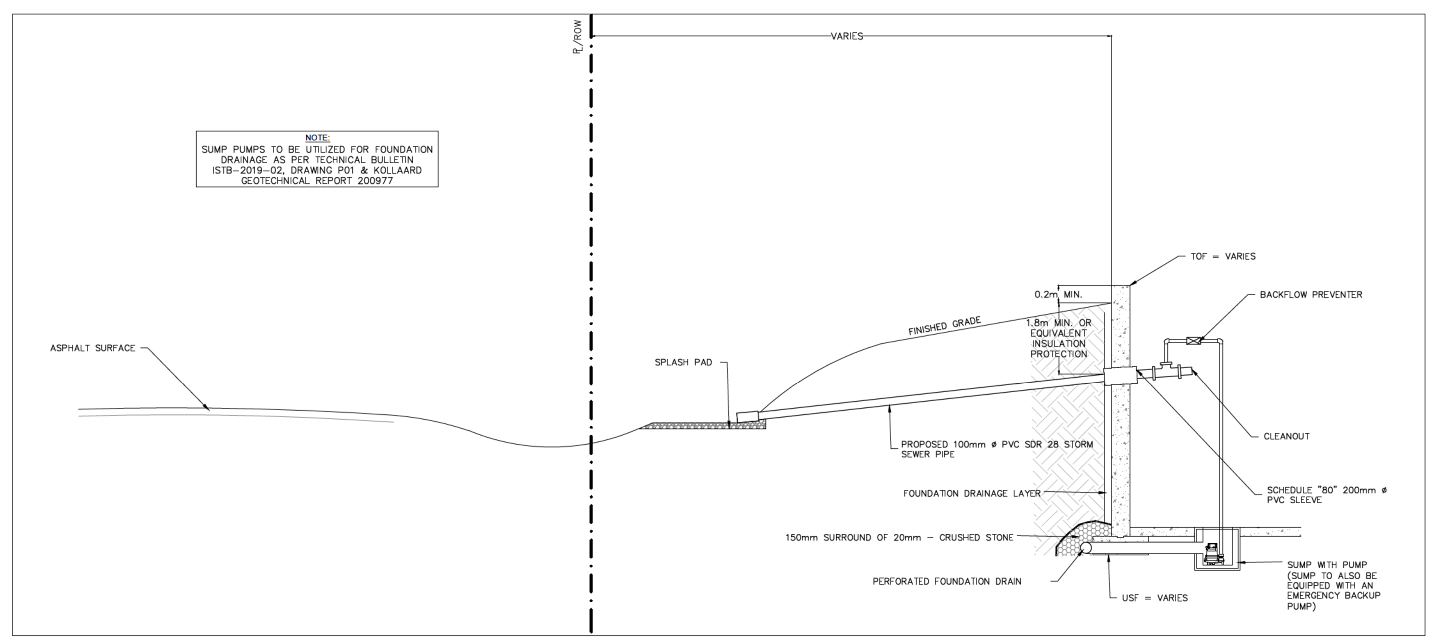




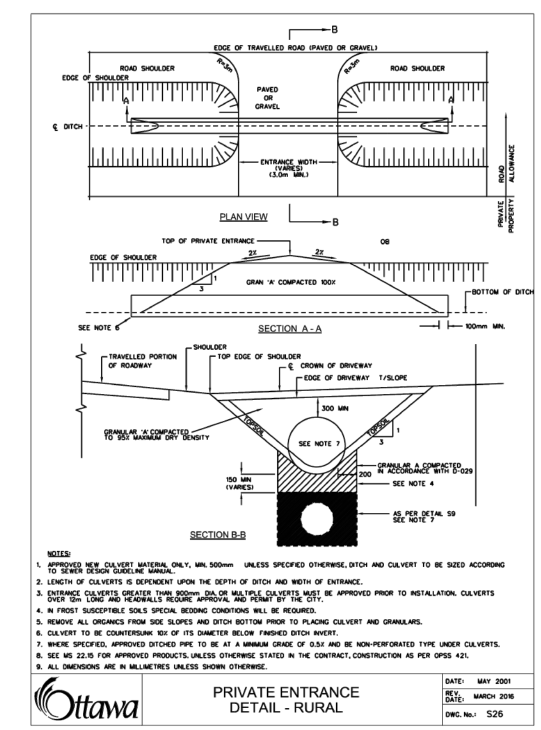
SECTION K–K
N.T.S.



SEPTIC BED LEGEND
N.T.S.



TYPICAL FOUNDATION DRAIN AND SUMP DETAIL
N.T.S.



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DRAWN: JR
CHECKED: SD
APPROVED: SD

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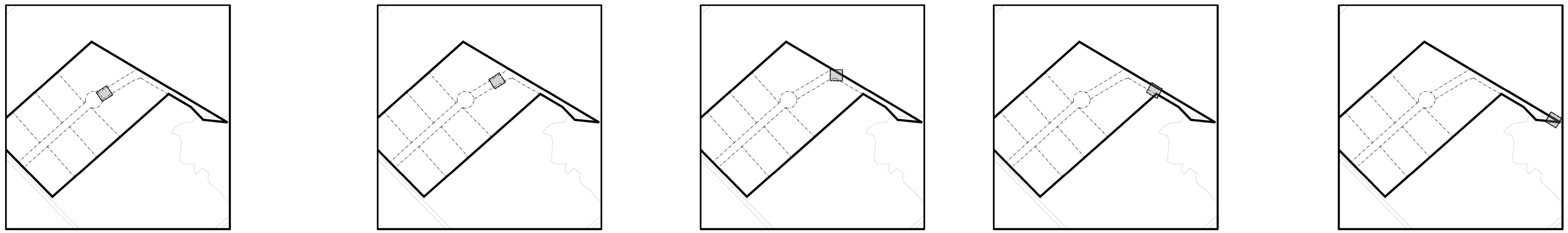
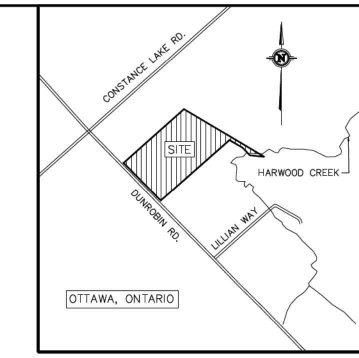
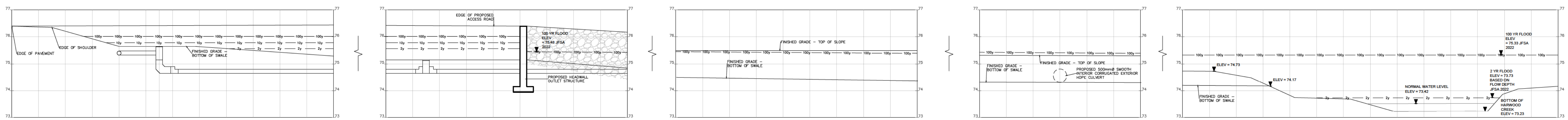
CLIENT NAME: ZBIGNIEW HAUDEROWICZ
PROJECT NAME: PROPOSED RESIDENTIAL SUBDIVISION
PROJECT LOCATION: 2050 DUNROBIN ROAD OTTAWA, ONTARIO
DRAWING: DETAILS (2)

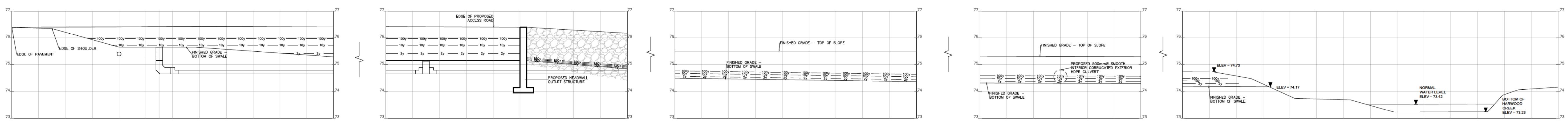
PROJECT No.: 200977
DATE: 2024/12/10
SCALE: AS NOTED
DRAWING No.: DET(2)



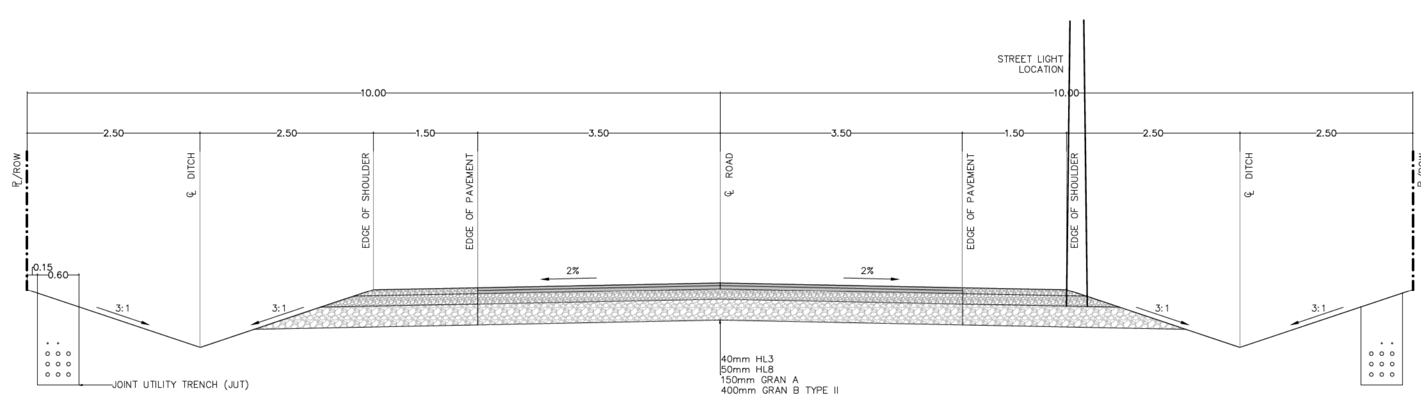




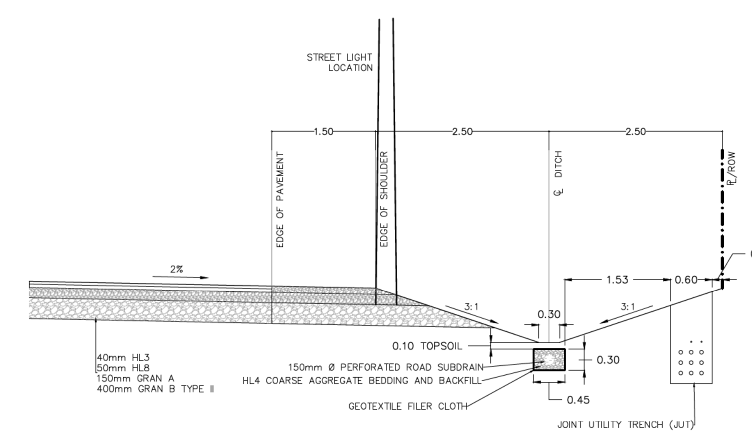
SWM POST DEVELOPMENT ELEVATIONS
(COINCIDENT EVENT)
SCALE = 1:75



SWM POST DEVELOPMENT ELEVATIONS
(NON-COINCIDENT EVENT)
SCALE = 1:75



TYPICAL ROAD SECTION
SCALE = 1:50



TYPICAL CUL-DE-SAC SECTION
SCALE = 1:50

NOTES:
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No.	REVISION	DATE	BY
4.	RESPONSE TO 5TH COMMENTS	2025.MAR.27	SD

CONSULTANTS

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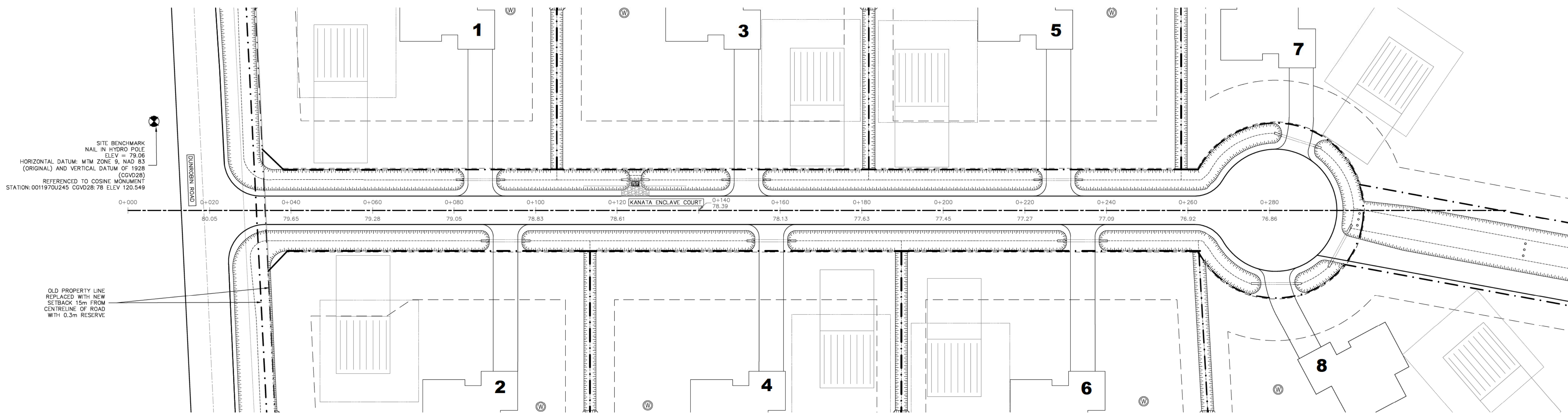
FACSIMILE (613) 258-0475
(613) 860-0923

DESIGN	SD
DRAWN	JR
CHECKED	SD
APPROVED	SD

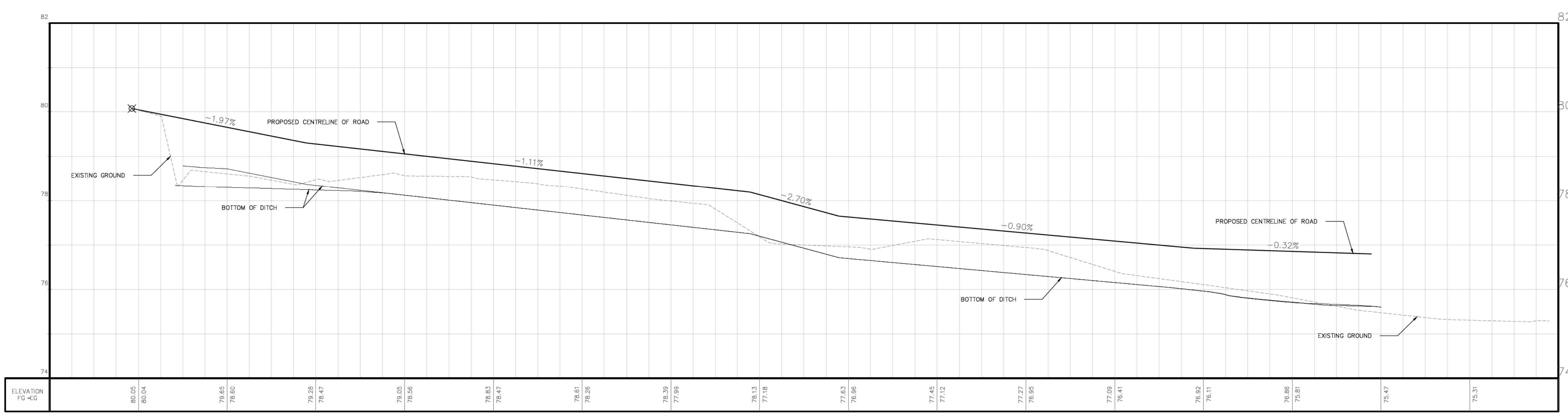
STAMP: LICENSED PROFESSIONAL ENGINEER 2025.MAR.27 S.E. deWit 100079612 PROVINCE OF ONTARIO

CLIENT NAME	ZBIGNIEW HAUDEROWICZ	PROJECT No.	200977
PROJECT NAME	PROPOSED RESIDENTIAL SUBDIVISION	DATE	2025/03/27
PROJECT LOCATION	2050 DUNROBIN ROAD OTTAWA, ONTARIO	SCALE	AS_NOTED
DRAWING	DETAILS(3)	DRAWING No.	DET(3)



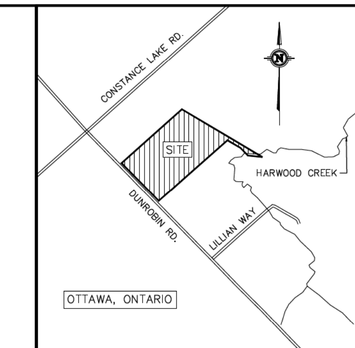
KANATA ENCLAVE COURT PLAN

SCALE = 1:500(H) 1:50(V)



KANATA ENCLAVE COURT PROFILE

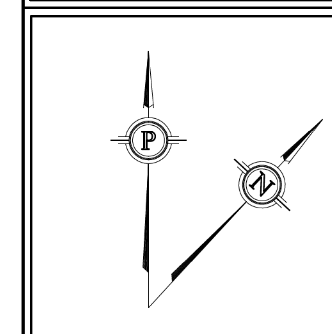
SCALE = 1:500(H) 1:50(V)



SCALE: 1:500 METERS (0, 20, 40)

LEGEND – PP

- PROPERTY LINE
- TOP OF SLOPE
- BOTTOM OF SLOPE
- PROPOSED CULVERT
- LOT RESERVE LINE
- ZONING SETBACK FOR BUILDING



- PROPOSED DWELLING FOOTPRINT
- PROPOSED SEPTIC BED
- SEPTIC BED MANTLE

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No.	REVISION	DATE	BY
4.	RESPONSE TO 5TH COMMENTS	2025.MAR.27	SD
3.	RESPONSE TO 4TH COMMENTS	2024.DEC.10	SD
2.	PARTIAL RESPONSE TO 4TH COMMENTS	2024.SEP.10	SD
1.	RESPONSE TO SECOND REVIEW COMMENTS	2024.APR.19	SD

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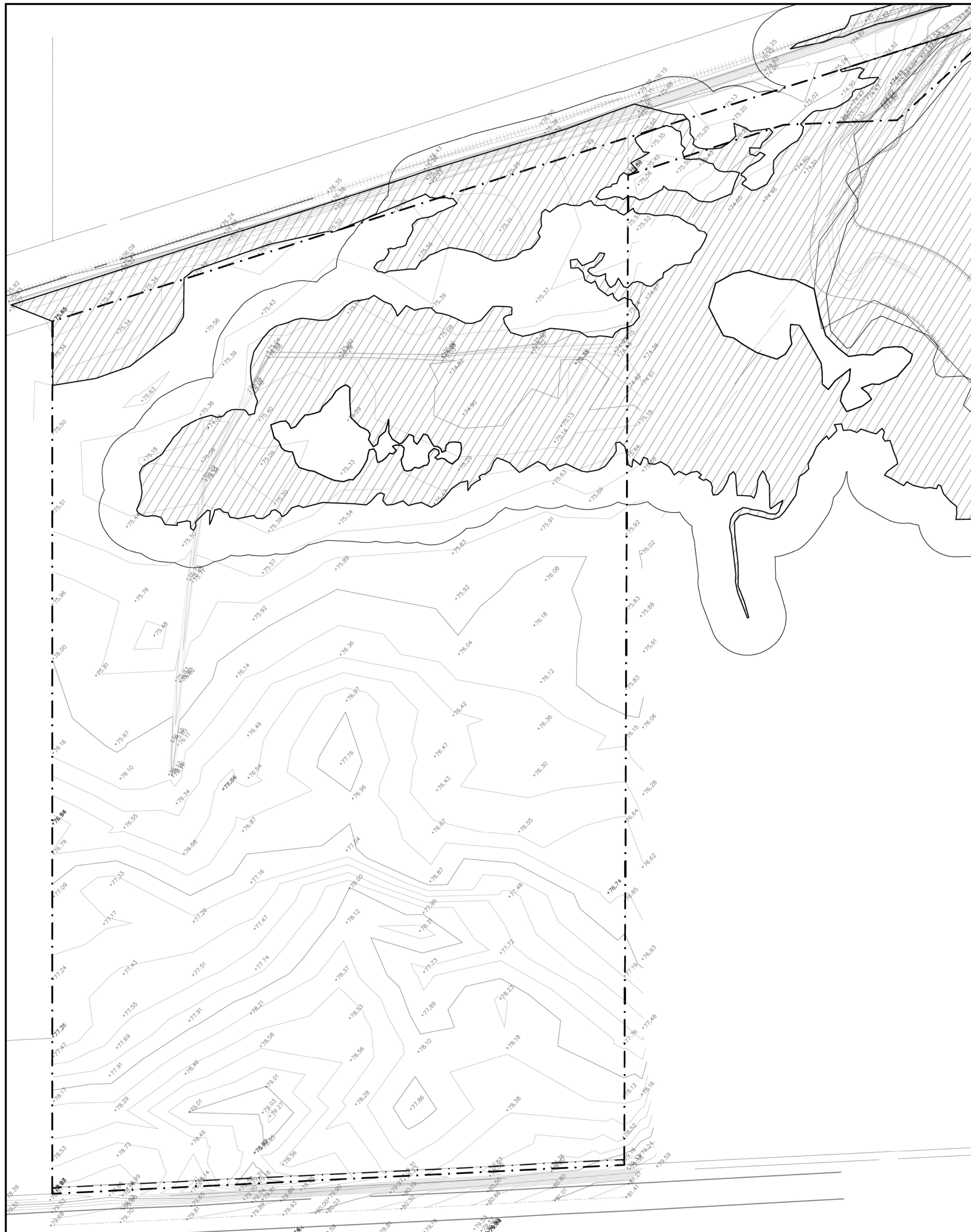
DESIGN: AJ/SD
DRAWN: AJ
CHECKED: SD
APPROVED: SD

STAMP: LICENSED PROFESSIONAL ENGINEER — 2025.MAR.27 — S. E. deWit — 100079612 — PROVINCE OF ONTARIO

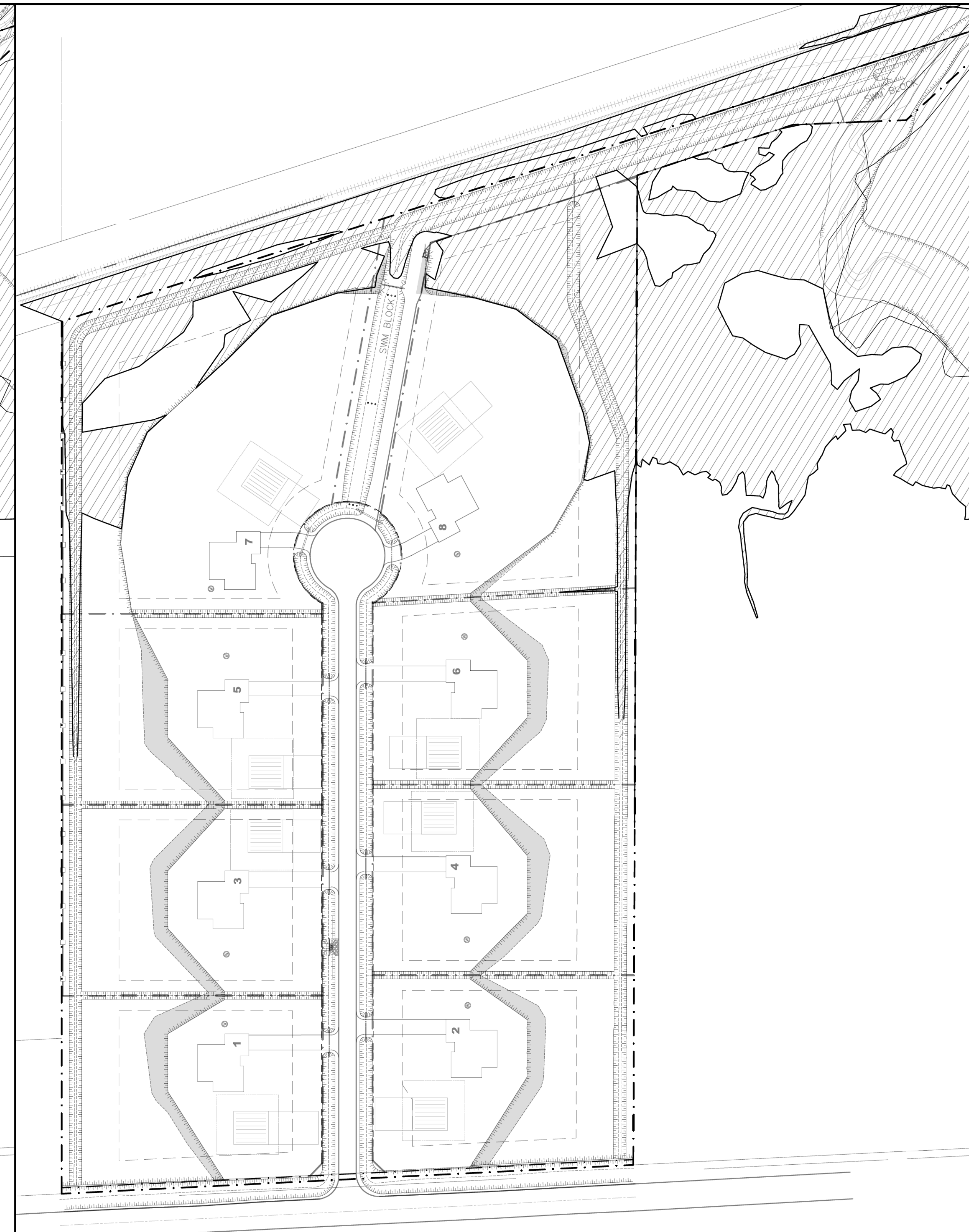
CLIENT NAME	ZBIGNIEW HAUDEROWICZ
PROJECT NAME	PROPOSED RESIDENTIAL SUBDIVISION
PROJECT LOCATION	2050 DUNROBIN ROAD OTTAWA, ONTARIO
DRAWING	PLAN AND PROFILE
PROJECT No.	200977
DATE	2024/12/10
SCALE	1:500
DRAWING No.	PP

D02-02-22-0018



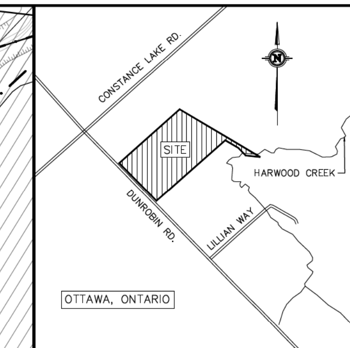
PRE-DEVELOPMENT 100YR FLOODPLAIN

SCALE = 1:1000



POST-DEVELOPMENT 100YR FLOODPLAIN

SCALE = 1:1000

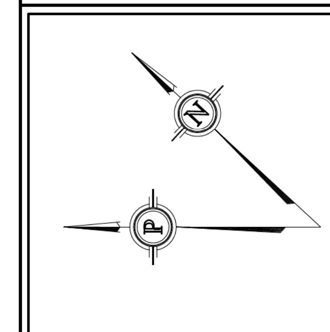


0 40 80

SCALE: 1:1000 METERS

LEGEND – FLOODPLAIN COMPARISON

(dash-dot line)	PROPERTY LINE
(hatch)	100YR FLOODPLAIN HATCH



	PROPOSED DWELLING FOOTPRINT
	– PROPOSED SEPTIC BED
	– SEPTIC BED MANTLE

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4.	RESPONSE TO 5TH COMMENTS	2025.MAR.27	SD
3.	RESPONSE TO 4TH COMMENTS	2024.DEC.10	SD
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1.	RESPONSE TO SECOND REVIEW COMMENTS	2024.APR.19	SD

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DRAWN	AJ
CHECKED	SD
APPROVED	SD

STAMP: LICENSED PROFESSIONAL ENGINEER 2025.MAR.27 S.E. deWit 100079612 PROVINCE OF ONTARIO

CLIENT NAME	ZBIGNIEW HAUDEROWICZ	PROJECT No.	200977
PROJECT NAME	PROPOSED RESIDENTIAL SUBDIVISION	DATE	2024/12/10
PROJECT LOCATION	2050 DUNROBIN ROAD OTTAWA, ONTARIO	SCALE	1:1000
DRAWING	FLOODPLAIN COMPARISON	DRAWING No.	FP

D02–02–22–0018