Brigil Kanata North Functional Site Servicing and Stormwater Management Report

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Sign-off Sheet

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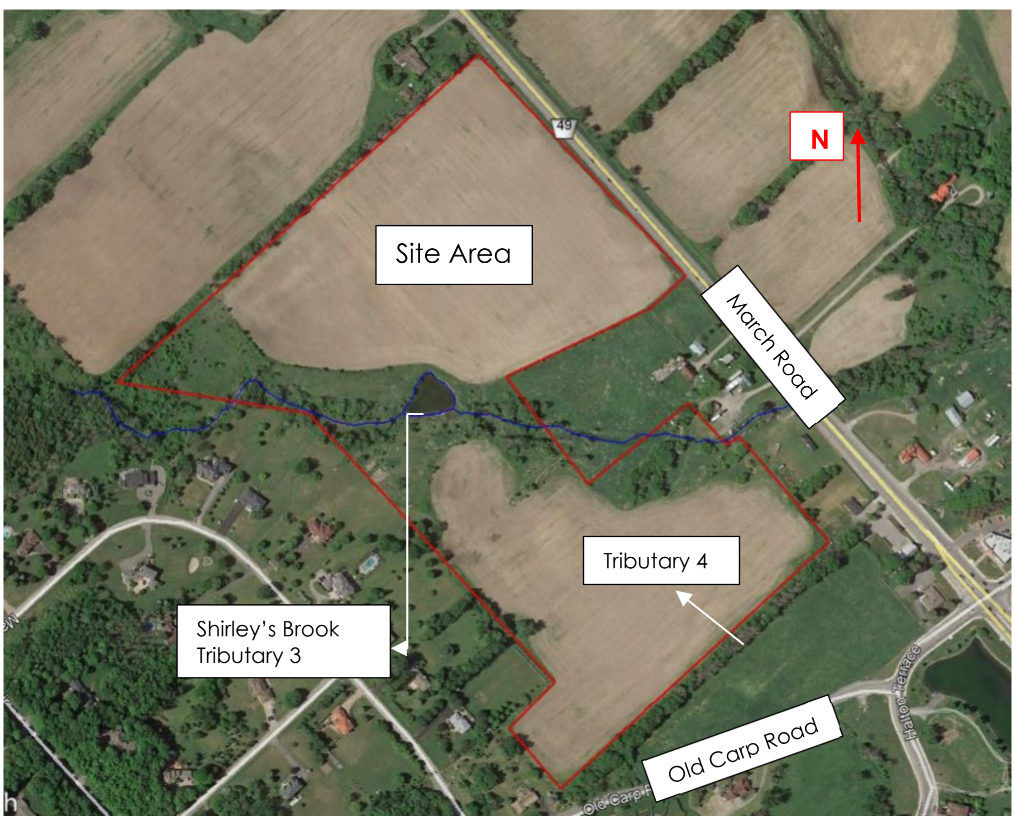
1.0 INTRODUCTION

Stantec Consulting Ltd. has been retained by 3223701 Canada Inc. (Brigil) to provide a functional servicing plan in support of their application for draft plan approval and Official Plan Amendment (OPA) to permit mid-rise apartment dwellings in the service mixed use block fronting March Road. The intent of this report is to provide a servicing scenario for the proposed development that is free of conflicts, includes external areas, and utilizes the existing/future infrastructure in accordance with the background studies.

Brigil is proposing a mixed use development that measures approximately 17.7 ha and is located north of Old Carp Road and west of March Road within the Kanata North Urban Expansion Area (KNUEA). The proposed site is shown in **Figure 1.**

The proposed draft of subdivision consists of 28 single detached units, 33 town-home units, a future school block (by others), a designated park area, and multi-unit buildings comprising 1800 units. The roads proposed consist of 24 m wide right of way (ROW) collector roads and 18 m wide ROW local roads.

Figure 1: Approximate Location of Kanata North Brigil Site



1.1 BACKGROUND

The proposed development is within the Kanata North Community Design Plan (CDP) and servicing criteria for the site is outlined in the Kanata North Master Servicing Study (KNMSS) and the Kanata North Environmental Management Plan (KNEMP) prepared by Novatech Engineers, Planners & Landscape Architects (Novatech) in June 2016. The proposed development is referred to as the southwest quadrant of the KNUEA within the KNMSS and the KNEMP. The background reports describe the conceptual trunk sewers and watermains that will service all developments within the KNUEA, establish targets for site-specific stormwater management (SWM) plans, and identify required infrastructure upgrades to support growth within the KNUEA.

The KNEMP outlined an environmental compensation and mitigation plan for each quadrant within the KNUEA. The southwest quadrant environmental compensation and mitigation plan is summarized as follows (see report excerpts in **Appendix C.5**).

- Realigned 40m corridor + 6m pathway for Shirley's Brook Tributary 3.
- Channel 'G' (Marchbrook Circle) should be intercepted at the KNUEA property boundary and piped to Tributary 3.
- Blanding's turtle compensation with deep pools, artificial nesting areas, shallow pans/pools, and deep channel pockets.
- Headwater features compensation within the protected and/ or enhanced creek corridor.

1.2 EXISTING CONDITIONS

The site is predominantly occupied by agricultural uses under existing conditions. The lands to the north and east are also predominantly occupied by agricultural uses, while the lands to the west are occupied by a rural subdivision (Marchbrooke Circle) and the lands to the south are occupied by urban mixed-use development.

The proposed development is located within the jurisdiction of the Mississippi Valley Conservation Authority (MVCA) and within the Shirley's Brook sub-watershed. Tributary 3 of Shirley's Brook crosses the site from west to east towards March Road and Tributary 4, identified as Channel G in the KNEMP, borders the southern property line as shown in **Figure 1**.

The existing elevations within the site range from 88 m to 79m generally draining from west to east.

1.3 OBJECTIVE

This functional servicing report is being prepared in support of draft plan approval and OPA for the Brigil Kanata North Development. This report will provide a recommended servicing plan for the major municipal infrastructure needed to support development of the subject property. The review will be a macro level detail study with further details to be confirmed and provided during the detailed design process. This report will demonstrate how proposed municipal servicing is in conformance with the KNMSS and the KNEMP recommendations. Any deviation from the background documents will also be identified with rationalization for the change.

1.4 BACKGROUND RESOURCES

The following documents were referenced in the preparation of this report:

- *Kanata North Community Design Plan,* Novatech, June 28, 2016
- *Kanata North Master Servicing Study,* Novatech, June 28, 2016
- *Kanata North Environmental Management Plan,* Novatech, June 28, 2016
- *Kanata North Transportation Master Plan, Novatech, June 28, 2016*
- *Consolidated Preliminary Geotechnical Investigation Kanata North Urban Expansion Area Community Development Plan March Road, Ottawa, Ontario,* Paterson Group Inc., October 7, 2013

Additional documents referenced in designing the functional servicing plans for the proposed development include:

- *Erosion & Sediment Control Guidelines for Urban Construction*, Greater Golden Horseshoe Area Conservation Authorities, December 2006
- *Stormwater Management Planning and Design Manual*, Ministry of the Environment (Ontario), March 2003
- *Ottawa Design Guidelines – Water Distribution*, City of Ottawa, July 2010
    - *Technical Bulletin ISD-2010-2*, City of Ottawa, December 15, 2010
    - *Technical Bulletin ISDTB-2014-02*, City of Ottawa, May 27, 2014
    - *Technical Bulletin ISTB-2018-02*, City of Ottawa, March 21, 2018
- *City of Ottawa Sewer Design Guidelines*, 2nd Ed., City of Ottawa, October 2012
    - *Technical Bulletin ISDTB-2014-01*, Revisions to Ottawa Design Guidelines – Sewer, City of Ottawa, February 5, 2014. (ISDTB-2014-01)
    - *Technical Bulletin PIEDTB-2016-01*, Revisions to Ottawa Design Guidelines – Sewer, City of Ottawa, September 6, 2016. (PIEDTB-2016-01)
    - *Technical Bulletin ISTB-2018-01*, Revisions to Ottawa Design Guidelines – Sewer, City of Ottawa, March 21, 2018. (ISTB-2018-01)

2.0 POTABLE WATER

The KNUEA is located within the existing City of Ottawa 2Ww pressure zone. An existing 400 mm diameter watermain on March Road services the existing subdivisions south of Maxwell Bridge Road.

The KNMSS completed a review of the existing water plan adjacent to the area and made recommendations for improvements and expansion to the City's water transmission and distribution system to support the Kanata North Urban Expansion Area (KNUEA). Excerpts from the KNMSS outlining the design criteria and indicating the limits of existing watermains in the vicinity of the subject property are included in **Appendix A.**

The proposed development will ultimately be serviced through two watermain connections to a future 400 mm diameter watermain on March Road as shown on **Drawing OSSP-1**.

It is our understating that Novatech has completed the design of the March Road watermain and that construction is expected to start in the Fall of 2020. However, March Road widening is not in the current TMP and construction timing for March Road urbanization is currently unknown.

The proposed watermain network will be designed in accordance with City of Ottawa Design Guidelines and the recommendations provided in the KNMSS summarized as follows.

- Site grading should not exceed 93 m to maintain minimum pressures greater than 40 psi.
- Services installed in areas where the grade is less than 74 m will need pressure reducing valves to keep the maximum pressure below 80 psi.

At the detailed design stage, a complete hydraulic analysis will be prepared for the proposed development water distribution network to confirm that water supply is available within the required pressure range under the anticipated demands during average day, peak hour and fire flow conditions prior to full buildout of the KNUEA.

3.0 WASTEWATER SERVICING

3.1 BACKGROUND

Two existing sanitary sewer systems will service the KNUAE as outlined in the KNMSS (see report excerpts in **Appendix B.2**). An existing sanitary sewer network that conveys wastewater to the Briar Ridge Pump Station (BRPS) and discharges into the East March Trunk sanitary sewer, and a second sanitary sewer system which consists of the future extension of the sanitary trunk sewer on March Road and the upgrade of the existing 375 mm diameter sanitary sewer on Shirley's Brook Drive to 600 mm diameter. The existing sanitary on Shirley's Brook Drive discharges into the East March Trunk sanitary sewer. The design of the sanitary trunk sewer on March Road has been completed with an anticipated construction completion date of fall 2020.

The proposed site will be serviced through two connections to the future March Road sanitary sewer as shown on **Drawing OSA-1**. The portion of the proposed site north of Tributary 3 is encompassed by KNMSS drainage areas W-11, W-10 and A Community Park area (see KNMSS SAN-1 Drawing in **Appendix B.2**). Similarly, the portion of the proposed site south of Tributary 3 is encompassed by part of KNMSS drainage area W-12. The KNMSS assumed sewage from areas W-11 and W-10 (no infiltration component was included for the community park) would be directed to the March Road northern outlet with a total peak flow of 8.7 L/s, and sewage from area W-12 which includes the future school block (by others), the future mixed-use block (by others) and a small future low density residential area (by others) would be serviced through the future Old Carp Road extension and directed to the March Road southern outlet with a total peak flow of 25.3 L/s (see KNMSS excerpts in **Appendix B.2**).

As part of the KNMSS, it was concluded that based on the information provided by the City, a hydraulic grade line (HGL) analysis was not necessary for the March Road trunk sewer.

A sensitivity analysis was conducted as part of the KNMSS to assess the wasterwater network residual capacity by increasing the average per capita daily discharge from 350 L/c/day to 450 L/c/d and a second scenario was analyzed by increasing the extraneous flow allowance from 0.28 L/s/ha to 0.50 L/s/ha. The analysis concluded that the wastewater system within the KNUEA has been designed with an appropriate amount of residual capacity to permit a moderate degree of intensification within the KNUEA.

3.2 DESIGN CRITERIA AND KNMSS DEVIATIONS

The conceptual sanitary sewer design sheet is included in **Appendix B.1**. The sewers are to be designed in conformance with all relevant City of Ottawa and MECP Guidelines and Policies. Per ISTB-2018-01, the City's current design parameters represent a flow reduction from the outdated standards used within the KNMSS. As a result, the revised sanitary sewer design criteria differs from the criteria previously used in the KNMSS as shown in the table below.

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Table 1: Sanitary Sewer Design Criteria Comparison

Design Parameters	Revised Design Criteria (City Guidelines - 2018)	2016 KNMSS Criteria
Minimum Velocity (m/s)	0.6	
Maximum Velocity (m/s)	3.0	
Manning roughness coefficient for all smooth wall pipes	0.013	
Minimum size	200mm dia. for residential areas, 250mm for commercial areas	
Single Family Persons per unit	3.4	3.4
Townhouse Persons per unit	2.7	2.7
Average Apartment Persons per unit	1.8	1.8
Extraneous Flow Allowance (L/s/ha)	0.33	0.28
Manhole Spacing (m)	120 m	
Minimum Cover (m)	2.5 m	
Average Daily Discharge / Person (L/cap/day)	280	350
Harmon Correction Factor	0.8	1.0
Institutional Daily Flow (L/ha/day)	28,000	50,000
Commercial Daily Flow (L/ha/day)	28,000	50,000

The KNMSS unit count for Residential Multi-Unit blocks was based on an average density of 71.6 units/ net ha with 50% of the units assumed to have a population density of 2.7 person/units (townhomes) and 50% of the units assumed to have a population of 1.8 persons/units (apartments). Similarly, Residential-Street Oriented areas were assumed as low density with 16.6 singles/net ha at 3.4 persons/unit plus 16.5 townhomes/net ha at 2.7 persons/unit. Service Mixed Use Blocks were assumed as commercial areas for peak flow calculations and community park areas were not included for infiltration flow calculations.

The following is a summary of the proposed deviations from the KNMSS assumptions.

- Proposed drainage area R6A includes a block adjacent to March Road that consists of two (2) nine-storey buildings. This block is zoned service mixed-use in the KN CDP which permits low rise apartment dwellings (an application for OPA has been submitted to permit mid-rise apartment dwellings within this block). However, commercial flows were assumed for this area in the KNMSS sanitary peak flow calculations. Peak flow calculations for this area are based on 50% of the proposed units at 2.7 person/units and 50% of the proposed units at 1.8 person/units as per the KNMSS assumptions for Residential Multi-Unit Blocks.

- Infiltration peak flows from the community park area within area R6A have been included in the total peak flow calculations.

- The KNMSS shows a second connection to the future 600mm diameter trunk sewer on March Road would be provided through the realigned Old Carp River Road to service the portion of the proposed site south of Tributary 3. However, based on the proposed development layout and development timing of the adjacent properties, it is proposed to service the southern portion of the site through a connection to the future March Road trunk sewer at the proposed local street. The proposed local street sanitary sewer has been sized to service the future school block (area I12, by others), as well as the future service mixed-use blocks fronting March Road (areas C11B and C11C, by others) to avoid deep service connections along the March Road trunk sewer. The remainder of external areas within KNMSS area W-12 which consist of a future mixed-use block (R-EXT1, by others) and a future low density residential area (R-EXT2, by others) will be serviced through a future sewer along the future Old Carp Road realignment connected to the trunk sewer March Road.

3.3 PROPOSED SERVICING

Drawing OSA-1 illustrates the conceptual main trunk sewer alignment and sanitary drainage areas. As per the KNMSS, the proposed development sanitary sewer system is split in two with two separate connections to the future 600 mm diameter March Road trunk sewer to avoid crossing Tributary 3. The March Road sanitary sewer design has been completed (see design drawings in **Appendix B.2**).

The proposed development will be serviced by a network of gravity sewers, designed in accordance with the wastewater design parameters from ISTB-2018-01 and the Sewer Design Guidelines, summarized in **Table 1**. The conceptual sanitary sewer design sheet can be found in **Appendix B.1**. A breakdown of the estimated sewage peak flows that will be directed to each outlet is shown in **Table 2**.

Table 2: Estimated Wastewater Peak Flows

Outlet	Residential Population (persons)	Residential Peak Flow (L/s)	Institutional Area (ha)	Commercial Area (ha)	Commercial /Institutional Peak Flow (L/s)	Total Area (ha)	Extraneous Flow (L/s)	Total Peak Flow (L/s)
Northern Outlet	1,439	14.7	N/A	N/A	N/A	8.18	2.7	**17.4**
Southern Outlet	2,795	26.9	2.05	0.61	1.3	10.46	3.5	**31.7**

1. As per KNMSS, 8.7L/s were assumed from the site to the northern outlet to March Road (Areas W-10 and W-11, 1.08ha commercial , 390 persons, 71.6 units/net ha, 50% at 2.7p/unit and 50% at 1.8p/unit).
2. As per KNMSS, 25.3L/s were assumed from the site to the southern outlet to March Road (Area W-12, 1350 persons, 71.6 units/net ha, 50% at 2.7p/unit and 50% at 1.8p/unit, 2.01ha institutional).
3. The park area was not included in the infiltration peak flow calculations in the KNMSS, but it has been included here.
4. Institutional area (Area I12) corresponds to a future school block (by others) which will be serviced through the proposed local street and southern outlet to March Road and as such, it has been included in the proposed sanitary sewer sizing.
5. Commercial Area (C11B and C11C) corresponds to future commercial blocks (by others) which have been included in the proposed sanitary sizing of the local street sewer.

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As can be seen in the above table, the total estimated peak flow of 17.4 L/s to the northern March Road outlet exceeds the assumed KN MSS peak flow of 8.7 L/s (8.7 L/s exceedance). This is in part due to the higher density proposed for the service mixed-use block adjacent to March Road within area R6A which was assumed as commercial sewage in the KN MSS which generates significantly lower peak flows, and to the addition of the park area in the infiltration calculations for the propose site.

Similarly, the total estimated peak flow to the proposed southern March Road outlet is approximately 31.7 L/s which includes future commercial areas by others C11B and C11C that were part of a different drainage area in the KN MSS (MR-3) and have been included in the proposed sanitary sewer sizing to avoid future service connections to the deep trunk sewer on March Road. These future commercial areas generate approximately 0.3 L/s as per the KN MSS assumptions and as such, the peak flow contribution from these areas should be removed when comparing the proposed peak flow to the assumed KN MSS peak flows from area W-12 to the southern March Road outlet.

Two external areas to be developed by others (R-EXT1 and R-EXT2) were included in the KN MSS area W-12, so in order to compare the total proposed peak flows to the March Road southern outlet to the assumed KN MSS peak flow of 25.3 L/s, the peak flows from these areas which will be serviced through a future sanitary sewer connection to March Road along the Old Carp Road realignment need to be estimated. Area R-EXT1 is zoned Mixed-Use and has been assumed as multi-unit residential as per the KN MSS (71.6 units/net ha, 50% townhomes at 2.7p/unit and 50% apartments at 1.8p/unit). Area R-EXT-2 is zoned Residential-Street Oriented and has been assumed as low density as per the KN MSS (16.6 singles/net ha * 3.4pers/unit + 16.5 Towns/net ha * 2.7pers/unit). The total peak flow generated from these areas is approximately 2.9 L/s (see detailed calculations in the conceptual sanitary sewer design sheet included in **Appendix B.1**).

Based on the above peak flow breakdown, the proposed sanitary peak flows to the southern outlet (31.7 L/s) include commercial peak flows from external areas (0.3 L/s) which results in a proposed peak flow of 31.4 L/s within the KN MSS area W-12. An additional 2.9 L/s will be generated by the external areas R-EXT1 and R-EXT2 which are also within the KN MSS area W-12, for a total proposed peak flow of 34.3 L/s, which exceeds the KN MSS assumed peak flow from area W-12 of 25.3 L/s by 9.0 L/s.

Based on the sanitary design sheet provided in the KN MSS (see **Appendix B.2**), there is 18 L/s residual capacity in the downstream sanitary sewers. The total peak flow exceedance to the March Road trunk sewer from the KN MSS areas W-10, W-11 and W-12 is expected to be approximately 17.7 L/s based on the unit count and expected population density for the proposed Brigil Kanata North Development.

4.0 STORM DRAINAGE

The proposed development encompasses approximately 17.7 ha of land at 56% imperviousness and comprises a mixed-use block, five residential multi-unit blocks, designated park land, a SWM pond block, and a mix of single family homes and town homes. A small portion of the site is within a school block that will be developed by others. The proposed development will be serviced through two separate storm sewer systems that will discharge into Tributary 3 of Shirley's Brook. Post development runoff from the majority of the development will be directed to the proposed KNUEA SWM Pond 2. The KNUEA SWM Pond 2 will provide quantity and quality control (80% TSS removal) of runoff before discharging into Tributary 3 of Shirley's Brook. The rest of the site will be serviced through a separate storm sewer system (secondary storm outlet) that will discharge into Tributary 3 of Shirley's Brooke. On-site quantity control will be provided in each block tributary to the secondary storm outlet to meet the target peak outflows outlined in the Kanata North Environmental Management Plan (KN EMP) completed by Novatech in 2016 and the Kanata North Master Servicing Study (KN MSS) completed by Novatech in June 2016. Similarly, each block tributary to the secondary storm outlet provide on-site quality control to meet 80% TSS removal. **Drawing OSD-1** shows the overall major and minor system flow direction, storm drainage areas and extent of external areas.

The storm drainage objective is to complete a conceptual stormwater management plan for the proposed development that meets all relevant design criteria.

4.1 BACKGROUND AND SWM CRITERIA

The study area is located within the south-west quadrant of the Kanata North Urban Expansion Area (KNUEA) and is within the Shirley's Brook sub-watershed. Tributary 3 of Shirley's Brook bisects the site from west to east and discharges into existing 1500 mm diameter twin culverts at March Road. Under existing conditions, the study area generally drains in a north-east direction towards March Road or Tributary 3. Tributary 4 of Shirley's Brooke follows the southern property line from west to east.

4.1.1 Kanata North Master Servicing Study and Environmental Management Plan

The KN MSS and KN EMP outlined the SWM criteria for the proposed development as follows (see **Appendix C.5** for KN MSS excerpts showing the SWM criteria for the site).

- A new end-of-pipe SWM facility (SWM Pond 2) is proposed to service a tributary drainage area of approximately 17.6 ha at 41% imperviousness from the south-west quadrant of the KNUEA. The KN EMP assumed SWM Pond 2 would have a bottom elevation at 78.50 m, a normal water level at 79.50 m, extended detention storage at 79.75 m and 100-year water level at 81.50 m (10,030 m^3 active storage). The recommended SWM facility design will incorporate:

- Baseflow enhancement
- Water quality control (80% long-term TSS removal)
- Erosion Control (based on geomorphic assessment)
- Peak flow control of 16 L/s during the 2-year storm, 32.0 L/s during the 5-year storm and 84 L/s during the 100-year storm
- The normal water level (permanent pool) in wet ponds should be above the 2-year water level in the receiving watercourse
- SWM facilities should be integrated into the community through the use of pathways or other linkages
- The SWM facility will require an impermeable liner as the pond will be excavated into rock
- SWM facilities should be designed using narrow pond configurations with bank plantings to promote shading and inhibit temperature increases
- Baseflows should be routed through a stone-filled subsurface trench: The length of the trench should be maximized to increase the opportunity for heat transfer from the water to the stone
- Establishing / preserving riparian cover for outlet watercourses will further help to reduce the temperature of runoff.

- On-site water quality and quantity controls are proposed for approximately 7.2 ha in the southwest quadrant of the KNUEA tributary to the secondary storm outlet to Tributary 3:
  - Quantity control storage can be provided using a combination of surface and underground storage to restrict minor system post development peak flows up to the 100-year storm from KNUEA areas tributary to the secondary storm outlet to 816 L/s (2-year runoff from proposed local street catchments and approximately 115 L/s/ha from future/proposed multi-unit, mixed-use and school block).
  - Quality control could be provided using treatment units (Stormceptor, Vortechnics, etc.) or through the use of low-impact development design to achieve 'Enhanced' quality control (i.e. 80% TSS removal).
- Marchbrook Circle drainage – A primarily rural residential area, approximately 19 hectares in size, southwest of the KNUEA drains to an existing ditch which outlets to Tributary 4 as shown on **Drawing OSD-1**. It is proposed to collect a portion of this drainage area (15.1 ha) in a storm sewer along Old Carp Road. The storm sewer will convey the major and minor system drainage though the southwest quadrant and outlet directly to Tributary 3 (approx. 386 L/s in the 100-year as per KN EMP SWMHYMO modeling) through the proposed secondary storm outlet. The remainder of the area (3.5ha) will have the minor system drain to Pond 2 through the Street A storm sewer and the major system directed overland through the proposed rear yards directly to Tributary 2.
- The soils west of March Road generally consist of tight clays with relatively shallow depths to bedrock. While this does not preclude the use of LIDs in this area, infiltration based stormwater best management practices should be considered a low priority west of March Road.
- The recommended servicing strategy includes storm and water crossings under Tributary 3. The proposed trenches for these crossings will be in rock and will require a clay cap to

prevent surface water in the tributaries from migrating into the underlying trenches. Details of the proposed crossings will be prepared at the detailed design stage.

- Watercourse crossings are to be sized to convey the 100-year peak flow without overtopping the roadways.
- Watercourse crossings should be designed in accordance with geomorphology principles.
- Watercourse crossings should be designed to ensure they meet any additional requirements for terrestrial and aquatic habitat.
- As outlined in the KN EMP, the environmental compensation and mitigation plan for the south-west quadrant of the KNUEA is summarized as follows.
    - 40m corridor + 6m pathway for Shirley's Brook Tributary 3.
    - Channel 'G' (Marchbrook Circle) should be intercepted at the KNUEA property boundary and piped to Tributary 3.
    - Blanding's turtle compensation with deep pools, artificial nesting areas, shallow pans/pools, and deep channel pockets.
    - Headwater features compensation within the protected and/ or enhanced creek corridor
- As part of the KN EMP, a HEC-RAS model for Shirley's Brook Northwest Branch Tributaries 2 and 3 was created to assess existing condition peak flows and water levels along the tributaries as well as erosion control thresholds. The existing conditions model was then modified to reflect post development peak outflows generated in a SWMHYMO model (which included the conceptual SWM Pond designs), and included culvert crossings and the proposed channel realignment for Tributary 2.

  The results of the analysis indicated that the 100-year floodplain limits will be confined within the proposed 40m stream corridors, as shown on Figure 10.1 of the KN EMP (see **Appendix C.5**). The stormwater management facilities were designed to ensure no changes in post development peak flows from the KNUEA int Shirley's Brook. The post development water levels at the KNUEA SWM Pond 2 outlet and secondary storm outlet locations (station 3271.49) are 77.81m, 77.97m, and 78.31m during the 2-year, 5-year and 100-year storm respectively.

As per the KN MSS, the storm sewers servicing the KNUEA are to be designed as summarized below.

- Storm Sewer Design Sheets created using Rational Method
- IDF Rainfall Data as per City of Ottawa Sewer Design Guidelines
- Initial Time of Concentration Tc = 15 minutes (trunk sewers only). A Tc of 10 minutes will be used as per the most up-to-date City of Ottawa Sewer Guidelines.
- Runoff Coefficients
    - Mixed Use / Commercial, C=0.85
    - Arterial Roads / Transitway, C=0.65

- Parks, C=0.40
- Open Space, C=0.20
- Schools / Church, C=0.65
- Street Oriented Residential, C=0.65
- Multi / Unit Residential, C=0.70
- Park and Ride, C=0.85

The KN MSS outlined that the proposed storm sewers are to be sized to convey the 5-year storm for local and collector roads and the 10-year storm for arterial roads. However, the proposed storm sewer system will be designed in accordance with the latest City of Ottawa SWM bulletins which deviate from the design criteria used in the KN MSS. The proposed storm sewers and inlet control devices (ICDs) will be designed to convey/capture the 2-year runoff for local streets, and 5-year runoff for collector roads.

Drawing STM2 from the KN MSS shows the direction of major system drainage from the KNUEA (**Appendix C.5**). The KN MSS shows all major system peak flows from the site area north of Tributary 3 directed to the KNUEA SWM Pond 2, while all multi-unit residential blocks and the school block south of Tributary 3 are to provide on-site storage up to the 100-year storm (i.e. no 100-year major system discharges to Tributary 3). The KN MSS shows major system peak flow discharges to Tributary 3 during the 100-year event from the part of the existing rural residential areas south of Tributary 3 (KN MSS area M2.6). However, a detailed review of the SWMHYMO modeling exercise completed as part of the KN EMP to compare post development peak flows to pre-development levels along the tributaries indicated that the KN EMP assumed all major flows from the areas tributary to SWM Pond 2 were directed to the pond (i.e. no 100-year major system discharges to Tributary 3). As a result, the proposed functional SWM plan for the proposed site assumes 100-year capture into the minor system from areas F114C and F112A.

The KN MSS and KN EMP assessed two locations for SWM Pond 2. However, grading constraints, proposed site layout and the unavailability of the adjacent land assumed as the location for SWM Pond 2, resulted in a revised location for SWM Pond 2 as shown on **Drawing OSD-1**. The proposed KNUEA SWMP Pond 2 drainage area is approximately 18.6 ha at 48% imperviousness, which is comparable to the 17.6 ha at 41% imperviousness assumed in the KNEMP.

4.1.2 City of Ottawa Sewer Guidelines

The following summarizes the SWM criteria and constraints that will govern the detailed design of the proposed development as per City of Ottawa Sewer Design Guidelines.

- Design using the dual drainage principle.
- Maximum 100-year water depth of 0.35 m in road sags, including overflow spill depth.
- Rear-yard storage is not to be included in calculations.
- 100-year hydraulic grade line (HGL) to be a minimum 0.30 m below lowest building underside of footing elevation.
- Design inlets along local roadways to capture the 2-year peak flow.

- Design storm sewers along local and collector roadways to convey the 2-year and 5-year peak flow respectively under free-flow conditions using 2004 City of Ottawa I-D-F parameters and an inlet time of 10 minutes.
- Provide adequate emergency overflow conveyance as shown on **Drawing OSD-1**.

4.2 PROPOSED CONDITIONS

As outlined in the KN MSS, there are two minor system outlets for the proposed site. **Drawing OSD-1** shows the proposed drainage areas named with a C for collector roads (5-year peak flows into the minor system), an L for local streets (2-year peak flows into the minor system) and starting either by 1 or 2 to differentiate between the two storm sewer outlets. A preliminary storm sewer design sheet is provided in **Appendix C.1**.

Minor system peak flows from the majority of the site (drainage areas starting with 1) will be directed to the proposed KNUEA SWM Pond 2 for quality and quantity control prior to discharging into a network of 600 mm diameter storm sewers that will ultimately discharge into Tributary 3 at March Road. The minor system peak flow to SWM Pond 2 will require a crossing at Tributary 3. The KNUEA SWM Pond 2 is intended to provide Enhanced Protection quality control (80% TSS removal), and operate at a permanent pool elevation of 79.5 m, consistent with the conceptual design outlined in the KN MSS.

Minor system peak flows from the rest of the site (drainage areas starting with 2) will be directed to the proposed storm sewer along the local street which will ultimately discharge into Tributary 3 at March Road. This secondary storm outlet will service three (3) proposed multi-unit residential blocks (drainage areas C224C, C223B and C223C), future (by others) service mixed-use blocks, multi-unit residential blocks, a school block, a low density residential block, as well as a portion of the existing rural residential development on Marchbrook Circle as identified in the KNMSS (area F202A) which currently discharges into Tributary 4 (see **Drawing OSD-1**). Proposed and future blocks serviced through the proposed secondary storm outlet will require on-site quantity and quality control as per the KN MSS.

The proposed conceptual grading plan is outlined on **Drawing OGP-1** which shows the proposed overland flow direction and identifies the direction of emergency overland flows for blocks with on-site storage up to the 100-year storm and for areas with 100-year minor system capture rate. As per the assumptions made in the hydrological analysis completed as part of the KN EMP, major system peak flows from the majority of the site will be directed to the proposed KNUEA SWM Pond 2 for quantity control prior to discharging into Tributary 3. Areas that cannot be graded to direct the major system towards the proposed streets and ultimately to the SWM Pond have been assumed to capture the 100-year into the minor system (i.e. rear yard areas F112A and F114C). On-site storage up to the 100-year storm will be provided for proposed/future multi-unit residential blocks south of Tributary 3, future mixed-use service blocks south of Tributary 3, and the future school block.

The proposed collector road will require a culvert crossing along Tributary 3. The culvert for the proposed crossing of Tributary 3 was sized in the KN EMP based on the required hydraulic capacity to convey the 100-year peak flows in the tributary. The conceptual design for the proposed crossing is based on the 1800mm x 1200mm concrete box culvert identified in the KN EMP. At the detailed design stage, the culvert crossing will be designed to meet all applicable requirements and guidelines, including hydraulic capacity, geomorphology, fish passage and species at risk.

4.3 POST DEVELOPMENT CONCEPTUAL MODELING RATIONALE

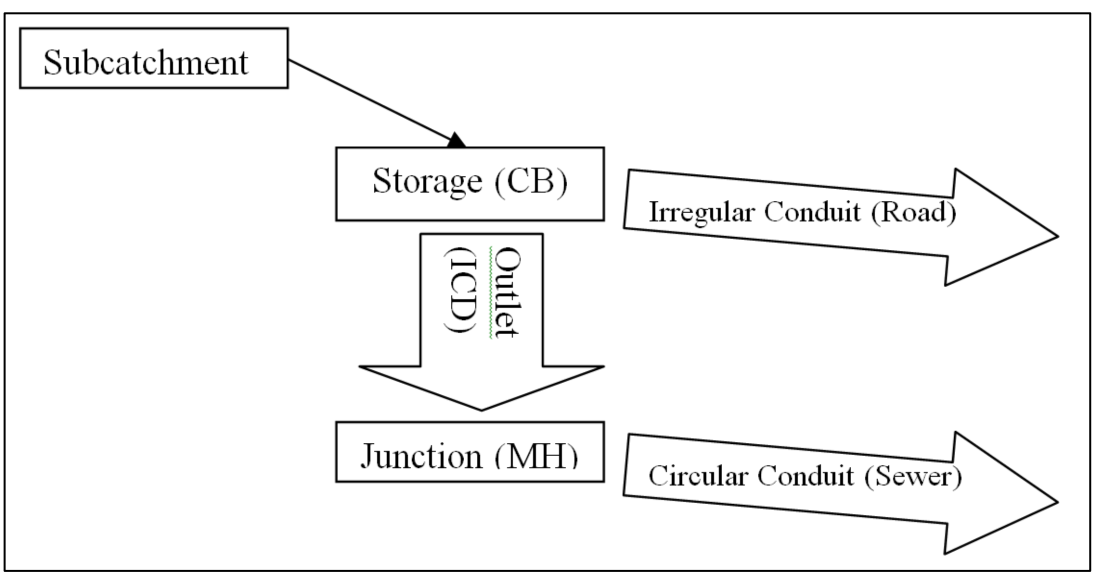
Hydrologic and hydraulic modeling of the proposed storm sewer system was completed using PCSWMM modeling software which uses the EPA-SWMM 5.1.013 computational engine for analysis. The included models can also be opened and reviewed using the free EPA-SWMM GUI. PCSWMM model layout, input parameters, and example input file are provided in **Appendix C**. Electronic model files are provided with the digital submission package.

As previously noted, the site design is currently at a conceptual level and will be further refined at the detailed design stage. The following sections summarize the input parameters used in the conceptual post development model.

4.3.1 SWMM Dual Drainage Methodology

The proposed development is modeled in one modeling program as a dual conduit system (see **Figure 2**), with: 1) circular conduits representing the sewers & junction nodes representing manholes; 2) irregular conduits using street-shaped cross-sections to represent the approximate overland road network and storage nodes representing catchbasins. The dual drainage systems are connected via outlet link objects from storage node (i.e. CB) to junction (i.e. MH), and represent inlet control devices (ICDs). Subcatchments are linked to the storage node on the surface so that generated hydrographs are directed there firstly.

Figure 2 : Schematic Representing Model Object Roles



Storage nodes are used in the model to represent catchbasins. The invert of the storage node represents the invert of the CB and the rim of the storage node represents the top of the CB plus the allowable flow depth on the segment. For the purpose of this conceptual SWM plan, CB inverts have been assumed to be 2 m below the top of the CB and a flow depth of 0.30 m has been assumed on grassed swale segments and of 0.40 m on road segments.

Proposed street catchments and proposed park and mixed-use block north of Tributary 3 have been assumed to provide no surface storage for conservatism. Future/proposed mixed-use, school and multi-unit residential blocks south of Tributary 3 were assigned a stage-storage curve with sufficient storage to contain the 100-year overflows. Storage curves in PCSWMM are required to be input as depth-area curves, as such an equivalent area was calculated at a depth of 2.35 m. All storage was assumed to occur between the top of the CB (2.0 m head) and a 0.35 m depth (2.35 m head) prior to spilling into the downstream segment. If the available storage volume in a storage node is exceeded, flows spill above the storage node and into the downstream irregular conduit (representing roads/swales) and continue routing through the system until ultimately flows reach the outfall of the major system. No storage has been accounted for within the storage node of the park area.

Capture curves were defined for each catchment to restrict outlet link flows to the 2-year for local street catchments, 5-year rate for collector road catchments, proposed park block, and proposed mixed-use service and multi-unit residential blocks tributary to SWM Pond 2, while the future school block, future mixed-use service blocks, future multi-unit residential block, and proposed multi-unit residential blocks tributary to the secondary storm outlet were assigned a minor system capture rate of 117 L/s/ha to meet the allowable release rate of 816 L/s assumed in the KN EMP. Rear yard catchments F112A and F114C have been assigned 100-year minor system capture rates to avoid discharging uncontrolled major system peak flows into Tributary 3.

4.3.2 Land Use

The proposed site will be developed as a mixture of low and medium density residential areas with one park area, multi-unit residential blocks, a mixed-use service block and a SWM Pond block. Future development blocks consisting of a school, low density residential areas, multi-unit residential areas and mixed-use service areas have been included in the hydrologic/hydraulic analysis of the two proposed storm sewer systems as per the KN MSS and KN EMP assumptions. Similarly, 100-year runoff (approx. 386 L/s as per the KN MSS/EMP) from the existing Marchbrook Circle rural subdivision has been included in the design of the secondary storm outlet. Runoff coefficients based on land use were obtained from the KN MSS as shown in the excerpts included in **Appendix C**.

4.3.3 Design Storms

The 3 hour, Chicago distribution was selected to estimate the 2-year, 5-year and 10-year capture rates for the proposed and future subcatchments, and to assess the 100-year HGL across the proposed development. The Chicago distribution was selected due to its tendency to generate high peak flows in urban catchments, similar to the proposed development. The SCS distribution was selected for the conceptual design of the proposed KNUEA SWM Pond 2 due to its tendency to produce a greater total volume of runoff. The following storm events were used to evaluate the minor and major systems performance, assess the worst-case HGL across the development and assess the proposed functional SWM Pond performance:

- 25mm, 4 hour Chicago Storm, 10-minute time step (25mm)
- 2-year, 3 hour Chicago storm, 10-minute time step (2yr3hrChicago)
- 5-year, 3 hour Chicago storm, 10-minute time step (5yr3hrChicago)
- 100-year, 3 hour Chicago storm, 10-minute time step (100yr3hrChicago)
- 2-year, 24 hour SCS storm Type II, 10 min time step (2yr24hrSCS)
- 5-year, 24 hour SCS storm Type II, 10 min time step (5yr24hrSCS)
- 100-year, 24 hour SCS storm Type II, 10-minute time step (100yr24hrSCS)
- 100-year, 12 hour SCS storm Type II, 30-minute time step (100yr12hrSCS)

Further storm events, including the climate change scenario will be assessed during the detailed design stage.

4.3.4 Boundary Conditions

Static backwater elevations in Tributary 3 at the proposed storm outlets' location were obtained from the KN EMP (station 3271.49) as 77.81 m, 77.97 m, and 78.31 m during the 2-year, 5-year and 100-year storm respectively.

4.3.5 Modeling Parameters

Table 3 presents the general subcatchment parameters used:

Table 3: General Subcatchment Parameters

Subcatchment Parameter	Value
Infiltration Method	Horton
Max. Infil. Rate (mm/hr)	76.2
Min. Infil. Rate (mm/hr)	13.2
Decay Constant (1/hr)	4.14
N Imperv	0.013
N Perv	0.25
Dstore Imperv (mm)	1.57
Dstore Perv (mm)	4.67

Table 4 presents the individual parameters that vary for each of the proposed and future subcatchments.

Table 4: Conceptual Subcatchment Parameters

Area ID	Area (ha)	Width (m)	Slope (%)	% Imp.	C	Subarea Routing	% Routed	Minor System Capture
C103A	0.31	128.0	2.0	64.3%	0.65	OUTLET	100	Collector (5-year)
C103B	1.32	297.0	2.0	85.7%	0.80	OUTLET	100	Multi-Unit (5-year)
C103C	4.27	961.0	2.0	28.6%	0.40	PERVIOUS	100	Park (5-year)
C107A	0.30	130.0	2.0	64.3%	0.65	OUTLET	100	Collector (5-year)
C109A	0.65	183.0	3.0	64.3%	0.65	OUTLET	100	Res. Collector (5-year)
C113A	0.29	122.0	2.0	64.3%	0.65	OUTLET	100	Collector (5-year)
C114A	0.94	320.0	3.0	64.3%	0.65	OUTLET	100	Res. Collector (5-year)
C114B	1.04	231.0	2.0	71.4%	0.70	OUTLET	100	Multi-Unit (5-year)
C115A	0.86	306.0	3.0	64.3%	0.65	OUTLET	100	Res. Collector (5-year)
C115B	1.27	286.0	2.0	71.4%	0.70	OUTLET	100	Multi-Unit (5-year)
C117A	0.38	132.0	3.0	64.3%	0.65	OUTLET	100	Res. Collector (5-year)
C117B	0.44	99.0	2.0	64.3%	0.65	OUTLET	100	Fut-Resid. (5-year)
C117C	0.21	72.0	2.0	64.3%	0.65	OUTLET	100	Fut-Road (5-year)
C223B	0.54	122.0	2.0	71.4%	0.70	OUTLET	100	Multi-Unit (117 L/s/ha)
C223C	0.54	121.0	2.0	71.4%	0.70	OUTLET	100	Multi-Unit (117 L/s/ha)
C223D	1.92	432.0	2.0	92.9%	0.85	OUTLET	100	Fut-Mixed-Use (117 L/s/ha)
C223E	0.26	59.0	2.0	92.9%	0.85	OUTLET	100	Fut-Mixed-Use (117 L/s/ha)
C224B	2.06	463.0	2.0	64.3%	0.65	OUTLET	100	Fut-School (117 L/s/ha)
C224C	1.02	229.0	2.0	71.4%	0.70	OUTLET	100	Multi-Unit (117 L/s/ha)
F112A	0.60	159.0	4.0	28.6%	0.40	PERVIOUS	100	Prop.Rear-Yard (100-year)
F114C	2.87	321.0	3.0	14.3%	0.30	PERVIOUS	100	Ex. RearYard (100-year)
F202A	15.10	3398.0	2.0	21.4%	0.35	PERVIOUS	100	Ex. Rural (386 L/s)
L110A	0.55	224.0	3.0	64.3%	0.65	OUTLET	100	Res.Local (2-year)
L116A	0.67	185.0	3.0	64.3%	0.65	OUTLET	100	Res.Local (2-year)
L223A	0.26	137.0	2.0	64.3%	0.65	OUTLET	100	Local-Street (2-year)
L224A	0.29	159.0	2.0	64.3%	0.65	OUTLET	100	Local-Street (2-year)
POND	1.60	360.0	2.0	42.9%	0.50	OUTLET	100	Pond (N/A)

1. The width parameter was estimated as twice the road/rear yard swale for two-sided catchments and equal to the length of the road/rear yard swale for one-sided catchments. The width parameter for the proposed/future mixed-use, multi-unit residential and school blocks, as well as for the SWM Pond and the existing rural subdivision was defined as 225m/ha as per the City of Ottawa Sewer Design Guidelines.

Table 5 summarizes the storage node parameters used in the conceptual model.

Table 5: Storage Node Parameters

Storage Node	Invert Elevation (m)	Rim Elevation (m)	Total Depth (m)	100-yr Surface Storage (m^3)	Storage Description
C103A-S	80.24	82.64	2.40	0	-
C103B-S	81.00	83.75	2.75	0	-
C103C-S	81.00	82.80	1.80	0	-
C107A-S	80.52	82.92	2.40	0	-
C109A-S	84.96	87.36	2.40	0	-
C113A-S	82.05	84.45	2.40	0	-
C114A-S	82.29	84.69	2.40	0	-

Storage Node	Invert Elevation (m)	Rim Elevation (m)	Total Depth (m)	100-yr Surface Storage (m^3)	Storage Description
C114B-S	80.95	83.60	2.65	101	100-year
C115A-S	83.00	85.40	2.40	0	-
C115B-S	81.35	84.00	2.65	117	100-year
C117A-S	83.03	85.43	2.40	0	-
C117B-S	83.17	85.47	2.30	0	-
C117C-S	83.09	85.49	2.40	0	-
C223B-S	79.15	81.80	2.65	98	100-year
C223C-S	78.87	81.62	2.75	100	100-year
C223D-S	78.65	81.30	2.65	463	100-year
C223E-S	78.65	81.30	2.65	63	100-year
C224B-S	81.10	83.85	2.75	341	100-year
C224C-S	80.65	83.30	2.65	187	100-year
F112A-S	82.00	84.30	2.30	0	-
F114C-S	82.34	84.64	2.30	0	-
F202A-S	83.00	85.35	2.35	N/A	N/A
L110A-S	85.75	88.15	2.40	0	-
L116A-S	83.31	85.71	2.40	0	-
L223A-S	79.10	81.50	2.40	0	-
L224A-S	83.00	85.40	2.40	0	-

1. The existing rural subdivision (area F202A) was modeled in PCSWMM with a minor system capture rate equal to 386 L/s as per the assumptions made in the KN EMP/MSS.

As per the Ottawa Sewer Design Guidelines (OSDG 2012), Manning's roughness values of 0.013 were used for sewer modeling and overland flow corridors representing roadways, while a value of 0.025 was used for grassed swales.

Table 6 summarizes the outlet link maximum flow rates for the 100-year, 3hr Chicago storm event.

Table 6: Conceptual Minor System Capture Rates

Outlet Name	Drainage Area ID	Inlet Node	Outlet Node	Invert Elevation (m)	100-year Minor System Capture Rate (L/s)
C103A-IC	C103A	C103A-S	103	80.24	63.9
C103B-IC	C103B	C103B-S	103	81.00	383.9
C103C-IC	C103C	C103C-S	103	81.00	344.0
C107A-IC	C107A	C107A-S	107	80.52	67.3
C109A-IC	C109A	C109A-S	109	84.96	143.4
C113A-IC	C113A	C113A-S	113	82.05	66.3
C114A-IC	C114A	C114A-S	114	82.29	211.6
C114B-IC	C114B	C114B-S	114	80.95	240.0
C115A-IC	C115A	C115A-S	115	83.00	196.8
C115B-IC	C115B	C115B-S	115	81.35	300.9
C117A-IC	C117A	C117A-S	117	83.03	87.1

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Outlet Name	Drainage Area ID	Inlet Node	Outlet Node	Invert Elevation (m)	100-year Minor System Capture Rate (L/s)
C117B-IC	C117B	C117B-S	117	83.17	96.5
C117C-IC	C117C	C117C-S	117	83.09	46.9
C223B-IC	C223B	C223B-S	223	79.15	68.7
C223C-IC	C223C	C223C-S	223	78.87	67.1
C223D-IC	C223D	C223D-S	223	78.65	224.9
C223E-IC	C223E	C223E-S	223	78.65	30.5
C224B-IC	C224B	C224B-S	224	81.10	261.6
C224C-IC	C224C	C224C-S	224	80.65	129.6
F112A-IC	F112A	F112A-S	112	82.00	186.6
F114C-IC	F114C	F114C-S	114	82.34	391.6
F202A-IC	F202A	F202A-S	202	83.00	383.7
L110A-IC	L110A	L110A-S	110	85.75	80.6
L116A-IC	L116A	L116A-S	116	83.31	96.3
L223A-IC	L223A	L223A-S	223	79.10	36.3
L224A-IC	L224A	L224A-S	224	83.00	41.2

Exit losses at manholes were set for all pipe segments based on the flow angle through the structure. Exit losses were assigned as per City guidelines (Appendix 6b), see **Table 7** below.

Table 7: Exit Loss Coefficients for Bends at Manholes

Degrees	Coefficient
11	0.060
22	0.140
30	0.210
45	0.390
60	0.640
90	1.320
180	0.020

4.4 CONCEPTUAL MODEL RESULTS AND DISCUSSION

The following section summarizes the key hydrologic and hydraulic conceptual model results. For detailed model results or inputs please refer to the example input file in **Appendix C.3** and the electronic model files included in the digital submission.

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4.4.1 Proposed Development Conceptual Hydraulic Grade Line Analysis

The preliminary 100-year hydraulic grade line (HGL) elevation across the proposed development was estimated using the functional post development PCSWMM model for the worst-case 100-year storm with fixed water elevations at the Tributary 3 outlets of 78.31 m as per the KN EMP. A conceptual configuration of the proposed SWM Pond 2 (i.e. storage and outlet structure) has been included in the PCSWMM model. **Table 8** below presents the clearance between the trunk sewer 100-year HGL and the estimated under side of footing (USF) along the trunk sewer. The storm sewer design sheet is included in **Appendix C.1**.

Table 8: Brigil Kanata North Development Functional HGL Results

STM MH	Prop. Grade (m)	Approx. USF Elevation (m)[1]	100-year, 3 HR Chicago HGL (m)	100-year, 12 HR SCS HGL (m)	100-year, 24 HR SCS HGL (m)	Worst-Case 100-year HGL (m)	Approx. USF-HGL Clearance (m)
202	86.48	N/A	80.43	80.43	80.35	80.43	6.05
201	85.20	N/A	80.20	80.20	80.11	80.20	5.00
200	85.09	N/A	79.98	79.98	79.90	79.98	5.11
110	88.02	85.92	85.06	85.07	85.07	85.07	0.85
109	86.79	84.69	83.68	83.68	83.68	83.68	1.01
108	86.15	84.05	82.94	82.94	82.94	82.94	1.11
117	85.13	83.03	82.25	82.39	82.28	82.39	0.64
116	85.11	83.01	82.17	82.27	82.18	82.27	0.74
225	85.01	N/A	79.83	79.83	79.75	79.83	5.18
115	84.93	82.83	81.82	82.03	81.87	82.03	0.80
224	84.85	N/A	79.70	79.69	79.64	79.70	5.15
114	84.49	82.39	81.57	81.80	81.62	81.80	0.59
111	83.91	N/A	81.13	81.43	81.23	81.43	2.48
107	83.88	81.78	81.05	81.37	81.17	81.37	0.41
113	83.67	81.57	81.28	81.57	81.37	81.57	0.00
112	83.60	N/A	81.20	81.49	81.30	81.49	2.11
106	83.26	N/A	80.95	81.29	81.08	81.29	1.97
105	82.51	N/A	80.87	81.24	81.01	81.24	1.27
102	82.07	N/A	80.85	81.24	80.87	81.24	0.83
101	82.04	N/A	80.85	81.24	80.87	81.24	0.80
104	82.00	N/A	80.85	81.24	80.95	81.24	0.76
100	81.86	N/A	80.85	81.24	80.87	81.24	0.62

STM MH	Prop. Grade (m)	Approx. USF Elevation (m)[1]	100-year, 3 HR Chicago HGL (m)	100-year, 12 HR SCS HGL (m)	100-year, 24 HR SCS HGL (m)	Worst-Case 100-year HGL (m)	Approx. USF-HGL Clearance (m)
100C	81.83	N/A	80.85	81.24	80.87	81.24	0.59
223	81.80	N/A	79.27	79.25	79.03	79.27	2.53
103	81.75	N/A	80.85	81.24	80.90	81.24	0.51
150	82.34	N/A	79.66	79.70	79.69	79.70	2.64
222	79.38	N/A	78.57	78.57	78.52	78.57	0.81
149	81.88	N/A	79.60	79.65	79.64	79.65	2.23
148	81.83	N/A	79.39	79.48	79.46	79.48	2.35
147	80.49	N/A	79.30	79.40	79.38	79.40	1.09

1. Approximate USF assumed to be approximately 2.1m below the proposed road centre line grade.

As can be seen in the above table, there is sufficient clearance between the preliminary 100-year HGL and the approximate USFs for most of the site, with the exception of areas in the proximity of manhole 113, where it is anticipated that multiple risers will be required to obtain the required HGL-USF clearance. Detailed grading of the proposed development will be completed based on the above results to ensure that a minimum clearance of 0.3 m is provided between all under side of footings (USFs) and the 100-year HGL, and that no basement flooding occurs in the climate change scenario (which will be assessed at the detailed design stage).

4.4.2 Major Flow

Major system peak flows from the majority of the proposed site will be directed to the proposed KNUEA SWM Pond 2 as shown on **Drawing OSD-1** with the exception of the multi-unit residential, school and service mixed-use blocks south of Tributary 3 which will provide on-site storage for all storms up to the 100-year event. Due to grading constraint and following the assumptions of the KN MSS, major flows from the proposed local street areas L223A and L224A will be directed to March Road.

The PCSWMM model is based on lumped drainage areas with no major system storage assumed along the proposed streets and as such, major system peak flows to the proposed major system outlets are over estimated. It is anticipated that the actual major system peak flow contribution from the proposed development will be significantly lower once detailed grading is completed and the actual road configuration with available sag storage is included in the model during detailed design.

The major flow outlet to the SWM Pond was modeled in PCSWMM as a trapezoidal channel with a 1m-wide bottom, 3:1 side slopes, average longitudinal slope of 4.5%, and 0.6 m depth. Similarly, the southern major flow outlet through Block 303 was modeled as a trapezoidal channel with 2m-wide bottom, 3:1 side slopes,25% longitudinal slope, and 0.5 m depth. The maximum flow depth, velocity and peak flow have been obtained from PCSWMM and the results are presented in **Table 9** below for the 100-year, 3 hour Chicago storm which is commonly used to evaluate the urban component of dual drainage, specifically on-site detention.

Table 9: 100-Year, 3hr Chicago Conceptual Overland Flow Results

Location	Peak Flow (L/s)	Max. Velocity (m/s)	Depth (m)
Northern Major System Outlet – SWM Pond 2 Channel	1,341	5.07	0.18
Northern Most Downstream Street	438	0.78	0.14
Southern Major System Outlet – Local Street to March Road	151	1.05	0.07

4.4.3 KNUEA SWM Pond 2 Hydraulic Modeling Results

Each PCSWMM model scenario was analysed for the peak pond inflow and discharge rate as well as for peak pond HGL. **Table 10** below summarizes the peak pond outflow rates for the different storm events. Modelling of the proposed KNUEA SWM Pond 2 for the different storm events indicates that the proposed stage-storage and stage-discharge curves provide sufficient detention of runoff to meet the target release rates which were obtained from the KN EMP. The Chicago storm scenarios were used to estimate the minor system capture rates and to assess the worst case 100-year HGL across the site.

Table 10: KNUEA SWM Pond 2 Peak Outflow Rates and Water Levels

Storm Event	Peak Pond Inflow (m^3/s)	Peak Pond Discharge (m^3/s)	Pond Water Level (m)	Target Peak outflow (m^3/s)
25mm 4hr Chicago	0.932	0.007	79.81	0.003
2yr3hrChicago	1.362	0.011	79.97	N/A
5yr3hrChicago	2.122	0.018	80.18	N/A
100yr3hrChicago	3.961	0.030	80.85	0.084
100yr12hrSCS	3.021	0.033	81.04	0.084
2yr24hrSCS	1.189	0.014	80.04	0.016
5yr24hrSCS	1.796	0.020	80.23	0.032
100yr24hrSCS	3.146	0.029	80.74	0.084

As can be seen in the above table, the proposed SWM pond block provides sufficient storage to meet the target peak outflows into Tributary 3 with sufficient room for changes during the detailed design stage. The proposed SWM pond outflow is slightly higher than the peak flow obtained in the KN EMP because the proposed functional design assumes an 83 mm diameter orifice will be used as per City guidelines, instead of the 55 mm diameter orifice assumed in the KN EMP.

4.5 KNUEA SWM POND 2 FUNCTIONAL DESIGN COMPONENTS

The following sections describe the stormwater management design approach and hydraulic results for the proposed stormwater management facility. **Drawing POND-1** shows a plan view of the proposed SWM pond. Detailed pond cross sections will be provided during the detailed design stage.

4.5.1 SWM Pond Design Approach

The proposed KNUEA SWM Pond 2 is designed to service a tributary drainage area of approximately 18.6 ha at 48% imperviousness from the south-west quadrant of the KNUEA and to meet the quantity and quality control requirements outlined in **Section 4.1**, while achieving all physical design criteria established for wet pond facilities by the Ministry of the Environment, Conservation and Parks (MECP). These physical design criteria are provided in the MECP's Stormwater Management Design and Planning Manual (March 2003).

From the preceding sections, the general design approach for the SWMF is as follows:

1. Provide MECP Enhanced water quality treatment (80% TSS removal), thereby establishing the permanent pool and extended detention volumes
2. Size inlet structure and forebay based on generated inflow and MECP guidelines
3. Provide peak flow control of 16 L/s during the 2-year storm, 32 L/s during the 5-year storm and 84 L/s during the 100-year storm
4. Consider environmental and operations and maintenance concerns in orientation and design of all pond components

Detailed forebay calculations are provided in **Appendix C.4**.

4.5.2 Pond Grading and Storage Design

Side slopes for safety (max 3:1) have been provided throughout the facility and along the forebay berm. These slopes are varied throughout to promote a less-engineered, more aesthetically pleasing design, where sufficient room is available.

4.5.2.1 Water Quality Control

The required level of treatment for the proposed SWM Pond is 'enhanced' or 80% TSS removal as per the KN EMP. **Table 11** illustrates how the proposed functional end-of-pipe SWMF design provides this level of treatment. Detailed pond design calculations have been provided in **Appendix C.4**.

Table 11: KNUEA SWM Pond 2 MEPC Stormwater Quality Volumetric Requirements

Drainage Area (ha)	Actual % Imp.	Water Quality Unit Volume Requirements			Water Quality Volume Requirements		Water Quality Volumes Provided	
		Total Unit Volume (m^3/ha)	Permanent Pool (m^3/ha)	Extended Detention (m^3/ha)	Permanent Pool (m^3)	Extended Detention (m^3)	Permanent Pool (m^3)	Extended Detention (m^3)
18.58	48	173	132.5	40	2,462	743	2,510	1,536

The SWM pond bottom elevation has been set at 78.50 m, while the normal water level in the SWM pond has been set at 79.50 m as per the KN EMP/MSS.

4.5.2.2 Water Quantity Control

Water quantity control is provided for the future and proposed multi-unit residential, service mixed-use and school blocks south of Tributary 3 through on-site storage for all storm events up to the 100-year storm. Quantity control for the rest of the site will be provided in the proposed SWM pond. Overland flow from proposed site areas north of Tributary 3 and from the proposed collector road and residential developments along this road south of Tributary 3 will be directed to the SWM Pond through the proposed roads. Preliminary design of the storm sewers across future development areas was based on the assumptions made in the KN MSS as shown in the storm sewer design sheet included in **Appendix C.1**.

The SWM facility is required to restrict post development peak flows to pre-development levels with a maximum release rate of 0.084 m^3/s during the 100-year storm. The first 0.4 m of active storage is controlled by an 83 mm diameter orifice (invert at 79.50 m). A second 83 mm diameter orifice with an invert at 79.90 m provides quantity control for minor storm events, while further quantity control for major storm events is provided through a 150 mm-wide by 300 mm-high weir with a weir crest invert at 81.20 m. A 10.0 m-wide rip-rap lined emergency spillway at invert 81.70 m is also provided as an emergency overflow path for emergency conditions and/or extreme events. The SWM pond flow regulators will be located within a common outlet chamber which will discharge into a network of 600 mm diameter storm sewers that will ultimately outlet into Tributary 3, immediately upstream of March Road. The emergency spillway discharges directly into Tributary 3 (see **Drawing POND-1**).

The functional SWM design for the proposed development combined with the proposed SWM Pond 2 functional design result in a 100-year water level of 81.04 m (10,414 m^3 active storage).

4.5.3 Forebay Design

The purpose of the forebay is to act as the primary settling zone in the pond for the initial influx of coarse sediment and associated pollutants flushing off the sewershed. The forebay is designed to provide sufficient cross-section and length to reduce velocities and promote settling, minimize resuspension of settled solids, minimize percentage of overall permanent pool, provide sufficient sediment storage for infrequent clean out (>5 years), and have adequate accessibility and bottom-treatment for maintenance operations.

The required forebay characteristics dictate a required forebay settling length of 9.8 m. Similarly, the required forebay dispersion length is equal to 29.8 m. The provided length is approximately 54.0 m. The resulting average length to width ratio of the proposed configuration is approximately 5:1, also meeting MECP design recommendations. The provision of 1.0 m depth within the forebay provides for 0.5 m sediment accumulation prior to recommended cleanout while maintaining 0.5 m permanent pool depth, thereby minimizing the risk of scour and re-suspension. The designed sediment storage volume provided in the bottom 0.5 m corresponds to an estimated sediment removal frequency of approximately 10 years for the forebay.

4.5.4 Outlet Design

The outlet will be located opposite the inlet and will drain to Tributary 3 of Shirley's Brook. A concrete outlet structure will house the required extended detention orifice, quantity control orifice and weir, and outlet pipes, including the associated maintenance infrastructure (i.e. sluice gates, etc.).

4.5.4.1 Extended Detention Control

The design of the required outlet structure incorporates three hydraulic components. An 83 mm orifice provides an approximate 53-hour extended detention for quality control. The entire extended detention volume is stored between 79.50 m and 79.81 m, as calculated below.

<u>Required Storage:</u>
Tributary Area = 18.58 ha
Extended Detention Storage = 40 m^3/ha
Required Extended Detention Storage = 18.58 x 40 = 743 m^3

<u>Provided Storage</u>:
Pond area at NWL = 4,336 m^2
Pond area at 79.81 = 5,511 m^2
Provided Depth = 79.81 – 79.50 = 0.31 m
Provided Extended Detention Active Volume = 1,526 m^3

4.5.4.2 Flow Control Weir

Quantity control of the pond discharge above the extended detention elevation is provided by and orifice and weir within the outlet structure. These components have been incorporated into the outlet to meet the quantity control target peak flows which correspond to post to pre-development levels to a maximum of 0.084 m^3/s as per the KN EMP/MSS. An 83 mm diameter orifice with invert at 79.90 m and a 1500 mm-wide weir with invert at 81.20 m is proposed to meet quantity control requirements.

4.5.4.3 Overland Spillway

The emergency spillway location is separate from the outlet control structure. The emergency spillway elevation is set to 81.70 m and acts as a broad-crested weir, approximately 10.0 m wide. Should the stormwater management facility outlet structure clog or be subject to rare rainfall events (beyond the 100-year event), the spillway is designed to safely convey runoff to Tributary 3. Similarly, the spillway crest has been set above the 100-year water level in Tributary 3 at that location which is expected to be approximately 81.47 m as per the KN EMP.

4.5.5 Pond Performance

As **Table 12** indicates, the water quality objectives of the SWM facility are met by providing extended detention of 24-48 hours and exceeding the MECP recommended water quality volumes.

August 21, 2020

Table 12: SWM Facility Operational Characteristics

SWM Basin Parameters	Basin Value
Total Contributing Area	18.58 ha
Imperviousness of Contributing Area [of Sewershed Area]	48 %
Unit Area Storage Volume Requirements as per SWMPD Manual	173 m^3/ha
Required Total Water Quality Volume	3,205 m^3
Wet Pond Bottom Elevation	78.50 m
Required Permanent Pool Volume	2,462 m^3
Permanent Pool Volume Provided (excluding sediment storage)	2,510 m^3
Permanent Pool Elevation	79.50 m
Required Extended Detention Volume	743 m^3
Extended Detention Volume Provided	1,537 m^3
Peak Release Rate for Extended Detention (25mm Storm)	0.008 m^3/s
Extended Detention Drawdown Time	53 hours
Extended Detention Elevation (25mm Storm)	79.81 m
5 Year Storm Maximum Ponding Level (24hr SCS)	80.23 m
5 Year Storm Peak Pond Release (24hr SCS)	0.020 m^3/s
100 Year Storm Maximum Ponding Level (12hr SCS)	81.04 m
100 Year Storm Peak Pond Release (12hr SCS)	0.033 m^3/s
100 Year Storm Active Volume Required (12hr SCS)	10,414 m^3
Top of Berm (minimum grade of surrounding properties)	81.80 m
Forebay Parameters	
Forebay Bottom Elevation	78.50 m
Sediment Accumulation Depth	0.50 m
Forebay Depth from Permanent Pool	1.00 m
Required Forebay Length	29.8 m
Actual Forebay Length	54.0 m
Clean Out Frequency	~10 years
Outlet Parameters	
Quality Orifice Size (Orifice #1)	83 mm
Quality Orifice Invert (Orifice #1)	79.50 m
Quantity Orifice Size (Orifice #2)	83 mm
Quantity Orifice Invert (Orifice #2)	79.90 m
Quantity Weir Size (Weir #1)	150mm-W x 300mm-H
Quantity Weir Cres Invert	81.20 m
Emergency Spillway Weir Crest Length	10.00 m
Emergency Spillway Weir Crest Elevation	81.70 m

4.5.6 Other Considerations

A 5-m wide access road which consists of 3-m wide pavement and 1-m wide gravel shoulders has been provided for ease of inspection and maintenance of the inlet, forebay and main cell. The access road will have an engineered base consisting of granular 'A' and granular 'B' for durability and strength, while the surface will be asphaltic concrete for erosion protection. The route will be designed with a minimum slope to facilitate maintenance equipment maneuverability.

4.6 TRIBUTARY 3 COMPENSATION PLAN

Matrix Solutions Inc. has been retained to prepare a preliminary corridor enhancements design for Tributary 3 of Shirley's Brook within the proposed site as per the KN EMP requirements. The report will be included as an appendix in the next submission.

5.0 GEOTECHNICAL CONSIDERATIONS AND GRADING

A Geotechnical Report was prepared by Paterson Group in 2013 as part of the KN MSS to outline the geotechnical constraints for the KNUEA CDP. The report consolidated all existing geotechnical studies completed for individual properties. The proposed development lands were identified as 927 March Road in the geotechnical investigation. Excerpts from the geotechnical report are included in **Appendix D**.

The geotechnical investigation concluded that the undeveloped parcel on 927 March Road which represents the south-west quadrant of the KNUEA consists of a surficial topsoil layer underlain by a very stiff silty clay deposit followed by a glacial till layer and sound bedrock encountered at all test holes on the two parcels of land located on 927 March Road.

Groundwater levels measured in February 2008 showed levels that ranged between 0.7 m to 1.6 m below ground surface elevation.

Based on the information provided, a 2 m grade raise restriction is expected for the site.

A Permit to Take Water (PTTW) was recommended to be obtained for the site servicing work due to the potential for groundwater inflow in areas of rock excavation.

Preliminary grading for the proposed site has been provided as shown on **Drawing GP-1.** Grading design has been provided to direct overland flows from most the proposed development to the proposed KNUEA SWM Pond 2. Overland flows from the proposed local street have been directed to march Road as per the KN MSS. Proposed grading for the proposed site was designed to tie into existing March Road elevations. Proposed grading along the southern and northern property lines were based on the master grading plan provided as part of the KN MSS.

6.0 EROSION CONTROL DURING CONSTRUCTION

Erosion and sediment controls must be in place during construction. The following recommendations to the contractor will be included in contract documents.

1. Until the local storm sewer and SWM pond are constructed, groundwater in trenches will be pumped into a filter mechanism prior to release to the environment. After construction of the SWM facility, any construction dewatering will be routed to the nearest storm sewer.
2. Seepage barriers to be constructed in any temporary drainage ditches.
3. Install a silt fence along the site perimeter.
4. Limit extent of exposed soils at any given time.
5. Re-vegetate exposed areas as soon as possible.
6. Minimize the area to be cleared and grubbed.
7. Protect exposed slopes with plastic or synthetic mulches.
8. Provide sediment traps and basins during dewatering.
9. Install sediment traps (such as SiltSack® by Terrafix) between catchbasins and frames.
10. Plan construction at proper time to avoid flooding.

The contractor will, at every rainfall, complete inspections and guarantee proper performance. The inspection is to include:

1. Verification that water is not flowing under silt barriers.
2. Clean and change silt traps at catchbasins.

7.0 UTILITIES

Utility services were consulted as part of the KN MSS process to provide information regarding their existing infrastructure, initial plans for servicing the KNUEA, and identify any known constraints.

Hydro Ottawa is reported to have overhead infrastructure running through the KNUEA on the east side of March Road. Per the KNMSS, the existing infrastructure on March Road will need to be upgraded in order to service the KNUEA.

Similarly, Enbridge Gas is reported to have service extended off the 6" high-pressure gas main within the west side of March Road near the site.

Bell and Rogers are reported to have services up to the intersection of March Road and Old Carp Road, south of the study area. Service to the KNUEA would extend off this location. Per the KN MSS, Rogers' existing infrastructure would require upgrading to service the KNUEA.

8.0 APPROVALS

The City of Ottawa will review and approve most development applications as they relate to provision of water supply, wastewater collection and disposal, and stormwater conveyance and treatment. The City of Ottawa will issue a commence work notification for construction of the sanitary, storm sewers and SWM Pond once an Environmental Compliance Approvals (ECA) is issued by the Ontario Ministry of Environment, Conservation and Parks (MECP).

Ontario Ministry of Environment, Conservation and Parks (MECP) Environmental Compliance Approvals (ECA) will be required for the proposed subdivision works related to stormwater management, the SWM Pond, inlet control devices, storm sewers and sanitary sewers. The MECP is expected to review the proposed servicing works by transfer of review submission.

A Permit under Ontario Regulation 153/06, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulation is expected to be required from the Mississippi Valley Conservation Authority (MVCA) due to alterations of existing watercourses through site as part of the proposed development. A permit will also be required from the MVCA for the portion of the proposed development within the regulation limit.

An MECP Permit to Take Water (PTTW) may be required for the site. The geotechnical consultant shall confirm at the time of application that a PTTW is required.

9.0 CONCLUSIONS

9.1 WATER SERVICING

The KNUEA is located within the existing City of Ottawa 2Ww pressure zone. The proposed development will be serviced through two watermain connections to the future 400 mm diameter watermain on March Road.

At the detailed design stage, a complete hydraulic analysis will be prepared for the proposed development water distribution network to confirm that water supply is available within the required pressure range under the anticipated demands during average day, peak hour and fire flow conditions prior to full buildout of the KNUEA.

9.2 SANITARY SERVICING

The proposed development will be serviced by a network of gravity sewers. The wastewater servicing strategy for the proposed site was considered within the KN MSS, with a portion of the study area draining to the north connecting to the future 600 mm diameter sanitary sewer on March Road and the rest of the site draining south to a separate connection to the future 600 mm diameter trunk sanitary sewer on March Road.

The total estimated peak flow to the northern March Road outlet is approximately 17.4 L/s which exceeds the assumed KN MSS peak flow of 8.7 L/s by 8.7 L/s. Similarly, the total estimated peak flow to the proposed southern March Road outlet is approximately 31.7 L/s, which include commercial peak flows from external areas (0.3 L/s) and results in a proposed peak flow of 31.4 L/s within the KN MSS area W-12. An additional 2.9 L/s will be generated by the external areas R-EXT1 and R-EXT2 which are also within the KN MSS area W-12, for a total proposed peak flow of 34.3 L/s, which exceeds the KN MSS assumed peak flow from area W-12 of 25.3 L/s by 9.0 L/s.

Based on the sanitary design sheet provided in the KNMSS, there is 18 L/s residual capacity in the downstream sanitary sewers. The total peak flow exceedance to the March Road trunk sewer from the KN MSS areas W-10, W-11 and W-12 is expected to be approximately 17.7 L/s based on the unit count and expected population density for the proposed Brigil Kanata North Development.

9.3 STORMWATER SERVICING

The proposed stormwater management plan is in compliance with the requirements outlined in the background documents and the City of Ottawa Sewer Design Guidelines.

There are two minor system outlets for the proposed site. Minor system peak flows from the majority of the site will be directed to the proposed KNUEA SWM Pond 2 for quality and quantity control prior to discharging into a network of 600 mm diameter storm sewers that will ultimately discharge into Tributary 3 at March Road. The minor system peak flow to SWM Pond 2 will require a crossing at Tributary 3. The KNUEA SWM Pond 2 is intended to provide Enhanced Protection quality control (80% TSS removal), and operate at a permanent pool elevation of 79.5 m, consistent with the conceptual design outlined in the KN MSS. Minor system peak flows from the rest of the site will be directed to the proposed storm sewer along the local street which will ultimately discharge into Tributary 3 at March Road. This secondary storm outlet will service three (3) proposed multi-unit residential blocks, future (by others) service mixed-use blocks, multi-unit residential blocks, a school block, a low density residential block, as well as a portion of the existing rural residential development on Marchbrook Circle which currently discharges into Tributary 4. Proposed and future blocks serviced through the proposed secondary storm outlet will require on-site quantity and quality control as per the KN MSS.

Major system peak flows from the majority of the site will be directed to the proposed KNUEA SWM Pond 2 for quantity control prior to discharging into Tributary 3. Areas that cannot be graded to direct the major system towards the proposed streets and ultimately to the SWM Pond have been assumed to capture the 100-year into the minor system. On-site storage up to the 100-year storm will be provided for proposed/future multi-unit residential blocks south of Tributary 3, future mixed-use service blocks south of Tributary 3, and the future school block.

The proposed collector road will require a culvert crossing along Tributary 3. The conceptual design for the proposed crossing is based on the 1800mm x 1200mm concrete box culvert identified in the KN EMP. At the detailed design stage, the culvert crossing will be designed to meet all applicable requirements and guidelines, including hydraulic capacity, geomorphology, fish passage and species at risk.

Quantity and 'Enhanced' quality control will be provided in the KNUEA SWM Pond 2 to restrict peak flows to Tributary 3 of Shirley's Brook to existing conditions and to achieve 80% TSS removal.

9.4 UTILITIES

Hydro Ottawa is reported to have overhead infrastructure running through the KNUEA on the east side of March Road. Per the KNMSS, the existing infrastructure on March Road will need to be upgraded in order to service the KNUEA.

Similarly, Enbridge Gas is reported to have service extended off the 6" high-pressure gas main within the west side of March Road near the site.

Bell and Rogers are reported to have services up to the intersection of March Road and Old Carp Road, southwest of the study area. Service to the KNUEA would extend off this location. Per the KNMSS, Rogers' existing infrastructure would require upgrading to service the KNUEA.

Exact size, location and routing of utilities will be finalized at the detailed design stage.

Appendix A POTABLE WATER SERVICING BACKGROUND

Kanata North Urban Expansion Potable Water Assessment

Final Report

Prepared for:
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March 28, 2016

Sign-off Sheet

This document entitled Kanata North Urban Expansion Potable Water Assessment was prepared by Stantec Consulting Ltd. for the account of Novatech Engineering Consultants. The material in it reflects Stantec's best judgment in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Stantec Consulting Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Prepared by ______________________________
(signature)

Megan Young, E.I.T

Reviewed by ______________________________
(signature)

Kevin Alemany M.A.Sc., P.Eng.

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Appendix A – Development Concept Plan

Abbreviations

PRV	Pressure Reducing Valve
Dia.	Diameter
w/m	Watermain
HGL	Hydraulic Gradeline
KNUE	Kanata North Urban Expansion
AVDY	Average Day Demand
MXDY	Maximum Day Demand
PKHR	Peak Hour Demand
EPS	Extended Period Simulation
SS	Steady State
FF	Fire Flow
FUS	Fire Underwriters Survey

1.0 Background

1.1 PROPOSED DEVELOPMENT AREA

The proposed development site is located in Kanata, northwest of Old Carp Road and Maxwell Bridge Road, on the northwest and southeast side of March Road. It is the proposed location for a housing development that is projected to have a total of 3340 units and an estimated population of 9230 persons. **Figure 1-1** outlines the proposed development site boundary in red.

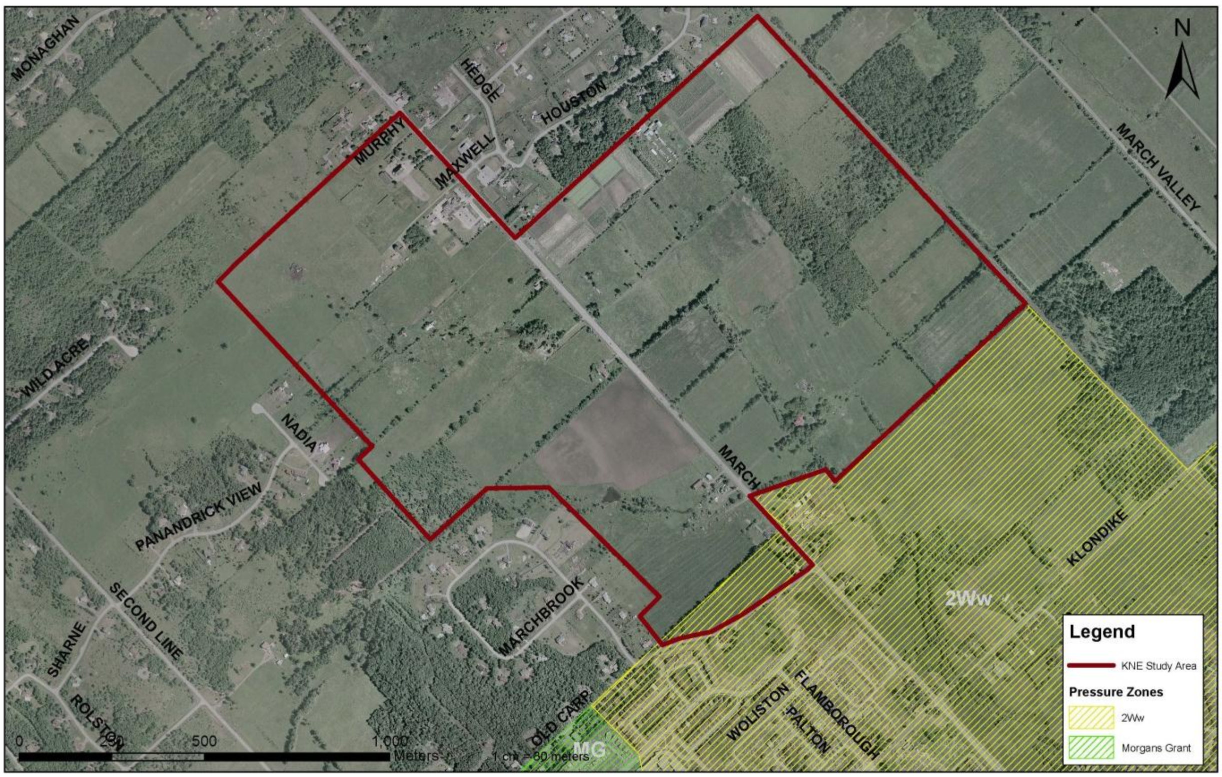


Figure 1-1: Proposed Development Site Location

The lands will include a mixture of low density, medium density and high density residential units including a mix of commercial and institutional lands. A development concept plan for the area is provided in **Appendix A.**

The southwest boundary of the site is adjacent to an existing residential development which has potable water serviced by the City of Ottawa. These lands are serviced by "Pressure Zone 2W". Given that it is on the most western boundary of Zone 2W, this particular area is also referred to as Zone 2Ww herein to distinguish its general location.

The northwest and northeast limits of the proposed development site border residential estate lots and farmland lots which are currently serviced by individual/private wells. The southeast boundary of the development site is bordered by an existing railway corridor, which is contiguous to farmland also currently serviced by well infrastructure.

1.2 GROUND ELEVATIONS

Ground elevations on the proposed development site vary between 69 and 94 metres. The portion of the site located on the west side of March Road decreases gradually in elevation from 94 metres on the western limits to about 80 metres along March Road. The portion of the site located east of March Road consists of 2 plateaus separated by a ridge. The western Plateau adjacent to March Road has an elevation of 80 metres, and the eastern plateau has an elevation of 69 metres. **Figure 1-2** illustrates the ground elevations assigned to nodes in the hydraulic model.

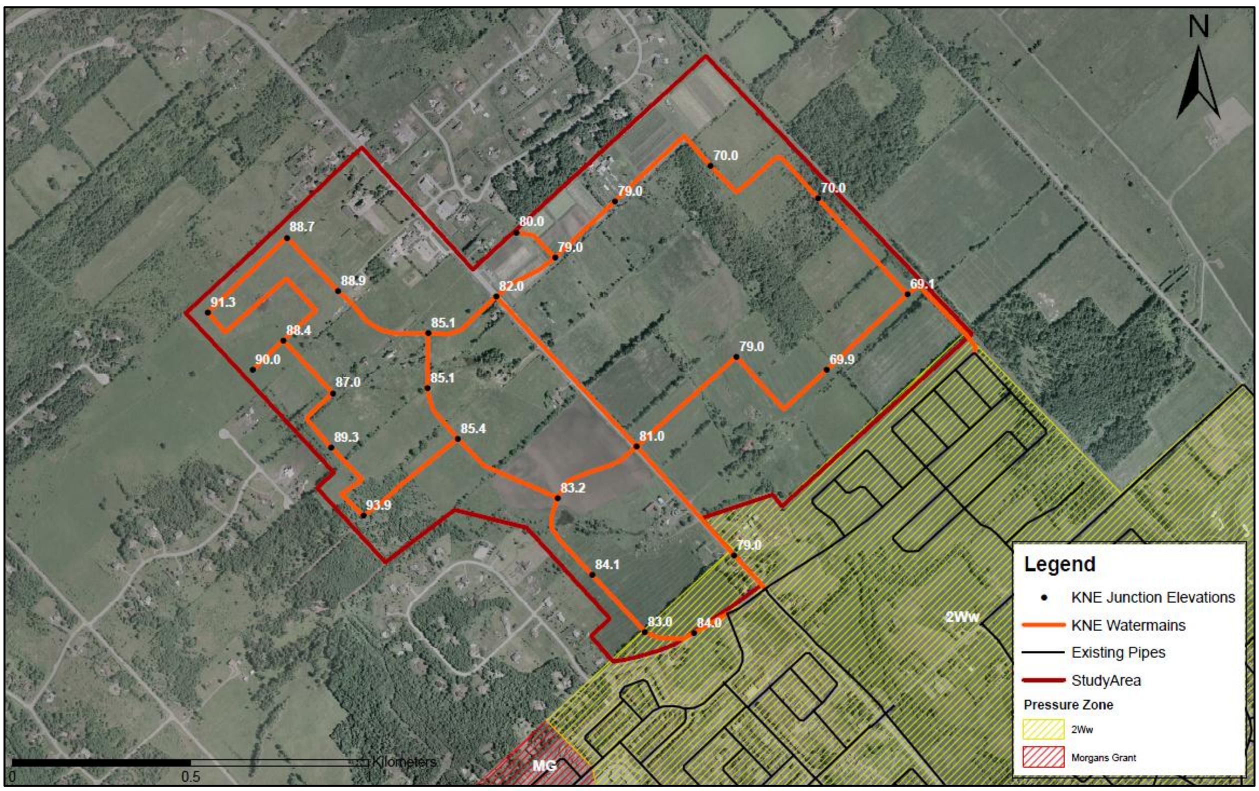


Figure 1-2: Development Site Elevations

1.3 EXISTING PRESSURE ZONES

The proposed site is situated near two existing water distribution pressure zones. Both of these pressure zones were analyzed to determine their compatibility with the potential site infrastructure.

Pressure zone 2Ww is located adjacent to the southeastern boundary of the proposed development site. This adjacency allows potential connection at several locations. Zone 2Ww has ground elevations similar to that of the proposed site, with values ranging between 68 and 99 metres. The overall hydraulic grade line in Zone 2Ww typically varies between 125 and 131 metres. The resulting pressures in Zone 2Ww typically range between 40 and 90 psi.

The Morgan's Grant Pressure Zone (Zone MG) is located approximately 250 metres southwest of the proposed development area. Connection to this pressure zone, given the existing structures and property ownership in the area, may require the creation of a minimum of 350 metres of additional pipeline – this does not account for the requirements to get a second redundant feed to the area. With ground elevations ranging between 91 and 107 metres, Zone MG is elevated compared to the upstream Zone 2W. To meet pressure servicing requirements at these elevations the Morgan's Grant Pumping Station was constructed. This pumping station allows the watermain infrastructure to maintain pressures between 58 and 82 psi. The overall hydraulic grade line in Zone MG varies from approximately 138 to 151 m.

1.4 EXISTING WATERMAIN NETWORK

Zone 2Ww is fed from a large dia. transmission w/m in Zone 2W along Timm Road and Robertson Road. Ultimately, this area is fed by pumps located at the Britannia Water Purification Plant and the Carlington Heights Pumping Station. The Glen Cairn Reservoir located to the south of Zone 2Ww provides balancing and emergency storage to Zone 2W/2Ww.

The existing Zone 2Ww pipe network consists primarily of a 1067mm dia. feedermain along Eagleson that drops down to 914mm, 610mm and 406mm before reaching the boundary of the KNUE lands (see **Figure 1-3**). Two sections of the 610mm dia. w/m along March Road step down in diameter from a 610mm to 406mm and back up to 610mm. These sections are discussed later in this assessment as they are deemed to create significant headloss relative to their lengths under high demands.

A secondary larger dia. w/m loops to the eastern boundary of Zone 2Ww with pipes ranging in size from 305 to 406mm dia. There is a small section of the secondary feed that drops down to 203mm on Penfield Drive.

The entire Zone 2Ww area north of Campeau Drive is fed by a single 914mm dia. watermain along Teron Road. There is an interzonal 203mm dia. w/m connection to Zone 3W in the western boundary of Zone 2Ww along Beaverbrook. Although the interzonal valve along Beaverbrook could be opened, this pipe has minimal capacity to provide to Zone 2Ww. The City has indicted that are two redundant feeds to the 2Ww area, however both include sections of private watermain which cannot be relied upon by the City for back-up supply purposes. These segments are shown in white in **Figure 1-3** below. The Critical Infrastructure Identification Study for Zone 2W recommended that ownership of some of these 406mm and 305mm sections of private watermain be transferred to the City to ensure adequate back-up supply in the event of a major failure condition. It is understood that this recommendation has yet to be implemented but it is the City's intent to pursue it.

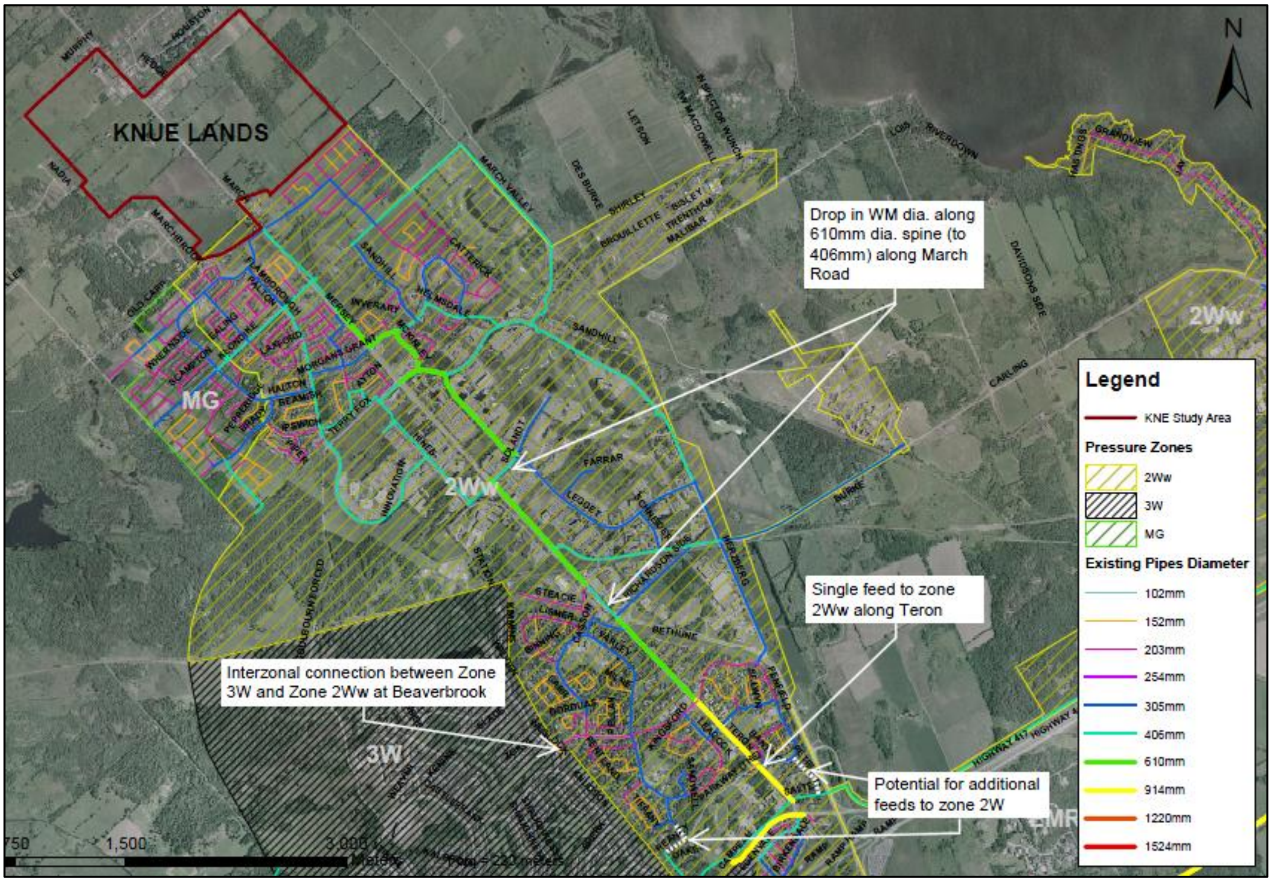


Figure 1-3: Existing Zone 2Ww Pipe Network (diameter shown in mm)

2.0 Approach

The following sections provide an analysis of the system pressures based on anticipated hydraulic gradelines to determine the appropriate servicing pressure zone, the system demands associated with the development area being assessed, and the modifications to the hydraulic model used in the assessment.

2.1 ALLOWABLE PRESSURES

An analysis of the existing pressure zone boundaries was performed to determine the appropriate servicing pressure zone for the KNUE lands. The proposed site has a total elevation change of 25m which is equivalent to a change in pressure of 36 psi. The desired pressure range for a given structure, as per the City of Ottawa Design Guidelines (Newell, W.R., 2010), is between 50 and 70 psi, with an absolute range between 40 and 80 psi. If pressures within the service area exceed 80 psi then, per the Ontario Plumbing Code (Government of Ontario, 2012), pressure controls are required, such as pressure reducing valves, to restrict high pressures to a maximum of 80 psi.

Considering the ground elevations of the proposed development, the proximity to existing watermains of each potential servicing pressure zone and the existing HGLs of the pressure zones, direct connections to the Zone 2Ww are the preferred alternative to the Zone MG. The Morgan's Grant pressure zone would produce tolerable pressures for a very small portion of the proposed site, but would produce excessively high pressures in the majority of the site. Pressure reducing valves would be required to mitigate the high pressures (as per the Ontario Plumbing Code) for most of the site. Servicing from Zone 2Ww allows for the higher elevation areas within the site to be inside tolerable servicing limits, while maintaining a more suitable HGL in the areas of lower elevations.

The North Eastern portion of the proposed site, located past the existing ridge, reaches elevations as low as 69 metres. This portion of the site will require pressure reduction measures to alleviate the high pressure in the region, regardless of the elected pressure zone. Connection of this area to Zone 2Ww will result in pressures up to 88 psi based on a maximum Zone 2Ww HGL of 130.9m. As per the Ontario Pluming Code, pressure reduction measures (i.e. individual household PRVs) will be required to mitigate high pressures in the system.

2.2 ANTICIPATED WATER DEMAND

The projected population for the KNUE lands is approximately 9230. Accordingly, zone/system level basic unit demands and outdoor water projections were applied to determine average day, maximum day and peak demands. **Table 2-1** summarizes the projected demands. These demands were distributed across all the new nodes added to the hydraulic model to simulate the pipe network in the KNUE lands. The total average day maximum day and peak hour demand (determined from the model) for the KNUE lands are 39.0L/s, 52.0L/s and 89.3L/s.

It is noted that each individual subdivision within the expansion area must be designed in accordance with the design parameters in the City's Water Design Guidelines (Newell, W.R., 2010), which has demands that are significantly higher than the system level parameters.

Table 2-1 - Projected Potable Water Demands for KNUE Lands

					Average Daily Demand (L/s)						Outdoor Water Demand		
Land Use	Area (ha)	Quantity of Housing Units	Population	Avg Daily Flow (L/cap) [Res] (L/ha) [Comm & Inst]	SFH	MLT	APT	COM_OGB	INS_OGB	Total AVDY	OWD_OGB		
Institutional	15.6	-	-	50000					9.0	9.0			
Commercial	15.3	-	-	50000				8.9		8.9			
Firehall	0.8	-	-	50000					0.5	0.5			
Subtotal:	*31.7*	*0.0*	*0.0*					*8.9*	*9.5*	*18.3*			
Low density (SF)	64.7	1073	3637	180	7.6					7.6	13.0		
Med density (Street Town)		1067	2881	198		6.6				6.6			
Med Density (Multi-Unit Town)	16.8	600	1620	198		3.7				3.7			
High density (Apt)		600	1080	219			2.7			2.7			
Subtotal:		*3340*	*9218*		*7.6*	*10.3*	*2.7*	*0.0*	*0.0*	*20.6*	*13.0*		
												Max Daily Demand	**PKHR from Model:**
Total:	***31.7***	***3340***	***9218***		***7.6***	***10.3***	***2.7***	***8.9***	***9.5***	***39.0***	***13.0***	***52.0***	***89.3***

PKHR Factor
1.7

2.3 WATERMAIN INFRASTRUCTURE DESIGN ALTERNATIVES

Given the layout of the existing Zone 2Ww large dia. w/m, the recommended alignment for a larger diameter feedermain to and through the KNUE lands, is along March Road. This alignment preserves the continuity of the larger diameter network and serves as the main feed to the proposed growth area.

To provide redundancy and added capacity to the KNUE lands, a secondary 305mm dia. w/m looping to the existing Zone 2Ww pipe network was considered. Two alternative alignments were considered, the first, an extension off an existing 305mm dia. w/m on Old Carp Road/Halton to the west of March Road, and the second, to an existing looped 203mm diameter network along Celtic Ridge to the east of March Road as depicted in **Figure 2-1**.

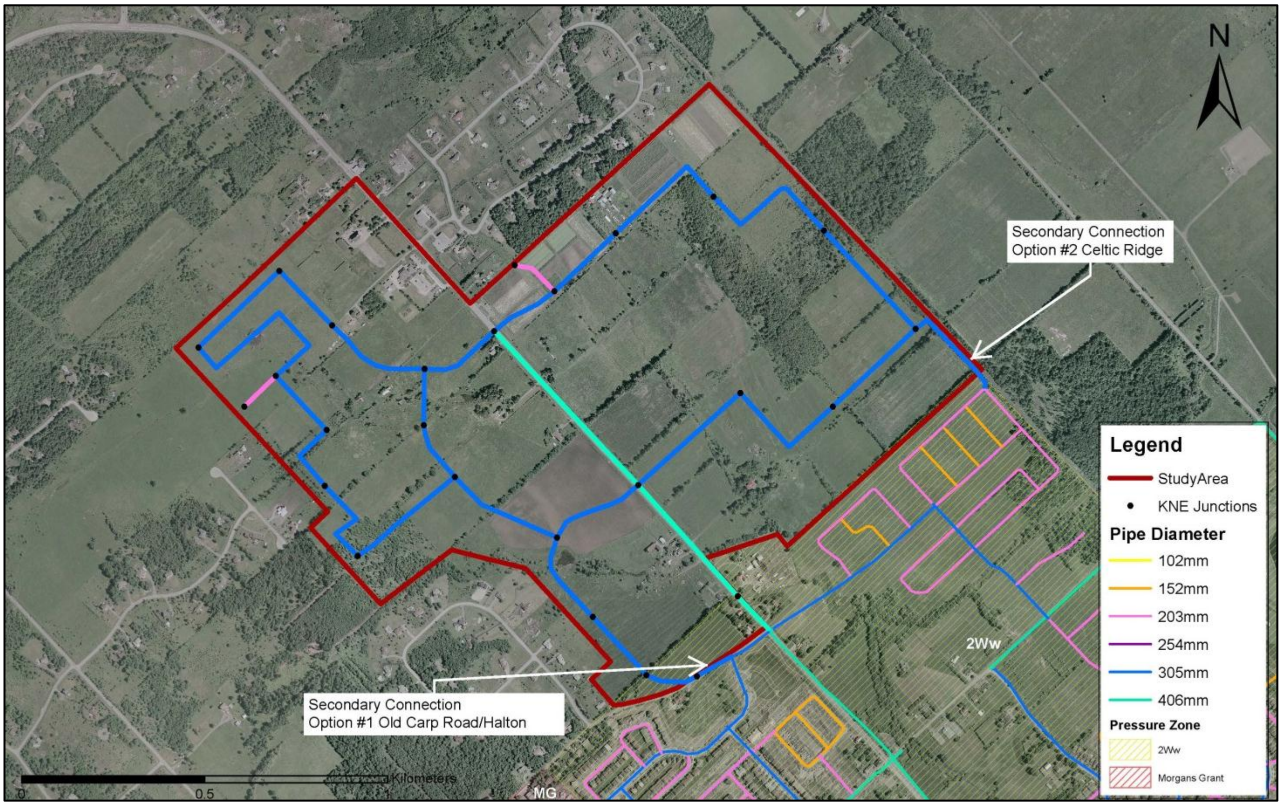


Figure 2-1: Proposed KNUE Pipe Diameters (mm) & Access Points to Existing Infrastructure

3.0 Hydraulic Modeling

3.1 HYDRAULIC MODEL DEVELOPMENT

With the permission of the City of Ottawa, the City's 2013 Water Master Plan all pipe computer model was used to assess the proposed growth scenarios. The hydraulic modeling software used is H2OMap water by Innovyze.

A watermain network in the KNUE lands was created using the proposed road network plans. Nodes were input into the model to provide a good distribution of demands and a good representation of ground elevation conditions. **Figure 3-1** and **Figure 3-2** show the locations and the IDs of the future nodes and watermains entered into the model respectively.

Using the base 2012 summer and winter scenarios, new child scenarios were developed with future KNUE nodes and pipes included in the model. An additional set of scenarios was created to model the future upgrades to the existing Zone 2Ww network, in particular, the two sections of 406mm dia. w/m along the 610mm dia. feedermain on March Road.

Ground elevations were assigned to nodes according to the location of the node with respect to the topography.

Residential, Institutional and Commercial demands were distributed according to the Kanata North Community Design Plan (Novatech, 2016). The Kanata North Community Design Plan (Novatech, 2016) was used in conjunction with the Kanata North Onsite Sanitary Drainage Area Plan (Novatech, 2016) to distribute residential and outdoor water demands according to the projected population and housing type present in each area.

Pipe diameters were assigned with diameters ranging from 305mm to 406mm to provide a strong network of watermains along primary routes. Hazen Williams carrying capacity "C" factors were applied based on City of Ottawa Design Water Guidelines (Newell, W.R., 2010)(110 for 203mm and 120 for 305/406mm).

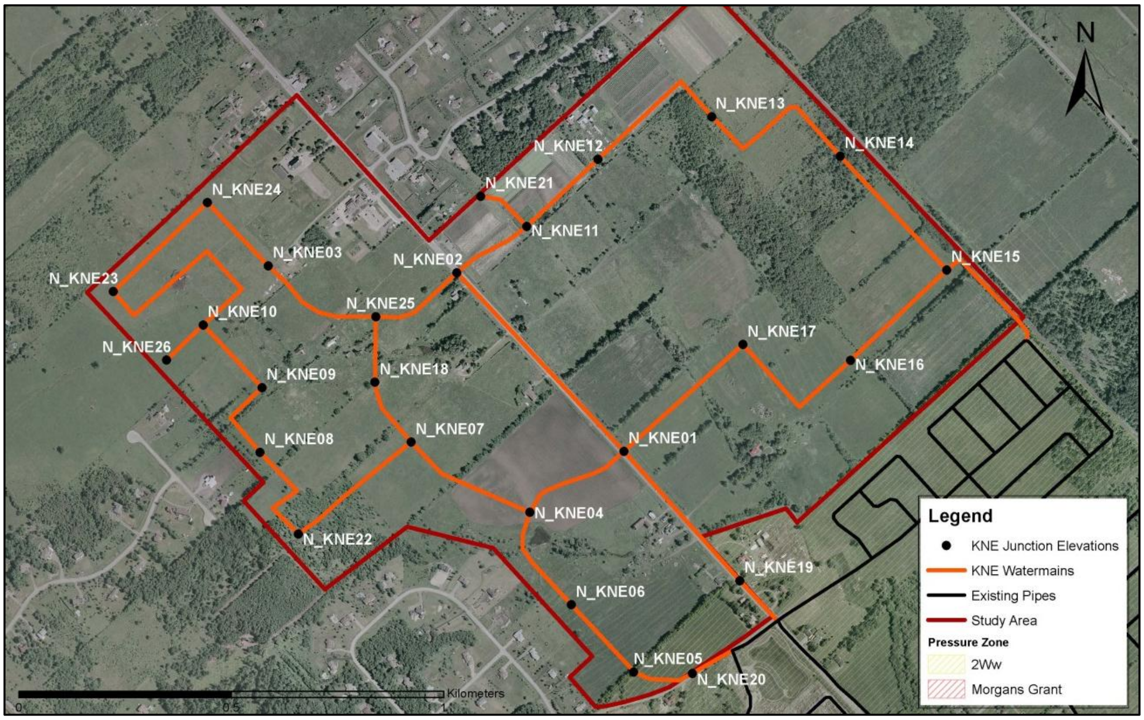


Figure 3-1: KNUE Lands Model Node ID's

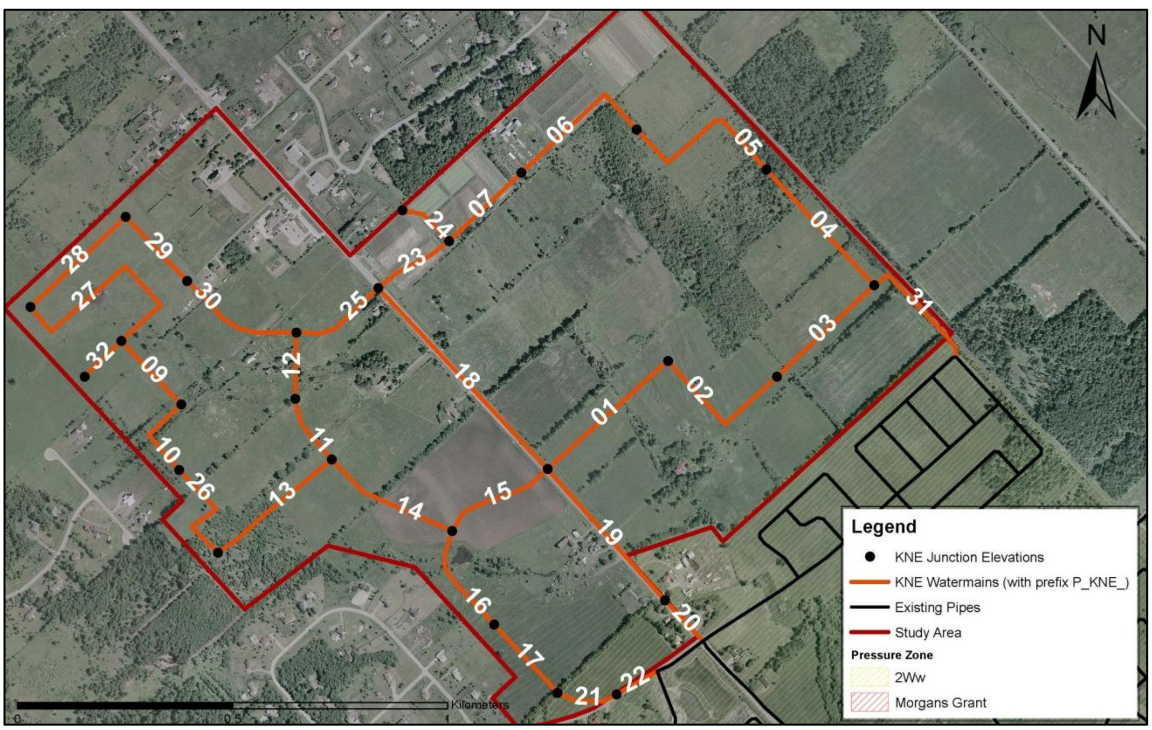


Figure 3-2: KNUE Lands Model Pipe ID's

Figure 3-3 provides the node allocation of each area of development to the watermain network. Areas shown without colour shading do not have allocated demands.

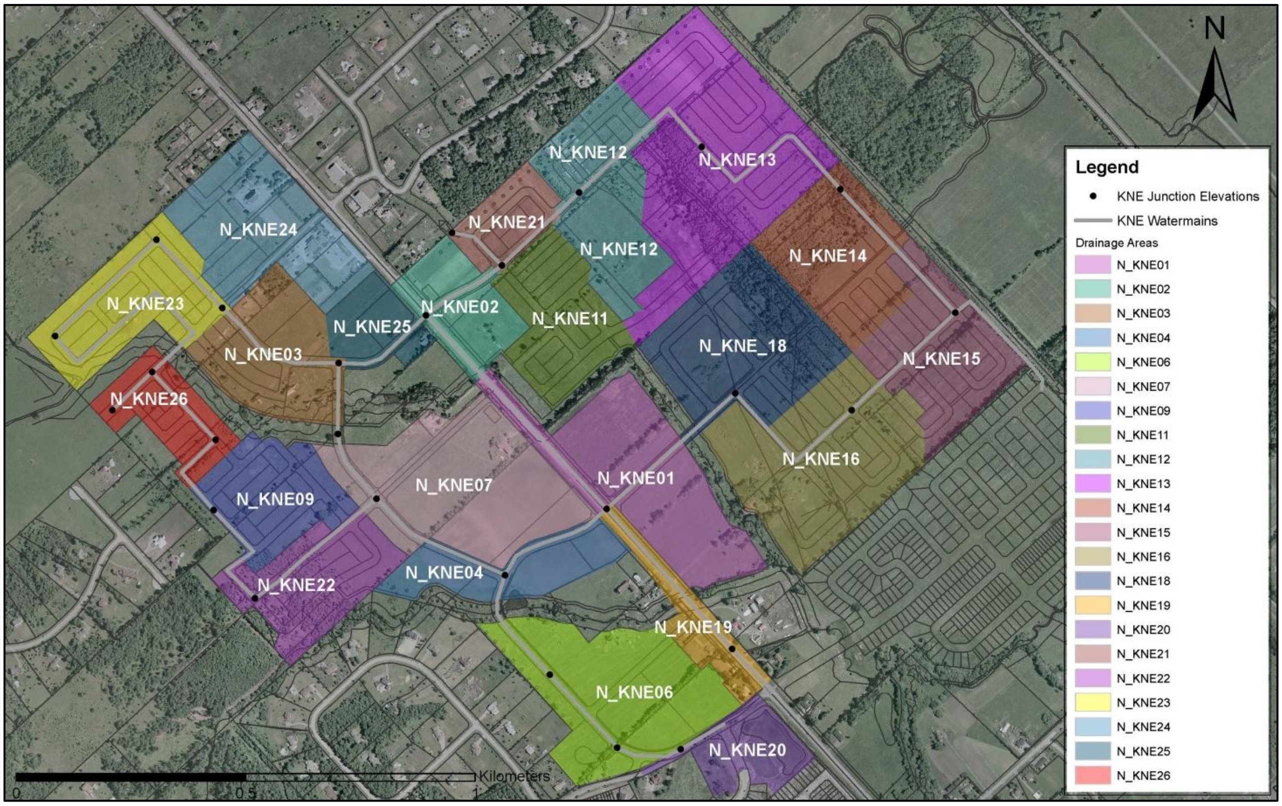


Figure 3-3: Area Demand Allocation

The demand applied from each of these areas on the respective node is summarized in **Table 3-1** below. This table summarizes residential, commercial, institutional and outdoor water demands.

Table 3-1: Node Average Day Demand Allocations

Node Allocation	Average Day Demand (L/s)				Total
	Residential	Commercial	Institutional	Outdoor	
N_KNE01	0.00	5.11	0.00	0.00	5.11
N_KNE02	0.00	0.00	0.00	0.00	0.00
N_KNE03	1.42	1.82	0.00	0.00	3.24
N_KNE04	1.15	0.39	0.00	0.00	1.54
N_KNE05	0.00	0.00	0.00	0.00	0.00
N_KNE06	2.53	0.00	1.18	0.53	4.25
N_KNE07	0.55	0.13	2.31	0.00	3.00
N_KNE08	0.00	0.00	0.00	0.00	0.00
N_KNE09	0.93	0.00	0.00	0.00	0.93
N_KNE10	0.00	0.00	0.00	4.07	4.07
N_KNE11	1.33	0.00	0.00	0.00	1.33
N_KNE12	0.74	0.00	1.67	0.00	2.41
N_KNE13	2.38	0.00	0.00	4.54	6.92
N_KNE14	0.81	0.00	1.33	0.00	2.14
N_KNE15	1.41	0.00	0.00	3.87	5.28
N_KNE16	1.80	0.00	0.00	0.00	1.80
N_KNE17	1.83	0.00	0.00	0.00	1.83
N_KNE18	0.00	0.00	0.00	0.00	0.00
N_KNE19	0.00	1.19	0.00	0.00	1.19
N_KNE20	0.32	0.00	0.00	0.00	0.32
N_KNE21	0.48	0.00	0.00	0.00	0.48
N_KNE22	0.95	0.00	0.00	0.00	0.95
N_KNE23	1.15	0.00	0.00	0.00	1.15
N_KNE24	0.53	0.00	2.50	0.00	3.03
N_KNE25	0.00	0.20	0.48	0.00	0.68
N_KNE26	0.62	0.00	0.00	0.00	0.62
TOTAL:	20.9	8.9	9.5	13.0	52.3

3.2 RESULTS

3.2.1 Average Daily Demands

The winter model scenario was tested to observe the pressures in the KNUE lands under the 2012 average daily demand conditions. No outdoor water demand was applied in this scenario. **Figure 3-4** provides the results of each node within the KNUE lands. The Hydraulic Gradeline under average day demands varies between 127m and 130m, as a result, **nodes with ground elevations lower than 74m can anticipate maximum pressures to exceed 80 psi**. The Ontario Building Code requires services with pressures greater than 80 psi to have pressure reduction measures such as pressure reduction valves installed along the service lines. The same results are observed for both secondary looping scenarios (i.e. option 1 through Old Carp Road and option 2 through Celtic Ridge).

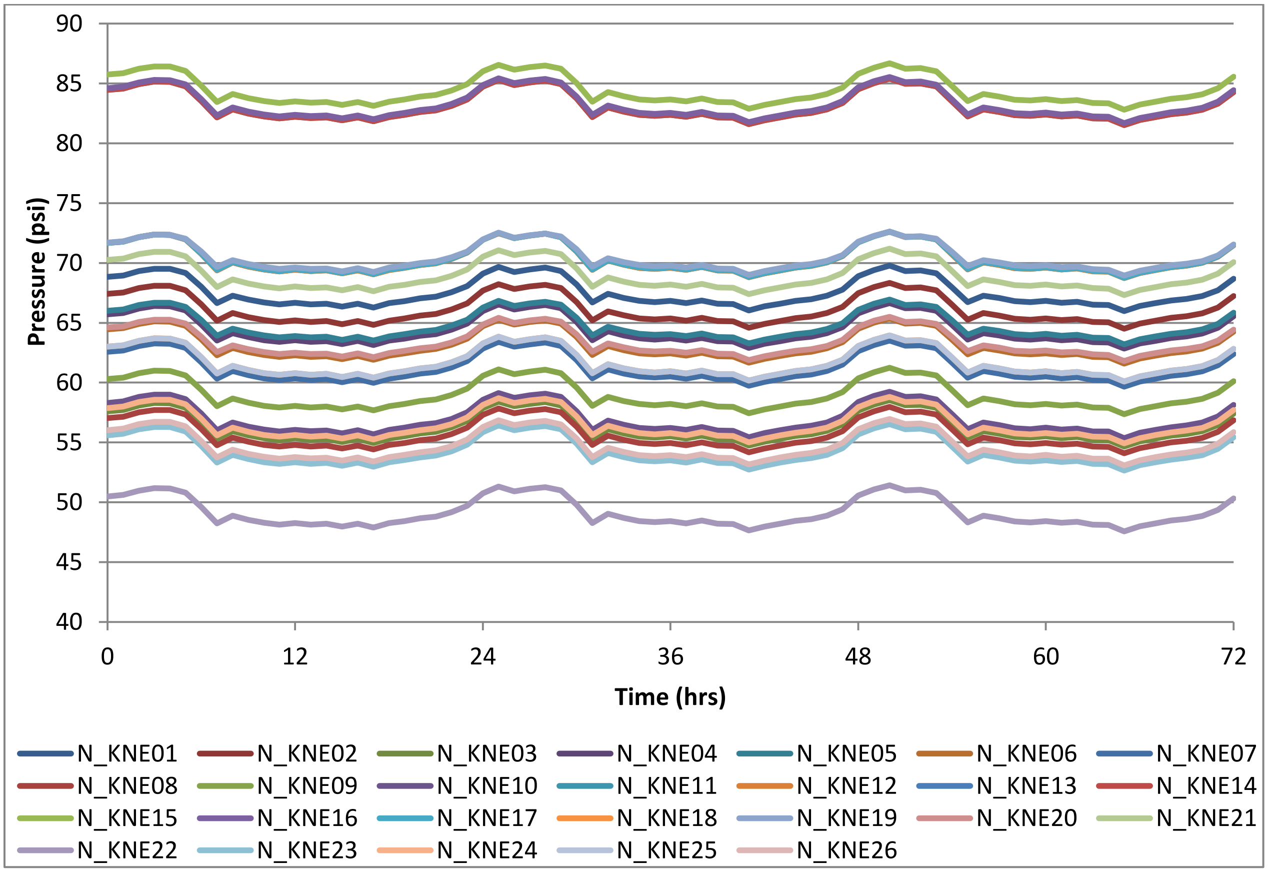


Figure 3-4: Pressures under Existing (2012) Plus KNUE Build-out AVDY Demands

3.2.2 Peak Hour Demands

The summer model scenario was tested to observe the pressures in the KNUE lands under the 2012 maximum daily demand & peak hour conditions. **Figure 3-5** shows the resulting minimum pressures in Zone 2Ww prior to the KNUE lands being added to the network. Minimum pressures in Zone 2Ww drop down close to 40 psi at the suction side to the Morgan's Grant Pump Station.

Figure 3-6 shows the resulting minimum pressures throughout zone 2Ww and the KNUE lands when the KNUE buildout demand is added to the network. As shown, there is a slight impact on the pressures in the existing Zone 2Ww due to additional headloss through the existing Zone 2Ww pipe network. Under peak demands, pressures drop by up to 4 psi, resulting in some "borderline" minimum pressure areas in the existing Zone 2Ww area falling below the 40 psi threshold. **Figure 3-7** further illustrates how the node pressures in the KNUE lands are impacted under peak demand conditions. Under this scenario, the HGL drops to approximately 121m in the KNUE lands resulting in elevations greater than 93m experiencing pressures less than the design guideline minimum requirement of 40 psi.

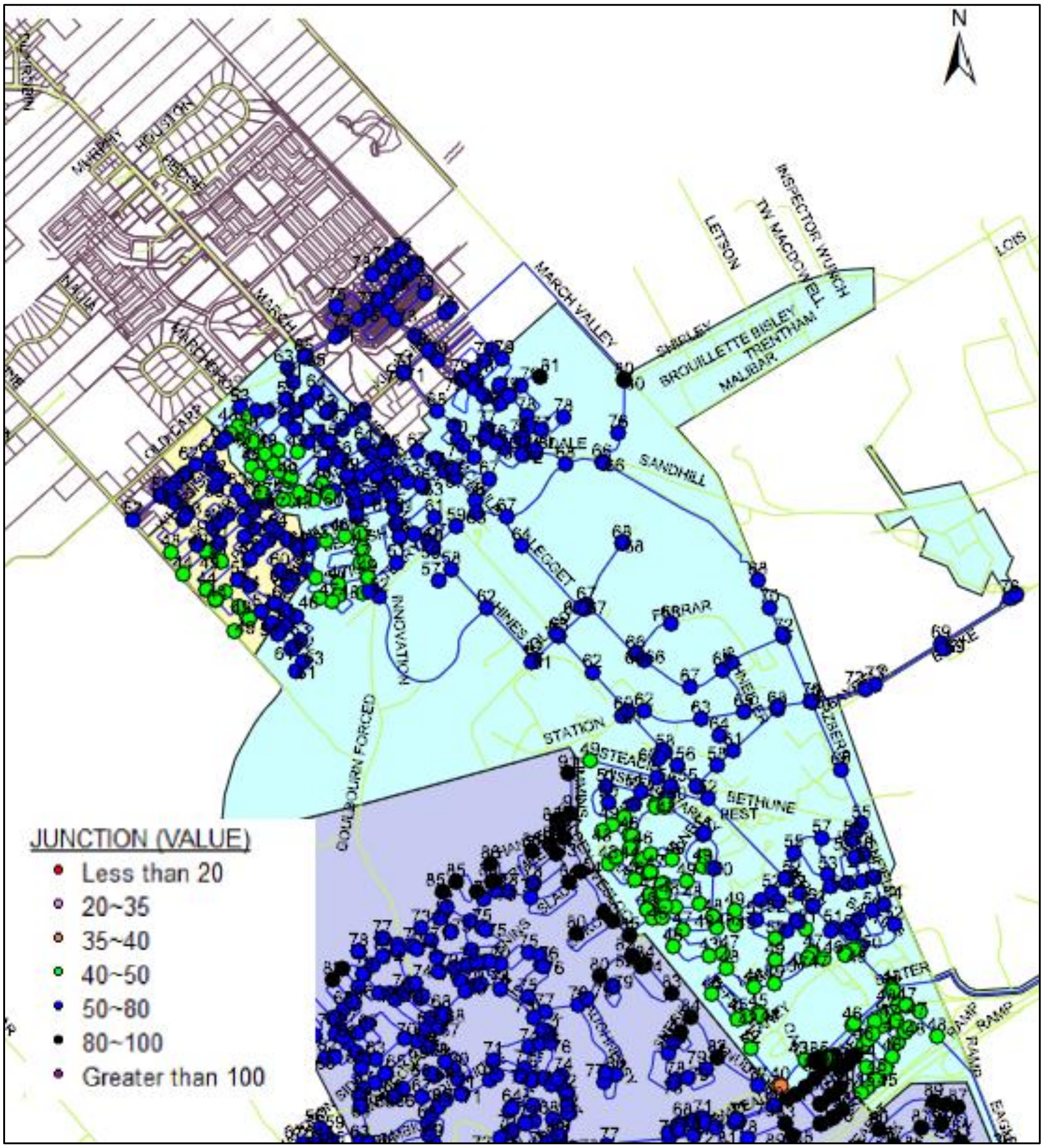


Figure 3-5: Zone 2Ww Minimum Pressures under Existing Network & Existing 2012 PKHR Demands (no KNUE)

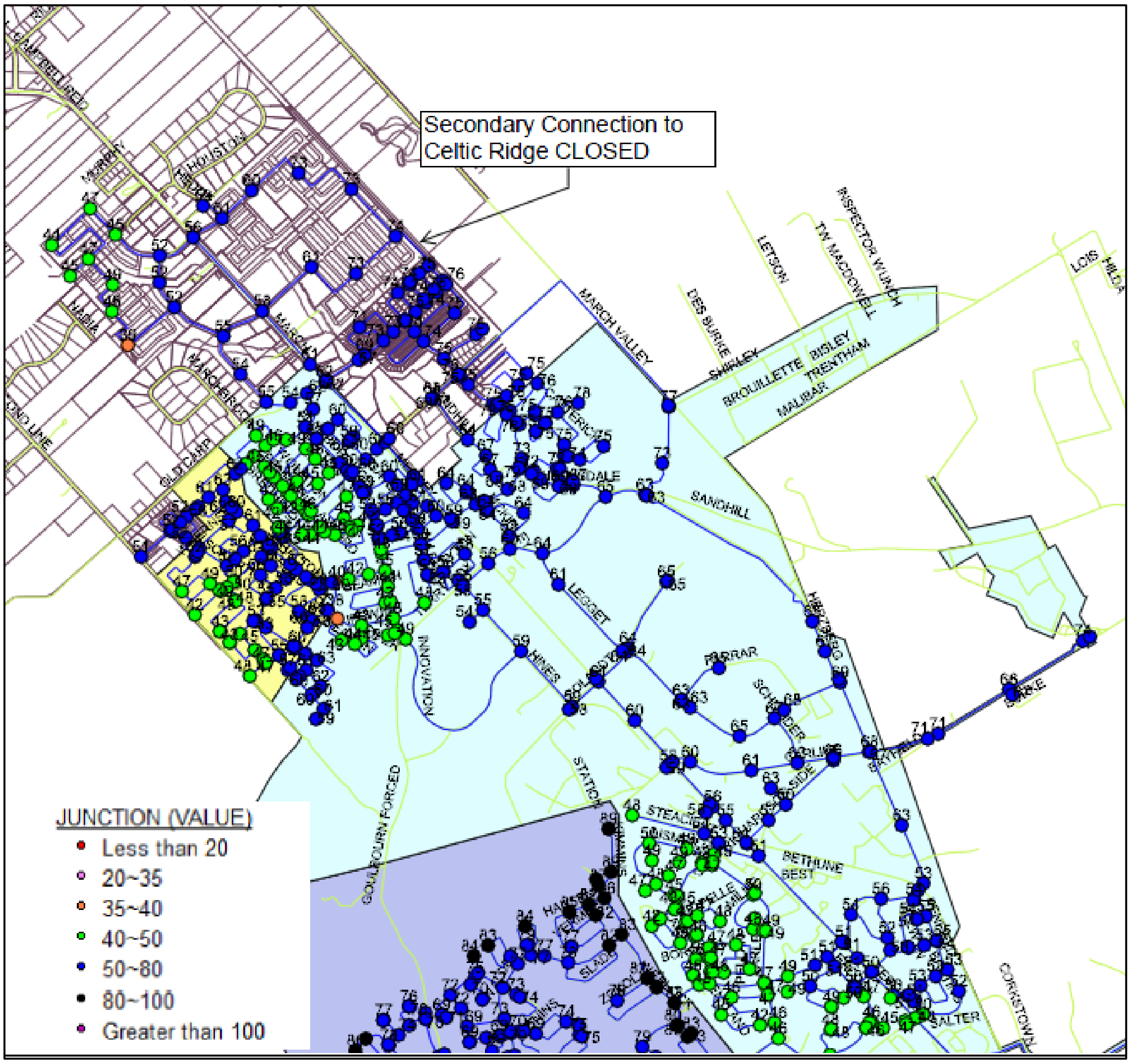


Figure 3-6: Zone 2Ww Minimum Pressures with Existing Network & Existing + KNUE 2012 PKHR Demands

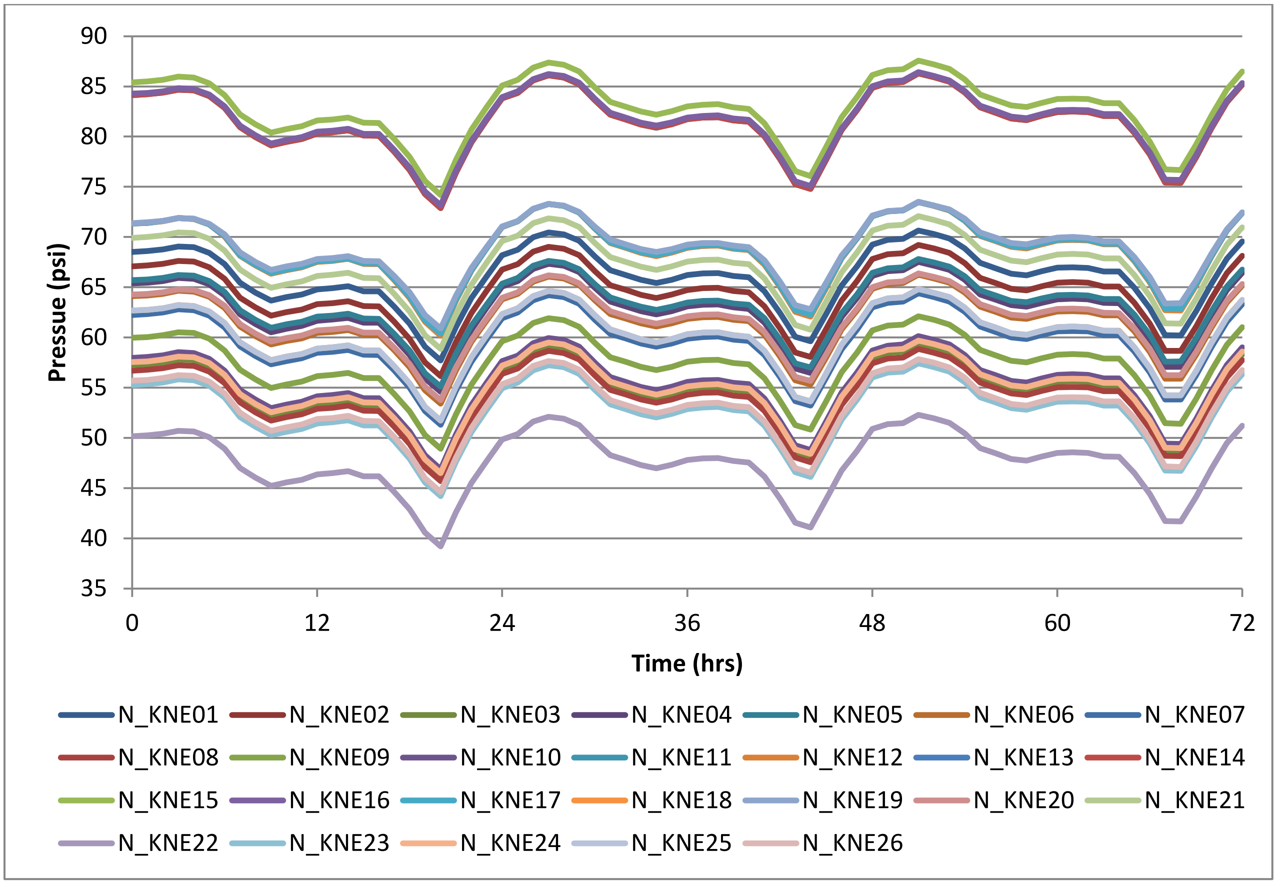


Figure 3-7: Pressures under Existing Network & Existing + KNUE 2012 PKHR EPS Demands

To improve minimum pressures, upgrades to two lengths of 406mm dia. w/m along the March Road alignment were made in the model (sections were upsized to 610mm dia.) **Figure 3-8** shows the resulting improvements to the minimum pressures in Zone 2Ww and the KNUE lands. These improvements decrease the headloss under peak demands and increase the minimum HGL in the KNUE lands to 122m. Under this scenario, nodes in the KNUE lands with ground elevations greater than 94m would experience pressures less than 40 psi. **Figure 3-9** further illustrates how the node pressures in the KNUE lands are impacted under peak demand conditions. Development exceeding 93m in elevation will therefore need to be phased such the replacement of the 406mm watermain on March and Solandt Road is occurs first. Elevations exceeding 93m are only seen at node N_KNE22 in the model.

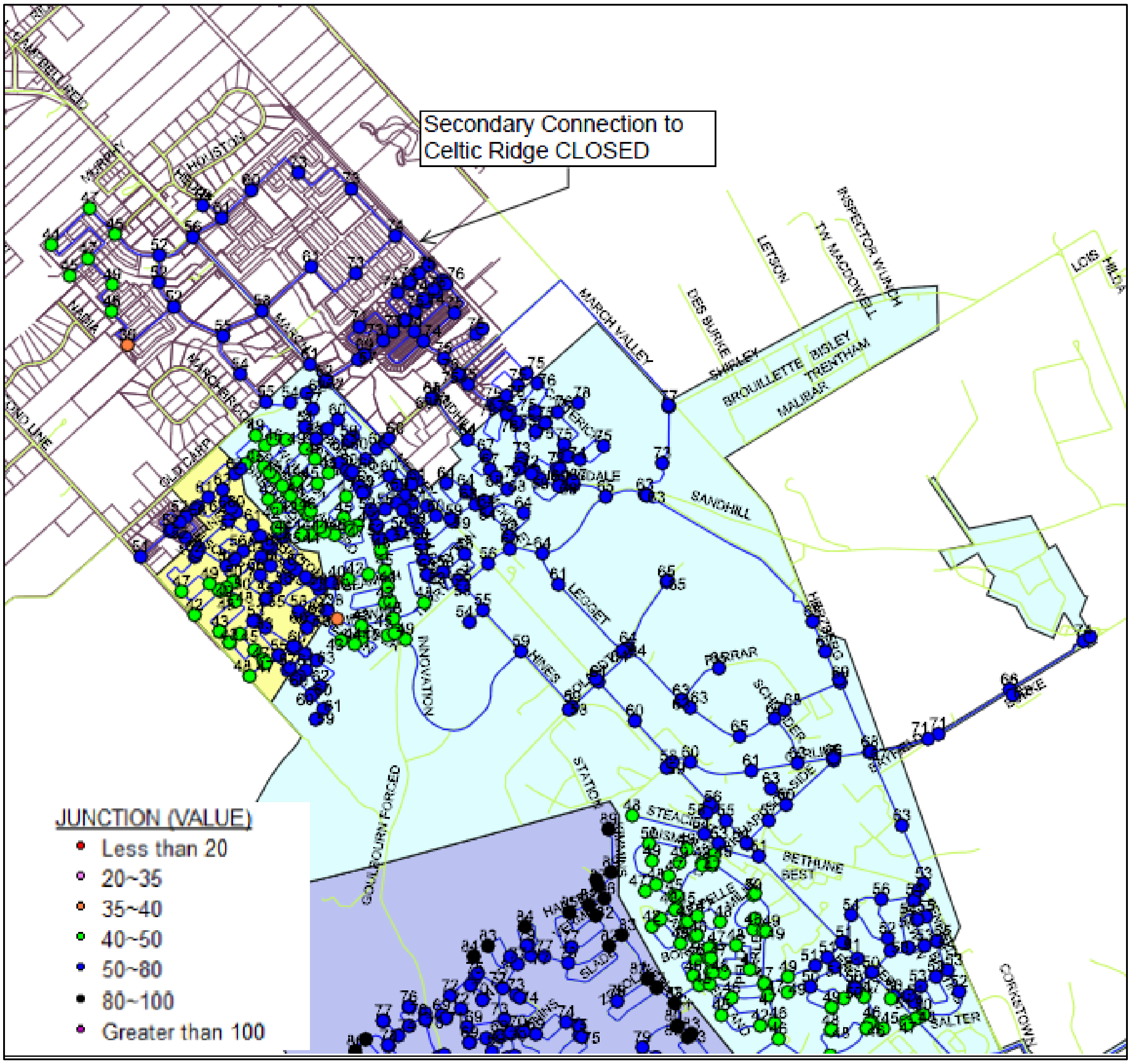


Figure 3-8: Minimum Pressures (psi) with Upgraded 2Ww Network & Existing + KNUE PKHR Demands

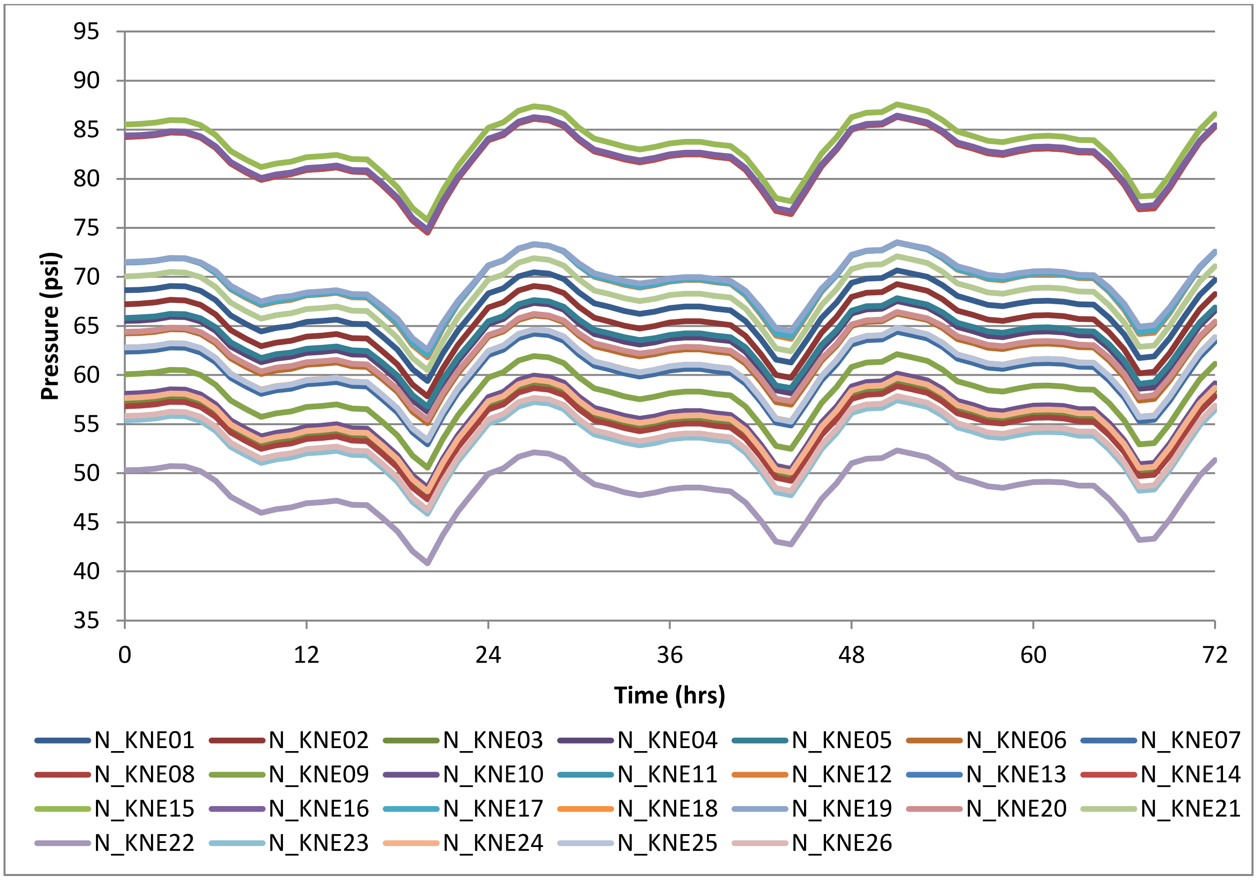


Figure 3-9: Pressures with upgraded 2Ww Network & Existing + KNUE 2012 MXDY EPS Demands

3.2.3 Max Day + Fire Flow Demands

A fire flow assessment was carried out on the proposed KNUE pipe network under MXDY steady state (SS) demand conditions and existing Zone 2Ww pipe conditions.

Table 3-2 provides the results of the fire flow analysis. Two scenarios were considered, existing Zone 2Ww piping with the main 406mm dia. w/m feed along March Road into the KNUE land and the secondary 305mm dia. w/m feed either from Old Carp Road (Option 1) or Celtic Ridge (Option 2).

The Old Carp Road (Option 1) scenario provides fire flow capacities greater than 117 L/s (7,020 L/min) at all nodes. The Celtic Ridge (Option 2) scenario is able to provide fire flow capacities greater than 115 L/s (6,900 L/min) at all nodes. A fire flow 167L/s (10,000L/min) is considered to be a strong flow capable of meeting typical residential construction requirements. Both layouts provide protection above the 167L/s (10,000L/min) at all nodes with the exception nodes N_KNE26 and N_KNE21, which are located at the ends of dead ends. The fireflow at these dead ends would be improved with additional looping with watermains outside the trunk system. This should be accounted for in the implementation strategy for this area. Further information on implementation strategies is provided in **section 3.3** of this report.

Fire flow requirements will still need to be assessed at a subdivision level to determine the Fire Underwriter Survey (FUS) fire flow requirements and any special provisions that may be required in the building designs. Fire flow assessments specific to the development of individual subdivisions within the study area will be carried out as part of each subdivision approval process. Infrastructure will have to be designed accordingly to ensure design guidelines are met and that building designs satisfy the available fire flow requirements as outlined in the Fire Underwriters Survey (FUS).

Table 3-2 - Projected Fire Flows in KNUE Lands Under 2012 MXDY SS Demands

	Available Flow at Hydrant (L/s)	
ID	**Feed from Old Carp Road**	**Feed from Celtic Ridge**
N_KNE01	418	413
N_KNE02	360	357
N_KNE03	222	215
N_KNE04	367	314
N_KNE05	366	215
N_KNE06	353	245
N_KNE07	310	290
N_KNE08	216	208
N_KNE09	220	213
N_KNE10	206	199
N_KNE11	323	335
N_KNE12	294	316
N_KNE13	335	372
N_KNE14	323	380
N_KNE15	335	428
N_KNE16	347	400
N_KNE17	328	354
N_KNE18	301	288
N_KNE19	497	501
N_KNE20	374	318
N_KNE21	131	132
N_KNE22	206	196
N_KNE23	193	188
N_KNE24	213	206
N_KNE25	311	300
N_KNE26	117	115
MIN	117	115
AVG	295	288

3.2.4 Failure Scenarios

The failure scenario analysis was completed to simulate average day demands with a pipe failure along the 406mm dia. w/m March Road feed into the KNUE lands. The winter demand scenario was tested. The two secondary servicing options were assessed. **Table 3-3** shows that under a failure scenario of the large dia. feed into the KNUE lands, the system will continue to provide the typical average day demands and a reduced fire flow as compared to the maximum day + fire flow scenario. The secondary service connection, referred to as Option 1 (Old Carp Road), provides on average 22% greater fire flow capacity than the Celtic Ridge connection.

Table 3-3 - Projected Fire Flows in KNUE Lands Under 2012 BSDY Demands with Pipe Failures

	Available Flow at Hydrant (L/s)		
ID	**BSDY + Fire + 406 BRK March Feed from Old Carp Road**	**BSDY + Fire + 406 BRK March Feed from Celtic Ridge**	**% Difference**
N_KNE01	176	135	-23%
N_KNE02	165	125	-24%
N_KNE03	131	100	-23%
N_KNE04	176	120	-32%
N_KNE05	266	109	-59%
N_KNE06	215	114	-47%
N_KNE07	158	115	-27%
N_KNE08	127	95	-25%
N_KNE09	133	102	-23%
N_KNE10	125	96	-23%
N_KNE11	167	136	-18%
N_KNE12	162	139	-14%
N_KNE13	185	166	-10%
N_KNE14	184	172	-6%
N_KNE15	186	184	-1%
N_KNE16	188	170	-10%
N_KNE17	166	140	-16%
N_KNE18	152	113	-26%
N_KNE19	172	133	-23%
N_KNE20	306	358	17%
N_KNE21	149	94	-37%
N_KNE22	115	84	-27%
N_KNE23	119	92	-23%
N_KNE24	129	100	-23%
N_KNE25	154	114	-26%
N_KNE26	115	76	-34%
MIN	115	76	-34%
AVG	166	130	-22%

Figure 3-10 shows the results of a failure of the 406mm feed along March Road into the KNUE lands under winter demands conditions. As shown, pressures remain above 40 psi under this condition.

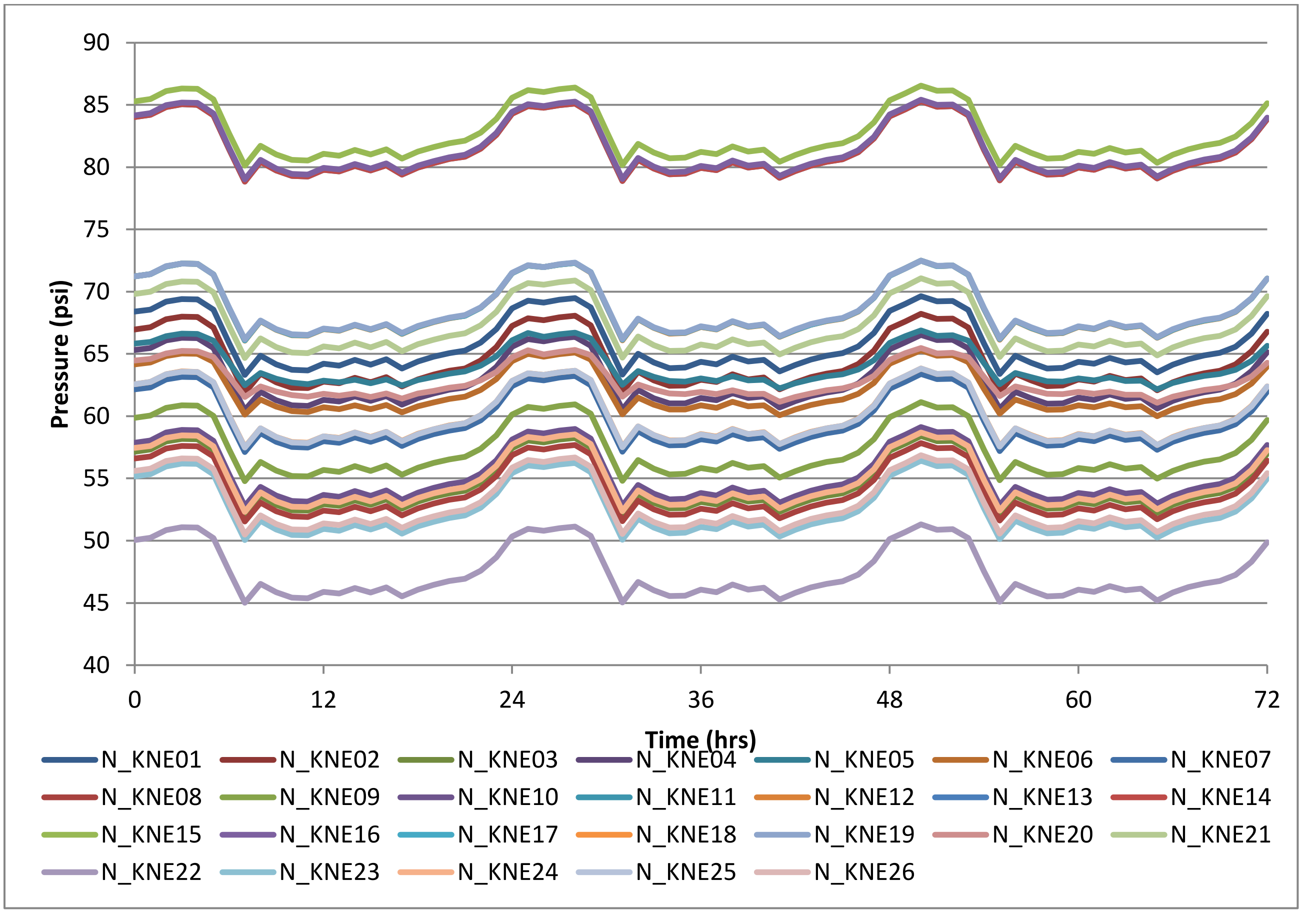


Figure 3-10: KNUE Pressures under Existing 2Ww Pipe Network & Existing + KNUE 2012 BSDY Demands with a pipe failure along the KNUE March Road feed.

3.2.5 2031 Demands

The winter model scenario was tested to observe the pressures in the KNUE lands and zone 2Ww under the 2031 average daily demand conditions. No outdoor water demand was applied in this scenario. **Figure 3-11** shows the resulting maximum pressures throughout zone 2Ww and the KNUE lands when the KNUE build-out demand is added to the network. It should be noted that all 2031 scenarios are represent the assumed replacement of the 406mm watermain along Solandt Road and March Road to 610mm.

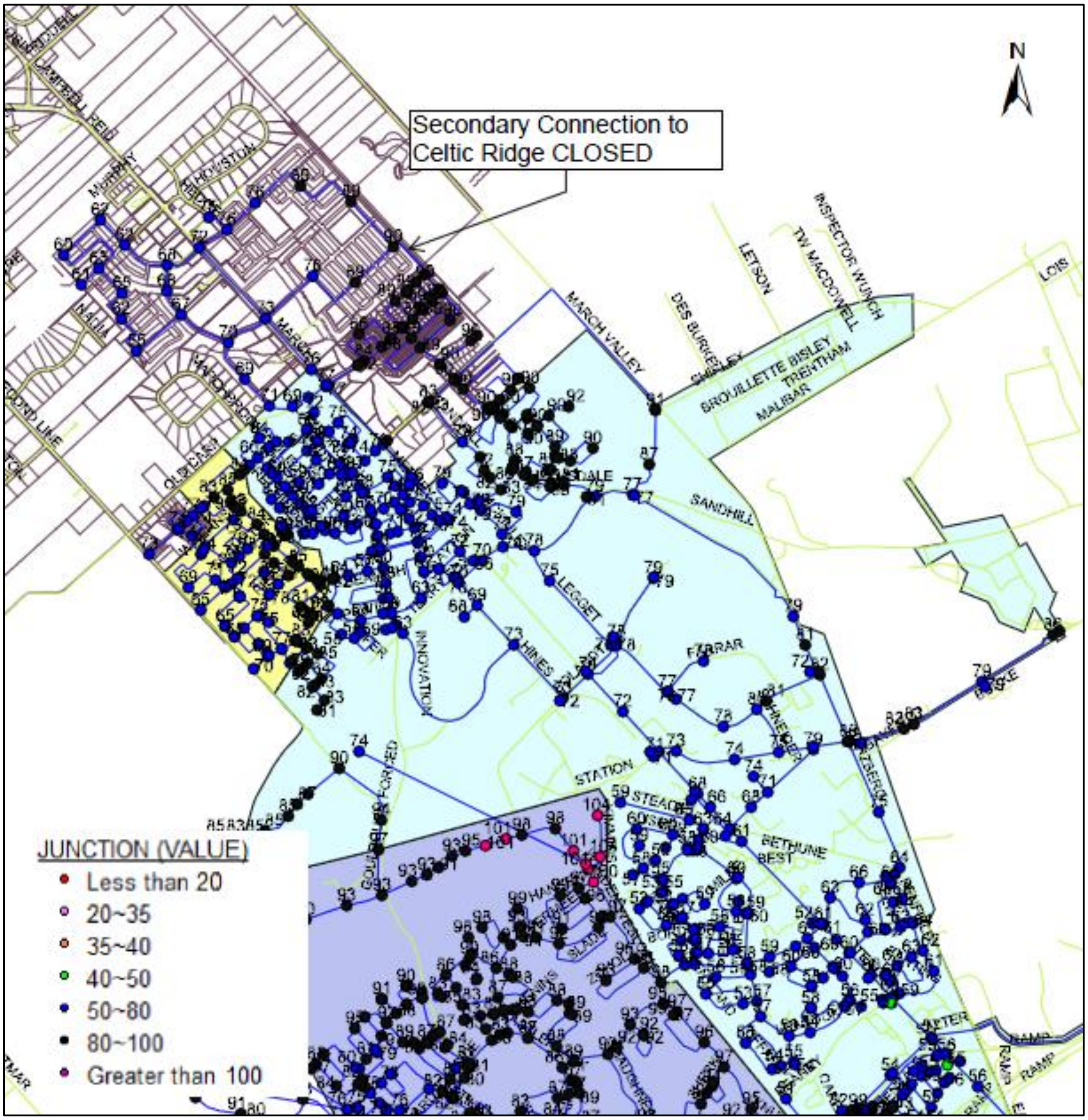


Figure 3-11: Resulting Maximum Pressures Under 2031 Average Day Demands

The summer model scenario was tested to observe the pressures in the KNUE lands and the 2Ww under the 2031 maximum daily demand & peak hour conditions. **Figure 3-12** shows the resulting minimum pressures throughout zone 2Ww and the KNUE lands when the KNUE build-out demand is added to the network. There was no significant change in the KNUE lands servicing.

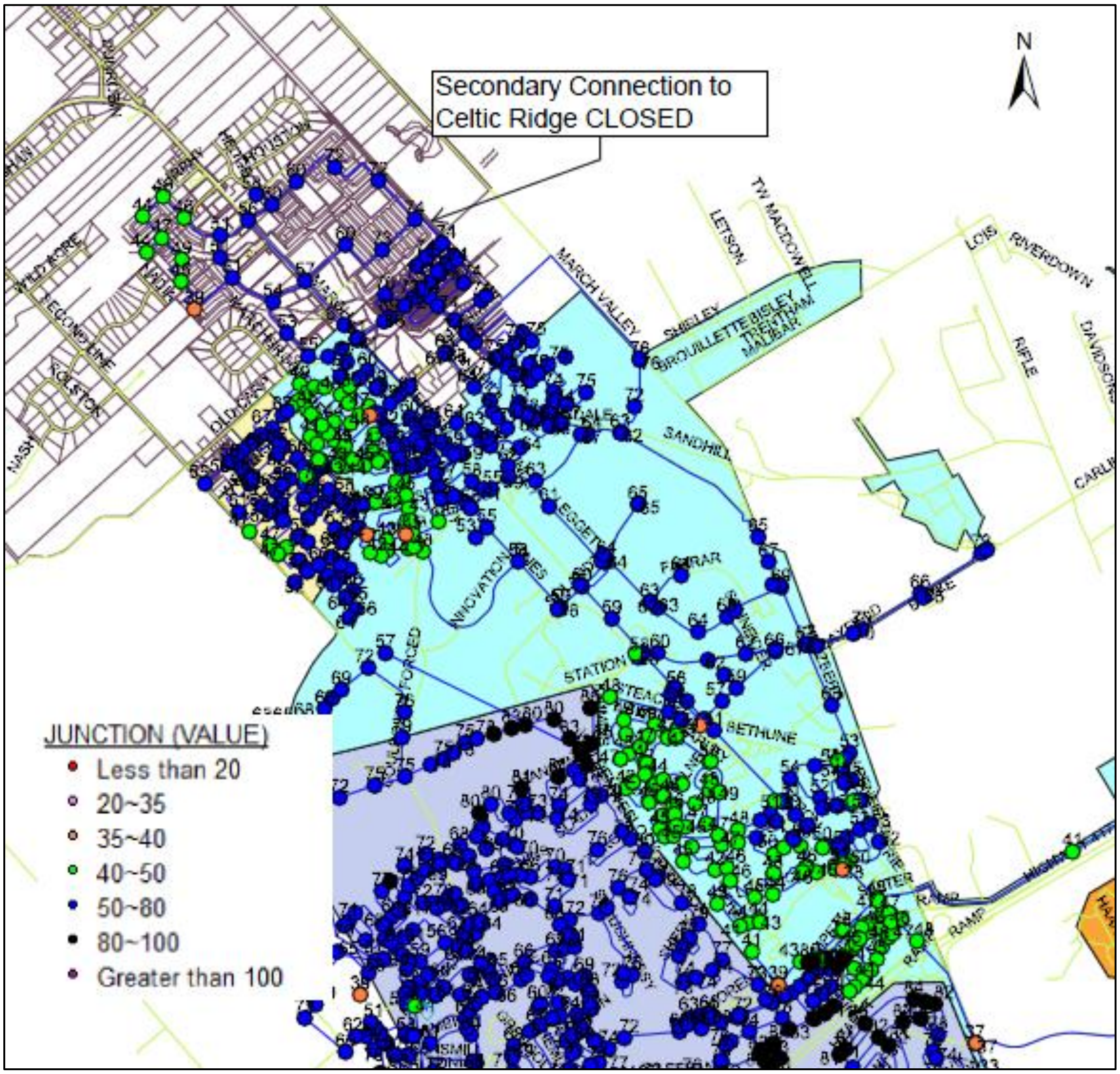


Figure 3-12: Resulting Minimum Pressures Under 2031 Peak Hour Demands

3.3 WATERMAIN INFRASTRUCTURE PHASING

The City of Ottawa Water Design Guidelines (Section 4.3.1) (Newell, W.R., 2010) state that two watermain connections are required to service a development area where the total water demand exceeds 50m^3/d. A secondary w/m connection to the March Road w/m, either along Old Carp Road or Celtic Ridge is required to achieve this guideline objective.

As an interim condition, fireflow and peak hour demand scenarios were modeled in a scenario where the entire development area was serviced by the single 406mm feed on March Road. The minimum pressure in the peak hour scenario was not reduced and fireflow was reduced below the 167 L/s minimum only at dead end locations. Under this interim single feed condition, the development area could be serviced; however the overall reliability would be reduced until the secondary feed is constructed.

Where dead ends must be used, a minimum pipe size of 150mm is required and water age analyses for flushing requirements must be completed. A dead end can service a maximum of 49 homes permanently and 75 homes on a temporarily basis of 2 years. Watermain implementation phasing, determined on site by site basis, will need to follow all requirements presented in the City of Ottawa Water Design Guidelines (Newell, W.R., 2010).

Two dead ends have been incorporated into the model to show potential connection points of the trunk watermain to surrounding areas that may be developed in the future. These dead-end watermains are highlighted in **Figure 3-13** below. The nodes at the end of these dead ends provide a worse-case scenario analysis for fireflow. It should be noted that these dead ends will need to follow the above mentioned requirements per the City of Ottawa Water Design Guidelines (Newell, W.R., 2010). Additional watermain may need to be implemented when these trunk mains develop to ensure the dead ends meet required standards. A proposed strategy for implementation is provided in **Figure 3-13** below. Development with elevations exceeding 93m cannot occur until the upgrade of the 406mm watermains on Solandt Road and March Road to 610mm watermains has occurred.

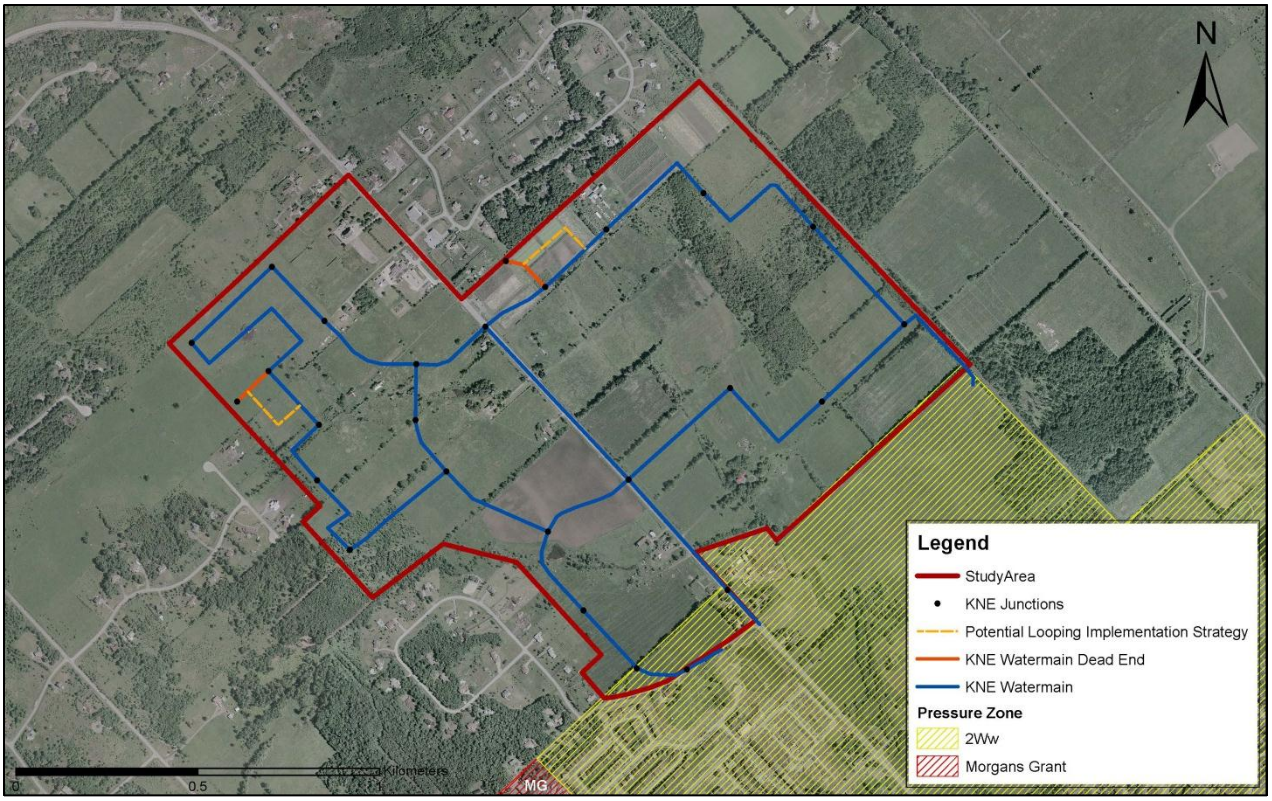


Figure 3-13: Dead End Implementation Strategy

4.0 Recommendations

Stantec Consulting LTD. (Stantec) has completed a hydraulic assessment of the potable water servicing alternatives for Kanata North Urban Expansion (KNUE) area on behalf of Novatech Engineering Consultants LTD. The purpose of this study is to provide a review of the existing conditions and watermain infrastructure in the area of the proposed development as well as offer an analysis of the potential servicing alternative opportunities and constraints.

Based on the findings of the analysis, the proposed pipe network shown in **Figure 2-1** of this report provides sufficient internal capacity to meet the pressure and flow requirements within the KNUE lands. There are two alternative secondary 305mm dia. w/m connections proposed (Old Carp Road and Celtic Ridge). Under typical demand conditions and pipe network conditions, both options provide similar results. The secondary connection to Old Carp Road provides better fire flow capacity under a pipe failure scenario, and thus is the preferred scenario. A diagram of this alternative is provided in **Figure 4-1** below:

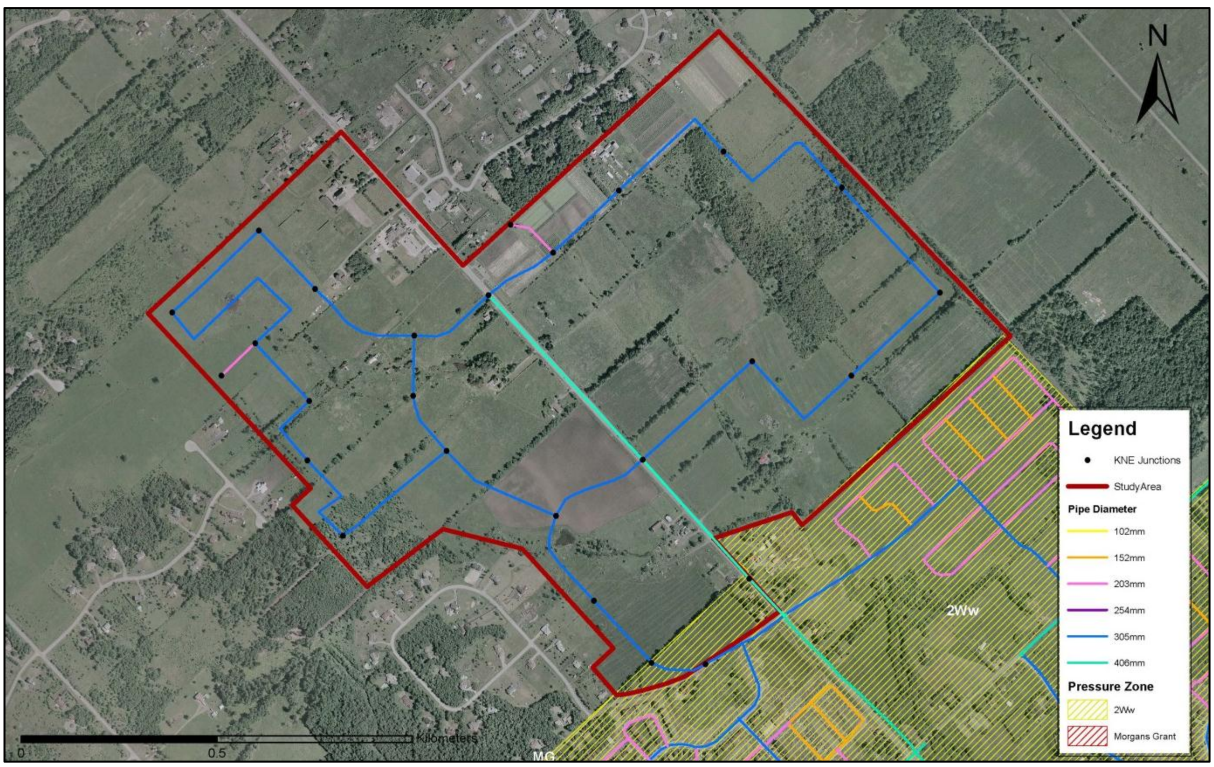


Figure 4-1: Preferred Watermain Layout

It should be noted that the dead end watermains shown above are to provide potential connection points of the trunk watermain to future development. These dead ends may require more watermain looping in actual development than shown in the layout above such that no permanent dead end permanently services greater than 49 homes as per section 4.3.1 of the City of Ottawa Water Design Guidelines (Newell, W.R., 2010).

The proposed KNUE area is recommended to be serviced entirely by the Zone 2Ww due to its topography and location. However, to keep minimum pressures above 40 psi and maximum pressures below 80 psi the following is recommended:

- Ensure site grading does not exceed 93m to maintain minimum pressures above 40 psi.
- Ensure services installed on lands with elevations less than 74m are equipped with pressure reduction valves to meet building code requirements (i.e. keeping maximum pressure below 80 psi).
- Upgrade the two sections of 406mm dia. w/m that break up the 610mm dia. watermain (a total length of approximately 550m) along March Road as described in this report to reduce headloss under build-out demands. This will allow site grading to be increased up to 94m in elevation, while still providing the minimum 40psi of pressure. It is recommended that these upgrades be carried prior to any lands greater than 93m being developed.

From a fire flow perspective, under normal conditions both secondary 305mm dia. connections to the KNUE lands (Old Carp Road and Celtic Ridge) provide adequate flows for typical fire flow requirements. Fire flow requirements will still need to be evaluated at the subdivision planning level to establish FUS requirements.

From a redundancy perspective, under a major pipe failure, the Old Carp Road alignment provides better capacity than the Celtic Ridge connection but both scenarios provide reduced fire flow compared to the maximum day plus fire flow scenario with no break.

In critical areas, where performance is expected to be close to design limits, additional losses through the local system could result in substandard service. Adjustments to future plans of subdivision or site plans in the study area may be needed in these areas. Adjustments could include one or more of the following:

- ROW adjustments to allow for improved watermain looping;
- reduce maximum elevation of serviced land; and/or
- adjust development characteristics to reduce fire flow requirements.

Lastly, through this assessment, there is a section of 914mm diameter watermain along Teron Drive that provides a “singe feed” to the entire Zone 2Ww area north of Campeau Drive. This single feed connection is noted for the City to consider for improved reliability from a zone servicing perspective. The City has indicated that it is the City’s intent to acquire existing private watermain connections at the south end of the 2Ww service area to improve back-up supply to the zone.

5.0 Works Cited

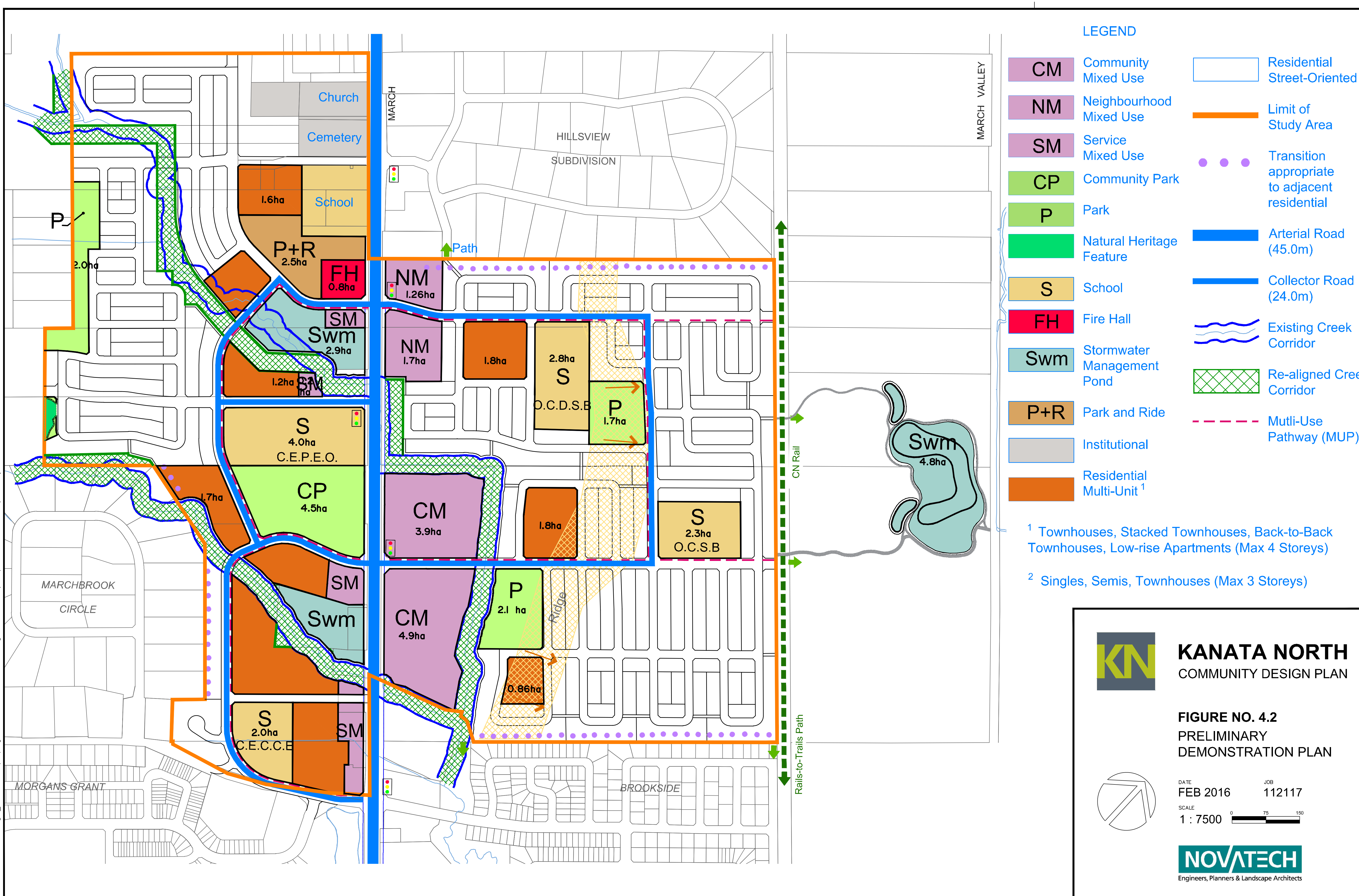
Ministry of the Environment. (2008). *Design Guideline for Drinking Water Systems* . Government of Ontario.

Newell, W.R. (2010). *Ottawa Design Guidelines - Water Distribution*. Ottawa: City of Ottawa.

Novatech. (2016). *Kanata North Community Design Plan* . Ottawa: Novatech.

Novatech. (2016). *Kanata North Onsite Sanitary Drainage Area Plan*. Ottawa: Novatech.

Appendix A Development Concept Plan



KANATA NORTH
COMMUNITY DESIGN PLAN

FIGURE NO. 4.2
PRELIMINARY DEMONSTRATION PLAN

M:\2012\112117\CAD\Design_EMP\MEMO (CS)\Figure 9.1 Demonstration Plan.dwg, DEMO PLAN (MSS), Feb 23, 2016 - 2:00pm, lseely

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

No.	REVISION	DATE	BY
3.	ISSUED WITH DRAFT MASTER SERVICING STUDY	MAY 20/16	JLS
2.	ISSUED WITH DRAFT MASTER SERVICING STUDY	APR 4/16	JLS
1.	ISSUED WITH DRAFT MASTER SERVICING STUDY	FEB 26/16	JLS

SCALE 1:3000

1:3000 — 0 30 60 90 120

DESIGN ARM / TB
CHECKED ARM
DRAWN TB
CHECKED CJR
APPROVED JLS

FOR REVIEW ONLY

NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

LOCATION
KANATA NORTH URBAN EXPANSION AREA
COMMUNITY DESIGN PLAN

DRAWING NAME
WATERMAIN

PROJECT No. 112117-04
REV REV # 3
DRAWING No. 112117-WM

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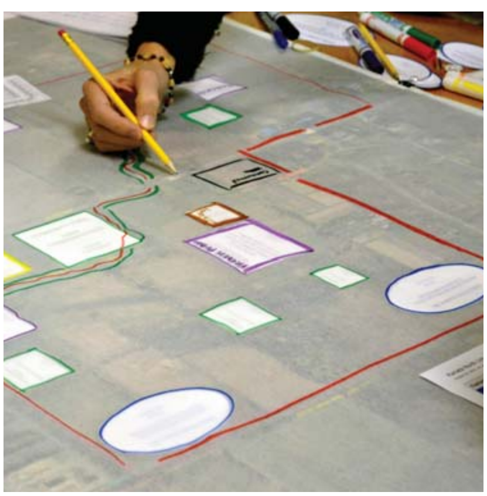
PLANB1.DWG - 1000mmx707mm

KANATA NORTH
COMMUNITY DESIGN PLAN

MASTER SERVICING STUDY **REPORT**



FINAL
JUNE 28, 2016

Ottawa

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7.4 Water Servicing Alternatives and Evaluation

Stantec Consulting was retained to analyze the regional-level impact to the water distribution system associated with development of the Kanata North Urban Expansion Area. Their analysis and findings are presented subsequently. Stantec's '*Kanata North Urban Expansion Potable Water Assessment Report'* is contained in **Appendix D** for reference.

Topographical contours and a preliminary collector road system were provided for Stantec's use in their analysis. Land use areas and estimated populations were also provided as shown in **Table 7.4**.

Table 7.4: Land Use and Estimated Populations

	Area (ha)	Units*	Population**
Schools	11.12		
Creek Corridor	12.22		
SWM Blocks	4.08		
Parks	10.65		
Commercial - Mixed Use	15.91		
Park and Ride	2.54		
Misc. Ex. Lands (School)	5.70		
Fire Hall	0.83		
Residential	80.10		
Singles	64.14	1056	3590
Street Townhouse		1045	2822
Multi-Unit Residential	15.96	1144	2574
Roads	40.21		
Total	**183.36**	**3339**	**8986**

* Based on May 13, 2016 Novatech Memo (included in **Appendix C-6**) + 10%
** Population calculated based on the following:
Singles = 3.4 persons per unit
Street Townhouse = 2.7 persons per unit
Multi-Unit Residential = 50% Towns @ 2.7 persons per unit & 50% Apartments @ 1.8 persons per unit

The projected water demands as provided in the Stantec report are shown in **Table 7.5** below.

Table 7.5: Projected Water Demands

Condition	Demand (L/s)	Min/Max Allowable Operating Pressures (psi)	Limits of Design Operating Pressures (psi)
Average Day	39.0	80psi (Max)	48-87
Max Day	52.0	40psi (Min)	44-80
Peak Hour	89.3	40psi (Min)	40-87*
Max Day + Fire Flow	177.0	20psi (Min)	23-65**

*With the exception of Node N_KNUE22 which reached a minimum pressure of 39 psi in the peak hour scenario. The elevation assigned to this node in the model (93.9m) exceeded the node elevation that was identified as serviceable per the report (93.0m).

**With the exception of Node N_KNUE26 which is able to maintain a residual pressure of 16psi with an applied fireflow of 125L/s. This node is able to maintain the required residual pressure of 20psi with an applied fireflow of 115L/s. This node achieves a lower fireflow as a result of being on a dead end. As mentioned in the report, dead ends were used to show potential future service connections. In actual implementation these dead ends will have smaller watermains connected to them to provide looping which will increase the available fireflow.

There is a 24m elevation change between the northwest corner and southeast corner of the development. This grade change affects all potential water servicing alternatives. The site is adjacent to two existing water distribution pressure zones. The southeast boundary of the site is adjacent to Zone 2Ww and the Morgan's Grant Pressure Zone is to the southwest of the site. Figure 1-3, from the Stantec Report, shows the existing watermain infrastructure, the subject site and the pressure zone areas.

It is preferable to connect to the Zone 2Ww pressure zone since it is at comparable elevations to the subject property. This will allow for servicing of all of the development area to be within tolerable servicing limits. Pressure reducing valves would be required if the development were serviced from the Morgan's Grant Pressure Zone because of excessively high pressures within the watermain system for the majority of the development. A small area in the northeastern portion of the site, below the ridge at lower elevations, will require pressure reduction valves regardless of which pressure zone is chosen to service the development.

Therefore, the preferred servicing alternative is to service the development through connection to the Zone 2Ww pressure distribution zone.

It is proposed to extend the existing 406mm diameter watermain along March Road north to service the development. A secondary connection to the existing watermain along Old Carp Road at Halton or at Celtic Ridge can be made with a 305mm diameter watermain to provide redundancy in the system. Figure 2-1, from the Stantec Report, shows the preliminary proposed watermain system and connection points to the existing system.

Refer to **Figure 7.1** for proposed onsite watermain infrastructure. Detailed watermain drawings (112117-WM1 and 112117-WM2) are included in **Appendix D.** There are some watermain crossings proposed under Tributaries 2 and 3. The proposed trenches for these crossings will be in rock and will require a clay cap to prevent surface water in the tributaries from migrating into the underlying trenches. Details of the proposed crossings will be provided at detailed design.

Based on the modelling completed by Stantec, the following recommendations were made:

- The Kanata North Urban Expansion should be serviced entirely from the Zone 2Ww pressure zone due to topography and location.

- Site grading should not exceed 93m to maintain minimum pressures greater than 40 psi.

- Services installed in areas where the grade is less than 74m will need pressure reducing valves to keep the maximum pressure below 80 psi.

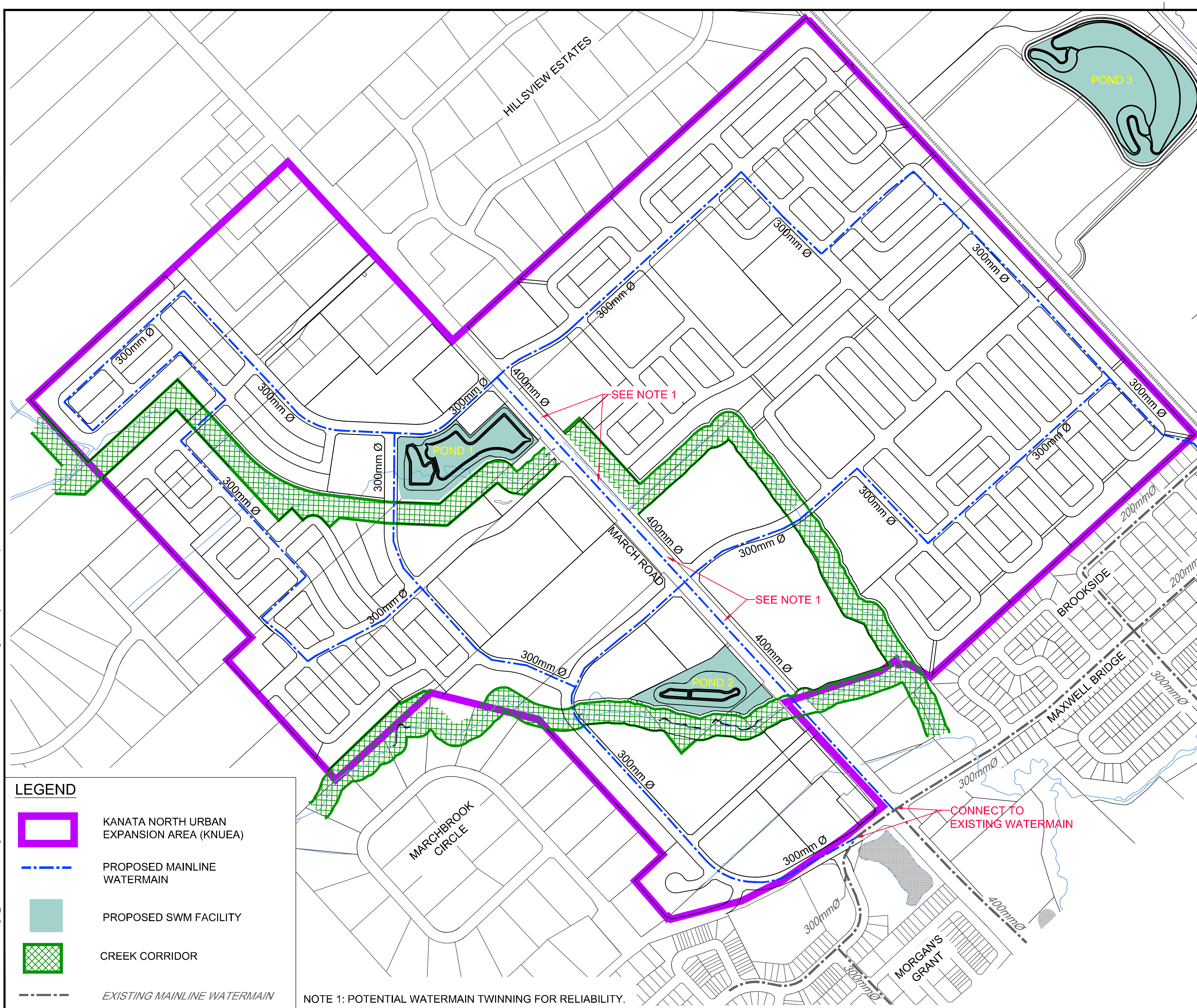
- To improve minimum pressures, two sections of off-site 406mm diameter watermain could be upgraded to reduce headloss from full buildout demands. In particular the upgrade along March Road and Solandt Drive would be required prior to any development within the KNUEA above the 93m elevation.

- A secondary connection from Old Carp Road is the preferred secondary connection over the Celtic Ridge connection. However, either connection will adequately service the development.

It should be noted that it is not anticipated that site grading within the KNUEA will be above the 93m elevation. Therefore, the two existing sections along March Road and Solandt Drive do not require upgrading to service the KNUEA. Also, in the ultimate, full build out scenario, both secondary connections should be completed.

The staging of development is unknown at this time. The City has agreed that a maximum of 200 units can be constructed and serviced with the single watermain connection along March Road. Once more than 200 units have been constructed a secondary connection is required for system reliability. This secondary connection can either be at the Old Carp Road location, the Celtic Ridge location or a second watermain within the March Road ROW (in the interim). Internal looping will also be required as development progresses. This will be reviewed at the subdivision stage on a case by case basis.

The on-site servicing was evaluated in order to confirm the preferred servicing alternative and to understand the impacts of the servicing scenario and provide any mitigation required. On-site servicing was determined based on factors such as optimum routing to the outlet/connection points, minimizing creek crossings, avoiding crossing conflicts with other



LEGEND

KANATA NORTH URBAN EXPANSION AREA (KNUEA)

PROPOSED MAINLINE WATERMAIN

PROPOSED SWM FACILITY

CREEK CORRIDOR

EXISTING MAINLINE WATERMAIN

NOTE 1: POTENTIAL WATERMAIN TWINNING FOR RELIABILITY.

KANATA NORTH
COMMUNITY DESIGN PLAN

FIGURE NO. 7.1
PROPOSED WATERMAIN INFRASTRUCTURE

DATE	JOB
MAY 2016	112117

SCALE
N.T.S.

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Appendix B SANITARY SEWER CALCULATIONS

B.1 CONCEPTUAL SANITARY SEWER DESIGN SHEET

Stantec

SUBDIVISION:

BRIGIL KANATA NORTH

DATE: 8/17/2020
REVISION: 1
DESIGNED BY: WAJ
CHECKED BY: AMP

SANITARY SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 160401347

DESIGN PARAMETERS

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	280 L/p/day	MINIMUM VELOCITY	0.60 m/s
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	28,000 L/ha/day	MAXIMUM VELOCITY	3.00 m/s
PEAKING FACTOR (INDUSTRIAL):	2.4	INDUSTRIAL (HEAVY)	55,000 L/ha/day	MANNINGS n	0.013
PEAKING FACTOR (ICI >20%):	1.5	INDUSTRIAL (LIGHT)	35,000 L/ha/day	BEDDING CLASS	B
PERSONS / SINGLE	3.4	INSTITUTIONAL	28,000 L/ha/day	MINIMUM COVER	2.50 m
PERSONS / TOWNHOME	2.7	INFILTRATION	0.33 L/s/ha	HARMON CORRECTION FACTOR	0.8
PERSONS / APARTMENT	1.8				

LOCATION			RESIDENTIAL AREA AND POPULATION									COMMERCIAL		INDUSTRIAL (L)		INDUSTRIAL (H)		INSTITUTIONAL		GREEN / UNUSED		C+I+I	INFILTRATION			TOTAL	PIPE								
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (ha)	UNITS SINGLE	UNITS TOWN	UNITS APT	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (L/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (L/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	FLOW (L/s)	LENGTH (m)	DIA (mm)	MATERIAL	CLASS	SLOPE (%)	CAP. (FULL) (l/s)	CAP. V PEAK FLOW (%)	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
Northern Outlet to March Road																																			
R9A	9	8	1.83	0	33	0	89	1.83	89	3.61	1.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	1.83	1.83	0.6	1.6	86.1	200	PVC	SDR 35	1.50	41.0	**4.0%**	1.29	0.53
	8	7	0.00	0	0	0	0	1.83	89	3.61	1.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	1.83	0.6	1.6	45.0	200	PVC	SDR 35	1.50	41.0	**4.0%**	1.29	0.53
	7	6	0.00	0	0	0	0	1.83	89	3.61	1.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	1.83	0.6	1.6	148.5	200	PVC	SDR 35	1.50	41.0	**4.0%**	1.29	0.53
R6A	6	5	6.35	0	300	300	1350	8.18	1439	3.15	14.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	6.35	8.18	2.7	17.4	41.4	200	PVC	SDR 35	0.70	28.0	**62.2%**	0.88	0.81
	5	4	0.00	0	0	0	0	8.18	1439	3.15	14.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	8.18	2.7	17.4	45.9	200	PVC	SDR 35	0.70	28.0	**62.2%**	0.88	0.81
	4	3	0.00	0	0	0	0	8.18	1439	3.15	14.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	8.18	2.7	17.4	33.6	200	PVC	SDR 35	0.65	27.0	**64.6%**	0.85	0.78
	3	2	0.00	0	0	0	0	8.18	1439	3.15	14.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	8.18	2.7	17.4	34.6	200	PVC	SDR 35	0.65	27.0	**64.6%**	0.85	0.78
	2	1	0.00	0	0	0	0	8.18	1439	3.15	14.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	8.18	2.7	17.4	109.6	250	PVC	SDR 35	0.60	47.0	**37.1%**	0.95	0.74
																										+8.7 L/s		250							
Southern Outlet to March Road																																			
R14A	14	12	0.40	4	0	0	14	0.40	14	3.72	0.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.40	0.40	0.1	0.3	68.1	200	PVC	SDR 35	1.00	33.4	**0.9%**	1.05	0.28
R16A	16	15	2.03	11	112	112	541	2.03	541	3.36	5.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	2.03	2.03	0.7	6.6	156.9	200	PVC	SDR 35	0.40	21.1	**31.1%**	0.67	0.49
R15A	15	12	2.01	8	168	168	783	4.04	1325	3.17	13.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	2.01	4.04	1.3	15.0	143.4	200	PVC	SDR 35	0.40	21.1	**70.7%**	0.67	0.63
R17A	17	12	0.74	5	0	0	17	0.74	17	3.71	0.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.74	0.74	0.2	0.4	69.8	200	PVC	SDR 35	0.50	23.6	**1.9%**	0.74	0.24
R12A, I12	12	11	1.27	0	160	160	720	6.45	2075	3.06	20.6	0.00	0.00	0.00	0.00	0.00	0.00	2.06	2.06	0.00	0.00	1.0	3.33	8.51	2.8	24.4	172.7	250	PVC	SDR 35	0.90	57.5	**42.4%**	1.16	0.94
R11A, C11B, C11C	11	10	1.35	0	160	160	720	7.80	2795	2.97	26.9	0.61	0.61	0.00	0.00	0.00	0.00	0.00	2.06	0.00	0.00	1.3	1.96	10.47	3.5	31.7	132.8	250	PVC	SDR 35	0.90	57.5	**55.1%**	1.16	1.02
External Areas to be serviced through future Old Carp Road Extension - Included for KNMSS Peak Flow Comparison																												250							
R-EXT1, R-EXT2			1.48	7	45	38	214	1.48	214	3.51	2.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	1.48	1.48	0.5	2.9	132.8	250	PVC	SDR 35	0.90	57.5	**5.1%**	1.16	0.51

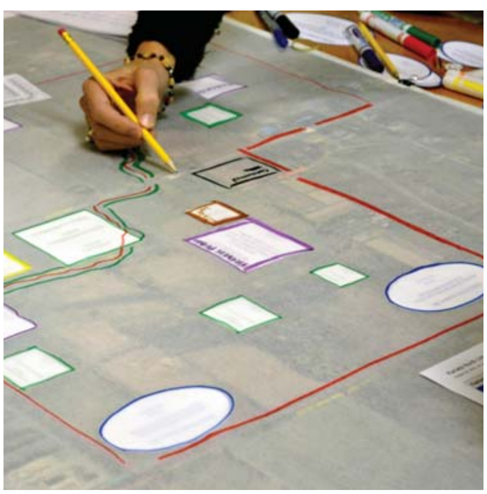
+9.1 L/s
17.8 L/s

Notes:
1. As per KNMSS, 8.7L/s were assumed from the site to the northern outlet to March Road (Areas W-10 and W-11, 1.08ha commercial , 390 persons, 71.6 units/net ha, 50% at 2.7p/unit and 50% at 1.8p/unit)
2. As per KNMSS, 25.3L/s were assumed from the site to the southern outlet to March Road (Area W-12, 1350 persons, 71.6 units/net ha, 50% at 2.7p/unit and 50% at 1.8p/unit, 2.01ha institutional)
3. Future external areas (R-EXT-1 and R-EXT2) to be serviced through the future Old Carp River Expansion have been added only for comparison to KNMSS peak flows since they are part of KNMSS area W-12
4. Area R-EXT1 is zoned Mixed-Use and will be developed by others and was assumed as high density as per KNMSS (71.6 units/net ha, 50% townhomes at 2.7p/unit and 50% apartments at 1.8p/unit)
5. Area R-EXT-2 is zoned Residential-Street Oriented and will be developed by others and was assumed as low density as per KNMSS (16.6 singles/net ha * 3.4pers/unit + 16.5 Towns/net ha * 2.7pers/unit)
6. The park area was not included in the infiltration calculations in the KNMSS, but it has been included here
7. Area I12 corresponds to a future school block (by others) which will be serviced through the proposed local street and southern outlet to March Road and as such, it has been included in the proposed sanitary sewer sizing
8. Based on the sanitary design sheet provided in the KNMSS, there is 18L/s residual capacity in the downstream sewers.
9. Areas C11B and C11C are future commercial blocks (by others) and have been included in the proposed sanitary sizing of the local street sewer. However, these areas were part of a different drainage area in the KNMSS (MR-3), and as such the peak flow contribution from these areas has not been taken into account when comparing the proposed peak flow exceedances to the residual capacity of the downstream sewers

B.2 SANITARY DESIGN BACKGROUND REPORT EXCERPTS AND CORRESPONDENCE

KANATA NORTH
COMMUNITY DESIGN PLAN

MASTER SERVICING STUDY **REPORT**



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JUNE 28, 2016

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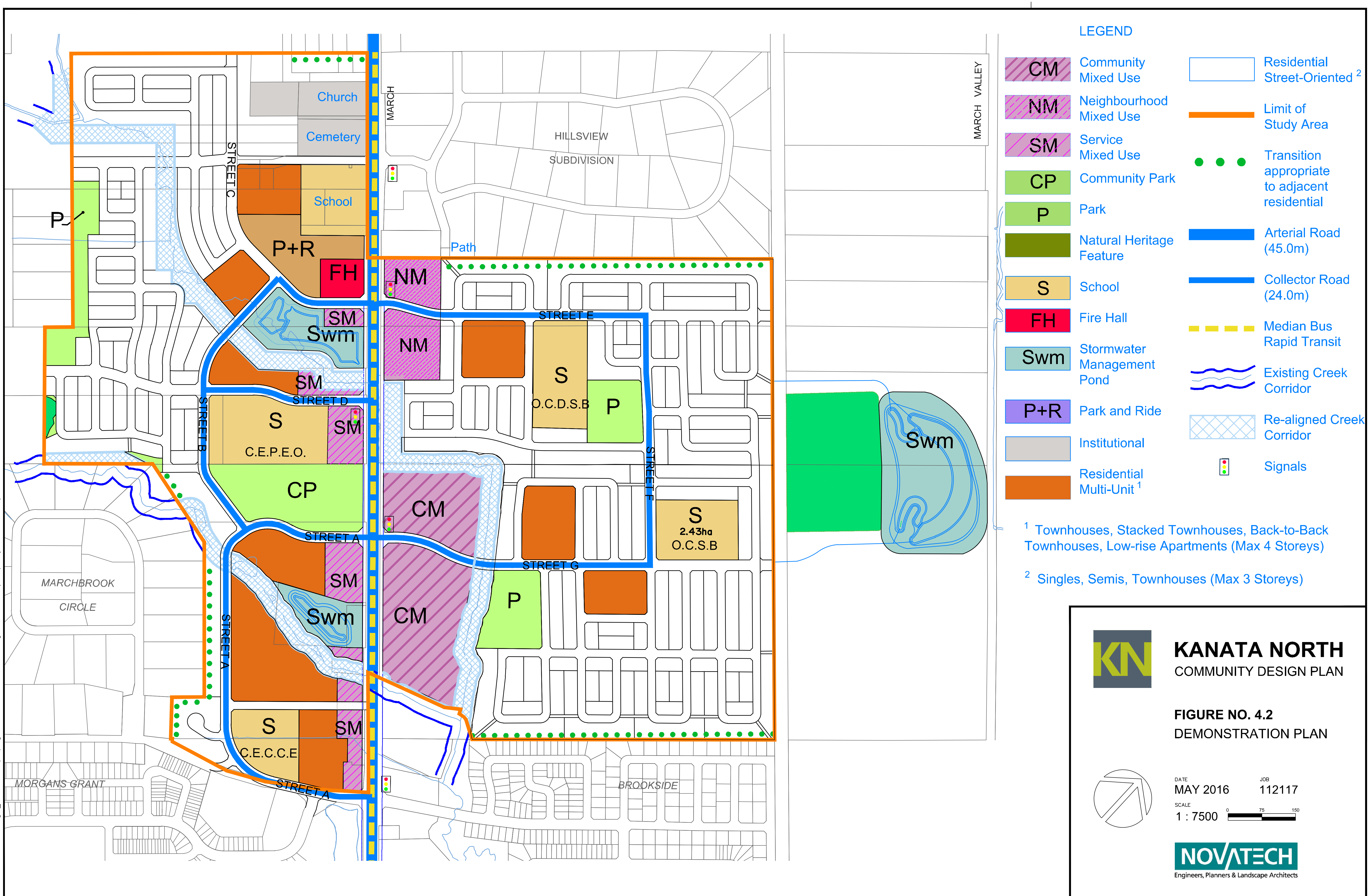


M:\2012\112117\CAD\Design_EMP\MEMO (CS)\Figure 9.1 Demonstration Plan.dwg, DEMO PLAN (MSS), May 26, 2016 - 3:56pm, tbrooks

6.5 Wastewater Servicing Options

Six off-site sanitary servicing alternatives were developed and are summarized below. A figure illustrating each option is also attached for reference. The existing topography within the subject property shows a ridge that runs north-south through the eastern side of the property. This ridge is a natural drainage boundary as indicated in some of the servicing scenarios. These servicing alternatives and a preliminary evaluation were included in a technical memorandum and presented to the Master Servicing Study Technical Advisory Committee for their review. A copy of this technical memorandum and subsequent City comments are provided in **Appendix C-5** for reference.

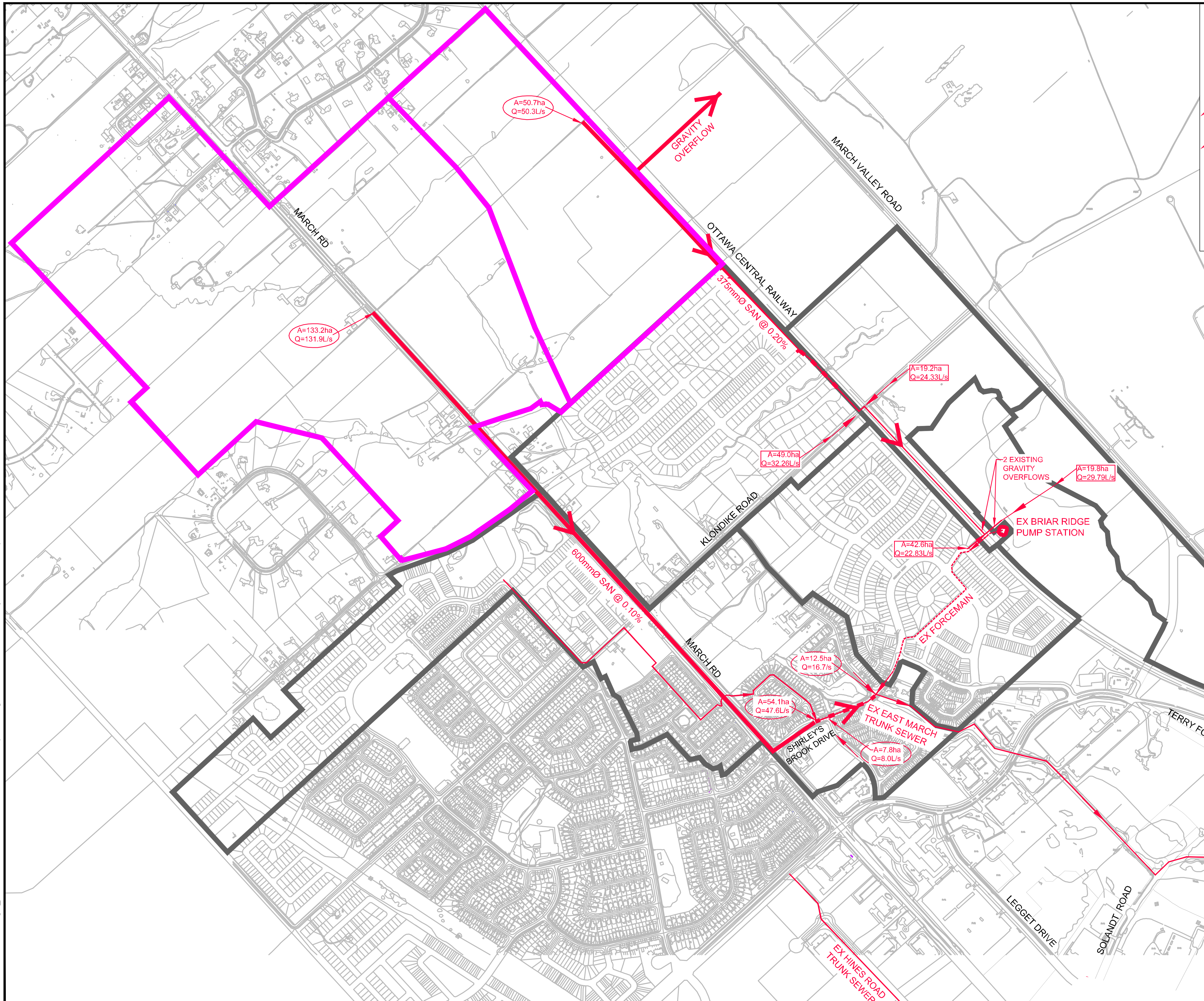
Option 1
The area west of March Road and west of the ridge will be serviced by a new gravity sanitary sewer along March Road to Shirley's Brook Drive. The area east of the ridge will drain by gravity to a small pump station (50L/s) and a forcemain will carry the pumped sewage to the proposed sanitary sewer on March Road. A gravity overflow from the new pump station is proposed to outlet to the proposed Stormwater Management Facility east of the existing rail corridor.

This servicing option will require upgrading an existing 375mm diameter sanitary sewer along Shirley's Brook Drive to a 600mm diameter to be able to accommodate the increased flows and the existing sewer will be lowered to provide a lower outlet elevation. This servicing option is shown on **Figure 6.5.1.**

Option 2
The area west of March Road and west of the ridge will be serviced by a new gravity sanitary sewer along March Road to Shirley's Brook Drive. The area east of the ridge will drain by gravity to the existing 375mm diameter sanitary sewer along the rail corridor by the eastern property limit. This existing sanitary sewer outlet is to the Briar Ridge Pump Station (BRPS).

This servicing option will require upgrading an existing 375mm diameter sanitary sewer along Shirley's Brook Drive to a 600mm diameter to be able to accommodate the increased flows and provide a lower outlet elevation. Upgrades will also be required to existing infrastructure along the rail corridor. A section of the existing 375mm diameter sanitary sewer will be replaced with 450mm diameter sewer. The BRPS can accommodate the flow from the Kanata North Urban Expansion Area (50L/s) within the ultimate design capacity of the station (183L/s). This servicing option is shown on **Figure 6.5.2.**

Option 3
This option proposes that the development outlet to the sanitary sewer along the existing rail corridor. A substantial amount of the existing sanitary sewer along the rail corridor would require upgrading or replacing to service the development. A 525mm diameter sanitary sewer would be installed to replace the existing 375mm and 450mm diameter sewers along the rail corridor. The BRPS will also require upgrading to service the development by expanding the original ultimate design capacity of the BRPS from 183L/s to a firm capacity of 256L/s. The existing 200mm and 300mm diameter forcemains from the BRPS to the EMT will also require adding an additional 300mm diameter forcemain. This servicing option is shown on **Figure 6.5.3.**



M:\2012\112117\CAD\Design_MSS\FIGURES\FIGURE 6.5.1 - 6.5.5 SAN Options.dwg, FIG 6.5.2 SAN OPT 2, May 16, 2016 - 3:22pm, mhrehoriak

KANATA NORTH
COMMUNITY DESIGN PLAN

FIGURE NO. 6.5.2
WASTEWATER SERVICING OPTION #2

DATE
MAY 2016

JOB
112117

SCALE
N.T.S.

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6.6 Detailed Wastewater Servicing Evaluation

6.6.1 Onsite Servicing

6.6.1.1 Design Criteria

The proposed development will be serviced by a gravity sanitary sewer network within the road right-of-ways. A proposed trunk sanitary sewer (preferred wastewater Option 2) and associated drainage areas are shown on **Figure 6.6.1.1** and in more detail in the Onsite & Offsite Sanitary Drainage Area Plans (112117-SAN1 & 112117-SAN2.) for the KNUEA. Sanitary sewers, for the proposed development, are designed based on criteria established in Section 4.0 of the *City of Ottawa Sewer Design Guidelines* (October 2012) and are summarized as follows:

Commercial/Institutional flows = 50,000 L/ha/day
Industrial flows = 35,000 L/ha/day
Population Flow = 350 L/capita/day
Infiltration = 0.28 L/s/ha
Single Family Home = 3.4 persons per unit
Townhouse = 2.7 persons per unit
Apartment = 1.8 persons per unit
Maximum Residential Peak Factor = 4.0
Commercial/Institutional Peak Factor = 1.5
Industrial Peak Factor = per MOE/City of Ottawa graph (included in **Appendix C-6**)
Minimum velocity = 0.6m/s
Manning's n = 0.013

6.6.1.2 Probable Wastewater Flow

Based on the land uses proposed in the Demonstration Plan (**Figure 4.2**) the following flow rates were calculated. Detailed flow calculations are included in **Appendix C-6**.

Table 6.6.1 – Land Use and Probable Flow

	Area (ha)	Units*	Population**	Population Flow (L/s)	Peak Factor	Infiltration (L/s)	Total Sanitary Flow (L/s)
Schools	11.12			9.7	1.5	3.1	12.8
Creek Corridor	12.22			0.0	0.0	0.0	0.0
SWM Blocks	4.08			0.0	0.0	0.0	0.0
Parks	10.65			0.0	0.0	0.0	0.0
Commercial - Mixed Use	15.91			13.8	1.5	4.5	18.3
Park and Ride	2.54			0.0	0.0	0.7	0.7
Misc. Ex. Lands (School)	5.70			4.9	1.5	1.6	6.5
Fire Hall	0.83			0.7	1.5	0.2	1.0
Residential	80.10					22.4	22.4
Singles	64.14	1056	3590	43.6	3.0	0.0	0.0
Street Townhouse		1045	2822	34.3	3.0	0.0	0.0
Multi-Unit Residential	15.96	1144	2574	31.3	3.0	0.0	0.0
Roads	40.21			0.0	0.0	11.3	11.3
Total	**183.36**	**3339**	**8986**	**138.4**		**43.8**	**182.2**

* Based on May 13, 2016 Novatech Memo (included in **Appendix C-6**) + 10%
** Population calculated based on the following:
Singles = 3.4 persons per unit
Street Townhouse = 2.7 persons per unit
Multi-Unit Residential = 50% Towns @ 2.7 persons per unit & 50% Apartments @ 1.8 persons per unit

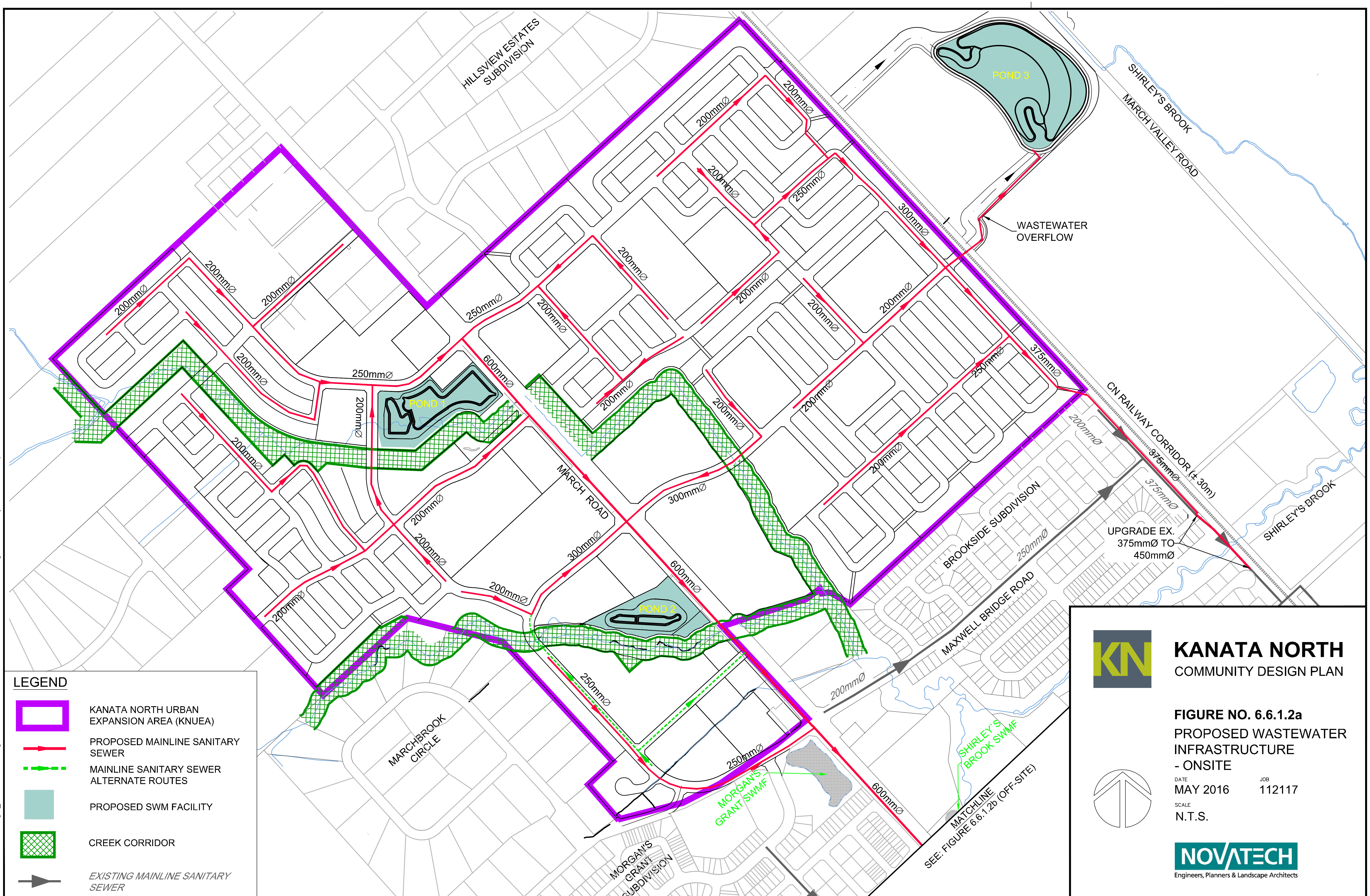
For the purpose of this analysis and evaluation, a trunk wastewater sewer network was established within the proposed road network as shown on the Demonstration Plan. The purpose is to demonstrate the feasibility of servicing the property using the Demonstration Plan. It is expected that refinements to the design of the trunk storm sewer system will be made as plans of subdivision are developed. For example there is an option of servicing a portion of the KNUEA in the northwest corner from a sewer along March Road as opposed to through the KNUEA lands. A cost benefit analysis could be completed during the detail design to determine the preferable option to service this area.

One of the constraints for wastewater servicing is the existing tributaries to Shirleyǒs Brook. The wastewater sewer network was designed to minimize crossings of the wastewater sewer with these tributaries. However, some tributary crossings are proposed. The proposed crossings will be in rock and will require a clay cap to prevent surface water in the tributaries from migrating into the underlying trenches. Details of the proposed crossings will be provided at the detailed design stage.

Another site constraint was the depth to bedrock. Where possible, the trunk wastewater sewer network was design to reduce rock removal. A review was also conducted of the proposed sanitary trunk sewer network with respect to other proposed trunk networks such as storm sewer and watermain to avoid sewer conflicts. The trunk sewer network for the proposed development is shown on **Figure 6.6.1.2a** and the off-site sewers are shown on **Figure 6.6.1.2b**. The detailed drainage areas are shown on the attached Onsite Sanitary Drainage Area Plan (112117-SAN1) included in **Appendix C-6**.

6.6.1.3 On-Site Servicing Evaluation

As indicated previously, a trunk wastewater sewer network was established. This servicing design was determined based on factors such as optimum routing to the outlet/connection point, minimizing creek crossings, avoiding crossing conflicts with other sewers/watermain, minimizing rock removal and following the right-of-way layout on the preferred demonstration plan. The following criteria were used to evaluate the infrastructure servicing concept.



M:\2012\112117\CAD\Design_MSS\FIGURES\Figure 6.6.1.2 -PROP WASTEWATER INFRASTRUCTUE.dwg, 6.6.1.2a, May 18, 2016 - 1:26pm, mhrehoriak

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6.6.3 Hydraulic Grade Line Analysis

A Hydraulic Grade Line (HGL) analysis should be performed on wastewater trunk sewers to determine if surcharged conditions may be present. If the HGL is analysed and determined to be above the obvert of the sanitary sewers then measures such as overflows may be required to protect buildings/basements. These measures may include establishing minimum underside of footing elevations for all proposed buildings to be above the HGL, per City Design Guidelines. In addition, sanitary sewer overflows may be provided to allow relief of the system prior to potential flooding of basements.

Based on the information provided by the City with respect to the EMT and any future trunk sewer works (i.e., NKT Phase 2 works) it is assumed that there are free flow conditions within the EMT and MPS. As such, no HGL analysis was performed on the EMT.

An HGL analysis is required to be completed on the BRPS to ensure that, when the future lands are added to the system, there are no negative impacts to the existing developments. The existing BRPS has two existing overflow outlets to provide relief to the system in the event of failure. With the additional flows generated by the KNUEA, an additional overflow outlet would be required to minimize any negative impacts on the existing subdivision.

The HGL in the Trunk sewer, along the existing rail corridor to the BRPS, was analysed using Autodesk Storm and Sanitary Analysis (SSA). This model was used to determine the elevation and location of an additional sanitary overflow. Based on *City of Ottawa Sewer Design Guidelines*, the overflow must outlet to a Stormwater Management Facility, and be located 0.5m above the 100 year water level. This is to ensure that the overflow outlet is able to operate under free flow conditions during major storm events. A flow monitoring system will be required on the wastewater overflow to the SWM Facility to alert City staff if a wastewater overflow occurs. This system will need to be specified during the detailed design phase of the wastewater and SWM Facility.

The HGL is governed by the overflow elevation provided. The BRPS contains a primary over flow at an elevation of 67.29. The design of the Brookside subdivision proposed a secondary overflow at an invert elevation of 67.30. The resultant HGL for the sanitary sewer upstream of this secondary overflow is 67.44. This is the starting point for the HGL model. Four scenarios were modelled and summarized in an email to City Staff. A copy of the email and a plan and profile drawing showing the hydraulic grade lines for the scenarios is included in **Appendix C-7**. The scenarios evaluated are as follows:

Scenario #1 ï Original HGL resulting from the development of the Brookside Subdivision.

Scenario #2 ï KNUEA flow of 52 L/s added to original HGL resulting from development of the Brookside Subdivision

Scenario #3 ï KNUEA flow of 52L/s added to original HGL resulting from development of Brookside Subdivision and upgraded trunk sewers downstream (approx. 900m of ex 375mm and 450mm upgraded to 600mm)

Scenario #4 ï KNUEA flow of 52 L/s added to original HGL resulting from the development of the Brookside Subdivision with proposed tertiary (third) overflow to the proposed KNUEA SWM pond. Elevation of overflow is 67.50 and resultant HGL is 67.67

6.6.4 Sensitivity Analysis

A sensitivity analysis is conducted to test the sensitivity of the wastewater network which incorporates a variance in the design conditions, and evaluates the system response. This provides an understanding of how the network would be affected should the land use density increase appreciably. The wastewater collection network was tested by adjusting two of the key design parameters. In the first test, the proposed population flow increases from 350 L/s to 450 L/s which is an increase of 28.5%. The second test increases the infiltration rate from 0.28 L/s/ha to 0.5 L/s/ha which is an increase of 78.6%. All other design conditions remain fixed, including existing monitored flows. The results of the sensitivity analysis are summarized in **Table 6.6.4** with details provided in **Appendix C-8**.

Table 6.6.4: Wastewater Sensitivity Analysis

Sewer Reach					**Results**		
Location	**From Node**	**To Node**	**Nominal Pipe Size (mm)**	**Free-Flow Capacity (L/s)**	**Design Condition**	**Flow (L/s)**	**Q/Qcap (%)**
March Road Trunk (Above ridge)	MR-3	MH 186	600	202.4	Standard Design	138.3	68
					Scenario 1 Q_{pop}=450L/s	160.7	79
					Scenario 2 Q_{Inf}=0.50L/s/ha	164.6	81
Shirleyô s Brooke Drive	MH 186	EX MH 1	600	202.4	Standard Design	184.4	91
					Scenario 1 Q_{pop}=450L/s	205.3	101
					Scenario 2 Q_{Inf}=0.50L/s/ha	210.6	104
Rail Corridor Trunk (Below Ridge)	E-9	MH 209	375	85.7	Standard Design	66.5	78
					Scenario 1 Q_{pop}=450L/s	80.7	94
					Scenario 2 Q_{Inf}=0.50L/s/ha	78.1	91
BRPS Trunk	MH 209	PS	450	132.9 to 197.2	Standard Design	178.1	73 - 99
					Scenario 1 Q_{pop}=450L/s	190.6	83 -106
					Scenario 2 Q_{Inf}=0.50L/s/ha	198.6	82 -109

The conclusion from this analysis is that the wastewater system has been designed with an appropriate amount of residual capacity to permit land use flexibility and to safeguard the community should flow rates temporarily exceed expected values. This design approach permits a moderate degree of intensification within the KNUEA. In similar fashion, minor adjustments to the land use plan are readily accommodated.

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M E M O R A N D U M

DATE: MAY 13, 2016

TO: KANATA NORTH LANDOWNERS' GROUP

FROM: MURRAY CHOWN

RE: PRELIMINARY DEMONSTRATION PLAN A-26 – UNIT COUNTS AND DENSITIES

PROJECT NO.: 112117-0

CC: LEE SHEETS, CARA RUDDLE, ALEX MCAULEY

The following discussion of unit counts and densities is based on Preliminary Demonstration Plan A-26, dated May 12, 2016. The total ñnetò residential area for this demonstration plan is 80.10 ha. Given the Official Plan requirement to achieve a minimum average residential density of 34 uph, the demonstration plan must accommodate a minimum of 2,725 dwelling units.

Subject to the assumptions discussed below, the total number of units that could develop under Preliminary Demonstration Plan A-26 is 2,950 dwelling units for an average residential density of 36.8 uph. The potential distribution of total units by unit type is as follows:

- 1,040 Multi-Unit Residential;
- 960 single family units;
- 950 street townhouses;

Saleable street frontage has been split between singles and townhouses so as to provide roughly 50% singles and 50% townhouses. This is reasonable reflection of the market preference between these two forms of housing.

With this distribution of units, 960 single family units represent just over 32% of the total of 2,950 units. This does not meet the Official Plan requirement to accommodate a minimum of 45% singles. 960 single family units represent just over 35% of the minimum of 2,725 dwelling units. (1,225 single family units would represent 45% of 2,725 units.)

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A minimum of 295 ñapartmentsò will be required to meet the minimum Official Plan requirement of 10% of total units. If 30% of the potential ñMulti-Unit Residentialò units are constructed as ñapartmentsò this requirement will be met.

Multi-Unit Residential:

The density of the Foxwoods (EQ Homes) in Kanata is 49 uph. The density of Klondike Crossing (Minto) is 63 uph. The density of Fairwinds West (Mattamy) is 77 uph. The density of Heritage Hills (Birgil) is 164 uph. For the purposes of this memo, an average density of 65 uph was assumed for the 15.96 ha. of Multi-Unit Residential land for a total of approximately 1040 dwelling units.

Note that as the average density for ñMulti-Unit Residentialò units goes up, the total number of units in the development will increase, requiring a proportional increase in the number of single family dwellings to respect current Official Plan polices (45% singles).

Single Family Units:

Demonstration Plan A-19 provides a total of approximately 59,350 feet of saleable street frontage. Assuming an average lot width of 40 feet for single family dwellings, 960 singles would take up 38,400 feet of available saleable street frontage.

Street Townhouses:

Assuming an average lot width of 22 feet for street townhouses, 950 street townhouses would take up 20,950 of the saleable street frontage.

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KANATA NORTH URBAN EXPANSION AREA
COMMUNITY DESIGN PLAN

TABLE C-6b:
SANITARY SEWER DESIGN SHEET

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LOCATION				RESIDENTIAL AREA AND POPULATION										ICI								INFILTRATION				FLOW	PIPE					
									Cumulative					IND			COMM		INST													
Street	From	To	Total	Dwellings		Density (Net ha)		Pop.	Residential			Peak	Peak	Area	Accu.	Peak	Area	Accu.	Area	Accu.	Peak	Total	Accu. Area		Infiltration	Total	Dia	Dia	Slope	Velocity	Capacity	Ratio
	Node	Node	Area	SFH	SD/TH	Low[3]	High[4]		Area	Pop.		Factor	Flow		Area	Factor		Area		Area	Flow	Area	New	Exist	Flow	Flow	Act	Nom		(Full)	(Full)	Q/Qfull
			(ha)	3.4	2.7	101	161		(ha)	New	Exist		(l/s)	(ha)	(ha)		(ha)	(ha)	(ha)	(ha)	(l/s)	(ha)	(ha)		(l/s)	(l/s)	(mm)	(mm)	(%)	(m/s)	(l/s)	(%)
				pers/ea	pers/ea	pers/ha	per/ha																									
EAST KNCDP																																
E-1	E-1	E-3	4.47			3.00		303.0	3.00	**303**		4.00	4.9								0.0	4.47	4.47		1.3	6.2	203	200	0.40	0.67	21.6	28%
E-2	E-2	E-3	5.91			4.29		433.3	7.29	**736**		3.88	11.6								0.0	5.91	10.38		2.9	14.5	203	200	0.35	0.62	20.2	72%
E-3	E-3	E-6	9.42			6.51		657.5	13.80	**1394**		3.70	20.9								0.0	9.42	19.80		5.5	26.4	254	250	0.40	0.77	39.2	67%
E-4	E-4	E-5	6.89			3.12	1.36	534.1	3.12	**534**		3.96	8.6								0.0	6.89	6.89		1.9	10.5	203	200	1.00	1.05	34.2	31%
E-5	E-5	E-9	4.70			1.46		147.5	4.58	**682**		3.90	10.8						**2.29**	2.29	2.0	4.70	11.59		3.2	16.0	203	200	0.35	0.62	20.2	79%
E-6	E-6	E-9	3.28			2.32		234.3	16.12	**1628**		3.65	24.1								0.0	3.28	23.08		6.5	30.6	305	300	0.25	0.69	50.4	61%
E-7	E-7	E-8	10.04			7.21		728.2	7.21	**728**		3.88	11.5								0.0	10.04	10.04		2.8	14.3	203	200	0.40	0.67	21.6	66%
E-8	E-8	E-9	4.05			2.94		296.9	10.15	**1025**		3.79	15.8								0.0	4.05	14.09		3.9	19.7	254	250	0.30	0.67	33.9	58%
E-9	E-9	MH 209	3.98			3.06		309.1	33.91	**3644**		3.37	49.7							2.29	2.0	3.98	52.74		14.8	66.5	381	375	0.22	0.75	85.7	78%
Total Flows From East KNUEA			**52.74**					**3644**	**33.91**	**3644**		**3.37**	**49.7**							**2.29**	**1.99**		**52.74**		**14.77**	**66.49**						
*X-1 (Brookside Subdivision)**		MH 209	32.80					2216.1	26.04		2216	3.55	18.2				6.76	6.76			2.3	32.80		32.80	11.5	32.0						
				*Population from Novatech #103106 Sanitary Sewer Design Sheet																												
	MH 209	MH 208						0.0	59.95	**3644**	2216	3.18	63.3					6.76		2.29	7.9	0.00	**52.74**	32.80	26.2	97.4	457	450	0.20	0.81	132.9	73%
	MH 208	MH 207						0.0	59.95	**3644**	2216	3.18	63.3					6.76		2.29	7.9	0.00	**52.74**	32.80	26.2	97.4	457	450	0.20	0.81	132.9	73%
X-2 (Brookside Subdivision)	MH 207	MH 206	3.12		44			118.8	63.07	**3644**	2335	3.17	64.0					6.76		2.29	7.9	3.12	**52.74**	35.92	27.3	99.2	457	450	0.20	0.81	132.9	75%
X-3 (Brookside Subdivision)**	MH 206	MH 205	9.81		244			658.8	72.88	**3644**	2994	3.13	67.9					6.76		2.29	7.9	9.81	**52.74**	45.73	30.8	106.5	457	450	0.21	0.83	136.2	78%
				**244 TH units = 107 Units from Novatech #103106 Sanitary Sewer Design Sheet, plus future 137 units North of Klondike and West of Marconi (5.67ha @ 65pers/ha)																												
X-13 (Future Industrial Lands)	Future	MH 205	20.99											15.85	15.85	3.6					13.2	20.99	**20.99**		5.9	19.1						
Briar Ridge Pump Station Access Road	MH 205	MH 204							72.88	**3644**	2994	3.13	67.9		15.85	3.6		6.76		2.29	21.1	0.00	**73.73**	45.73	36.6	125.6	457	450	0.20	0.81	132.9	94%
Briar Ridge Pump Station Access Road	MH 204	MH 203							72.88	**3644**	2994	3.13	67.9		15.85	3.6		6.76		2.29	21.1	0.00	**73.73**	45.73	36.6	125.6	457	450	0.20	0.81	132.9	94%
Briar Ridge Pump Station Access Road	MH 203	MH 202							72.88	**3644**	2994	3.13	67.9		15.85	3.6		6.76		2.29	21.1	0.00	**73.73**	45.73	36.6	125.6	457	450	0.25	0.91	148.6	85%
Briar Ridge Pump Station Access Road	MH 202	MH 201A							72.88	**3644**	2994	3.13	67.9		15.85	3.6		6.76		2.29	21.1	0.00	**73.73**	45.73	36.6	125.6	457	450	0.26	0.92	151.6	83%
Briar Ridge Pump Station Access Road	MH 201A	MH 201							72.88	**3644**	2994	3.13	67.9		15.85	3.6		6.76		2.29	21.1	0.00	**73.73**	45.73	36.6	125.6	457	450	0.25	0.91	148.6	85%
Briar Ridge Pump Station Access Road	MH 201	MH 200							72.88	**3644**	2994	3.13	67.9		15.85	3.6		6.76		2.29	21.1	0.00	**73.73**	45.73	36.6	125.6	457	450	0.25	0.91	148.6	85%
Briar Ridge Pump Station Access Road	MH 200	EXMH1							72.88	**3644**	2994	3.13	67.9		15.85	3.6		6.76		2.29	21.1	0.00	**73.73**	45.73	36.6	125.6	457	450	0.23	0.87	142.5	88%
RIDDELL VILLAGE (X-4)***		EXMH1	42.42					3100			3100	3.43	24.6						2.96	2.96	1.0	42.42		42.42	14.8	40.5						
				***Population from Novatech #103106 Sanitary Sewer Design Sheet																												
	EXMH1	EXMH2							72.88	**3644**	6094	2.97	85.6		15.85	3.6		6.76		5.25	23.6	0.00	**73.73**	88.15	51.5	160.8	457	450	0.30	0.99	162.8	99%
	EXMH2	EXMH4							72.88	**3644**	6094	2.97	85.6		15.85	3.6		6.76		5.25	23.6	0.00	**73.73**	88.15	51.5	160.8	457	450	0.30	0.99	162.8	99%
X-14 (Future Industrial Lands east of Marshes Golf Course)	EXMH4	EXMH5	19.23						72.88	**3644**	6094	2.97	85.6	19.23	35.08	3.1		6.76		5.25	35.6	19.23	**92.96**	88.15	56.9	178.1	457	450	0.44	1.20	197.2	90%
	EXMH5	PS							72.88	**3644**	6094	2.97	85.6		35.08	3.1		6.76		5.25	35.6	0.00	**92.96**	88.15	56.9	178.1	457	450	0.40	1.14	188.0	95%
Briar Ridge Pump Station									72.88	**3644**	6094	2.97	85.6		35.08	3.1		6.76		5.25	35.6	0.00	**92.96**	88.15	56.9	178.1						
WEST KNUEA / MARCH ROAD																																
W-1	W-1	W-3	7.51			5.14		519.1	5.14	**519**		3.97	8.3								0.0	7.51	7.51		2.1	10.4	203	200	0.40	0.67	21.6	48%
													0.0																			
W-2	W-2	W-3	8.94			2.36		238.4	2.36	**238**		4.00	3.9						**4.32**	4.32	3.8	8.94	8.94		2.5	10.1	203	200	0.35	0.62	20.2	50%
													0.0																			
W-3	W-3	W-4	6.52			1.97	2.16	546.7	11.63	**1304**		3.72	19.7								0.0	6.52	22.97		6.4	26.1	254	250	0.70	1.02	51.9	50%
W-5	W-5	W-6	4.20			2.74		276.7	2.74	**277**		4.00	4.5								0.0	4.20	4.20		1.2	5.7	203	200	0.35	0.62	20.2	28%
W-6	W-6	W-8	4.29			3.04		307.0	5.78	**584**		3.94	9.3								0.0	4.29	8.49		2.4	11.7	203	200	0.35	0.62	20.2	58%
													0.0																			
W-7	W-7	W-8	7.39			4.24		428.2	4.24	**428**		4.00	6.9								0.0	7.39	7.39		2.1	9.0	203	200	1.60	1.33	43.2	21%
W-8	W-8	W-9	2.85			1.02	0.55	191.6	11.59	**1204**		3.75	18.3								0.0	2.85	18.73		5.2	23.5	254	250	0.35	0.72	36.7	64%
W-4	W-4	MR-1	3.10					0.0	23.22	**2508**		3.51	35.6				**0.35**	0.35	**0.83**	5.15	4.8	3.10	26.07		7.3	47.7	254	250	1.00	1.22	62.0	77%
													0.0																			
W-14	W-14	W-15	3.79			0.36		36.4	0.36	**36**		4.00	0.6						**2.89**	2.89	2.5	3.79	3.79		1.1	4.2	203	200	0.35	0.62	20.2	21%
W-15	W-15	W-17	3.17			2.20		222.2	2.56	**259**		4.00	4.2								0.0	3.17	6.96		1.9	6.1	203	200	0.35	0.62	20.2	30%

M:\2012\112117\DATA\Calculations\Sewer Calcs\SAN\SAN Design.xlsx

KANATA NORTH URBAN EXPANSION AREA
COMMUNITY DESIGN PLAN

TABLE C-6b:
SANITARY SEWER DESIGN SHEET

NOVATECH
Engineers, Planners & Landscape Architects

LOCATION				RESIDENTIAL AREA AND POPULATION										ICI								INFILTRATION				FLOW	PIPE					
									Cumulative					IND			COMM		INST													
Street	From Node	To Node	Total Area (ha)	Dwellings SFH 3.4	Dwellings SD/TH 2.7	Density (Net ha) Low[3] 101	Density (Net ha) High[4] 161	Pop.	Residential Area (ha)	Residential Pop. New	Residential Pop. Exist	Peak Factor	Peak Flow (l/s)	Area (ha)	Accu. Area (ha)	Peak Factor	Area (ha)	Accu. Area (ha)	Area (ha)	Accu. Area (ha)	Peak Flow (l/s)	Total Area (ha)	Accu. Area New (ha)	Accu. Area Exist	Infiltration Flow (l/s)	Total Flow (l/s)	Dia Act (mm)	Dia Nom (mm)	Slope (%)	Velocity (Full) (m/s)	Capacity (Full) (l/s)	Ratio Q/Qfull (%)
W-16	W-16	W-17	6.55			3.17	1.78	606.8	4.95	**607**		3.93	9.7								0.0	6.55	6.55		1.8	11.5	203	200	0.35	0.62	20.2	57%
W-17	W-17	MR-1	3.43					0.0	7.51	**865**		3.84	13.5				**3.05**	3.05		8.04	9.6	6.48	19.99		5.6	28.7	254	250	0.30	0.67	33.9	84%
MR-1 (MARCH ROAD)	MR-1	MR-2	1.36					0.0	30.73	**3373**		3.40	46.4					3.40		8.04	9.9	1.36	47.42		13.3	69.6	610	600	0.10	0.69	202.4	34%
W-9	W-9	MR-2	7.17				1.13	181.9	1.13	**182**		4.00	2.9				**1.38**	1.38	**3.77**	3.77	4.5	7.17	25.90		7.3	14.7	203	200	1.20	1.15	37.4	39%
MR-2 (MARCH ROAD)	MR-2	MR-3	1.37					0.0	33.23	**3555**		3.38	48.7					4.78		11.81	14.4	1.37	74.69		20.9	84.0	610	600	0.10	0.69	202.4	41%
W-10	W-10	W-11	1.53				0.78	125.6	0.78	**126**		4.00	2.0								0.0	1.53	1.53		0.4	2.5	203	200	0.70	0.88	28.6	9%
W-11	W-11	MR-3	3.55				1.64	264.0	2.42	**390**		4.00	6.3				**1.08**	1.08			0.9	3.55	5.08		1.4	8.7	203	200	0.70	0.88	28.6	30%
W-18	W-18	W-19	3.90			1.21	1.82	415.2	3.03	**415**		4.00	6.7								0.0	3.90	3.90		1.1	7.8	203	200	0.35	0.62	20.2	39%
W-19	W-19	MR-3	9.23					0.0	3.03	**415**		4.00	6.7				**8.83**	8.83			7.7	9.23	13.13		3.7	18.1	254	250	0.25	0.61	31.0	58%
MR-3 (MARCH ROAD)	MR-3	MR-4	4.74					0.0	38.68	**4360**		3.30	58.3				2.06	16.75		11.81	24.8	4.74	97.64		27.3	110.4	610	600	0.10	0.69	202.4	55%
W-12	W-12	X-12	11.62			2.24	6.98	1350.0	9.22	**1350**		3.71	20.3						**2.01**	2.01	1.7	11.62	11.62		3.3	25.3	254	250	0.30	0.67	33.9	75%
X-12 (BIDGOOD / HALTON TERRACE)	X-12	MR-4	3.54				0.79	127.2	10.01	**1477**		3.68	22.0								0.0	3.54	15.16		4.2	26.3	254	250	1.00	1.22	62.0	42%
X-5 (760 & 788 March Road)	X-5	MR-4	1.76				1.76	283.4	1.76	**283**		4.00	4.6								0.0	1.76	1.76		0.5	5.1						
MR-4 (MARCH ROAD)	MR-4	*MH 186*	4.71					0.0	50.45	**6120**		3.16	78.4					16.75		13.82	26.5	4.71	119.27		33.4	138.3	610	600	0.10	0.69	202.4	68%
*X-6 (750 March Road, Blue Heron Co-op Homes)*****	*X-6*	*X-8*	*1.29*		*83*			*224.1*	*1.29*		*224*	*4.00*	*2.1*								*0.0*	*1.29*		*1.29*	*0.5*	*2.5*						
			**** 83 units obtained from Co-op website (http://www.chaseo.ca/member/blue-heron-co-op/)																													
*X-7 (Morgans Grant) ******	*X-7*	*X-8*	*48.45*					*3188.0*	*49.74*		*3188*	*3.42*	*25.2*								*0.0*	*48.45*		*49.74*	*17.4*	*42.6*						
			***** Information obtained from JL Richards #24566, Sanitary Design Sheet, July 2012																													
X-8 (Inverary Drive)	*X-8*	*MH 186*	*4.31*	*39*	*49*			*264.9*	*54.05*		*3677*	*3.37*	*28.6*								*0.0*	*4.31*		*54.05*	*18.9*	*47.6*						
Shirley's Brooke Drive	*MH 186*	*MH 184*	*0.00*					*0.0*	*104.50*	**6120**	*3677*	*2.96*	*98.7*					*16.75*		*13.82*	*26.5*	*0.00*	*119.27*	*54.05*	*52.3*	*177.5*	610	600	0.10	0.69	202.4	88%
X-9 (Mckinley Drive)	*X-9*	*MH 184*	*7.84*		*117*			*315.9*			*316*	*4.00*	*2.9*				*2.73*	*2.73*			*2.4*	*7.84*		*7.84*	*2.7*	*8.0*						
Shirleys Brooke Drive	*MH 184*	*MH 182*	*0.00*					*0.0*	*104.50*	**6120**	*3993*	*2.95*	*100.4*					*19.48*		*13.82*	*28.9*	*0.00*	*119.27*	*61.89*	*55.1*	*184.4*	610	600	0.10	0.69	202.4	91%
Shirleys Brooke Drive	*MH 182*	*MH 1*	*0.00*					*0.0*	*104.50*	**6120**	*3993*	*2.95*	*100.4*					*19.48*		*13.82*	*28.9*	*0.00*	*119.27*	*61.89*	*55.1*	*184.4*	610	600	0.10	0.69	202.4	91%
X-10 (Sandhill Road)		*MH 1*	*11.62*	*9*	*60*		*5.32*	*1049.1*	*11.62*		*1049*	*3.79*	*9.2*						*2.11*	*2.11*	*1.8*	*11.62*		*11.62*	*4.1*	*15.1*						
X-11		*MH 1*	*0.87*				*0.87*	*140.1*	*0.87*		*140*	*4.00*	*1.3*								*0.0*	*0.87*		*0.87*	*0.3*	*1.6*						
Briar Ridge Pump Station	*PS*	*MH 1*							72.88	**3644**	6094	2.97	85.623	0	35.08	3.1	0.00	6.76	0.00	5.25	35.6	0.00	92.96	88.15	56.9	178.1						
EAST MARCH TRUNK	*MH 1*	*EMT*	0.00					0.0	189.87	**9764**	11276	2.63	172.7		35.08	3.1		26.24		21.18	66.3	0.00	212.23	162.53	116.3	355.3	762	750	0.10	0.80	367.1	97%

18L/s residual capacity

DESIGN PARAMETERS

Average Daily Flow (Future)=	350	L/cap/day
Average Daily Flow (Existing)=	200	L/cap/day
Indust/Comm/Inst Flow (Future)=	50000	L/ha/day
Indust/Comm/Inst Flow (Existing)=	20000	L/ha/day
Max Res Peak Factor=	4.00	
Comm/Inst Peak Factor=	1.50	

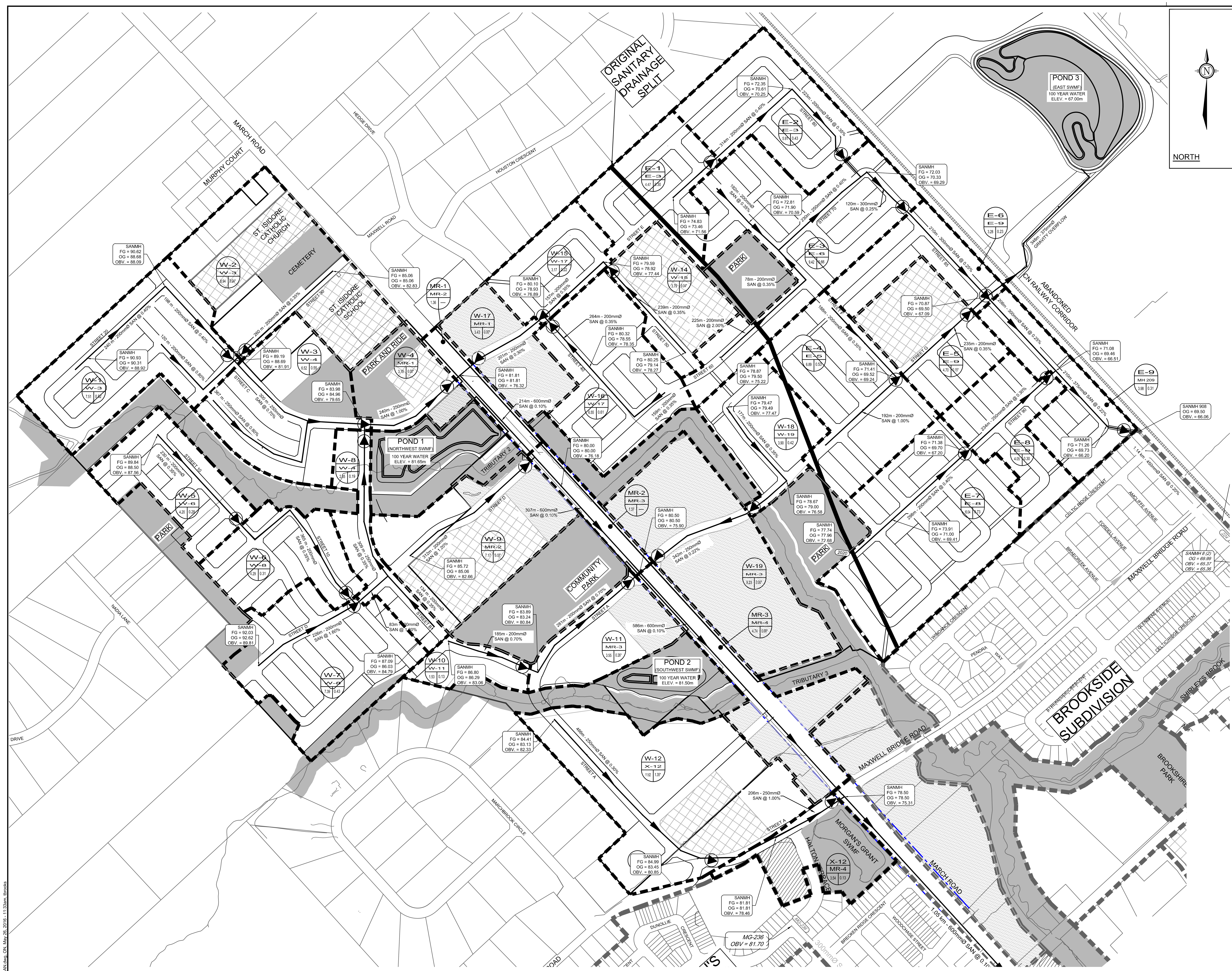
Industrial Peak Factor= per MOE graph		
Extraneous Flow (Future)=	0.28	L/s/ha
Extraneous Flow (Existing)=	0.35	L/s/ha (Jan 2008 monitored event)
Minimum Velocity=	0.60	m/s
Manning's n=	0.013	

Designed: Alex McAuley
Checked: CJR
Dwg. Reference: 112117-SAN1, 112117-SAN2

PROJECT:
Kanata North Community Design Plan
CLIENT:
Kanata North Land Owners
Date: May, 2016

Notes:
1. Existing sanitary sewers tributary to, and not receiving flow from the KNUEA Trunk sewer have not been analysed for capacity
2. Existing unit counts obtained from City of Ottawa geoOttawa (2014) parcel counts, unless otherwise indicated
3. Low Density based on (16.6 Singles/net ha * 3.4pers/unit) + (16.5 Towns/net ha * 2.7pers/unit)
4. High Density based on (35.8 Towns/net ha * 2.7pers/unit) + (35.8 Apartments/net ha * 1.8pers/unit)
5. Overall unit counts for the KNCDP are based on Demonstration Plan "A-24", plus 10% to allow for flexibility in unit type distribution

Upgraded Existing Sanitary Sewers



NORTH

KEY PLAN
N.T.S.

PROPOSED KANATA NORTH URBAN EXPANSION AREA

LEGEND

- AREA ID
- OUTLET AREA
- EQUIVALENT POPULATION (THOUSANDS) *PLUS ADDITIONAL NON-RESIDENTIAL FLOW
- AREA IN HECTARES
- PROPOSED DRAINAGE AREA
- EXISTING DRAINAGE AREA
- FLOW OUTLET
- SANMH 106: SAN ID; FG = 72.52 PRELIMINARY FINISHED GROUND ELEVATION; OG = 69.52 ORIGINAL GROUND ELEVATION; OBV. = 68.22 PRELIMINARY OBVERT ELEVATION
- PROPOSED SANITARY SEWER & FLOW DIRECTION
- EXISING SANITARY SEWER & FLOW DIRECTION
- LANDS TO BE SERVICED AND NOT PART OF STUDY AREA
- LANDS WHICH DO NOT GENERATE SANITARY FLOWS
- INSTIUTIONAL LANDS
- COMMERCIAL LANDS

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

No.	REVISION	DATE	BY
3.	ISSUED WITH DRAFT MASTER SERVICING STUDY	MAY 20/16	JLS
2.	ISSUED WITH DRAFT MASTER SERVICING STUDY	APR 4/16	JLS
1.	ISSUED WITH DRAFT MASTER SERVICING STUDY	FEB 26/16	JLS

SCALE 1:3000

DESIGN	ARM / TB
CHECKED	ARM
DRAWN	TB
CHECKED	CJR
APPROVED	JLS

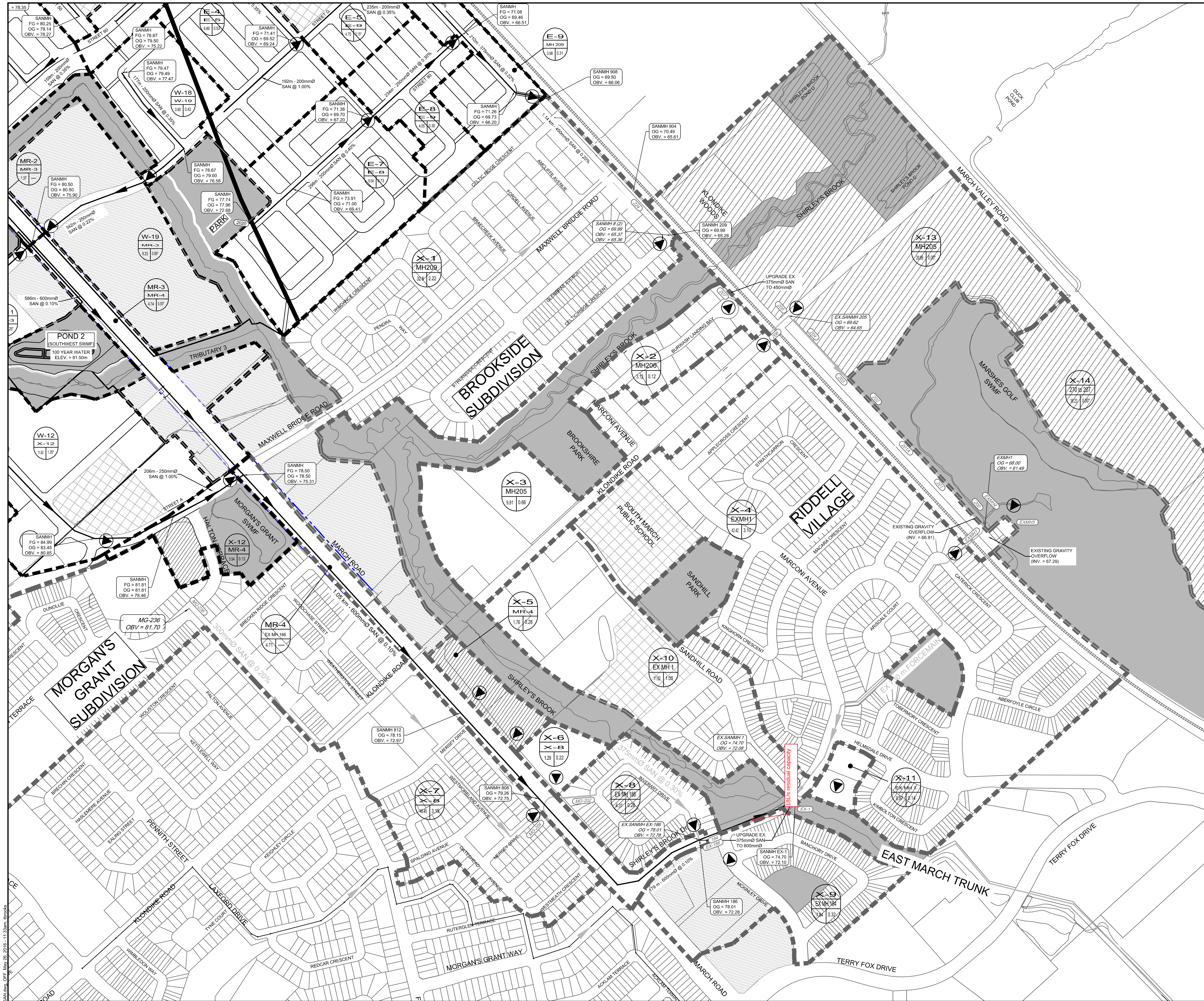
FOR REVIEW ONLY

NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

LOCATION
KANATA NORTH URBAN EXPANSION AREA
COMMUNITY DESIGN PLAN

DRAWING NAME
ONSITE SANITARY DRAINAGE AREA PLAN

PROJECT No. 112117-04
REV # 3
DRAWING No. 112117-SAN1



LEGEND

- AREA ID
- OUTLET AREA
- EQUIVALENT POPULATION (THOUSANDS) *PLUS ADDITIONAL NON-RESIDENTIAL FLOW
- CONTRIBUTING AREA IN HECTARES
- PROPOSED DRAINAGE AREA
- EXISTING DRAINAGE AREA
- FLOW OUTLET
- SAN ID (SANMH 106)
- PRELIMINARY FINISHED GROUND ELEVATION (FG = 72.52)
- ORIGINAL GROUND ELEVATION (OG = 69.52)
- PRELIMINARY OBVERT ELEVATION (OBV. = 68.22)
- PROPOSED SANITARY SEWER & FLOW DIRECTION
- EXISING SANITARY MAINLINE SEWER & FLOW DIRECTION
- UNDEVELOPED LANDS TO BE SERVICED AND NOT PART OF STUDY AREA
- LANDS WHICH DO NOT GENERATE SANITARY FLOWS
- INSTITUTIONAL LANDS
- COMMERCIAL LANDS

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

No.	REVISION	DATE	BY
3.	ISSUED WITH DRAFT MASTER SERVICING STUDY	MAY 20/16	JLS
2.	ISSUED WITH DRAFT MASTER SERVICING STUDY	APR 4/16	JLS
1.	ISSUED WITH DRAFT MASTER SERVICING STUDY	FEB 26/16	JLS

SCALE 1:3000

DESIGN ARM / TB
CHECKED ARM
DRAWN TB
CHECKED CJR
APPROVED JLS

FOR REVIEW ONLY

NOVATECH
Engineers, Planners & Landscape Architects
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Ottawa, Ontario, Canada K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

LOCATION
KANATA NORTH URBAN EXPANSION AREA
COMMUNITY DESIGN PLAN

DRAWING NAME
OFFSITE SANITARY DRAINAGE AREA PLAN

PROJECT No. 112117-04
REV # 3
DRAWING No. 112117-SAN2

From: Trevor McKay
To: Johnson, Warren; Paerez, Ana
Cc: Rathnasooriya, Thakshika; Kilborn, Kris; Edson Donnelly
Subject: RE: March Road and Tributary 3 Intersection - Brigil Lands
Date: Monday, June 29, 2020 12:33:23 PM
Attachments: 20200629-26-112117-PP-WorkingDwg.pdf

Warren,

See attached working drawing. Please review and ensure this meets your requirements.

We will formally issue the drawings with our next required submission (either construction or city).

Let me know if there are any concerns,

Trevor McKay, B.Eng., E.I.T., Project Coordinator | Engineering/Contract Administration
NOVATECH Engineers, Planners & Landscape Architects
240 Michael Cowpland Drive, Suite 200, Ottawa, ON, K2M 1P6 | Tel: 613.254.9643 Ext: 291 | Cell: 613.263.9113 | Fax: 613.254.5867

From: Johnson, Warren <Warren.Johnson@stantec.com>
Sent: Friday, June 26, 2020 2:56 PM
To: Trevor McKay <t.mcKay@novatech-eng.com>; Paerez, Ana <Ana.Paerez@stantec.com>
Cc: Rathnasooriya, Thakshika <Thakshika.Rathnasooriya@stantec.com>; Kilborn, Kris <kris.kilborn@stantec.com>; Edson Donnelly <e.donnelly@novatech-eng.com>
Subject: RE: March Road and Tributary 3 Intersection - Brigil Lands

Trevor,

We are currently utilizing a 200mm dia. @ 0.60% slope. To avoid any future revisions if draft plan modifications require us to increase the pipe size it might be best to be conservative and leave a 250 dia. stub that we can reduce within a manhole if necessary.

Thanks,

Warren Johnson C.E.T.
Civil Engineering Technologist

Direct: 613-784-2272
Mobile: 613-868-8692
warren.johnson@stantec.com

Stantec
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

From: Trevor McKay <t.mcKay@novatech-eng.com>
Sent: Friday, June 26, 2020 1:29 PM
To: Johnson, Warren <Warren.Johnson@stantec0.com>; Paerez, Ana <Ana.Paerez@stantec.com>
Cc: Rathnasooriya, Thakshika <Thakshika.Rathnasooriya@stantec.com>; Kilborn, Kris <kris.kilborn@stantec.com>; Edson Donnelly <e.donnelly@novatech-eng.com>
Subject: RE: March Road and Tributary 3 Intersection - Brigil Lands

Warren,

Based on a quick look, I don't see any major issue with this.

Please confirm slope and size. (currently spec'd as a 300 dia. @ 0.66%).

Trevor McKay, B.Eng., E.I.T., Project Coordinator | Engineering/Contract Administration
NOVATECH Engineers, Planners & Landscape Architects
240 Michael Cowpland Drive, Suite 200, Ottawa, ON, K2M 1P6 | Tel: 613.254.9643 Ext: 291 | Cell: 613.263.9113 | Fax: 613.254.5867

From: Johnson, Warren <Warren.Johnson@stantec.com>
Sent: Friday, June 26, 2020 10:34 AM
To: Trevor McKay <t.mcKay@novatech-eng.com>; Paerez, Ana <Ana.Paerez@stantec.com>
Cc: Rathnasooriya, Thakshika <Thakshika.Rathnasooriya@stantec.com>; Kilborn, Kris <kris.kilborn@stantec.com>; Edson Donnelly <e.donnelly@novatech-eng.com>
Subject: RE: March Road and Tributary 3 Intersection - Brigil Lands

Hi Trevor,

Due to conflicts within our site we would like to lower the sanitary stub at your future Street 1 connection. As per drawing PP-26 it currently sits at an invert of 78.22 however we require a maximum of 77.22. If possible it would be ideal to lower this an additional 0.5m to an invert of 76.72 to account for any variations during detailed design. If this is acceptable please revise your drawings accordingly and send me the updated pdf. If you have any questions feel free to get in touch.

Thanks

Warren Johnson C.E.T.
Civil Engineering Technologist

Direct: 613-784-2272
Mobile: 613-868-8692
warren.johnson@stantec.com

Stantec
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

From: Trevor McKay <t.mcKay@novatech-eng.com>
Sent: Tuesday, June 23, 2020 10:37 AM
To: Johnson, Warren <Warren.Johnson@stantec.com>; Paerez, Ana <Ana.Paerez@stantec.com>
Cc: Rathnasooriya, Thakshika <Thakshika.Rathnasooriya@stantec.com>; Kilborn, Kris <kris.kilborn@stantec.com>; Edson Donnelly <e.donnelly@novatech-eng.com>
Subject: RE: March Road and Tributary 3 Intersection - Brigil Lands

Warren,

The scope of the sanitary sewer and watermain upgrades on March road is to reinstate all disturbed areas to existing conditions and elevations.

Trevor McKay, B.Eng., E.I.T., Project Coordinator | Engineering/Contract Administration
NOVATECH Engineers, Planners & Landscape Architects
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From: Johnson, Warren <Warren.Johnson@stantec.com>
Sent: Tuesday, June 23, 2020 10:32 AM
To: Trevor McKay <t.mcKay@novatech-eng.com>; Paerez, Ana <Ana.Paerez@stantec.com>
Cc: Rathnasooriya, Thakshika <Thakshika.Rathnasooriya@stantec.com>; Kilborn, Kris <kris.kilborn@stantec.com>; Edson Donnelly <e.donnelly@novatech-eng.com>
Subject: RE: March Road and Tributary 3 Intersection - Brigil Lands

Hi Trevor,

Can you confirm the proposed centerline elevations of March Road at our site entrances (future street 1 and 2). On PP-26 it appears that your design is tying into existing elevations along March Road while in PP-17 and PP-18 there is a proposed profile elevation shown that is roughly 0.3m lower than existing.

Thanks,

Warren Johnson C.E.T.
Civil Engineering Technologist

Direct: 613-784-2272
Mobile: 613-868-8692
warren.johnson@stantec.com

Stantec
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

From: Trevor McKay <t.mcKay@novatech-eng.com>
Sent: Tuesday, June 16, 2020 5:22 PM
To: Johnson, Warren <Warren.Johnson@stantec.com>; Paerez, Ana <Ana.Paerez@stantec.com>
Cc: Rathnasooriya, Thakshika <Thakshika.Rathnasooriya@stantec.com>; Kilborn, Kris <kris.kilborn@stantec.com>; Edson Donnelly <e.donnelly@novatech-eng.com>
Subject: RE: March Road and Tributary 3 Intersection - Brigil Lands

Warren/Ana,

Please find attached CAD as requested.

This CAD file is being provided for horizontal layout of the sanitary sewer and watermain on March Road. In case of a disagreement between the provided pdf files and this CAD file, the pdf files govern.

Hopefully this is the information you need. Let me know if there is anything else or if you have any concerns.

Trevor McKay, B.Eng., E.I.T., Project Coordinator | Engineering/Contract Administration
NOVATECH Engineers, Planners & Landscape Architects
240 Michael Cowpland Drive, Suite 200, Ottawa, ON, K2M 1P6 | Tel: 613.254.9643 Ext: 291 | Cell: 613.263.9113 | Fax: 613.254.5867

From: Johnson, Warren <Warren.Johnson@stantec.com>
Sent: Tuesday, June 16, 2020 11:50 AM
To: Trevor McKay <t.mcKay@novatech-eng.com>; Paerez, Ana <Ana.Paerez@stantec.com>
Cc: Rathnasooriya, Thakshika <Thakshika.Rathnasooriya@stantec.com>; Kilborn, Kris <kris.kilborn@stantec.com>; Edson Donnelly <e.donnelly@novatech-eng.com>
Subject: RE: March Road and Tributary 3 Intersection - Brigil Lands

Thanks Trevor. Is it possible to get CAD of the plan view?

Warren Johnson C.E.T.
Civil Engineering Technologist

Direct: 613-784-2272
Mobile: 613-868-8692
warren.johnson@stantec.com

Stantec
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

From: Trevor McKay <t.mcKay@novatech-eng.com>
Sent: Tuesday, June 16, 2020 11:46 AM
To: Paerez, Ana <Ana.Paerez@stantec.com>
Cc: Johnson, Warren <Warren.Johnson@stantec.com>; Rathnasooriya, Thakshika <Thakshika.Rathnasooriya@stantec.com>; Kilborn, Kris <kris.kilborn@stantec.com>; Edson Donnelly <e.donnelly@novatech-eng.com>
Subject: RE: March Road and Tributary 3 Intersection - Brigil Lands

Ana,

Please see attached the latest design drawings for March road adjacent to the Brigil site.

Let us know if you need anything else.

Trevor McKay, B.Eng., E.I.T., Project Coordinator | Engineering/Contract Administration
NOVATECH Engineers, Planners & Landscape Architects
240 Michael Cowpland Drive, Suite 200, Ottawa, ON, K2M 1P6 | Tel: 613.254.9643 Ext: 291 | Cell: 613.263.9113 | Fax: 613.254.5867

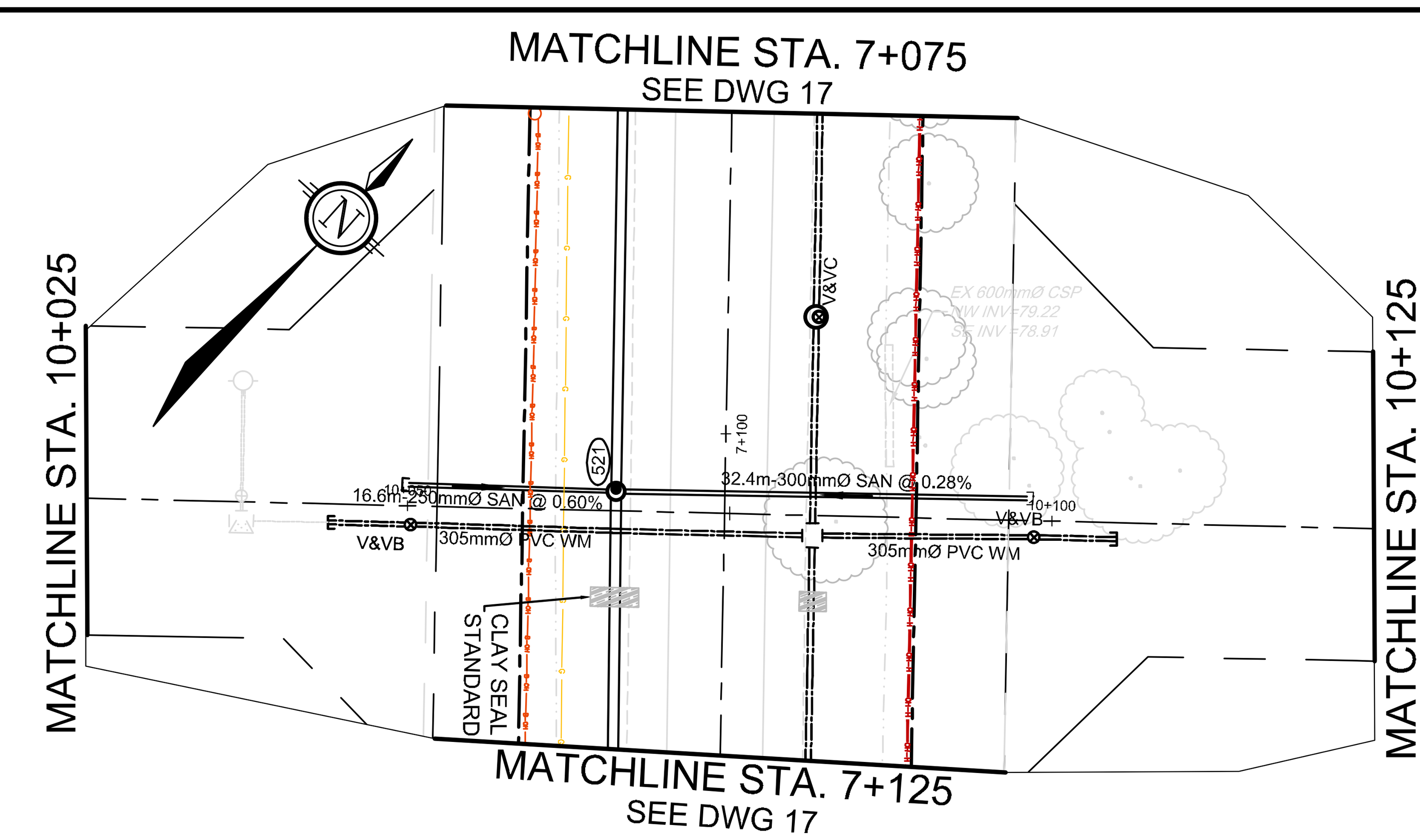
From: Paerez, Ana <Ana.Paerez@stantec.com>
Sent: Tuesday, June 16, 2020 10:15 AM
To: Trevor McKay <t.mcKay@novatech-eng.com>
Cc: Johnson, Warren <Warren.Johnson@stantec.com>; Rathnasooriya, Thakshika <Thakshika.Rathnasooriya@stantec.com>; Kilborn, Kris <kris.kilborn@stantec.com>
Subject: March Road and Tributary 3 Intersection - Brigil Lands

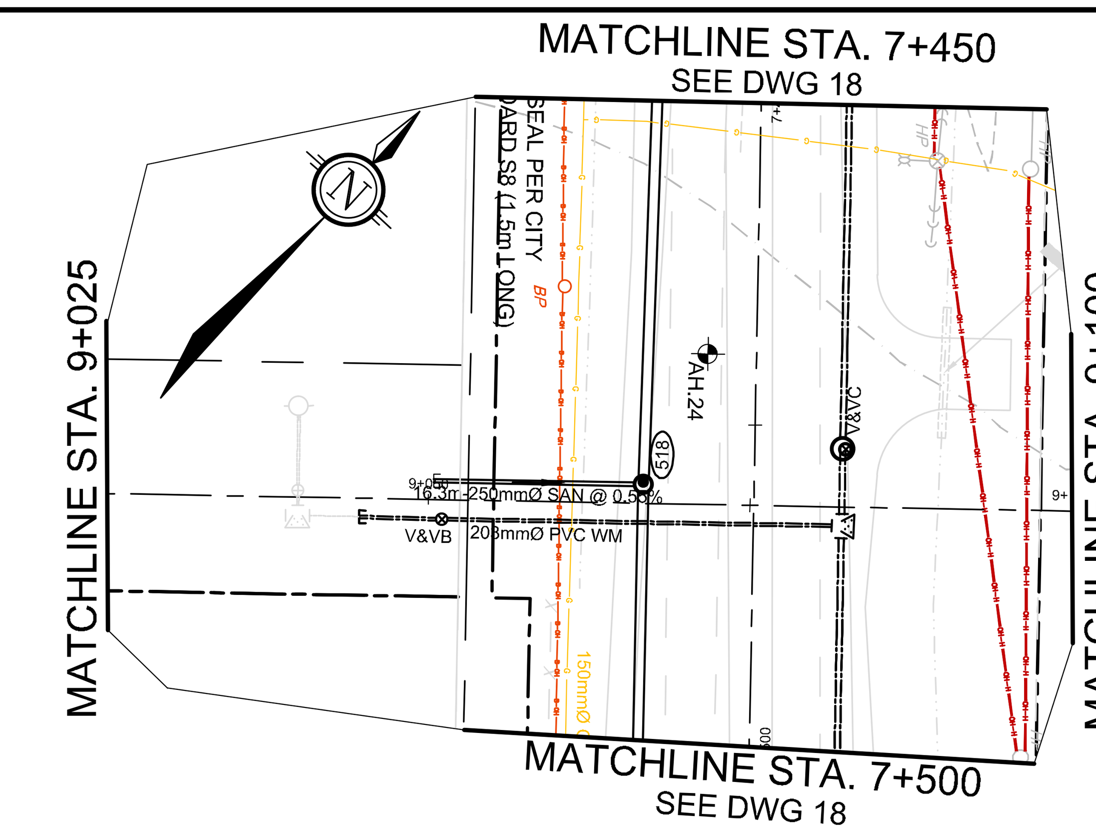
Hi Trevor,
We are working on the Brigil Lands Development in the Kanata North Urban Expansion Area (see attached drawing). The site will be serviced through the sanitary sewer and watermain on March Road. Could you please provide the latest design drawings for March Road in the vicinity of Tributary 3 (connections at two streets).
Thank you,

Ana Paerez, P. Eng.
Water Resources Engineer

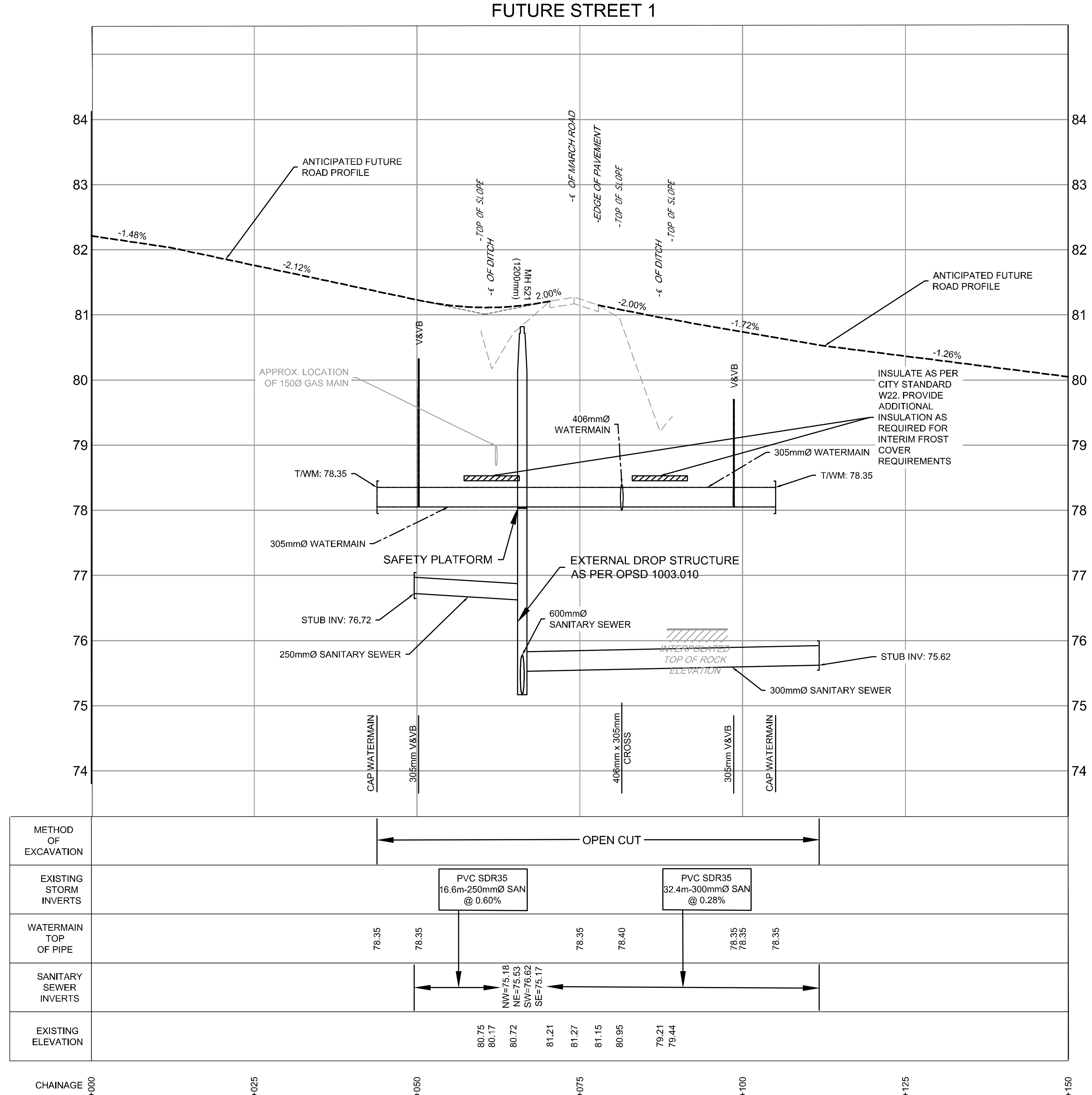
Direct: 506 204-5856
Fax: 506 858-8698
Ana.Paerez@stantec.com

Stantec

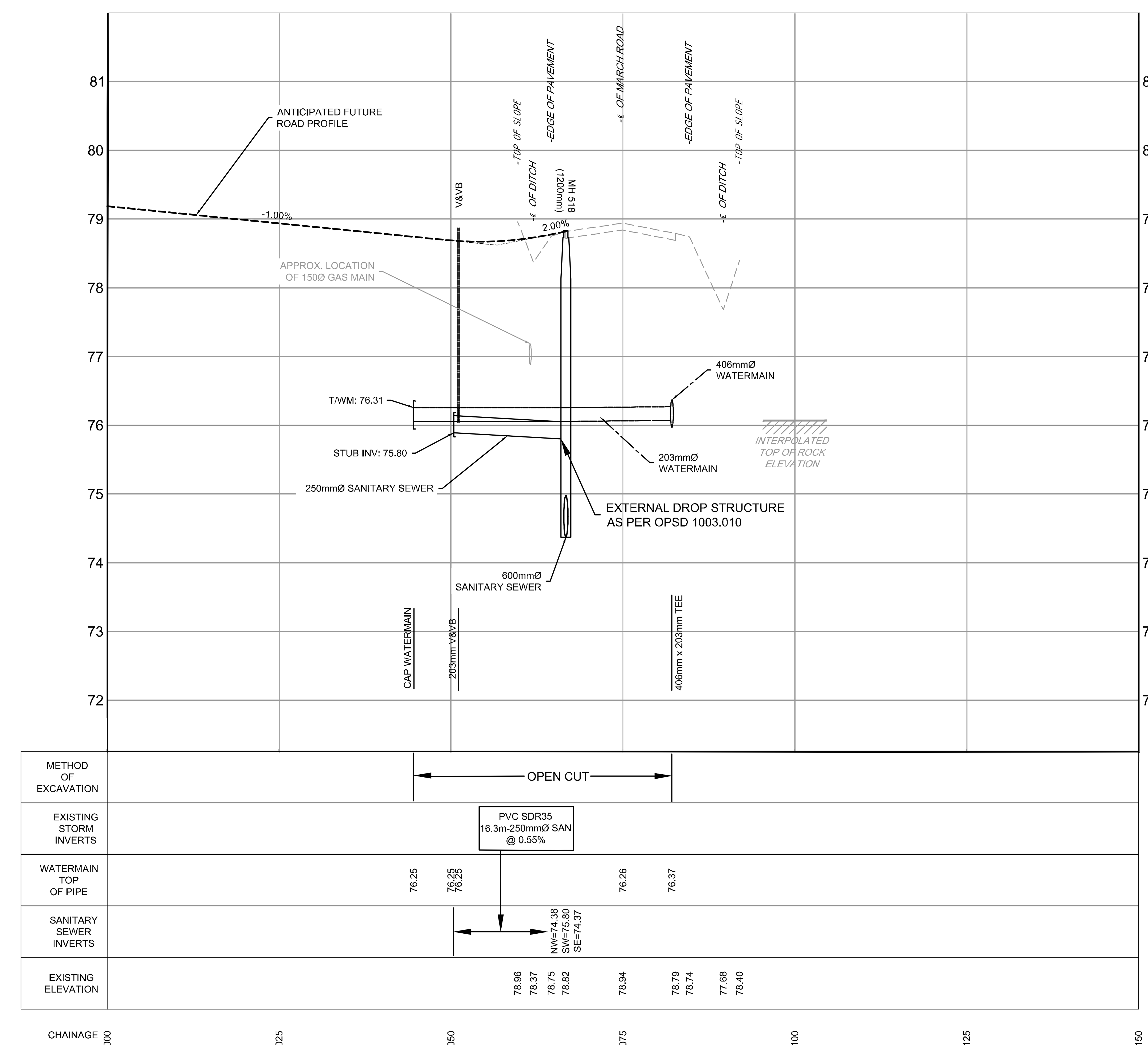




FUTURE STREET 1



FUTURE STREET 2



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

No.	REVISION	DATE	BY
	WORK IN PROGRESS	JUNE 29/20	
9.	ISSUED WITH CCN #1	APR 1/20	ERD
8.	ISSUED FOR CITY APPROVAL	OCT 17/19	ERD
7.	ISSUED FOR MECP APPROVAL	SEP 19/19	ERD
6.	REVISED AS PER CITY COMMENTS	AUG 27/19	ERD
5.	RE-ISSUED FOR CITY REVIEW/COMMENT	JULY 5/19	ERD
4.	ISSUED WITH ADDENDUM NO.1	JUNE 12/19	ERD
3.	ISSUED FOR MUNICIPAL CONSENT	MAY 31/19	ERD
2.	ISSUED FOR TENDER	MAY 29/19	JR
1.	ISSUED FOR CITY REVIEW/COMMENT	MARCH 8/19	FM

SCALE
1:500 HORIZONTAL
1:50 VERTICAL

DESIGN
CHECKED
DRAWN
CHECKED
APPROVED

FOR REVIEW ONLY

NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

LOCATION
MARCH ROAD SANITARY AND WATERMAIN UPGRADES

DRAWING NAME
PLAN AND PROFILE
FUTURE STREET 1 - 10+025 TO 10+125
FUTURE STREET 2 - 9+025 TO 9+100

PROJECT No. 112117
REV X
DRAWING No. 112117-PP-26

D07-20-19-0001

C:\temp\AcPublish_22404\112117_PP.dwg, PP-26, Jun 29, 2020 - 9:21am, jbertwistle

#18009

Appendix C STORMWATER MANAGEMENT CALCULATIONS

C.1 CONCEPTUAL STORM SEWER DESIGN SHEET

BRIGIL - KANATA NORTH		STORM SEWER DESIGN SHEET (City of Ottawa)
DATE:	2020-08-17	
REVISION:	1	
DESIGNED BY:	WAJ	FILE NUMBER: 160401347
CHECKED BY:	AMP	

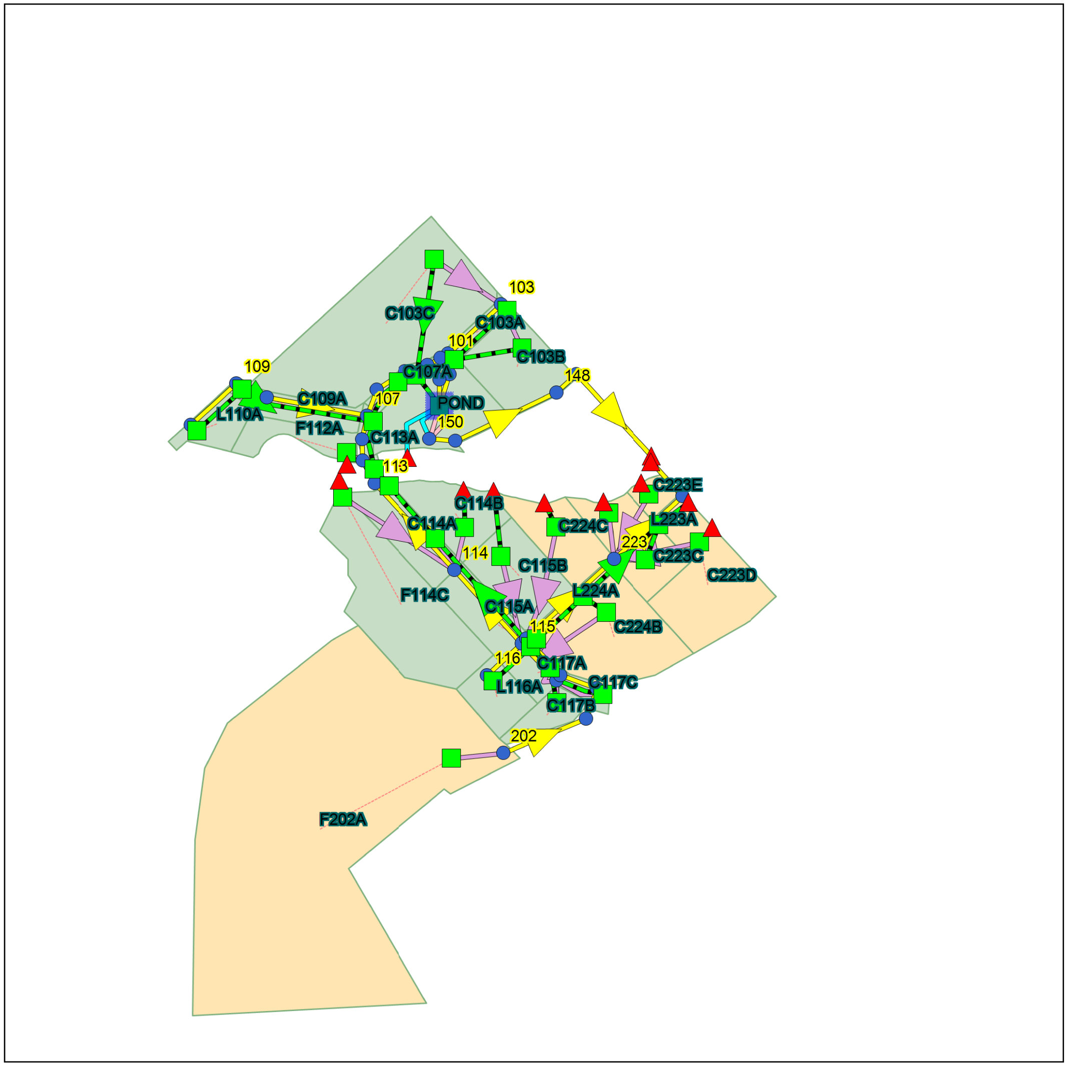
DESIGN PARAMETERS

$I = a / (t+b)^c$ (As per City of Ottawa Guidelines, 2012)

	1:2 yr	1:5 yr	1:10 yr	1:100 yr					
a =	732.951	998.071	1174.184	1735.688	MANNING'S n =	0.013		BEDDING CLASS =	B
b =	6.199	6.053	6.014	6.014	MINIMUM COVER:	2.00	m		
c =	0.810	0.814	0.816	0.820	TIME OF ENTRY	10	min		

LOCATION			DRAINAGE AREA																									PIPE SELECTION											
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (2-YEAR) (ha)	AREA (5-YEAR) (ha)	AREA (10-YEAR) (ha)	AREA (100-YEAR) (ha)	AREA (ROOF) (ha)	C (2-YEAR) (-)	C (5-YEAR) (-)	C (10-YEAR) (-)	C (100-YEAR) (-)	A x C (2-YEAR) (ha)	ACCUM AxC (2YR) (ha)	A x C (5-YEAR) (ha)	ACCUM. AxC (5YR) (ha)	A x C (10-YEAR) (ha)	ACCUM. AxC (10YR) (ha)	A x C (100-YEAR) (ha)	ACCUM. AxC (100YR) (ha)	T of C (min)	I_{2-YEAR} (mm/h)	I_{5-YEAR} (mm/h)	$I_{10-YEAR}$ (mm/h)	$I_{100-YEAR}$ (mm/h)	$Q_{CONTROL}$ (L/s)	ACCUM. $Q_{CONTROL}$ (L/s)	Q_{ACT} (CIA/360) (L/s)	LENGTH (m)	PIPE WIDTH OR DIAMETEI (mm)	PIPE HEIGHT (mm)	PIPE SHAPE (-)	MATERIAL (-)	CLASS (-)	SLOPE %	Q_{CAP} (FULL) (L/s)	% FULL (-)	VEL. (FULL) (m/s)	VEL. (ACT) (m/s)	TIME OF FLOW (min)
L103A, C103B, C103A	103	102	4.27	1.64	0.00	0.00	0.00	0.40	0.77	0.00	0.00	1.710	1.710	1.261	1.261	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	729.8	102.6	1050	1050	CIRCULAR	CONCRETE	100-D	0.10	900.9	81.01%	1.01	1.00	1.71
	102	101	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	1.710	0.000	1.261	0.000	0.000	0.000	0.000	11.71	70.80	95.94	112.42	164.29	0.0	0.0	672.3	12.5	1050	1050	CIRCULAR	CONCRETE	100-D	0.10	900.9	74.63%	1.01	0.98	0.21
																				11.93																			
C117A, C117B, C117C	117	115	0.00	1.03	0.00	0.00	0.00	0.00	0.65	0.00	0.00	0.000	0.000	0.668	0.668	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	193.5	73.1	450	450	CIRCULAR	CONCRETE	100-D	1.00	297.4	65.05%	1.81	1.67	0.73
																				10.73																			
L116A	116	115	0.67	0.00	0.00	0.00	0.00	0.65	0.00	0.00	0.00	0.438	0.438	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	93.5	66.5	375	375	CIRCULAR	PVC	SDR 35	1.00	164.8	56.71%	1.56	1.39	0.80
																				10.80																			
C115A, C115B	115	114	0.00	2.13	0.00	0.00	0.00	0.00	0.68	0.00	0.00	0.000	0.438	1.445	2.114	0.000	0.000	0.000	0.000	10.80	73.86	100.15	117.38	171.56	0.0	0.0	678.0	140.3	900	900	CIRCULAR	CONCRETE	100-D	0.20	844.6	80.27%	1.29	1.27	1.84
F114C, C114A, C114B	114	113	0.00	1.97	0.00	2.87	0.00	0.00	0.68	0.00	0.30	0.000	0.438	1.334	3.448	0.000	0.000	0.860	0.860	12.65	67.95	92.03	107.82	157.52	0.0	0.0	1340.5	168.6	1200	1200	CIRCULAR	CONCRETE	100-D	0.15	1575.3	85.10%	1.35	1.35	2.08
C113A	113	112	0.00	0.29	0.00	0.00	0.00	0.00	0.65	0.00	0.00	0.000	0.438	0.189	3.637	0.000	0.000	0.000	0.860	14.73	62.42	84.46	98.91	144.44	0.0	0.0	1274.4	36.8	1500	975	ELLIPTICAL	CONCRETE	100-D	0.15	1505.8	84.63%	1.31	1.31	0.47
F112A	112	111	0.00	0.00	0.00	0.60	0.00	0.00	0.00	0.00	0.40	0.000	0.438	0.000	3.637	0.000	0.000	0.240	1.100	15.19	61.32	82.94	97.13	141.83	0.0	0.0	1346.0	29.5	1200	1200	CIRCULAR	CONCRETE	100-D	0.15	1575.3	85.45%	1.35	1.36	0.36
	111	107	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.438	0.000	3.637	0.000	0.000	0.000	1.100	15.55	60.49	81.81	95.80	139.88	0.0	0.0	1327.6	35.3	1200	1200	CIRCULAR	CONCRETE	100-D	0.15	1575.3	84.28%	1.35	1.35	0.43
																				15.99																			
L110A	110	109	0.55	0.00	0.00	0.00	0.00	0.65	0.00	0.00	0.00	0.360	0.360	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	76.9	87.5	300	300	CIRCULAR	PVC	SDR 35	1.50	117.8	65.28%	1.67	1.55	0.94
C109A	109	108	0.00	0.65	0.00	0.00	0.00	0.00	0.65	0.00	0.00	0.000	0.360	0.422	0.422	0.000	0.000	0.000	0.000	10.94	73.38	99.49	116.60	170.42	0.0	0.0	190.1	47.2	450	450	CIRCULAR	CONCRETE	100-D	1.50	364.3	52.19%	2.22	1.92	0.41
	108	107	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.360	0.000	0.422	0.000	0.000	0.000	0.000	11.35	71.99	97.57	114.35	167.11	0.0	0.0	186.5	144.6	450	450	CIRCULAR	CONCRETE	100-D	1.50	364.3	51.19%	2.22	1.92	1.26
																				12.61																			
C107A	107	106	0.00	0.30	0.00	0.00	0.00	0.00	0.65	0.00	0.00	0.000	0.798	0.196	4.256	0.000	0.000	0.000	1.100	15.99	59.53	80.49	94.25	137.61	0.0	0.0	1504.1	39.4	1350	1350	CIRCULAR	CONCRETE	100-D	0.10	1760.8	85.42%	1.19	1.20	0.55
	106	105	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.798	0.000	4.256	0.000	0.000	0.000	1.100	16.54	58.37	78.90	92.38	134.87	0.0	0.0	1474.3	48.0	1350	1350	CIRCULAR	CONCRETE	100-D	0.10	1760.8	83.73%	1.19	1.19	0.67
	105	104	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.798	0.000	4.256	0.000	0.000	0.000	1.100	17.21	57.00	77.04	90.18	131.64	0.0	0.0	1439.4	33.6	1350	1350	CIRCULAR	CONCRETE	100-D	0.10	1760.8	81.75%	1.19	1.18	0.47
	104	101	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.798	0.000	4.256	0.000	0.000	0.000	1.100	17.68	56.08	75.78	88.71	129.48	0.0	0.0	1415.9	21.1	1350	1350	CIRCULAR	CONCRETE	100-D	0.10	1760.8	80.41%	1.19	1.17	0.30
																				17.98																			
	101	100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	2.508	0.000	5.517	0.000	0.000	0.000	1.100	17.98	55.52	75.01	87.81	128.16	0.0	0.0	1928.0	26.2	1500	1500	CIRCULAR	CONCRETE	100-D	0.10	2332.0	82.67%	1.28	1.27	0.34
Bypass Inlet	100	100C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	2.508	0.000	5.517	0.000	0.000	0.000	1.100	18.33	54.89	74.15	86.79	126.67	0.0	0.0	1905.8	16.4	1500	1500	CIRCULAR	CONCRETE	100-D	0.10	2332.0	81.72%	1.28	1.27	0.22
	100C	100B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	2.508	0.000	5.517	0.000	0.000	0.000	1.100	18.54	54.50	73.62	86.17	125.76	0.0	0.0	1892.2	19.8	1500	1500	CIRCULAR	CONCRETE	100-D	0.10	2332.0	81.14%	1.28	1.27	0.26
																				18.80									1500	1500									
			5.50	8.01	0.00	3.47	0.00					2.51		5.52		0.00		1.10																					
Forebay Inlet (Sized for 25mm Storm)	100	100A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	167.22	230.48	271.61	398.62	934.1	934.1	934.1	16.7	1500	1500	CIRCULAR	CONCRETE	100-D	0.10	2332.0	40.06%	1.28	1.02	0.27
																				0.27									1500	1500									
SWM Pond Outlet Pipe (Sized for maximum allowable release rate)	150	149	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	84.0	84.0	84.0	37.3	600	600	CIRCULAR	CONCRETE	100-D	0.14	239.7	35.05%	0.82	0.63	0.99
	149	148	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.99	73.22	99.26	116.33	170.03	0.0	84.0	84.0	158.9	600	600	CIRCULAR	CONCRETE	100-D	0.14	239.7	35.05%	0.82	0.63	4.20
	148	147	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	15.18	61.34	82.97	97.17	141.89	0.0	84.0	84.0	38.7	600	600	CIRCULAR	CONCRETE	100-D	0.14	239.7	35.05%	0.82	0.63	1.02
	147	146	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	16.20	59.06	79.86	93.50	136.51	0.0	84.0	84.0	159.0	600	600	CIRCULAR	CONCRETE	100-D	0.14	239.7	35.05%	0.82	0.63	4.20
																				20.40									600	600									
F202A - Future storm sewers (by others)	202	201	0.00	0.00	0.00	15.10	0.00	0.00	0.00	0.00	0.35	0.000	0.000	0.000	0.000	0.000	0.000	5.286	5.286	95.00	17.41	23.31	27.17	39.43	0.0	0.0	579.0	127.3	900	900	CIRCULAR	CONCRETE	100-D	0.20	844.6	68.55%	1.29	1.21	1.75
Future storm sewers (by others)	201	200	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5.286	96.75	17.17	22.98	26.80	38.88	0.0	0.0	570.9	45.7	900	900	CIRCULAR	CONCRETE	100-D	0.20	844.6	67.59%	1.29	1.20	0.63
	200	225	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5.286	97.38	17.09	22.87	26.66	38.69	0.0	0.0	568.0	55.0	900	900	CIRCULAR	CONCRETE	100-D	0.20	844.6	67.25%	1.29	1.20	0.76
	225	224	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5.286	98.14	16.99	22.73	26.50	38.46	0.0	0.0	564.6	70.7	900	900	CIRCULAR	CONCRETE	100-D	0.20	844.6	66.85%	1.29	1.20	0.98
C224B, C224C, L224A	224	223	0.29	3.09	0.00	0.00	0.00	0.65	0.67	0.00	0.00	0.188	0.188	2.057	2.057	0.000	0.000	0.000	5.286	99.12	16.86	22.56	26.30	38.16	0.0	0.0	698.0	167.6	900	900	CIRCULAR	CONCRETE	100-D	0.50	1335.4	52.27%	2.03	1.76	1.59
C223C, C223B, L223A, C223D	223	222	0.26	3.26	0.00	0.00	0.00	0.65	0.80	0.00	0.00	0.166	0.355	2.609	4.666	0.000	0.000	0.000	5.286	100.71	16.66	22.29	25.98	37.70	0.0	0.0	858.7	131.9	900	900	CIRCULAR	CONCRETE	100-D	0.50	1335.4	64.30%	2.03	1.88	1.17
	222	221	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.355	0.000	4.666	0.000	0.000	0.000	5.286	101.88	16.51	22.09	25.75	37.36	0.0	0.0	851.1	66.0	900	900	CIRCULAR	CONCRETE	100-D	0.50	1335.4	63.73%	2.03	1.88	0.59
																				102.47									900	900									
			0.55	6.35	0.00	15.10	0.00																																

C.2 PCSWMM LAYOUT



C103C
103
C103A
101
C103B
109
C107A
148
C109A
107
POND
L110A
F112A
150
C113A
113
C223E
C114B
C114A
C224C
L223A
223
114
C223C
C115B
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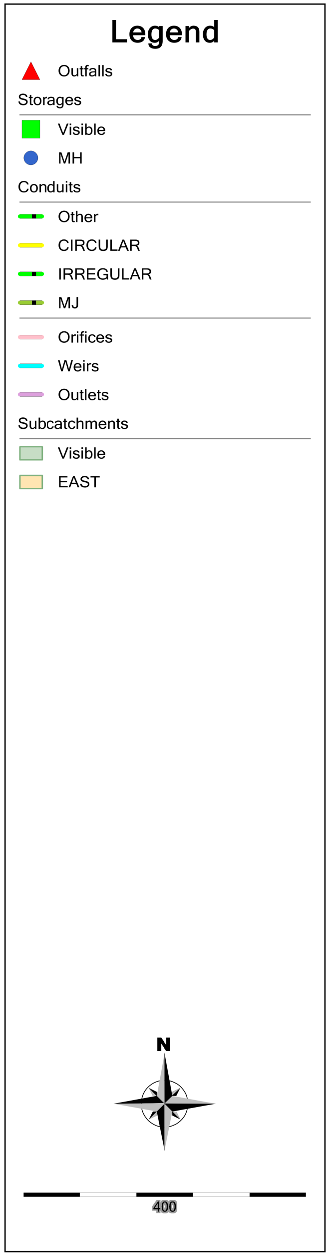
F202A



Legend
Outfalls
Storages
Visible
MH
Conduits
Other
CIRCULAR
IRREGULAR
MJ
Orifices
Weirs
Outlets
Subcatchments
Visible
EAST
N
400

C.3 POST DEVELOPMENT PCSWMM MODEL INPUT EXAMPLE

```
[TITLE]


[OPTIONS]
;;Options            Value
;;------------------ ------------
FLOW_UNITS           LPS
INFILTRATION         HORTON
FLOW_ROUTING         DYNWAVE
LINK_OFFSETS         ELEVATION
MIN_SLOPE            0
ALLOW_PONDING        NO
SKIP_STEADY_STATE    NO
START_DATE           09/14/2011
START_TIME           00:00:00
REPORT_START_DATE    09/14/2011
REPORT_START_TIME    00:00:00
END_DATE             09/16/2011
END_TIME             00:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:01:00
WET_STEP             00:05:00
DRY_STEP             00:05:00
ROUTING_STEP         5
RULE_STEP            00:00:00
INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  D-W
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         0
MAX_TRIALS           8
HEAD_TOLERANCE       0.0015
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              4

[FILES]
USE HOTSTART "C:\ana's\KNUEA-Brigil\PCSWMM\2CHI.HSF"

[EVAPORATION]
;;Type          Parameters
;;------------- ----------
CONSTANT     0.0
DRY_ONLY     NO

[RAINGAGES]
;;               Rain      Time   Snow   Data
;;Name           Type      Intrvl Catch  Source
;;-------------- --------- ------ ------ ----------
RG1              INTENSITY 0:10   1.0    TIMESERIES 2yr3hrChicago

[SUBCATCHMENTS]
;;                                                        Total    Pcnt.             Pcnt.
  Curb     Snow
;;Name           Raingage         Outlet           Area     Imperv   Width    Slope
  Length   Pack
;;-------------- ---------------- ---------------- -------- -------- --------
-------- -------- --------
;WEST
```

```
C103A            RG1              C103A-S          0.314557 64.286   128      2
 0
;WEST
C103B            RG1              C103B-S          1.320778 71.429   297      2
 0
;WEST
C103C            RG1              C103C-S          4.274378 28.571   961      2
 0
;WEST
C107A            RG1              C107A-S          0.302036 64.286   130      2
 0
;WEST
C109A            RG1              C109A-S          0.649469 64.286   183      3
 0
;WEST
C113A            RG1              C113A-S          0.290818 64.286   122      2
 0
;WEST
C114A            RG1              C114A-S          0.936058 64.286   320      3
 0
;WEST
C114B            RG1              C114B-S          1.037028 71.429   231      2
 0
;WEST
C115A            RG1              C115A-S          0.859531 64.286   306      3
 0
;WEST
C115B            RG1              C115B-S          1.266833 71.429   286      2
 0
;WEST
C117A            RG1              C117A-S          0.377939 64.286   132      3
 0
;WEST
C117B            RG1              C117B-S          0.437088 64.286   99       2
 0
;WEST
C117C            RG1              C117C-S          0.213365 64.286   72       2
 0
;EAST
C223B            RG1              C223B-S          0.536857 71.429   122      2
 0
;EAST
C223C            RG1              C223C-S          0.541145 71.429   121      2
 0
;EAST
C223D            RG1              C223D-S          1.920953 71.429   432      2
 0
;EAST
C223E            RG1              C223E-S          0.261162 71.429   59       2
 0
;EAST
C224B            RG1              C224B-S          2.061441 64.286   463      2
 0
;EAST
C224C            RG1              C224C-S          1.024207 71.429   229      2
 0
;WEST
F112A            RG1              F112A-S          0.599862 28.571   159      4
 0
;WEST
F114C            RG1              F114C-S          2.866914 14.286   321      3
 0
;EAST
```

```
F202A            RG1              F202A-S          15.10168 12       3398     2
  0
;WEST
L110A            RG1              L110A-S          0.554355 64.286   224      3
  0
;WEST
L116A            RG1              L116A-S          0.674081 64.286   185      3
  0
;EAST
L223A            RG1              L223A-S          0.255753 64.286   137      2
  0
;EAST
L224A            RG1              L224A-S          0.289706 64.286   159      2
  0
;WEST
POND             RG1              POND-S           1.600167 42.857   360      2
  0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo
PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ----------
----------
C103A            0.013      0.25       1.57       4.67       0          OUTLET
C103B            0.013      0.25       1.57       4.67       50         OUTLET
C103C            0.013      0.25       1.57       4.67       100        PERVIOUS
100
C107A            0.013      0.25       1.57       4.67       0          OUTLET
C109A            0.013      0.25       1.57       4.67       25         OUTLET
C113A            0.013      0.25       1.57       4.67       0          OUTLET
C114A            0.013      0.25       1.57       4.67       30         OUTLET
C114B            0.013      0.25       1.57       4.67       50         OUTLET
C115A            0.013      0.25       1.57       4.67       30         OUTLET
C115B            0.013      0.25       1.57       4.67       50         OUTLET
C117A            0.013      0.25       1.57       4.67       30         OUTLET
C117B            0.013      0.25       1.57       4.67       30         OUTLET
C117C            0.013      0.25       1.57       4.67       0          OUTLET
C223B            0.013      0.25       1.57       4.67       50         OUTLET
C223C            0.013      0.25       1.57       4.67       50         OUTLET
C223D            0.013      0.25       1.57       4.67       50         OUTLET
C223E            0.013      0.25       1.57       4.67       50         OUTLET
C224B            0.013      0.25       1.57       4.67       50         OUTLET
C224C            0.013      0.25       1.57       4.67       50         OUTLET
F112A            0.013      0.25       1.57       4.67       100        PERVIOUS
100
F114C            0.013      0.25       1.57       4.67       100        PERVIOUS
100
F202A            0.013      0.25       1.57       4.67       50         PERVIOUS
100
L110A            0.013      0.25       1.57       4.67       30         OUTLET
L116A            0.013      0.25       1.57       4.67       25         OUTLET
L223A            0.013      0.25       1.57       4.67       0          OUTLET
L224A            0.013      0.25       1.57       4.67       0          OUTLET
POND             0.013      0.25       1.57       4.67       0          OUTLET

[INFILTRATION]
;;Subcatchment   MaxRate    MinRate    Decay      DryTime    MaxInfil
;;-------------- ---------- ---------- ---------- ---------- ----------
C103A            76.2       13.2       4.14       7          0
C103B            76.2       13.2       4.14       7          0
C103C            76.2       13.2       4.14       7          0
C107A            76.2       13.2       4.14       7          0
C109A            76.2       13.2       4.14       7          0
```

```
C113A            76.2       13.2       4.14       7          0
C114A            76.2       13.2       4.14       7          0
C114B            76.2       13.2       4.14       7          0
C115A            76.2       13.2       4.14       7          0
C115B            76.2       13.2       4.14       7          0
C117A            76.2       13.2       4.14       7          0
C117B            76.2       13.2       4.14       7          0
C117C            76.2       13.2       4.14       7          0
C223B            76.2       13.2       4.14       7          0
C223C            76.2       13.2       4.14       7          0
C223D            76.2       13.2       4.14       7          0
C223E            76.2       13.2       4.14       7          0
C224B            76.2       13.2       4.14       7          0
C224C            76.2       13.2       4.14       7          0
F112A            76.2       13.2       4.14       7          0
F114C            76.2       13.2       4.14       7          0
F202A            76.2       13.2       4.14       7          0
L110A            76.2       13.2       4.14       7          0
L116A            76.2       13.2       4.14       7          0
L223A            76.2       13.2       4.14       7          0
L224A            76.2       13.2       4.14       7          0
POND             76.2       13.2       4.14       7          0

[OUTFALLS]
;;               Invert     Outfall      Stage/Table      Tide
;;Name           Elev.      Type         Time Series      Gate Route To
;;-------------- ---------- ------------ ---------------- ---- ----------------
MARCH-RD         78.94      FREE                          NO
MN-EAST          77.59      FIXED        77.81            NO
MN-WEST          78.99      FIXED        77.81            NO
T3-1             82         FREE                          NO
T3-2             84         FREE                          NO
T3-4             81.7       FREE                          NO
T3-5             82.2       FREE                          NO
T3-6             82.5       FREE                          NO
T3-7             81         FREE                          NO
T3-8             80.4       FREE                          NO
T3-9             80.2       FREE                          NO
T4-CLVT          78.5       FREE                          NO

[STORAGE]
;;               Invert   Max.     Init.    Storage    Curve
      Evap.
;;Name           Elev.    Depth    Depth    Curve      Params
      Frac.    Infiltration parameters
;;-------------- -------- -------- -------- ---------- -------- -------- --------
-------- -------- -----------------------
100              78.93    2.926    0        FUNCTIONAL 0        0        1.13     0
      0
100C             79.223   2.607    0        FUNCTIONAL 0        0        1.13     0
      0
101              78.959   3.083    0        FUNCTIONAL 0        0        1.13     0
      0
102              79.421   2.648    0        FUNCTIONAL 0        0        1.13     0
      0
102-S            82.07    0.4      0        FUNCTIONAL 0        0        0        0
      0
103              79.527   2.22     0        FUNCTIONAL 0        0        1.13     0
      0
104              79.13    2.867    0        FUNCTIONAL 0        0        1.13     0
      0
105              79.167   3.345    0        FUNCTIONAL 0        0        1.13     0
      0
```

105-S	82	0.4	0	FUNCTIONAL	0	0	0	0	0
106	79.218	4.042	0	FUNCTIONAL	0	0	1.13	0	0
107	79.287	4.594	0	FUNCTIONAL	0	0	1.13	0	0
107-S	83.89	0.4	0	FUNCTIONAL	0	0	0	0	0
108	82.357	3.792	0	FUNCTIONAL	0	0	1.13	0	0
109	83.109	3.684	0	FUNCTIONAL	0	0	1.13	0	0
110	84.571	3.451	0	FUNCTIONAL	0	0	1.13	0	0
111	79.49	4.416	0	FUNCTIONAL	0	0	1.13	0	0
112	79.539	4.059	0	FUNCTIONAL	0	0	1.13	0	0
113	79.624	4.047	0	FUNCTIONAL	0	0	1.13	0	0
113-S	84.05	0.4	0	FUNCTIONAL	0	0	0	0	0
114	79.881	4.613	0	FUNCTIONAL	0	0	1.13	0	0
115	80.462	4.472	0	FUNCTIONAL	0	0	1.13	0	0
116	81.652	3.455	0	FUNCTIONAL	0	0	1.13	0	0
117	81.643	3.484	0	FUNCTIONAL	0	0	1.13	0	0
147	78.884	1.605	0	FUNCTIONAL	0	0	1.13	0	0
148	78.96	2.865	0	FUNCTIONAL	0	0	1.13	0	0
149	79.155	2.723	0	FUNCTIONAL	0	0	1.13	0	0
150	79.2	3.14	0	FUNCTIONAL	0	0	1.13	0	0
200	79.234	5.856	0	FUNCTIONAL	0	0	1.13	0	0
201	79.386	5.814	0	FUNCTIONAL	0	0	1.13	0	0
202	79.67	6.81	0	FUNCTIONAL	0	0	1.13	0	0
222	77.32	2.062	0	FUNCTIONAL	0	0	1.13	0	0
223	78.04	3.76	0	FUNCTIONAL	0	0	1.13	0	0
223-S	83.25	0.4	0	FUNCTIONAL	0	0	0	0	0
224	78.893	5.956	0	FUNCTIONAL	0	0	1.13	0	0
225	79.094	5.912	0	FUNCTIONAL	0	0	1.13	0	0
C103A-S	80.24	2.4	0	FUNCTIONAL	0	0	0	0	0
C103B-S	81	2.75	0	TABULAR	C103B-S			0	0
C103C-S	81	1.8	0	FUNCTIONAL	0	0	0	0	0
C107A-S	80.52	2.4	0	FUNCTIONAL	0	0	0	0	0
C109A-S	84.96	2.4	0	FUNCTIONAL	0	0	0	0	

```
      0
C113A-S          82.05    2.4      0        FUNCTIONAL 0        0        0        0
      0
C114A-S          82.29    2.4      0        FUNCTIONAL 0        0        0        0
      0
C114B-S          80.95    2.65     0        TABULAR    C114B-S                    0
      0
C115A-S          83       2.4      0        FUNCTIONAL 0        0        0        0
      0
C115B-S          81.35    2.65     0        TABULAR    C115B-S                    0
      0
C117A-S          83.03    2.4      0        FUNCTIONAL 0        0        0        0
      0
C117B-S          83.17    2.3      0        FUNCTIONAL 0        0        0        0
      0
C117C-S          83.09    2.4      0        FUNCTIONAL 0        0        0        0
      0
C223B-S          79.15    2.65     0        TABULAR    C223B-S                    0
      0
C223C-S          78.87    2.75     0        TABULAR    C223C-S                    0
      0
C223D-S          78.65    2.65     0        TABULAR    C223D-S                    0
      0
C223E-S          78.65    2.65     0        TABULAR    C223E-S                    0
      0
C224B-S          81.1     2.75     0        TABULAR    C224B-S                    0
      0
C224C-S          80.65    2.65     0        TABULAR    C224C-S                    0
      0
F112A-S          82       2.3      0        FUNCTIONAL 0        0        0        0
      0
F114C-S          82.34    2.3      0        FUNCTIONAL 0        0        0        0
      0
F202A-S          83       2.35     0        FUNCTIONAL 0        0        1700     0
      0
L110A-S          85.75    2.4      0        FUNCTIONAL 0        0        0        0
      0
L116A-S          83.31    2.4      0        FUNCTIONAL 0        0        0        0
      0
L223A-S          79.1     2.4      0        FUNCTIONAL 0        0        0        0
      0
L224A-S          83       2.4      0        FUNCTIONAL 0        0        0        0
      0
POND-S           78.5     3.3      1        TABULAR    Pond-S                     0
      0

[CONDUITS]
;;               Inlet            Outlet                      Manning    Inlet
Outlet     Init.      Max.
;;Name           Node             Node             Length     N          Offset
Offset     Flow       Flow
;;-------------- ---------------- ---------------- ---------- ---------- ----------
---------- ---------- ----------
C1               F114C-S          T3-2             5          0.025      84.34
84         0          0
C10              C223B-S          T3-8             5          0.025      81.5
80.4       0          0
C11              C223E-S          T3-9             5          0.025      81
80.2       0          0
C12              C223D-S          T4-CLVT          5          0.025      81
78.5       0          0
C13              C223C-S          L223A-S          6          0.013      81.22
81.1       0          0
```

C2	F112A-S	T3-1	2	0.025	84	82	0	0
C3	C103C-S	105-S	5	0.025	82.5	82	0	0
C4	102-S	105-S	34.6	0.013	82.07	82	0	0
C5	L223A-S	MARCH-RD	117.6	0.013	81.1	78.94	0	0
C6	C224B-S	223-S	10	0.013	83.45	83.25	0	0
C7	C114B-S	T3-5	5	0.025	83.3	82.2	0	0
C8	C115B-S	T3-6	5	0.025	83.7	82.5	0	0
C9	C224C-S	T3-7	5	0.025	83	81	0	0
Pipe_10	113	112	36.778	0.013	79.924	79.869	0	0
Pipe_10-S	113-S	C113A-S	2	0.025	84.05	82.5	0	0
Pipe_11	114	113	168.623	0.013	80.181	79.928	0	0
Pipe_11_(1)	115	114	140.272	0.013	80.762	80.481	0	0
Pipe_11_(1)-S	C115A-S	C114A-S	196.5	0.013	85	84.29	0	0
Pipe_11-S	C114A-S	113-S	133.3	0.013	84.29	84.05	0	0
Pipe_12	117	115	73.093	0.013	81.943	81.212	0	0
Pipe_12-S	C117A-S	C115A-S	41	0.013	85.03	85	0	0
Pipe_14	116	115	66.549	0.013	81.952	81.287	0	0
Pipe_14-S	L116A-S	C115A-S	62.7	0.013	85.31	85	0	0
Pipe_17_(1)	222	MN-EAST	66	0.013	77.62	77.29	0	0
Pipe_18	223	222	131.874	0.013	78.34	77.68	0	0
Pipe_18-S	223-S	L223A-S	117.6	0.013	83.25	81.1	0	0
Pipe_19	224	223	167.63	0.013	79.193	78.355	0	0
Pipe_19-S	L224A-S	223-S	95	0.013	85	83.25	0	0
Pipe_2	100	POND-S	16.664	0.013	79.23	79.213	0	0
Pipe_2_(1)	101	100	26.248	0.013	79.259	79.233	0	0
Pipe_20	225	224	70.68	0.013	79.394	79.253	0	0
Pipe_20-S	C117B-S	C117A-S	2	0.025	85.17	85.15	0	0
Pipe_23	100C	POND-S	19.805	0.013	79.523	79.503	0	0
Pipe_24	100	100C	16.387	0.013	79.569	79.553	0	0
Pipe_3	102	101	12.501	0.013	79.721	79.709	0	0
Pipe_3_(1)	103	102	102.607	0.013	79.827	79.724	0	0
Pipe_3_(1)-S	C103A-S	102-S	79.2	0.013	82.24			

```
82.07       0           0
Pipe_4            104               101               21.076      0.013       79.43
79.409      0           0
Pipe_43           108               107               144.64      0.013       82.657
80.487      0           0
Pipe_44           109               108               47.158      0.013       83.409
82.702      0           0
Pipe_44-S         C109A-S           107-S             193.9       0.013       86.96
83.89       0           0
Pipe_45           110               109               87.497      0.013       84.871
83.559      0           0
Pipe_45-S         L110A-S           C109A-S           69.9        0.013       87.75
86.96       0           0
Pipe_4-S          C103B-S           102-S             6           0.013       83.35
82.042      0           0
Pipe_5            105               104               33.6        0.013       79.467
79.433      0           0
Pipe_50           200               225               54.977      0.013       79.534
79.424      0           0
Pipe_50-S         C117C-S           C117A-S           68.5        0.013       85.09
85.03       0           0
Pipe_53           201               200               45.687      0.013       79.686
79.594      0           0
Pipe_54           202               201               127.263     0.013       79.97
79.716      0           0
Pipe_56           147               MN-WEST           159.032     0.013       79.184
78.999      0           0
Pipe_57           148               147               38.734      0.013       79.26
79.214      0           0
Pipe_58           149               148               158.868     0.013       79.455
79.264      0           0
Pipe_58_(1)       150               149               37.302      0.013       79.503
79.458      0           0
Pipe_5-S          105-S             POND-S            2           0.025       82
81.5        0           0
Pipe_6            106               105               48.048      0.013       79.518
79.47       0           0
Pipe_6-S          C107A-S           105-S             33.4        0.013       82.52
82          0           0
Pipe_7            107               106               39.355      0.013       79.587
79.548      0           0
Pipe_7-S          107-S             C107A-S           88.5        0.013       83.89
82.52       0           0
Pipe_8            111               107               35.252      0.013       79.79
79.737      0           0
Pipe_8-S          C113A-S           107-S             77.6        0.013       84.05
83.89       0           0
Pipe_9            112               111               29.457      0.013       79.839
79.794      0           0

[ORIFICES]
;;                Inlet             Outlet            Orifice       Crest       Disch.
 Flap Open/Close
;;Name            Node              Node              Type          Height      Coeff.
 Gate Time
;;-------------- ---------------- ---------------- ------------ ----------
---------- ---- ----------
QUAL-ORF          POND-S            150               SIDE          79.5        0.62
 NO   0
QUANT-ORF         POND-S            150               SIDE          79.75       0.62
 NO   0

[WEIRS]
```

```
;;               Inlet            Outlet           Weir         Crest      Disch.
 Flap End      End
;;Name           Node             Node             Type         Height     Coeff.
 Gate Con.     Coeff.     Surcharge  RoadWidth  RoadSurf   Coeff. Curve
;;-------------- ---------------- ---------------- ------------ ----------
---------- ---- -------- ---------- ---------- ---------- ----------
----------------
OVERFLOW         POND-S           T3-4             TRANSVERSE   81.7       1.74
 NO   0        0          YES
QUANT-WEIR       POND-S           150              TRANSVERSE   81.2       1.7
 NO   0        0          YES

[OUTLETS]
;;               Inlet            Outlet           Outflow    Outlet
Qcoeff/                     Flap
;;Name           Node             Node             Height     Type
QTable           Qexpon      Gate
;;-------------- ---------------- ---------------- ---------- ----------------
---------------- ---------- ----
C103A-IC         C103A-S          103              80.24      TABULAR/HEAD
C103A-IC                    NO
C103B-IC         C103B-S          103              81         TABULAR/HEAD
C103B-IC                    NO
C103C-IC         C103C-S          103              81         TABULAR/HEAD
C103C-IC                    NO
C107A-IC         C107A-S          107              80.52      TABULAR/HEAD
C107A-IC                    NO
C109A-IC         C109A-S          109              84.96      TABULAR/HEAD
C109A-IC                    NO
C113A-IC         C113A-S          113              82.05      TABULAR/HEAD
C113A-IC                    NO
C114A-IC         C114A-S          114              82.29      TABULAR/HEAD
C114A-IC                    NO
C114B-IC         C114B-S          114              80.95      TABULAR/HEAD
C114B-IC                    NO
C115A-IC         C115A-S          115              83         TABULAR/HEAD
C115A-IC                    NO
C115B-IC         C115B-S          115              81.35      TABULAR/HEAD
C115B-IC                    NO
C117A-IC         C117A-S          117              83.03      TABULAR/HEAD
C117A-IC                    NO
C117B-IC         C117B-S          117              83.17      TABULAR/HEAD
C117B-IC                    NO
C117C-IC         C117C-S          117              83.09      TABULAR/HEAD
C117C-IC                    NO
C223B-IC         C223B-S          223              79.15      TABULAR/HEAD
C223B-IC                    NO
C223C-IC         C223C-S          223              78.87      TABULAR/HEAD
C223C-IC                    NO
C223D-IC         C223D-S          223              78.65      TABULAR/HEAD
C223D-IC                    NO
C223E-IC         C223E-S          223              78.65      TABULAR/HEAD
C223E-IC                    NO
C224B-IC         C224B-S          224              81.1       TABULAR/HEAD
C224B-IC                    NO
C224C-IC         C224C-S          224              80.65      TABULAR/HEAD
C224C-IC                    NO
F112A-IC         F112A-S          112              82         TABULAR/HEAD
F112A-IC                    NO
F114C-IC         F114C-S          114              82.34      TABULAR/HEAD
F114C-IC                    NO
F202A-IC         F202A-S          202              83         TABULAR/HEAD
F202A-IC                    NO
```

```
L110A-IC         L110A-S          110              85.75      TABULAR/HEAD
L110A-IC                    NO
L116A-IC         L116A-S          116              83.31      TABULAR/HEAD
L116A-IC                    NO
L223A-IC         L223A-S          223              79.1       TABULAR/HEAD
L223A-IC                    NO
L224A-IC         L224A-S          224              83         TABULAR/HEAD
L224A-IC                    NO

[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4
Barrels
;;-------------- ------------ ---------------- ---------- ---------- ----------
----------
C1               TRIANGULAR   0.3              1.8        0          0          1

C10              TRIANGULAR   0.3              1.8        0          0          1

C11              TRIANGULAR   0.3              1.8        0          0          1

C12              TRIANGULAR   0.3              1.8        0          0          1

C13              IRREGULAR    16.5mROW         0          0          0          1

C2               TRIANGULAR   0.3              1.8        0          0          1

C3               TRIANGULAR   0.3              1.8        0          0          1

C4               IRREGULAR    24mROW           0          0          0          1

C5               IRREGULAR    24mROW           0          0          0          1

C6               IRREGULAR    16.5mROW         0          0          0          1

C7               TRIANGULAR   0.3              1.8        0          0          1

C8               TRIANGULAR   0.3              1.8        0          0          1

C9               TRIANGULAR   0.3              1.8        0          0          1

Pipe_10          CIRCULAR     1.2              0          0          0          1

Pipe_10-S        TRIANGULAR   0.3              1.8        0          0          1

Pipe_11          CIRCULAR     1.2              0          0          0          1

Pipe_11_(1)      CIRCULAR     0.9              0          0          0          1

Pipe_11_(1)-S    IRREGULAR    24mROW           0          0          0          1

Pipe_11-S        IRREGULAR    24mROW           0          0          0          1

Pipe_12          CIRCULAR     0.45             0          0          0          1

Pipe_12-S        IRREGULAR    24mROW           0          0          0          1

Pipe_14          CIRCULAR     0.375            0          0          0          1

Pipe_14-S        IRREGULAR    18mROW           0          0          0          1

Pipe_17_(1)      CIRCULAR     0.9              0          0          0          1

Pipe_18          CIRCULAR     0.9              0          0          0          1
```

Pipe_18-S	IRREGULAR	18mROW	0	0	0	1
Pipe_19	CIRCULAR	0.9	0	0	0	1
Pipe_19-S	IRREGULAR	18mROW	0	0	0	1
Pipe_2	CIRCULAR	1.5	0	0	0	1
Pipe_2_(1)	CIRCULAR	1.5	0	0	0	1
Pipe_20	CIRCULAR	0.9	0	0	0	1
Pipe_20-S	TRIANGULAR	0.3	1.8	0	0	1
Pipe_23	CIRCULAR	1.5	0	0	0	1
Pipe_24	CIRCULAR	1.5	0	0	0	1
Pipe_3	CIRCULAR	1.05	0	0	0	1
Pipe_3_(1)	CIRCULAR	1.05	0	0	0	1
Pipe_3_(1)-S	IRREGULAR	24mROW	0	0	0	1
Pipe_4	CIRCULAR	1.35	0	0	0	1
Pipe_43	CIRCULAR	0.45	0	0	0	1
Pipe_44	CIRCULAR	0.45	0	0	0	1
Pipe_44-S	IRREGULAR	24mROW	0	0	0	1
Pipe_45	CIRCULAR	0.3	0	0	0	1
Pipe_45-S	IRREGULAR	18mROW	0	0	0	1
Pipe_4-S	IRREGULAR	16.5mROW	0	0	0	1
Pipe_5	CIRCULAR	1.35	0	0	0	1
Pipe_50	CIRCULAR	0.9	0	0	0	1
Pipe_50-S	IRREGULAR	24mROW	0	0	0	1
Pipe_53	CIRCULAR	0.9	0	0	0	1
Pipe_54	CIRCULAR	0.9	0	0	0	1
Pipe_56	CIRCULAR	0.75	0	0	0	1
Pipe_57	CIRCULAR	0.75	0	0	0	1
Pipe_58	CIRCULAR	0.75	0	0	0	1
Pipe_58_(1)	CIRCULAR	0.75	0	0	0	1
Pipe_5-S	TRAPEZOIDAL	0.5	1	3	3	1
Pipe_6	CIRCULAR	1.35	0	0	0	1
Pipe_6-S	IRREGULAR	24mROW	0	0	0	1

```
Pipe_7           CIRCULAR     1.35             0          0          0          1

Pipe_7-S         IRREGULAR    24mROW           0          0          0          1

Pipe_8           CIRCULAR     1.2              0          0          0          1

Pipe_8-S         IRREGULAR    24mROW           0          0          0          1

Pipe_9           CIRCULAR     1.2              0          0          0          1

QUAL-ORF         CIRCULAR     0.083            0          0          0
QUANT-ORF        CIRCULAR     0.083            0          0          0
OVERFLOW         RECT_OPEN    0.2              10         3          3
QUANT-WEIR       RECT_OPEN    0.3              0.12       0          0

[TRANSECTS]

;Full street, width = 10m, curb = 0.15m , cross-slope = 0.02m/m, bank-slope =
0.02m/m, bank-height = 0.23m.
NC 0.025    0.025    0.013
X1 10mROW           7        4        14       0.0       0.0       0.0      0.0
0.0
GR 0.23     0        0.15     4        0        4        0.1      9        0
14
GR 0.15     14       0.23     18

;Full street, width = 8.5m, curb = 0.15m , cross-slope = 0.02m/m, bank-slope =
0.02m/m, bank-height = 0.23m.
NC 0.025    0.025    0.013
X1 16.5mROW         8        4        12.5     0.0       0.0       0.0      0.0
0.0
GR 0.35     0        0.19     2.2      0.15     4        0        4        0.13
8.25
GR 0        12.5     0.15     12.5     0.35     16.5

;Half street, width = 4.25m, curb = 0.15m , cross-slope = 0.03m/m
NC 0.025    0.025    0.013
X1 16.5mROW_half    4        0.0      4.25     0.0       0.0       0.0      0.0
0.0
GR 0.13     0        0        4.25     0.15     4.25     0.35     8.25

NC 0.025    0.025    0.013
X1 16.5mROW_mountable_half 5        7        11.25    0.0       0.0       0.0
0.0      0.0
GR 0.22     0        0.16     3        0.08     7        0        7        0.13
11.25

NC 0.025    0.013    0.013
X1 16.5mROW_sidewalk_half 5        2.2      8.25     0.0       0.0       0.0
0.0      0.0
GR 0.35     0        0.19     2.2      0.15     4        0        4        0.13
8.25

;Full street, width = 8.5m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope =
0.02m/m, bank-height = 0.4m.
NC 0.025    0.025    0.013
X1 18mROW           7        12.5     21       0.0       0.0       0.0      0.0
0.0
GR 0.4      0        0.15     12.5     0        12.5     0.13     16.75    0
21
GR 0.15     21       0.4      33.5

;Half street, width = 4.25m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope =
```

```
0.02m/m, bank-height = 0.245m.
NC 0.025    0.025    0.013
X1 18mROW_half      4        0.0      4.25     0.0        0.0        0.0      0.0
0.0
GR 0.13     0        0        4.25     0.15     4.25     0.25     9

;Full street, width = 8.5m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope =
0.02m/m, bank-height = 0.27m.
NC 0.025    0.025    0.013
X1 20mROW           7        5.75     14.25    0.0        0.0        0.0      0.0
0.0
GR 0.27     0        0.15     5.75     0        5.75     0.13     10       0
14.25
GR 0.15     14.25    0.27     20.5

;Half street, width = 4.25m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope =
0.02m/m, bank-height = 0.27m.
NC 0.025    0.025    0.013
X1 20mROW_half      4        0.0      4.25     0.0        0.0        0.0      0.0
0.0
GR 0.13     0        0        4.25     0.15     4.25     0.27     10

;Full street, width =11m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope =
0.02m/m, bank-height = 0.23m.
NC 0.025    0.025    0.013
X1 24mROW           7        12.5     23.5     0.0        0.0        0.0      0.0
0.0
GR 0.4      0        0.15     12.5     0        12.5     0.17     18       0
23.5
GR 0.15     23.5     0.4      36

;Half street, width = 5.5m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope =
0.02m/m, bank-height = 0.28m.
NC 0.025    0.025    0.013
X1 24mROW_half      4        0.0      5.5      0.0        0.0        0.0      0.0
0.0
GR 0.17     0        0        5.5      0.15     5.5      0.28     12

;Full street, width = 5.5m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope =
0.02m/m, bank-height = 0.23m.
NC 0.02     0.02     0.013
X1 8.5mROW          7        1.5      7        0.0        0.0        0.0      0.0
0.0
GR 0.18     0        0.15     1.5      0        1.5      0.08     4.25     0
7
GR 0.15     7        0.18     8.5

NC 0.025    0.025    0.013
X1 8.5mROW_half     4        1.25     4.25     0.0        0.0        0.0      0.0
0.0
GR 0.35     0        0.15     1.25     0        1.25     0.09     4.25

NC 0.025    0.025    0.013
X1 8.5mROW_mountable_half 5        1.9      4.9      0.0        0.0        0.0
0.0      0.0
GR 0.12     0        0.11     0.65     0.08     1.9      0        1.9      0.09
4.9

[LOSSES]
;;Link           Inlet      Outlet     Average    Flap Gate  SeepageRate
;;-------------- ---------- ---------- ---------- ---------- ----------
Pipe_10          0          0.21       0          NO         0
Pipe_11          0          0.14       0          NO         0
```

```
Pipe_11_(1)      0          0.06       0          NO         0
Pipe_12          0          0.06       0          NO         0
Pipe_14          0          1.32       0          NO         0
Pipe_18          0          1.32       0          NO         0
Pipe_19          0          0.06       0          NO         0
Pipe_2_(1)       0          1.32       0          NO         0
Pipe_20          0          0.02       0          NO         0
Pipe_24          0          1.32       0          NO         0
Pipe_3           0          0.02       0          NO         0
Pipe_3_(1)       0          0.14       0          NO         0
Pipe_4           0          1.32       0          NO         0
Pipe_43          0          1.32       0          NO         0
Pipe_44          0          0.14       0          NO         0
Pipe_45          0          1.32       0          NO         0
Pipe_5           0          0.14       0          NO         0
Pipe_50          0          0.21       0          NO         0
Pipe_53          0          1.32       0          NO         0
Pipe_54          0          0.64       0          NO         0
Pipe_57          0          1.32       0          NO         0
Pipe_58          0          0.14       0          NO         0
Pipe_58_(1)      0          0.39       0          NO         0
Pipe_6           0          0.14       0          NO         0
Pipe_7           0          0.39       0          NO         0
Pipe_8           0          0.06       0          NO         0
Pipe_9           0          0.14       0          NO         0

[CURVES]
;;Name           Type       X-Value    Y-Value   
;;-------------- ---------- ---------- ----------
C103A-IC         Rating     0          0         
C103A-IC                    2          73.2      
C103A-IC                    2.4        80.5      

C103B-IC         Rating     0          0         
C103B-IC                    2          312.2     
C103B-IC                    2.35       328.8     
C103B-IC                    2.75       330       

C103C-IC         Rating     0          0         
C103C-IC                    1.5        394.9     
C103C-IC                    1.8        434       

C107A-IC         Rating     0          0         
C107A-IC                    2          70.7      
C107A-IC                    2.4        77.8      

C109A-IC         Rating     0          0         
C109A-IC                    2          148.4     
C109A-IC                    2.4        154       

C113A-IC         Rating     0          0         
C113A-IC                    2          67.9      
C113A-IC                    2.4        74.7      

C114A-IC         Rating     0          0         
C114A-IC                    2          218.5     
C114A-IC                    2.4        240.4     

C114B-IC         Rating     0          0         
C114B-IC                    2          244.9     
C114B-IC                    2.35       258       
C114B-IC                    2.65       260       
```

C115A-IC	Rating	0	0
C115A-IC		2	201.6
C115A-IC		2.4	221.8
C115B-IC	Rating	0	0
C115B-IC		2	299.6
C115B-IC		2.35	329.6
C115B-IC		2.65	333
C117A-IC	Rating	0	0
C117A-IC		2	88.5
C117A-IC		2.4	97.4
C117B-IC	Rating	0	0
C117B-IC		2	95.3
C117B-IC		2.3	104.8
C117C-IC	Rating	0	0
C117C-IC		2	48.6
C117C-IC		2.4	53.5
C223B-IC	Rating	0	0
C223B-IC		2	62
C223B-IC		2.35	68.9
C223B-IC		2.65	69
C223C-IC	Rating	0	0
C223C-IC		2	62.5
C223C-IC		2.35	69.4
C223C-IC		2.75	70
C223D-IC	Rating	0	0
C223D-IC		2	221.7
C223D-IC		2.35	246.5
C223D-IC		2.65	247
C223E-IC	Rating	0	0
C223E-IC		2	30.1
C223E-IC		2.35	33.6
C223E-IC		2.65	34
C224B-IC	Rating	0	0
C224B-IC		2	237.9
C224B-IC		2.35	264.4
C224B-IC		2.75	270
C224C-IC	Rating	0	0
C224C-IC		2	118.2
C224C-IC		2.35	131.5
C224C-IC		2.65	132
F112A-IC	Rating	0	0
F112A-IC		2	188.6
F112A-IC		2.3	207
F114C-IC	Rating	0	0
F114C-IC		2	391.2
F114C-IC		2.3	430.3
F202A-IC	Rating	0	0
F202A-IC		2	379
F202A-IC		2.35	386

L110A-IC	Rating	0	0
L110A-IC		2	84.4
L110A-IC		2.4	92.8
L116A-IC	Rating	0	0
L116A-IC		2	99.8
L116A-IC		2.4	109.8
L223A-IC	Rating	0	0
L223A-IC		2	39.2
L223A-IC		2.4	43.1
L224A-IC	Rating	0	0
L224A-IC		2	44.5
L224A-IC		2.4	49
C103B-S	Storage	0	0
C103B-S		2	0
C103B-S		2.35	1000
C103B-S		2.351	0
C103B-S		2.75	0
C114B-S	Storage	0	0
C114B-S		2	0
C114B-S		2.35	650
C114B-S		2.351	0
C114B-S		2.65	0
C115B-S	Storage	0	0
C115B-S		2	0
C115B-S		2.35	900
C115B-S		2.351	0
C115B-S		2.65	0
C223B-S	Storage	0	0
C223B-S		2	0
C223B-S		2.35	600
C223B-S		2.351	0
C223B-S		2.65	0
C223C-S	Storage	0	0
C223C-S		2	0
C223C-S		2.35	650
C223C-S		2.351	0
C223C-S		2.75	0
C223D-S	Storage	0	0
C223D-S		2	0
C223D-S		2.35	2500
C223D-S		2.351	0
C223D-S		2.65	0
C223E-S	Storage	0	0
C223E-S		2	0
C223E-S		2.35	350
C223E-S		2.351	0
C223E-S		2.65	0
C224B-S	Storage	0	0
C224B-S		2	0
C224B-S		2.35	2500
C224B-S		2.351	0
C224B-S		2.75	0

```
C224C-S          Storage    0          0
C224C-S                     2          0
C224C-S                     2.35       1500
C224C-S                     2.351      0
C224C-S                     2.65       0

Pond-S           Storage    0          1593
Pond-S                      0.7        2567
Pond-S                      0.8        3163
Pond-S                      0.9        3759
Pond-S                      1          4336
Pond-S                      1.25       5277
Pond-S                      1.4        5842
Pond-S                      1.6        6595
Pond-S                      2.35       7983
Pond-S                      2.39       8057
Pond-S                      3          9800
Pond-S                      3.3        10000

[REPORT]
INPUT      NO
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]
Subcatch   C103A            Collector
Subcatch   C103B            Multi-Unit
Subcatch   C103C            Park
Subcatch   C107A            Collector
Subcatch   C109A            Res.Collector
Subcatch   C113A            Collector
Subcatch   C114A            Res.Collector
Subcatch   C114B            Multi-Unit
Subcatch   C115A            Res.Collector
Subcatch   C115B            Multi-Unit
Subcatch   C117A            Res.Collector
Subcatch   C117B            Fut-Resid.
Subcatch   C117C            Fut-Road
Subcatch   C223B            Multi-Unit
Subcatch   C223C            Multi-Unit
Subcatch   C223D            Fut-Mixed-Use
Subcatch   C223E            Fut-Mixed-Use
Subcatch   C224B            Fut-School
Subcatch   C224C            Multi-Unit
Subcatch   F112A            Prop.Rear-Yard
Subcatch   F114C            Ex.RearYard
Subcatch   F202A            Ex.Rural
Subcatch   L110A            Res.Local
Subcatch   L116A            Res.Local
Subcatch   L223A            Local-Street
Subcatch   L224A            Local-Street
Subcatch   POND             Pond
Node       MARCH-RD         Major_System
Node       MN-EAST          MH
Node       MN-WEST          MH
Node       100              MH
Node       100C             MH
Node       101              MH
Node       102              MH
Node       102-S            Major_System
```

Node	103	MH
Node	104	MH
Node	105	MH
Node	105-S	Major_System
Node	106	MH
Node	107	MH
Node	107-S	Major_System
Node	108	MH
Node	109	MH
Node	110	MH
Node	111	MH
Node	112	MH
Node	113	MH
Node	113-S	Major_System
Node	114	MH
Node	115	MH
Node	116	MH
Node	117	MH
Node	147	MH
Node	148	MH
Node	149	MH
Node	150	MH
Node	200	MH
Node	201	MH
Node	202	MH
Node	222	MH
Node	223	MH
Node	223-S	Major_System
Node	224	MH
Node	225	MH
Node	C103A-S	Major_System
Node	C103B-S	100-YR
Node	C103C-S	Major_System
Node	C107A-S	Major_System
Node	C109A-S	Major_System
Node	C113A-S	Major_System
Node	C114A-S	Major_System
Node	C114B-S	100-YR
Node	C115A-S	Major_System
Node	C115B-S	100-YR
Node	C117A-S	Major_System
Node	C117B-S	Major_System
Node	C117C-S	Major_System
Node	C223B-S	100-YR
Node	C223C-S	100-YR
Node	C223D-S	100-YR
Node	C223E-S	100-YR
Node	C224B-S	100-YR
Node	C224C-S	100-YR
Node	F112A-S	Major_System
Node	F114C-S	Major_System
Node	F202A-S	EX.RURAL
Node	L110A-S	Major_System
Node	L116A-S	Major_System
Node	L223A-S	Major_System
Node	L224A-S	Major_System
Link	C1	Major_System
Link	C10	Major_System
Link	C11	Major_System
Link	C12	Major_System
Link	C13	Major_System
Link	C2	Major_System
Link	C3	Major_System

```
Link        C4              Major_System
Link        C5              Major_System
Link        C6              Major_System
Link        C7              Major_System
Link        C8              Major_System
Link        C9              Major_System
Link        Pipe_10         PIPE
Link        Pipe_10-S       Major_System
Link        Pipe_11         PIPE
Link        Pipe_11_(1)     PIPE
Link        Pipe_11_(1)-S   Major_System
Link        Pipe_11-S       Major_System
Link        Pipe_12         PIPE
Link        Pipe_12-S       Major_System
Link        Pipe_14         PIPE
Link        Pipe_14-S       Major_System
Link        Pipe_17_(1)     PIPE
Link        Pipe_18         PIPE
Link        Pipe_18-S       Major_System
Link        Pipe_19         PIPE
Link        Pipe_19-S       Major_System
Link        Pipe_2          PIPE
Link        Pipe_2_(1)      PIPE
Link        Pipe_20         PIPE
Link        Pipe_20-S       Major_System
Link        Pipe_23         PIPE
Link        Pipe_24         PIPE
Link        Pipe_3          PIPE
Link        Pipe_3_(1)      PIPE
Link        Pipe_3_(1)-S    Major_System
Link        Pipe_4          PIPE
Link        Pipe_43         PIPE
Link        Pipe_44         PIPE
Link        Pipe_44-S       Major_System
Link        Pipe_45         PIPE
Link        Pipe_45-S       Major_System
Link        Pipe_4-S        Major_System
Link        Pipe_5          PIPE
Link        Pipe_50         PIPE
Link        Pipe_50-S       Major_System
Link        Pipe_53         PIPE
Link        Pipe_54         PIPE
Link        Pipe_56         PIPE
Link        Pipe_57         PIPE
Link        Pipe_58         PIPE
Link        Pipe_58_(1)     PIPE
Link        Pipe_5-S        Major_System
Link        Pipe_6          PIPE
Link        Pipe_6-S        Major_System
Link        Pipe_7          PIPE
Link        Pipe_7-S        Major_System
Link        Pipe_8          PIPE
Link        Pipe_8-S        Major_System
Link        Pipe_9          PIPE

[MAP]
DIMENSIONS       348001.3187      5023765.22275    348950.4493      5025015.02625
UNITS            Meters
```

C.4 FUNCTIONAL KNUEA SWM POND 2 CALCULATIONS

160401347 Brigil Kanata North Development - Functional KNUEA SWM Pond 2

Stormwater Quality Volumetric Requirements

Pond	Drainage Area (ha)	Actual % Imp.	MOE Control Level	Water Quality Unit Volume Requirments			Water Quality Volume Requirements			Water Quality Volumes Provided			
				Total Unit Volume (m^3/ha)	Permanent Pool (m^3/ha)	Extended Detention (m^3/ha)	Permanent Pool (m^3)	Extended Detention (m^3)	Total MECP Volume	Permanent Pool (m^3)	Extended Detention (m^3)	Total MECP Volume	Actual Provided Unit Volume (m^3/ha)
KNUEA POND 2	18.58	48	Enhanced - 80% TSS Removal	173	132.5	40	2,462	743	3,205	2,510	1,537	4,046	218

For use in Interpolation of above formulae

	Wetpond					Wetland			
%	0	35	55	70	85	35	55	70	85
Enhanced - 80% TSS Removal	0	140	190	225	250	80	105	120	140
Normal - 70% TSS Removal	0	90	110	130	150	60	70	80	90
Basic - 60% TSS Removal	0	60	75	85	95	60	60	60	60

160401347 Brigil Kanata North Development - Functional KNUEA SWM Pond 2
Stage-Storage-Discharge Summary

Stage	Discharge	Storage		Depth	Forebay			Main Cell			Drawdown Time	
		Active	Total*		Area	Incremental Volume	Accumulated Volume	Area	Incremental Volume	Accumulated Volume		
(m)	(m^3/s)	(m^3)	(m^3)	(m)	(m^2)	(m^3)	(m^3)	(m^2)	(m^3)	(m^3)	(hr)	
78.50		0	0	0.00	358	0	0	1,519	0	0		
79.20		0	1,431	0.70	577	327	327	2,258	1,322	1,322		
79.30		0	1,740	0.80	818	70	397	2,523	239	1,561		
79.40		0	2,099	0.90	1,060	94	491	2,789	266	1,827		
79.50		0	2,510	1.00	1,301	118	609	3,055	292	2,119		Permanent Pool
79.50		0	2,510	1.00	0	0	609	4,336	0	2,119	0	Permanent Pool
79.81		1,525	4,035	0.31	0	0	609	5,502.9	1,525	3,644	53	Ext. Detention
79.90		2,036	4,545	0.40	0	0	609	5,842	511	4,154	16	
80.10		3,279	5,789	0.60	0	0	609	6,595	1,244	5,398	20	
80.85		8,746	11,255	1.35	0	0	609	7,983	5,467	10,865	49	
80.89		9,067	11,576	1.39	0	0	609	8,057	321	11,185	3	
81.50		14,513	17,023	2.00	0	0	609	9,800	5,446	16,632	19	
81.80		17,483	19,993	2.30	0	0	609	10,000	2,970	19,602	8	

* Total pond including forebay, excluding sediment storage (see forebay calculations)

160401347 Brigil Kanata North Development - Functional KNUEA SWM Pond 2

Conceptual Outlet Structure Discharge Calculations

Elevation (m)	Overflow Outlet			Piped Outlet				Weir 1	Total Discharge
		Spillway	Total	Orifice 1	Orifice 2		Control		
78.50									0.000
79.30									0.000
79.40									0.000
79.50									0.000
79.60		0.000	0.000	0.005	0.000		0.000	0.000	**0.005**
79.81		0.000	0.000	0.008	0.000		0.000	0.000	**0.008**
79.90		0.000	0.000	0.009	0.000		0.000	0.000	**0.009**
80.10		0.000	0.000	0.011	0.006		0.006	0.000	**0.018**
80.85		0.000	0.000	0.017	0.014		0.014	0.000	**0.031**
80.89		0.000	0.000	0.017	0.014		0.014	0.000	**0.031**
81.00		0.000	0.000	0.018	0.015		0.015	0.000	**0.033**
81.20		0.000	0.000	0.019	0.016		0.016	0.000	**0.035**
81.30		0.000	0.000	0.019	0.017		0.017	0.008	**0.044**
81.40		0.000	0.000	0.020	0.018		0.018	0.023	**0.060**
81.50		0.000	0.000	0.020	0.018		0.018	0.042	**0.080**
81.60		0.000	0.000	0.021	0.019		0.019	0.065	**0.104**
81.70		0.000	0.000	0.021	0.019		0.019	0.090	**0.131**
81.80		0.550	0.550	0.022	0.020		0.020	0.119	**0.710**

Discharge (m^3/s)

83 mm quality control outlet orifice #1 at inv. = 79.5 m
83 mm quantity conrol orifice #2 at inv. = 79.9 m
0.15 m long weir for quantity control at inv. = 81.2

Parameters

Spillway Weir

Crest Elevation	81.7 m
Crest Width	10 m*
Weir Coeff.	1.740

Orifice 1

Orifice Centre: 79.5415 m	Perimeter: 0.261 m
Orifice Invert: 79.50 m	Area: 0.0054 m^2
Orifice Diameter: 83 mm	Orifice Coeff.: 0.62
Orientation: Vertical	Permanent Pool: 79.50 m

Orifice 2

Orifice Centre: 79.9415 m	Perimeter: 0.261 m
Orifice Invert: 79.90 m	Area: 0.0054 m^2
Orifice Diameter: 83 mm	Orifice Coeff.: 0.62
Orientation: Vertical	

Weir 1

Top of Weir Structure: 81.50 m	Max Perimeter: 0.150 m
Weir Crest Invert: 81.20 m	Max Open Area: 0.045 m^2
Weir Dimensions (Height x Length): 0.30 m Height	0.15 m Len
Side Walls: Vertical	Weir Coeff.: 1.700

Water Quality Extended Detention Summary

Required Extended Detention Time	24-48 hrs for water quality drawdown		
Actual Extended Detention Time	53 hrs	Q_{peak}	0.008 m^3/s
Extended Detention Elevation	79.81 m	Q_{avg}	0.004 m^3/s

Watershed Area (ha)	18.58
Percent Impervious	48.0%
Water Quality Criteria	Enhanced - 80% TSS Removal
Req'd Ext. Det. Volume (m^3/ha)	40
Req'd Ext. Det. Volume (m^3)	743
Provided Ext. Det. (m^3)	1,537
Req'd Perm. Pool Volume (m^3/ha)	132.5
Req'd Perm. Pool Volume (m^3)	2,462
Provided Perm. Pool Volume (m^3)	2,510

Discharge Rates from PCSWMM (m^3/s)

Storm	Pond Inflow	Allowable	Pond Outflow	Storage (m^3)	Water Level
25mm, 4hr Chi	0.932	0.003	0.007	1537	79.81
2-yr, 24hr SCS	1.189	0.016	0.014	2912	80.04
5-yr, 24hr SCS	1.796	0.032	0.020	4246	80.23
100-yr, 24hr SCS	3.146	0.084	0.029	7949	80.74
2-yr, 3hr Chi	1.362	N/A	0.011	2451	79.97
100-yr, 12hr SCS	3.021	0.084	0.033	10414	81.04
100-yr, 3hr Chi	3.961	0.084	0.030	8707	80.85
5-yr, 3hr Chi	2.122	N/A	0.018	3894	80.18

$$Q = CA\sqrt{2g\left(h_2 - h_1 + \frac{D}{2000}\right)}$$

Where,
h2 = elevation at stage 2 (m)
h1 = elevation at stage 1 (m)
D = orifice diameter (mm)
C = orifice coefficient
A = orifice open area (m^2)

$$Q = CL\,(h_2 - h_1)^{1.5}$$

h2 = elevation at stage 2 (m)
h1 = elevation at stage 1 (m)
L = weir crest length (m)
C = weir coefficient

Weir flow calculation for orifice below centreline:

$$\theta = 2\cos^{-}(1 - \frac{2h}{D}) = 2\,\mathrm{acos}\,(1 - \frac{2h}{D})$$

$$P_W = \frac{D\theta}{2}$$

h = water level stage (m)
D = orifice diameter (m)
θ = angle based on water level (radians)
P_W = Wetted Perimeter = Crest Length (m)

160401347 Brigil Kanata North Development - Functional KNUEA SWM Pond 2

Sediment Forebay Sizing Calculations

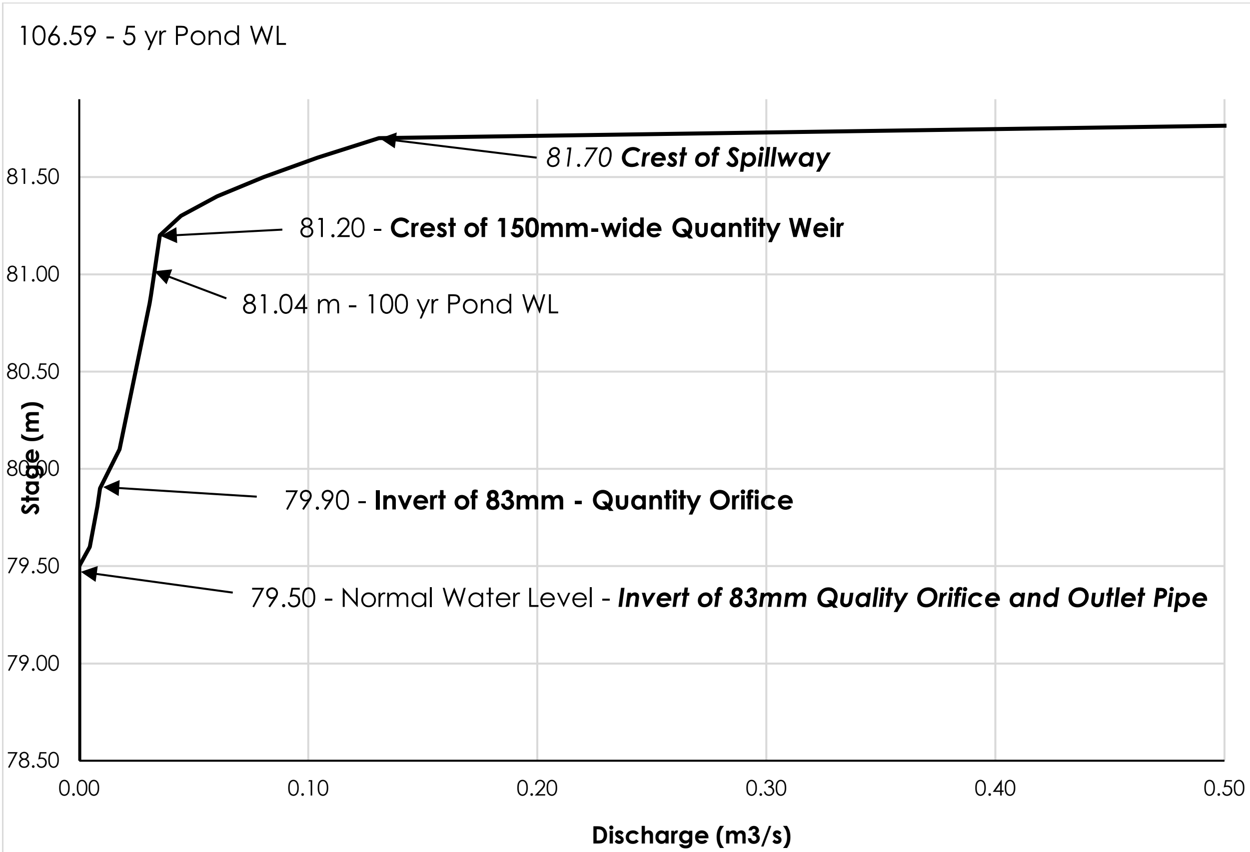
Using MOE - Stormwater Management Planning and Design Manual (2003)

Forebay

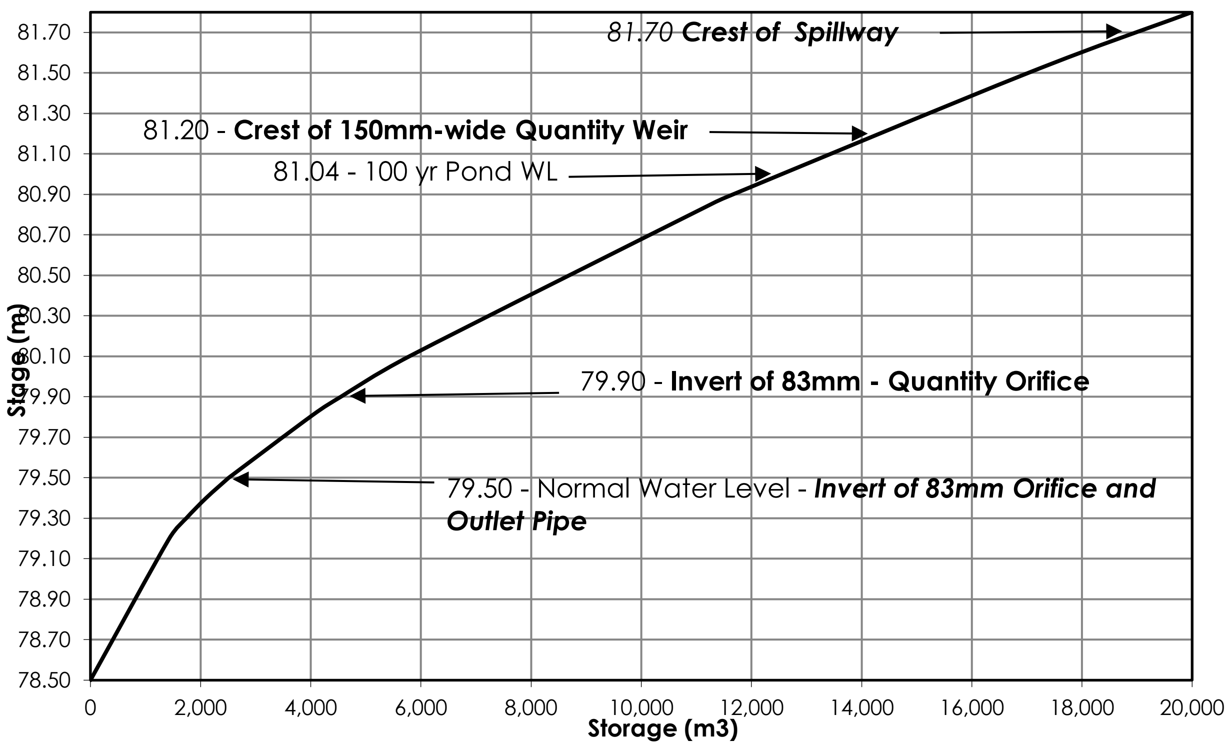
Settling Length	@ Perm. Pool				
Dist = $sqrt(r*Q_p/v_s)$		r : 1 = L to W ratio	r =	3.6	at permanent pool.
= **9.8**	**m**	Q_p = peak SWM outflow during quality storm	Q_p =	0.008	Note 1.
		v_s = settling velocity for 0.15 mm particles (m/s)	v_s =	0.0003	
Dispersion Length	@ Perm. Pool	y_d = total depth of sediment in forebay (m)	y_d =	0.5	
Dist = 8Q/dv		Q = 25mm max inlet flow (m^3/s)	Q =	0.932	Note 2.
= 29.8	**m**	d = depth of perm pool in forebay (m)	d =	0.5	
		v_f = desired vel in forebay (m/s)	v_f =	0.5	
Provided = 54.0	**m**	**Length Criteria Satisfied**	**Provided L:W =**	**7.6**	Average L:W
Velocity	@ Forebay Berm	y = total depth of forebay from perm. pool (m)	y =	0.5	Assume max. sediment depth
v = Q/A		b = bottom width of forebay (m)	b =	6.6	at forebay end
= **0.13**	**m/s**	Q = 25mm inlet flow (m^3/s)	Q =	0.932	
		A = cross-sectional area (m^2)	A =	7.40	Note 3.
		Target velocity = 0.15	V_{targ} =	0.15	
Velocity Target Satisfied					
Cleanout Frequency					
Table 6.3 MOE SWMPD Manual		Water Quality Level	Enhanced - 80% TSS Removal		
		A_{sew} = Contributing Sewer Area (ha)	A_{sew} =	18.58	
cleanout = $Vol/(load*A_{sew}*effic)$		Imp = Percent Impervious (%)	Imp =	48.0%	
= **10.2**	**years**	load = Sediment Loading (m^3/ha)	load =	1.4	Assume same as overall
		effic = Removal Efficiency (%) - Enhanced - 80% TSS Removal Level	effic =	80%	Note 4.
		Targ = Cleanout Frequency Target (years)	Targ =	10	
		Vol = Sediment volume (m^3)	Vol =	218	Note 5.
Surface Area Check					
SA_f/SA_{pp} = **29.9%**		SA_f = Forebay Surface Area (m^2)	SA_f =	1,301	
		SA_{pp} = Total Permanent Pool Surface Area (m^2)	SA_{pp} =	4,356	
		Targ = Forebay size (as % of Permanent Pool Area)	Targ =	33%	
Therefore, **The forebay size is OK!**					

Notes

1. Peak pond outflow at extended detention elevation
2. Inlet flow obtained from PCSWMM model as forebay inflow during 25mm storm
3. Cross-sectional area
4. Interpolated based on percent impervious
5. Volume of bottom 0.5 m depth, the maximum sediment accumulation depth



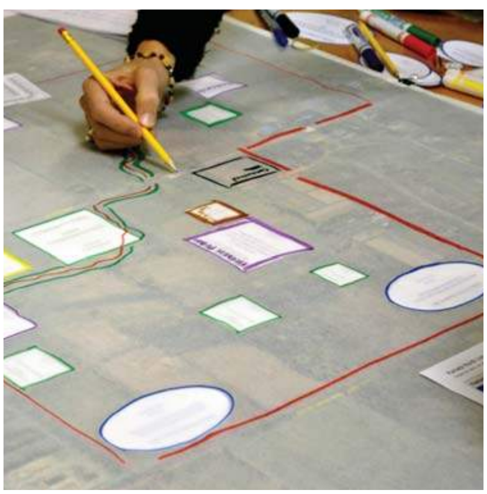
106.59 - 5 yr Pond WL
81.70 Crest of Spillway
81.20 - Crest of 150mm-wide Quantity Weir
81.04 m - 100 yr Pond WL
79.90 - Invert of 83mm - Quantity Orifice
79.50 - Normal Water Level - Invert of 83mm Quality Orifice and Outlet Pipe
Stage (m)
81.50
81.00
80.50
80.00
79.50
79.00
78.50
0.00
0.10
0.20
0.30
0.40
0.50
Discharge (m3/s)


81.70 Crest of Spillway
81.20 - Crest of 150mm-wide Quantity Weir
81.04 - 100 yr Pond WL
79.90 - Invert of 83mm - Quantity Orifice
79.50 - Normal Water Level - Invert of 83mm Orifice and Outlet Pipe
Stage (m)
Storage (m3)
81.70
81.50
81.30
81.10
80.90
80.70
80.50
80.30
80.10
79.90
79.70
79.50
79.30
79.10
78.90
78.70
78.50
0
2,000
4,000
6,000
8,000
10,000
12,000
14,000
16,000
18,000
20,000

C.5 STORM DESIGN BACKGROUND REPORT EXCERPTS

KANATA NORTH
COMMUNITY DESIGN PLAN

ENVIRONMENTAL MANAGEMENT PLAN **REPORT**



FINAL
JUNE 28, 2016

Ottawa

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Shirley's Brook Realignment

- The reach of Shirley's Brook within the March Valley Road right-of-way should be redesigned and relocated onto the adjacent federal lands managed by NCC to avoid any adverse impacts development of the KNUEA may have on erosion and washout of the roadway embankment along March Valley Road.

Low Impact Development

- Based on the findings of the geotechnical and hydrogeological investigations and feedback from the City, there are areas within the KNUEA where LID designs should be considered:
  - The alluvial sand deposits east of March Road represent the most suitable areas for LID within the KNUEA. The alluvial soils are relatively shallow and underlain by clay and/or bedrock, and do not provide any significant contribution to groundwater recharge. However, these soils can provide storage and attenuation of runoff, and contribute to baseflow in Shirley's Brook.
  - The soils west of March Road generally consist of tight clays with relatively shallow depths to bedrock. While this does not preclude the use of LIDs in this area, infiltration based stormwater best management practices should be considered a low priority west of March Road.

Stormwater Management

- Three (3) new end-of-pipe SWM facilities are proposed to service the KNUEA. The recommended SWM facility designs will incorporate:
  - Baseflow enhancement
  - Water quality control (80% long-term TSS removal)
  - Erosion Control (based on geomorphic assessment)
  - Peak flow control
- On-site water quality and quantity controls are proposed for approximately 8 hectares in the southwest quadrant of the KNUEA:
  - Quantity control storage can be provided using a combination of surface and underground storage.
  - Quality control could be provided using treatment units (Stormceptor, Vortechnics, etc.) or through the use of low-impact development design.
- Recommended best management practices for residential areas include:
  - Perforated pipes for rearyard catchbasin leads.
  - Direct roof leaders to rearyard areas.
  - Direct storm runoff from rearyard areas to stream corridors and/or headwater drainage channels.

Compensation by Quadrant

Each quadrant within the KNUEA lands will have a combination of environmental compensation and mitigation as outlined in the above sections relating to species at risk, headwater drainage features, and stream corridors.

Northwest uadrant

- Realigned 40m corridor + 6m pathway for Shirley's Brook Tributary 2.
- Channel 'F' (Nadia Lane) should be intercepted at the KNUEA property boundary and piped to Tributary 2.
- A portion of the southwest wooded area should be maintained as a part of the stream corridor for Shirley's Brook Tributary 3.
- A 0.30 ha portion of the southwest wooded area will be maintained as a part of the Natural Heritage system, and conveyed to the City for conservation.
- Blanding's turtle compensation with deep pools, artificial nesting areas, shallow pans/ pools, and deep channel pockets.
- Headwater features compensation within protected and/ or enhanced creek corridor

Southwest uadrant

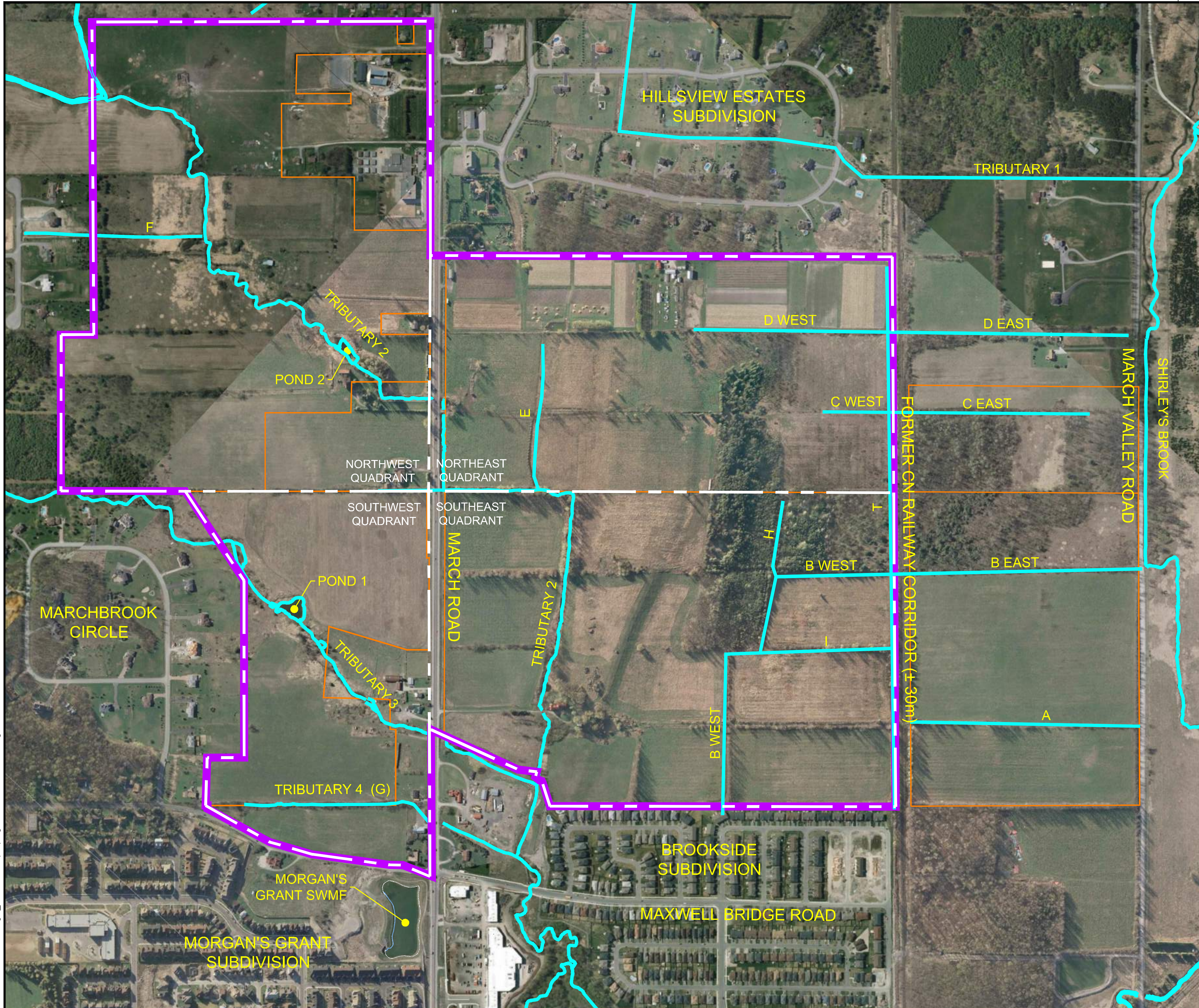
- 40m corridor + 6m pathway for Shirley's Brook Tributary 3.
- Channel 'G' (Marchbrook Circle) should be intercepted at the KNUEA property boundary and piped to Tributary 3.
- Blanding's turtle compensation with deep pools, artificial nesting areas, shallow pans/ pools, and deep channel pockets.
- Headwater features compensation within the protected and/ or enhanced creek corridor

Northeast uadrant

- Realigned 40m corridor + 6m pathway for Shirley's Brook Tributary 2.
- Healthy and mature white cedars in the northwest corner of Woodlot S20 should be retained as a part of the proposed parkland.
- Blanding's turtle compensation with shallow pans/ pools, and deep channel pockets.
- Rear-yard flows from properties along eastern boundary should be directed to culverts crossing the abandoned CN rail corridor to maintain flows in channels 'C' and 'D'
- Re-grade ditch west of the former rail corridor to eliminate perched culverts and direct rearyard drainage to headwater channels east of the rail corridor
- Replace headwater functions in protected stream corridors or other areas.

Southeast uadrant

- 40m corridor + 6m pathway for Shirley's Brook Tributary 2.
- Blanding's turtle compensation with deep pools, artificial nesting areas, shallow pans/ pools, and deep channel pockets.
- Rear-yard flows from properties along eastern boundary should be directed to culverts crossing the abandoned CN rail corridor to maintain flows in existing headwater channels.
- Re-grade ditch west of the former rail corridor to eliminate perched culverts and direct rearyard drainage to headwater channels east of the rail corridor.
- Replace headwater functions in protected stream corridors or other areas.



LEGEND

- KNUEA
- STUDY AREA QUADRANT BOUNDARY
- PROPERTY LINES
- DRAINAGE CHANNEL
- A — DRAINAGE CHANNEL ID

KANATA NORTH
COMMUNITY DESIGN PLAN

FIGURE NO. 3.1
NAMING CONVENTIONS FOR DRAINAGE CHANNELS

DATE: MAY 2016
JOB: 112117
SCALE: 1:7500 (0, 37.5m, 75m, 150m)

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M:\2012\112117\CAD\Design_EMP\MEMO (CS)\Figure 3.1 Watercourses.dwg, FIG-3.1, Mar 24, 2016 - 11:51am, kbanks

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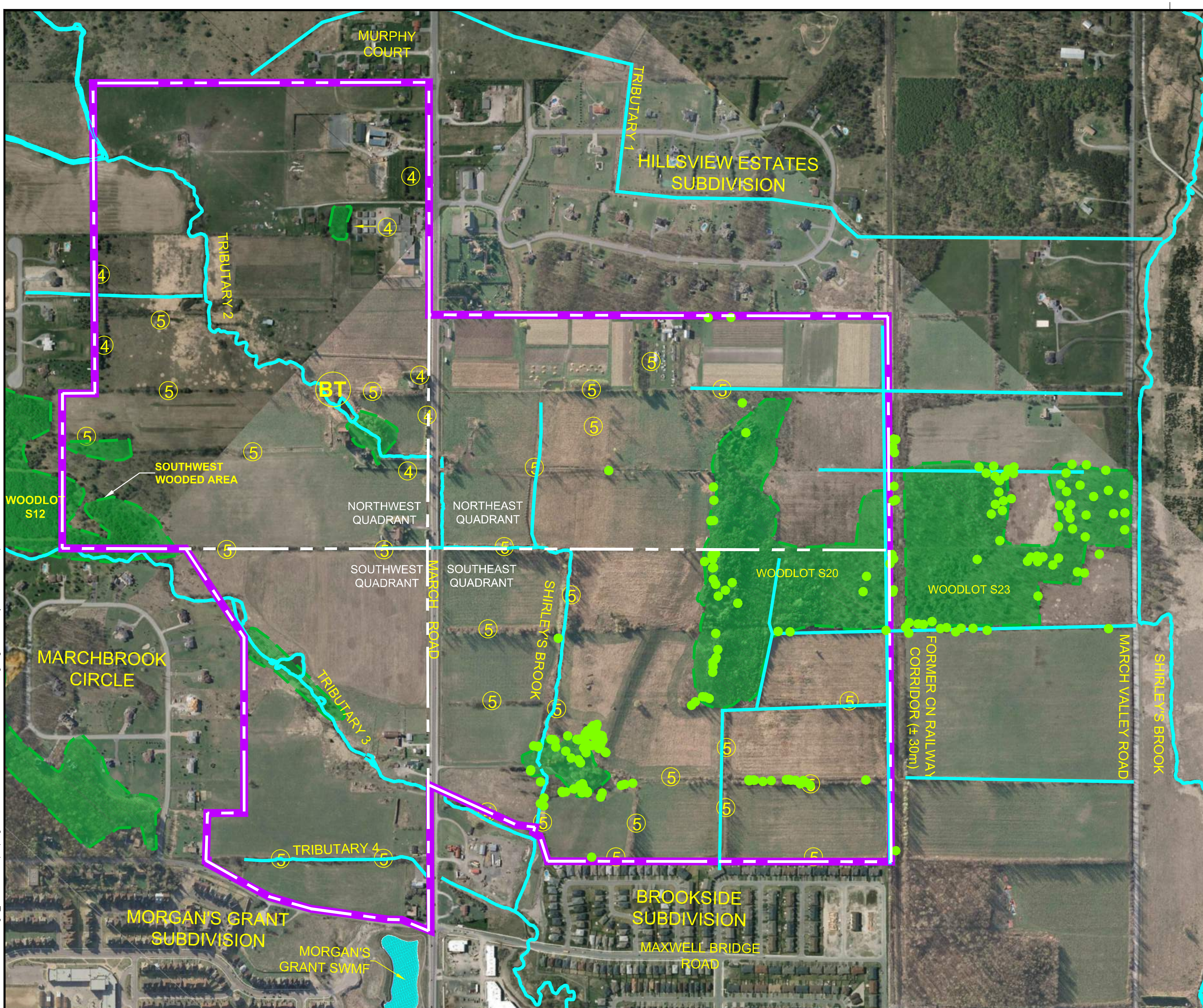

LEGEND

- KNUEA
- DRAINAGE CHANNEL
- (4) CONIFEROUS HEDGEROW
- (5) DECIDUOUS HEDGEROW
- BUTTERNUT LOCATIONS (EXAMPLES)
- (BT) BLANDING'S TURTLE SIGHTING LOCATION
- WOODED AREA

KANATA NORTH
COMMUNITY DESIGN PLAN

FIGURE NO. 3.3
EXISTING CONDITIONS - TERRESTRIAL ENVIRONMENT FEATURES

DATE MAY 2016
JOB 112117
SCALE 1:7500 (0, 75m, 150m)

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M:\2012\112117\CAD\Design_EMP\MEMO (CS)\Figure 3.3 Terrestrial Environment Features.dwg, Figure 3.3, May 11, 2016 - 2:26pm, wsloss

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3.10.5 Model Results

The pre-development SWMHYMO model of Shirley's Brook was run using a variety of storm distributions and durations. The peak flows, runoff volumes, and times to peak from the pre-development SWMHYMO model of the Northwest Branch correlate very closely to the 2013 AECOM model – refer to **Table 3.6**.

The SCS 24-hour storm distribution was found to generate the highest peak flows and was identified as the critical storm distribution for the Northwest Branch subwatershed. Peak flows for all storm distributions used in the analysis are provided in the existing conditions report under separate cover.

Table 3.6: Pre-Development Peak Flows (m^3/s)

Storm Distribution -	SCS 24-Hour Distribution			
Return Period -	**25mm**	**2 year**	**5 year**	**100 year**
Shirley's Brook Northwest Branch				
Tributary 2 *(230 m Upstream of Confluence, HEC-RAS Station 266.29)*	0.057	0.266	0.441	1.144
Tributary 3 *(230 m Upstream of Confluence, HEC-RAS Station 3005.60)*	0.044	0.245	0.426	1.180
Confluence of Tributaries 2 & 3 *(50 m upstream of Maxwell Bridge Road, HEC-RAS Station 0.86)*	0.110	0.549	0.929	2.481
KNUEA Lands to Main Branch of Shirley's Brook at March Valley Road				
Headwater Channels to Shirley s Brook Main Branch *(Channels A-D)*	0.045	0.237	0.407	1.102

3.11 Floodplain Mapping

Regulatory flood mapping for Shirley's Brook is not available for the tributaries comprising the Northwest Branch of Shirley's Brook east of March Road. The 2013 AECOM study includes an updated hydraulic analysis of the Shirley's Brook floodplain, but did not include floodplain mapping for the Northwest Branch of Shirley's Brook.

As part of the existing conditions analysis, a hydraulic model of the Northwest Branch of Shirley's Brook was developed using HEC-RAS to assess the floodplain limits through the KNUEA. Please refer to the following report (located in **Volume 3**, **Appendix J**) for more detailed information and supporting calculations:

- *Kanata North Urban Expansion Area - Existing Conditions Report – Storm Drainage, Hydrology, loodplain Mapping* (Novatech, February 2016)

3.11.1 Model Results

A steady-state analysis was performed using the peak flows listed in **Table 3.5** to calculate flood elevations and corresponding floodplain limits for the Northwest Branch tributaries. The water level elevations for the 2-year, 5-year, and 100-year return periods are summarized in **Table 3.7**. The resulting floodplain limits are shown on **Figure 3.17**. Model schematics, input, and output files can be found in **Volume 2**, **Appendix H**.

Table 3.7: HEC-RAS Model Results - Shirley s Brook Northwest Branch

Watercourse	River Station	Peak Flows (m^3/s)			Water Elevation (m)		
		2yr	5yr	100yr	2yr	5yr	100yr
Tributary 2	2310.70	0.17	0.29	0.77	89.01	89.02	89.05
	1920.64	0.17	0.29	0.77	85.92	85.97	86.12
	1589.43	0.17	0.29	0.77	83.31	83.34	83.39
	1293.80*	0.22	0.36	0.95	79.65	79.78	80.21
	1245.94**	0.22	0.36	0.95	79.44	79.53	79.80
	808.91	0.22	0.36	0.95	77.89	77.90	77.95
	514.32	0.22	0.36	0.95	76.57	76.63	76.78
	266.29	0.27	0.44	1.14	74.76	74.83	75.01
Tributary 3	4112.66	0.20	0.36	1.01	89.35	89.38	89.46
	3673.90	0.20	0.36	1.01	81.34	81.37	81.44
	3271.49*	0.24	0.42	1.16	77.79	77.79	78.03
	3158.50**	0.24	0.42	1.16	76.67	76.73	76.90
	3005.60	0.25	0.43	1.18	74.50	74.58	74.76
Northwest Branch (Confluence of Tributaries 2 & 3)	206.99	0.50	0.85	2.29	74.39	74.42	74.54
	0.86	0.55	0.93	2.49	71.88	71.96	72.13

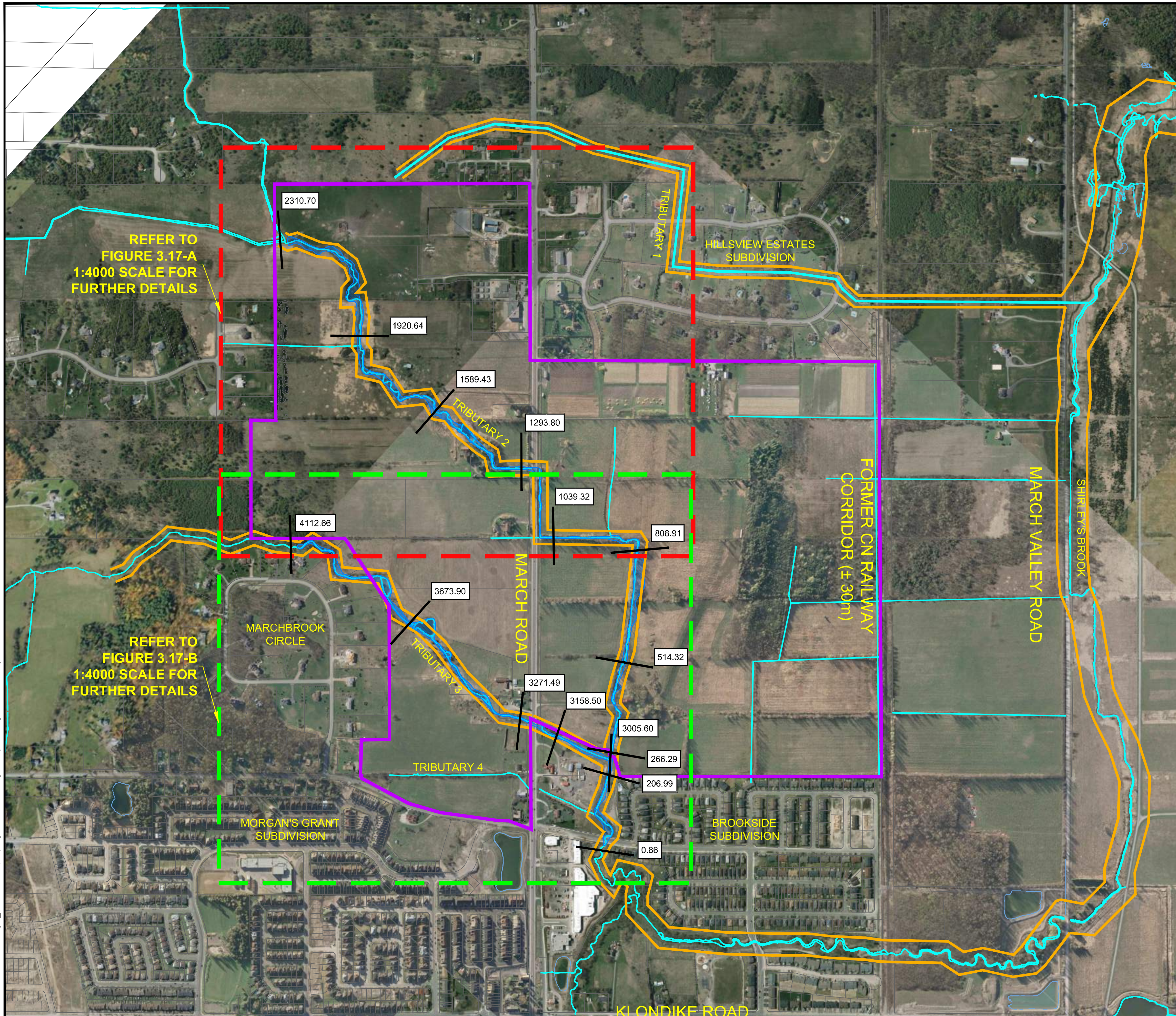
*Cross-Section Upstream of March Road
**Cross-Section Downstream of March Road

<u>Tributary 2</u>

Apart from some localized flooding immediately upstream of March Road (Hydraulic Structure S-2) Tributary 2 has sufficient capacity to confine the 100-year peak flow within the top of bank of the existing channel corridor.

<u>Tributary 3</u>

Tributary 3 has sufficient capacity to confine the 100-year peak flow within the top of bank of the existing channel corridor to the confluence with Tributary 2. The existing culvert crossing March Road (Hydraulic Structure S-6) provides sufficient capacity to convey the 100-year peak flow.



M:\2012\112117\CAD\Design_EMP\MEMO (CS)\Figure 3.17 Existing Floodplain.dwg, FIG-3.17, May 26, 2016 - 10:49am, bthurber

LEGEND

- KNUEA
- MEANDER BELT WIDTH
- DRAINAGE CHANNEL
- 2310.70 HEC-RAS STATION
- FLOODPLAIN EXTENTS

TRIBUTARY 2			
STATION	2-YEAR WL	5-YEAR WL	100-YEAR WL
2310.70	89.03	89.05	89.10
1920.64	86.00	86.11	86.25
1589.43	83.35	83.39	83.43
1293.80	79.86	80.12	80.51
1039.32	78.77	78.87	79.10
808.91	77.91	77.94	78.02
514.32	76.67	76.76	76.92
266.29	74.83	74.93	75.14
TRIBUTARY 3			
STATION	2-YEAR WL	5-YEAR WL	100-YEAR WL
4112.66	89.34	89.37	89.45
3673.90	81.34	81.36	81.43
3271.49	77.81	77.89	78.00
3158.50	76.66	76.72	76.87
3005.60	74.54	74.63	74.84
NORTHWEST BRANCH (CONFLUENCE OF TRIBUTARIES 2 & 3)			
STATION	2-YEAR WL	5-YEAR WL	100-YEAR WL
206.99	74.41	74.47	74.60
0.86	71.92	72.02	72.23

KANATA NORTH
COMMUNITY DESIGN PLAN

FIGURE NO. 3.17
EXISTING FLOODPLAIN LIMITS

DATE MAY 2016 JOB 112117

SCALE 1:10,000

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SHT11x17.DWG - 279mmx432mm

Storm Drainage

- Storm drainage within the urban area will be provided using storm sewers sized to convey the uncontrolled 5-year post-development peak flow (10-year for March Road).
- Major system flows are to be conveyed within the right-of-ways and/or along defined overland flow routes with no encroachment onto private property.
- Major system flows must not flow overland across arterial roads (March Road).

Watercourse Crossings (Culverts)

- Watercourse crossings are to be sized to convey the 100-year peak flow without overtopping the roadways.
- Watercourse crossings should be designed in accordance with geomorphology principles.
- Watercourse crossings should be designed to ensure they meet any additional requirements for terrestrial and aquatic habitat.

SWM Facilities

- All proposed SWM facilities are to be designed in accordance with the following guidelines and manuals:
  - City of Ottawa Stormwater Management Facility Design Guidelines & Standards (DRAFT, October 2012).
  - MOE SWM Planning and Design Manual (March 2003).
- The normal water level (permanent pool) in wet ponds should be above the 2-year water level in the receiving watercourse.
- Where possible, sanitary overflows are to be directed to SWM facilities. City design standards for overflows are currently in development. The following sanitary overflow criteria have been applied to the KNUEA:
  - Sanitary overflows are to operate by gravity and be directed to a SWM facility.
  - The sanitary overflow must be above the 100-year elevation in the SWM facility.
- SWM facilities should be integrated into the community through the use of pathways or other linkages.
- The depth of excavation should be considered when selecting the location of any future SWM facilities:
  - Deep excavations can result in potential issues with groundwater inflow;
  - Where possible, the bottom of the pond should be situated above the bedrock;
  - Deep excavations require a larger pond footprint to tie back into the surrounding grade and can be more difficult to integrate as a feature into the community.

5.3 Climate Change

Warm summers, relatively cold winters, a moderate growing season, and usually reliable rainfall characterize the local climate. Annual precipitation (rain + snow) in the City of Ottawa is approximately 944 mm/yr.

The City of Ottawa has implemented an adaptive management policy to address climate change.

directly to Tributary 2, or collected by the future March Road storm sewers and conveyed to a SWM pond on the east side of March Road.

6.4.2 Southwest uadrant

The recommended SWM strategy for the southwest quadrant of the KNUEA is a single SWM facility located on the north side of Tributary 3. A storm sewer crossing underneath Tributary 3 will allow the proposed street-oriented residential lands adjacent to Marchbrook Circle to be serviced by this facility.

The remaining areas in the southwest quadrant would require on-site stormwater controls for water quality and quantity treatment. The proposed land uses in this area (School, Multi-Unit Residential) are generally compatible with on-site SWM controls.

6.4.3 Northeast Southeast uadrants

The recommended SWM strategy for the KNUEA lands east of March Road is a single SWM facility located adjacent to March Valley Road at the eastern limit of Woodlot S23. Storm runoff from the KNUEA would be directed to the proposed facility through a pair of open channels on either side of the woodlot. The elevation of the proposed SWM facility will be low enough to accommodate the required sanitary overflow.

There is sufficient topographic relief across the eastern portion of the KNUEA for the lands between March Road and Tributary 2 to be serviced by this facility. Two storm sewer crossings under Tributary 2 would be constructed as part of the overall trunk sewer system.

6.4.4 Shirley's Brook at March Valley Road

The recommended SWM strategy to address erosion in the reach of Shirley's Brook Main Branch adjacent to March Valley Road is to realign this reach of the watercourse further east. This represents the most effective means of addressing the ongoing erosion and washout issues. This approach will provide the opportunity to improve the ecological health of the watercourse, create additional habitat, and provide the opportunity for future upgrades to March Valley Road.

6.5 Public Consultation

The evaluation of the SWM servicing alternatives and the selection of the preferred alternative for each subwatershed were presented at a public open house on March 30^{th}, 2016. Meeting details, Public Notices, and Presentation Materials are contained in a separate report along with the comments and inputs received.

6.6 City Consultation

Following presentation of the preferred alternative at the public open house, further analysis of SWM alternatives was completed in response to comments provided by the City in May 2016. The outcome of this analysis has not changed the preferred alternative as presented to the public on March 30, 2016. Refer to correspondence in **Volume 2, Appendix B.**

7.2 Event-Based Modeling

7.2.1 Critical Storm Distribution

Under pre-development conditions, the 24-hour SCS distribution generated the highest peak flows in the receiving watercourses and was consequently was used as the benchmark for the analysis of the proposed SWM strategy for the KNUEA.

7.2.2 Peak lows

The peak flows generated by the 24-hour SCS storm distribution are listed in **Table 7.2**. SWMHYMO model results for other storm distributions are provided in **Volume 2**, **Appendix D**. Pre- vs. post-development hydrographs for the 100-year storm events are provided as **Figures 7.2** to **7.5**.

Table 7.2: Pre vs. Post-Development Model Results (Event-Based)

Storm Distribution -		**SCS 24-Hour**			
Return Period -		**25mm**	**2 year**	**5 year**	**100 year**
Shirley s Brook Northwest Branch					
Tributary 2 *(230 m Upstream of Confluence)*	*Pre*	0.057	0.266	0.441	1.144
	Post	0.062	0.256	0.432	1.080
Tributary 3 *(230 m Upstream of Confluence)*	*Pre*	0.044	0.245	0.426	1.180
	Post	0.114	0.299	0.505	1.451
Confluence of Tributaries 2&3 *(50 m Upstream of Marchbrook Circle)*	*Pre*	0.110	0.549	0.929	2.481
	Post	0.125	0.509	0.895	2.457
KNUEA Lands to Main Branch of Shirley s Brook at March Valley Road					
Flows from East Pond (to Shirley s Brook Main Branch)	*Pre*	0.045	0.237	0.407	1.102
	Post	0.046	0.220	0.383	1.044

As outlined in the above table and following figures, the post development flows at the confluence of Shirley's Brook Tributaries 2 and 3 are less than the pre-development flows at this location. Although post-development peak flows in Tributary 3 are slightly higher downstream of the pond and on-site storage outlets, the overall flow at the confluence is less than pre-development. To ensure that there will be no increase in the erosive potential of the peak flows, continuous flow models were developed to show how the proposed SWM facilities will function through an average year of rainfall. This is discussed in the following **Section 7.3**.

The post-development SWMHYMO model was used to size the three proposed SWM facilities, based on the allowable release rates to Tributaries 2 & 3, and the Main Branch. The "Route Reservoir" command was used to determine the required amount of active storage in each of the facilities to ensure that the target peak flows are met. The volume of required on-site storage was also determined using the "Route Reservoir" command, based on the allowable release rate to Tributary 3. Peak flows in the above table and following graphs are taken downstream from the SWM facility outlets, and account for the storage and attenuation provided by these facilities.

Modeling results and conceptual designs for the proposed SWM facilities are provided in **Section 9.0**.

7.4 Erosion Analysis

To address the increase in erosion potential resulting from higher runoff volumes following development of the KNUEA, erosion threshold targets have been established for reaches of Shirley's Brook in the vicinity of the proposed SWM facility outlets (Parish Aquatic Services, 2016). The critical discharge indicates the minimum flowrate required to initiate sediment movement of the bed material. If flows exceeding this value are sustained for a prolonged period of time, then excessive erosion could occur.

The continuous hydrologic model was used to evaluate the duration of flow above the erosion threshold (critical flow) at three locations:

1. Shirley's Brook Tributary 2 at March Road (SBT-4)
2. Shirley's Brook Tributary 3 at March Road (SBT-5)
3. Confluence of Tributaries 2, 3, and 4 just east of March Road. (SBT-7B)

For Location 3 (SBT-7B), values for critical discharge and bankfull discharge were not provided. As this location is just downstream from SBT-5, the critical discharge and average bankfull discharge from SBT-5 was used for the erosion analysis.

Table 7.4: Pre vs. Post-Development Erosion Analysis (April – November 2014)

Location	Reach ID	Critical Discharge	Bankfull Discharge	Hours of Exceedance (hrs)		Peak Flow (m^3/s)		Average Flow (m^3/s)	
		(m^3/s)	(m^3/s)	Pre	Post	Pre	Post	Pre	Post
1	SBT-4	0.73	2.11	0.0	0.0	0.640	0.497	0.200	0.016
2	SBT-5	0.57	4.54	9.5	11.0	1.214	0.896	0.016	0.013
3	SBT-7B	0.57	4.33	44.5	28.0	1.802	1.368	0.037	0.033

<u>Results</u>

The results of the erosion analysis (**Table 7.4**) indicate that the attenuation and storage provided by the proposed SWM facilities will ensure that there will be no adverse erosion impacts resulting from development of the KNUEA.

At Location 2 (Tributary 3 / SBT-5) the post-development model results indicate a slight increase in the duration of flow above the erosion threshold (1.5 hours over a period of 217 days). While this increase is negligible, the underlying cause has been investigated and can be attributed to the following factors:

- The total increase in post-development flow above the erosion threshold is results from a single large storm (June 24, 2014), which was roughly equivalent to a 50-year return period event.
- The post-development peak flow is approximately 0.30 m^3/s lower than the pre-development peak, but the duration of flow is extended by the attenuation and storage provided by pond 2, as shown in **Figure 7.10**.

8.5.1 Infiltration

The proposed development will reduce annual infiltration from the KNUEA by approximately 35%, but this will only translate to a reduction of approximately 4% over the Shirley's Brook Northwest Branch drainage area (719 ha).

Based on the findings of the hydrogeologic investigation, the water surplus categorized as "infiltration" will consist primarily of shallow groundwater interflow through the weathered bedrock, which will contribute to baseflow in the watercourses, but will provide minimal contribution to groundwater recharge of the underlying aquifer.

8.5.2 Runoff

Annual runoff from the KNUEA will increase by 60% under post-development conditions. Due to the size of the Northwest Branch watershed (719 ha), the total annual runoff volume to the Northwest Branch of Shirley's Brook will only increase by approximately 7%.

The increase in runoff to the Main Branch of Shirley's Brook at March Valley Road will be less than 1%, as the upstream area (1,767 ha) is already heavily urbanized.

8.5.3 Evapotranspiration

Under pre-development conditions, the crop cover coefficient (used to calculate actual evapotranspiration) for vegetated lands will fluctuate over the course of the year during the dormant season and growing season. Under post-development conditions, the impervious surfaces increase the potential evapotranspiration rates during the dormant season and at the beginning and end of the growing season. However, this increase in annual potential evapotranspiration is offset by the reduction in soil moisture storage, leaving less available water for evapotranspiration.

8.6 Summary

Based on the findings of the hydrogeologic investigation, the streamflow monitoring program, and the site-specific water balance model, development of the KNUEA is not anticipated to have any significant impact on groundwater resources.

- The dominant surficial soil type is silty clay / glacial till, which have low infiltration potential.
- Bedrock outcrops of the March and Oxford Formations are assumed to have low infiltration potential as they have not exhibited the presence of karst features.
- No high recharge areas have been identified. An alluvial soils deposit is present in the vicinity of March Road, but it is underlain by stiff silty clay and does not provide any significant groundwater recharge/discharge function.
- The fish species and aquatic / terrestrial species identified within the site are not particularly sensitive to changes in the anticipated changes in the flow regime.

There is no planned future development upstream of the KNUEA. As such, the model results for post-development conditions in the KNUEA represent the total anticipated change to the hydrologic cycle in the Shirley's Brook Northwest Branch subwatershed in the foreseeable future.

Section 9.0 Conceptual SWM Design

Conceptual designs for SWM servicing of the KNUEA have been completed based on the preferred servicing options using the SWM criteria outlined in **Section 7.0**. The recommended areas for SWM blocks have been designed to service the KNUEA as shown on the Preferred Demonstration Plan (refer to **Figure 11.1** in **Section 11.0**), with flexibility in the configuration of the SWM facilities as it relates to available lands and participating landowners. The SWMHYMO hydrologic model has been used to confirm the required sizes for the proposed facilities.

The conceptual designs presented herein are intended to demonstrate the feasibility of implementing the recommended SWM strategy. The pond layouts are subject to change based on future revisions to the land use plan, grading plan, and/or servicing plans. Conceptual design drawings for the three proposed SWM facilities are provided on **Figures 9.1 through 9.4**. Refer to **Volume 2**, **Appendix F** for detailed pond design spreadsheets.

All SWM facilities are to conform to the *Stormwater Management Planning and Design Manual* (MOECC, 2003) and the *City of Ottawa Draft Stormwater Management acility Design Guidelines and Standards* (October, 2012).

9.1 SWM Facilities (General)

Three SWM facilities are proposed to provide water quality, erosion, and peak flow control for the proposed KNUEA development. Pond 1 is located immediately west of March Road and drains to Tributary 2. Pond 2 is located immediately west of March Road and drains to Tributary 3. Pond 3 is located to the east of the KNUEA and drains directly to Shirley's Brook just west of March Valley Road. The preservation and enhancement of Tributary 2 and Tributary 3, along with the existing topography and depth to bedrock were factors in determining the number of SWM facilities required to service this area.

9.1.1 Grading & Layout

The detailed designs of the facilities should avoid rectangular and/or linear shapes, and be landscaped with natural features to maximize their amenity values. The extensive use of retaining walls should be avoided. Sediment management areas should be sized such that they have the same areal coverage as the sediment forebay of the pond. Access roads and pathways should be located such that the entire sediment forebay can be easily accessed by a regular, or long-stick excavator (approximately 15m reach).

The conceptual layouts of the recommended stormwater management facilities provided on **Figures 9.1 to 9.4** are intended to demonstrate the approximate size and configuration of the Pond Block for the purposes of the Community Design Plan. The size and layout of the facilities are subject to change prior to Draft Plan Approval to ensure the Pond Blocks are appropriately sized to the satisfaction of the City.

9.1.2 Rock Excavation

Bedrock excavation will be required for the ponds west of March Road. The conceptual designs for the ponds incorporate measures to reduce the quantity of rock excavation, but the pond elevations are governed by other factors including the elevation of the receiving watercourses (Tributaries 2 and 3), and the overall grading and servicing design as outlined in the Master Servicing Study.

9.1.3 Pond Liner

The SWM facilities should ideally be constructed with native material. If the native material is not suitable due to hydraulic permeability, the bottom of the detention cells must be sealed with clay.

A geotechnical investigation is required for every SWM facility in the City of Ottawa. If it is determined that a liner is required, the appropriate bottom treatment will be recommended in the geotechnical report. Acceptable pond liner options include:

- A layer of compacted clay;
- A geosynthetic liner, covered by a layer of suitable fill (minimum depth 0.3 m);
- Bentonite; or,
- Other suitable materials approved by regulatory authorities.

Ponds 1 and 2 will require impermeable liners as the ponds will be excavated into rock. The requirement for a liner in Pond 3 will be determined at the detailed design stage based on recommendations from the geotechnical consultant.

Groundwater levels will need to be considered when designing the pond liners. Depending on the groundwater elevations, it may be necessary to install a perimeter drain around the facility to ensure the pond liner is not compromised or displaced by hydrostatic pressure from the surrounding water table.

9.1.4 SWM Outlet Structures

Pond 1 and Pond 2 have been sized to control outflows to match the existing flows in their respective tributaries. Pond 3 is sized to match post-development peak flows to pre-development levels for the contributing drainage area. A conceptual outlet configuration is provided as **Figure 9.5** which should be considered in the detail design of each pond. The outlet structure is comprised of:

- A perforated pipe outlet to a French drain to provide baseflow enhancement;
- A bottom draw extended detention outlet to provide quality control;
- A high flow outlet to attenuate peak flows to the allowable release rates;
- An overflow spillway to limit flood risk for events exceeding the available storage.

9.1.5 Temperature Mitigation

Urbanization commonly results in an increase in the temperature of storm runoff, most often due to extended detention within stormwater management facilities. Wet ponds have been found increase the temperature of runoff by approximately 5.1ºC (MOECC, 2003).

Incorporating the following mitigation measures into the design of the proposed SWM ponds will result in reduced thermal impacts from the SWM facilities:

- SWM facilities should be designed using narrow pond configurations with bank plantings to promote shading and inhibit temperature increases;
- Baseflows should be routed through a stone-filled subsurface trench: The length of the trench should be maximized to increase the opportunity for heat transfer from the water to the stone (refer to conceptual SWMF outlet design provided as Figure 10.5).
- Establishing / preserving riparian cover for outlet watercourses will further help to reduce the temperature of runoff.

9.3 Pond 2

Pond 2 is a wet pond SWM facility located in the southwest quadrant of the KNUEA on the north side of Tributary 3 (**Figure 9.2**). This pond would have a tributary drainage area of approximately 17.6 ha with a 5-year peak inflow of 3.4 m^3/s. The pond is oriented roughly perpendicular to March Road and has a total volume of approximately 14,000 m^3 at a depth of 3.0 m. The total area of the pond block is approximately 1.7 ha and includes provisions for grading, access roads, and sediment management.

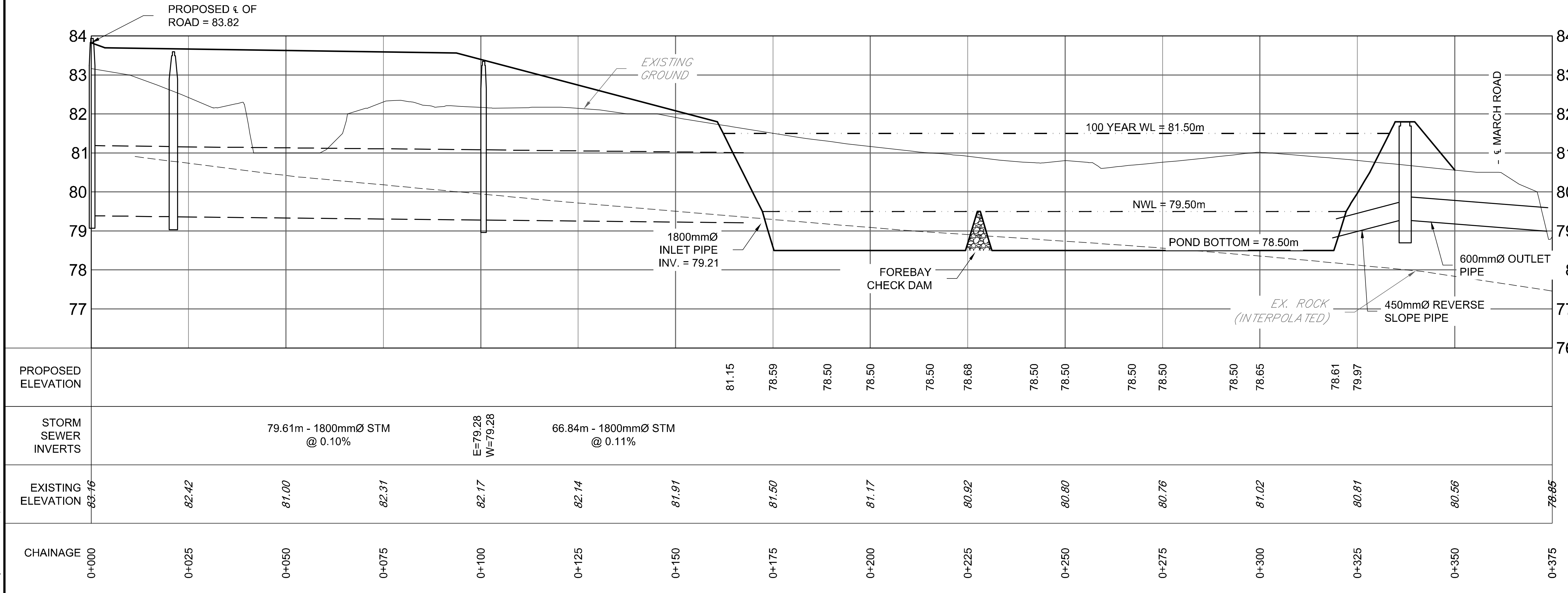
<u>Design Considerations</u>

Pond 2 would service the residential lands and Community Park in the southwest quadrant of the KNUEA. Runoff from the single family residential area south of Tributary 3 (adjacent to Marchbrook Circle) will be directed under Tributary 3 through a storm sewer to the SWM facility. The proposed storm crossing of Tributary 3 will not significantly increase rock excavation requirements, as there will also be crossings for water and sanitary services. The proposed crossing allows the single family residential areas to be serviced by the SWM facility and reduces the area requiring on-site control.

Further information on the tributary crossing can be found in the Master Servicing Study for the KNUEA. Bedrock elevations in the area of the proposed pond are high and the construction of Pond 2 will require bedrock excavation and a pond liner. Conceptual design information for Pond 2 is provided in **Table 9.2** and on **Figure 9.2**.

Table 9.2: Pond 2 Design Information

Area of SWM Block	1.7 ha		
Drainage Area to SWMF	17.6 ha	(41% Impervious)	
Quality Control	Enhanced	(80% TSS Removal)	
	1915 m^3	Req. Perm. Pool Volume	
	704 m^3	Req. Extended Detention Volume	
Quantity Control	100 year	(Allowable flow to Tributary 3)	
	0.084 m^3/s	Target 100-year release rate	
Stage	**Elevation (m)**	**Volume (m^3)**	**Release Rate (L/s)**
Bottom	78.50	0	0
Normal Water Level	79.50	1991	0
Extended Detention Storage	79.75	2891	3
2-year	80.50	6923	11
5-year	80.80	8819	21
100-year	81.50	13,905	58



M:\2012\112117\CAD\Design_EMP\MEMO (KJA)\Figure 9.2 Pond 2 Functional.dwg, Figure 9.2A, May 17, 2016 - 5:37pm, kbanks

KANATA NORTH
COMMUNITY DESIGN PLAN

FIGURE NO. 9.2A
POND 2
CROSS SECTION B-B'

DATE
MAY 2016

JOB
112117

SCALE
1:1000

0 5m 10m 20m

NOVATECH
Engineers, Planners & Landscape Architects

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9.4 Pond 2A

Pond 2 is located on lands that are not currently controlled by the KNLOG. In the event that land cannot be acquired for the preferred option (Pond 2) prior to development proceeding, Pond 2A (**Figure 9.3**) represents a feasible alternative which could be developed on an interim or permanent basis.

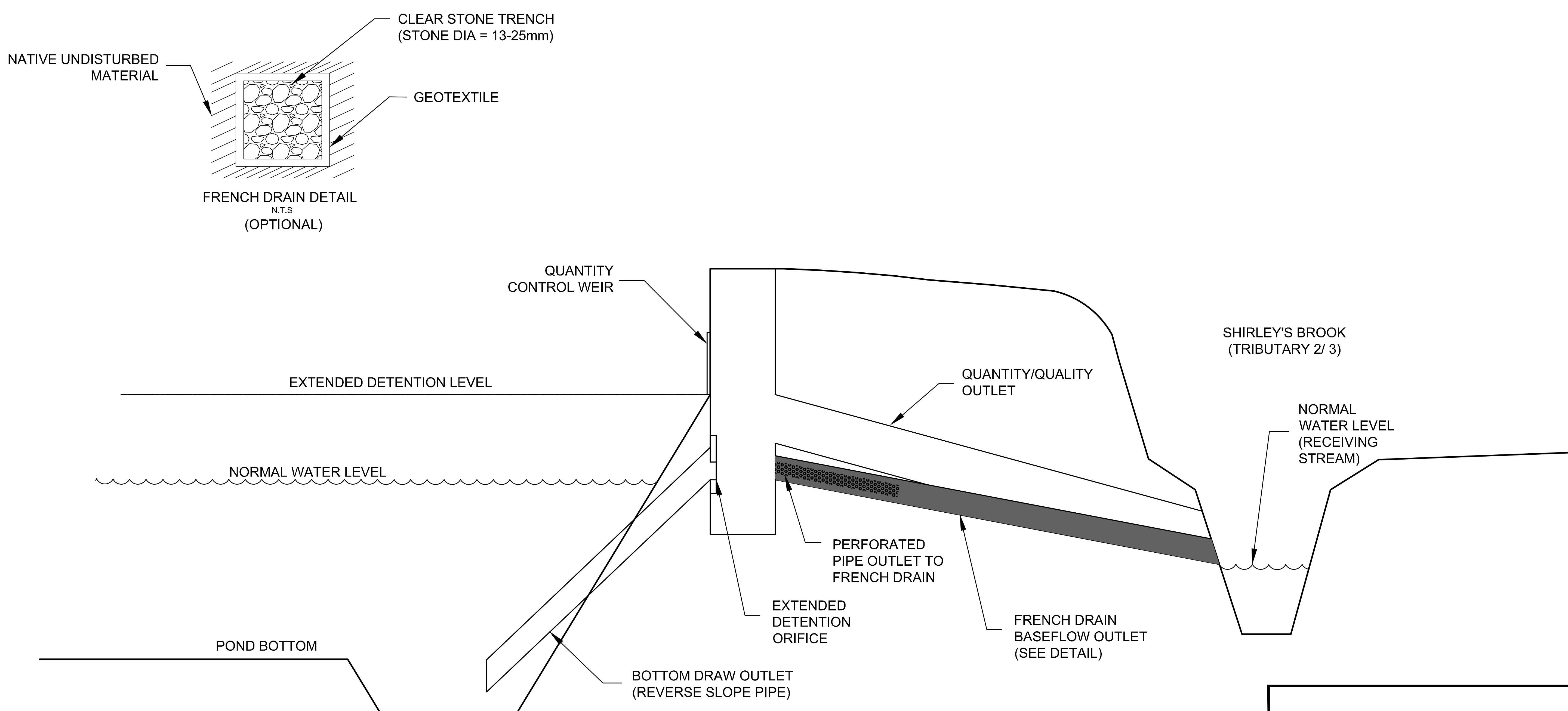
Pond 2A, like Pond 2, is a wet pond SWM facility located in the southwest quadrant of the KNUEA on the north side of Tributary 3 (**Figure 9.2**). This pond would have a tributary drainage area of approximately 17.6 ha with a 5-year peak inflow of 3.4 m^3/s. The pond is oriented roughly parallel to March Road and has a total volume of approximately 14,000 m^3 at a depth of 3.0 m. The total area of the pond block is approximately 1.6 ha and includes provisions for grading, access roads, and sediment management. While the release rates and tributary drainage area are the same, the topography and shape of the pond block differs, which results in slight differences to the required storage volumes compared with the Pond 2 option.

<u>Design Considerations</u>

Pond 2A would service the same area as Pond 2, and design considerations for Pond 2A are generally the same as Pond 2. One notable difference is the routing of emergency overland flows (from storms exceeding the available storage in Pond 2A). It is not possible to provide a direct overflow from Pond 2A to Tributary 3. In the event of a storm with runoff volumes exceeding the available storage, overflows from Pond 2A would spill onto the March Road right-of-way and flow south to Tributary 3. Conceptual design information for Pond 2A is provided in **Table 9.3** and on **Figure 9.3**.

Table 9.3: Pond 2A Design Information

Area of SWM Block	1.4 ha		
Drainage Area to SWMF	17.6 ha	(41% Impervious)	
Quality Control	Enhanced	(80% TSS Removal)	
	1915 m^3	Req. Perm. Pool Volume	
	704 m^3	Req. Extended Detention Volume	
Quantity Control	100 year	(Allowable flow to Tributary 3)	
	0.084 m^3/s	Target 100-year release rate	
Stage	**Elevation (m)**	**Volume (m^3)**	**Release Rate (L/s)**
Bottom	78.50	0	0
Normal Water Level	79.50	2106	0
Extended Detention Storage	79.75	2948	3
2-year	80.55	7092	11
5-year	80.85	9100	21
100-year	81.50	13,966	58



KANATA NORTH
COMMUNITY DESIGN PLAN

FIGURE NO. 9.5
CONCEPTUAL SWMF
OUTLET STRUCTURE

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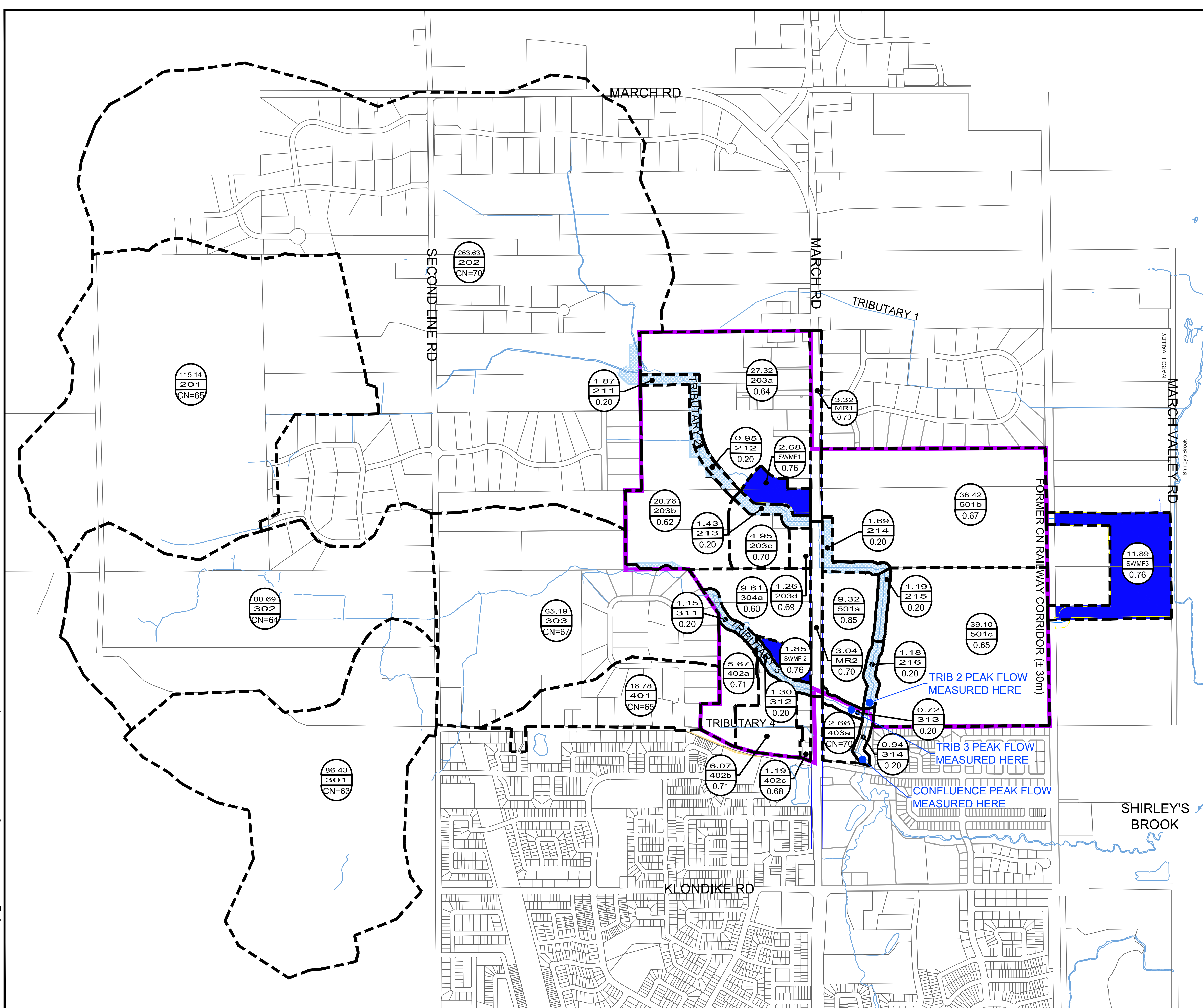

LEGEND

- KNUEA
- DRAINAGE CHANNEL
- SUBCATCHMENT DRAINAGE AREA BOUNDARIES
- CREEK CORRIDOR
- PROPOSED SWMF BLOCK

2.68 — SUBCATCHMENT AREA (ha)
SWMF1 — SUBCATCHMENT NAME
0.76 — RUNOFF COEFFICIENT (c)

KANATA NORTH
COMMUNITY DESIGN PLAN

FIGURE NO. 7.1
POST-DEVELOPMENT DRAINAGE AREA PLAN

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Engineers, Planners & Landscape Architects

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9.6 On-Site SWM Controls

On-site stormwater management controls are proposed for approximately7.2 ha in the southwest quadrant of the KNUEA. The proposed land uses in this area (school, multi-unit residential) are compatible with on-site stormwater management. On-site SWM will need to include pre-to-post quantity control for allowable flows into Tributary 3 and an enhanced level of quality control (80% TSS removal) consistent with the SWM criteria listed in **Section 5.0**.

The required quantity control storage for areas with on-site SWM controls was estimated using the 'Route Reservoir' command in SWMHYMO. The results of this analysis indicate that these areas will only require storage for flows in excess of the 5-year post-development peak flow. Runoff from storms up to and including the 5-year event can be released uncontrolled.

The allowable release rates and storage requirements are summarized as follows:

- Overall release rate (7.2 ha area): 816 L/s (5-year peak flow)
- **Allowable per-hectare release rate: 112 L/s/ha**

- Total required storage (7.2 ha area): 1,650 m^3
- Approximate on-site storage required: 227 m^3/ha

The overall release rate of 816 L/s was taken from the storm sewer design sheets prepared as part of the Master Servicing Study. The on-site storage requirements are approximate and will need to be confirmed as part of each individual site plan.

9.7 External Drainage Areas

9.7.1 Tributary 4

Under existing conditions, Tributary 4 serves as the outlet for approximately 30 ha upstream of the southwest quadrant of the KNUEA, including a portion of the Marchbrook Circle subdivision. Under post-development conditions, runoff from the upstream area will be captured by the proposed storm sewers and routed through the KNUEA lands to Tributary 3 at March Road.

9.7.2 Headwater Channel 'F'

Under existing conditions, Headwater Channel 'F' serves as the outlet for Nadia Lane. Under post-development conditions, runoff from Nadia Lane will be collected by a DICB at the KNUEA property boundary and piped directly to Tributary 2.

9.8 Culverts

9.8.1 March Road

The proposed SWM facilities will control post-development peak flows to pre-development levels, and there will be no increase in flow through the existing culverts crossing March Road at Tributaries 2 and 3. The existing culverts have sufficient capacity to convey the 100-year peak flows while confining the 100-year floodplain within the limits of the proposed 40m stream corridors.

The existing culverts crossing March Road do not need to be replaced as part of the planned development of the KNUEA, but will require either replacement or modification to accommodate the future widening of March Road.

9.8.2 Abandoned CN Rail Corridor

The existing culverts crossing the CN rail corridor have been evaluated, and will provide sufficient capacity to convey the anticipated post-development flows. Additional details and supporting calculations for the CN rail culverts (anticipated post-development flows, available capacity) are provided in the *Kanata North Community Design Plan Master Servicing Study* – refer to **MSS Section 5.4.2** Major System Drainage Areas and **MSS Appendix B, Table B4**.

9.8.3 Proposed Culverts

The culverts for the proposed crossings of Tributaries 2 and 3 have been sized based on the required hydraulic capacity to convey the 100-year flows in the tributaries. The conceptual designs for the proposed crossings (Street ‘A’ and Street ‘C’) are based on 1800mm x 1200mm concrete box culverts, which have been included in the post-development HEC-RAS model of the Northwest Branch – refer to **Section 10.0**. At the detailed design stage, the culvert crossings will need to be designed to meet all applicable requirements and guidelines, including:

- Hydraulic capacity;
- Geomorphology;
- Fish Passage (DFO); and
- Species at Risk (MNR).

9.9 Watercourse Crossings (STM / SAN / WATER)

The recommended servicing strategy (outlined in the Master Servicing Study) includes storm, sanitary, and water crossings under Tributaries 2 and 3. The proposed trenches for these crossings will be in rock and will require a clay cap to prevent surface water in the tributaries from migrating into the underlying trenches. Details of the proposed crossings will be prepared at the detailed design stage.

9.10 Shirley’s Brook Realignment

While the KNUEA boundary stops at the abandoned CN Rail line, storm drainage will be directed under the former rail corridor to Pond 3 which will outlet to the main branch of Shirley’s Brook. The reach of Shirley’s Brook adjacent to the proposed SWMF is located within the March Valley Road right-of-way. The roadway embankment along this reach is steep and prone to washout during periods of high flow and has been reinforced with gabion baskets and riprap. Further downstream, the watercourse resumes a more natural flow path outside of the right-of-way and flows northeast through the Department of National Defence (DND) lands towards Shirley’s Bay and the Ottawa River.

Post-development runoff from the KNUEA will be controlled to pre-development levels, but the volume of water entering Shirley’s Brook will increase. The reach of Shirley’s Brook within the March Valley Road right-of-way is at the downstream end of a large urban watershed and the additional flow contribution from the KNUEA will be relatively small.

To address the issue of roadway washout, it is suggested that the reach of Shirley’s Brook within the right-of-way be re-located. Currently, Shirley’s Brook flows parallel to the March Valley Road right-of-way for approximately 450m. There is an opportunity to relocate this reach of the watercourse outside of the right-of-way using natural channel design techniques.

Section 10.0 Post-Development Floodplain Evaluation

10.1 Stream Corridors

The existing conditions HEC-RAS model for Shirley's Brook Northwest Branch Tributaries 2 and 3 has been modified to reflect proposed conditions, including culvert crossings and the proposed channel realignment for Tributary 2.

A steady-state hydraulic analysis was performed using the post-development flows listed in **Table 7.2**. The results of this analysis indicate the 100-year floodplain limits will be confined within the proposed 40m stream corridors, as shown on **Figure 10.1**. The post-development model results are provided in **Volume 2**, **Appendix H**.

10.2 SWM Facility Outlet Elevations

The proposed stormwater management facilities have been designed to have normal water levels (NWL) above the 2-year water level in the receiving watercourses at the proposed SWMF outlet locations, as shown in **Table 10.1**.

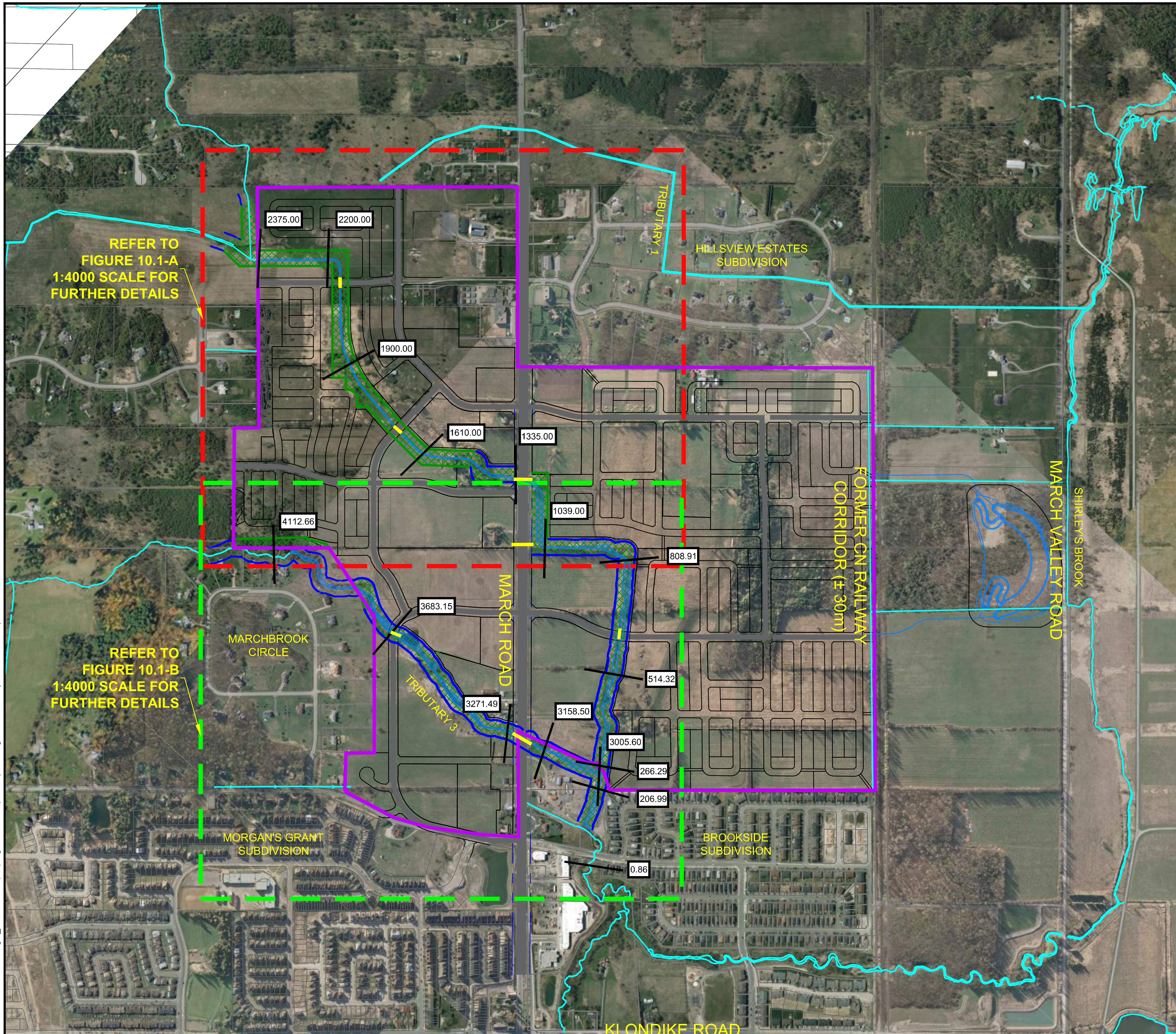
Table 10.1: Peak Flows and Water Levels at SWM Facility Outlets

SWM Facility	Outlet Location	2-year Event			100-year Event		
		Peak Flow in Receiver (m^3/s)	Water Level in Receiver (m)	NWL in SWMF (m)	Peak Flow in Receiver (m^3/s)	Water Level in Receiver (m)	100yr WL in SWMF (m)
SWMF 1	Tributary 2 (Sta. 1+335)	0.25	79.20	79.50	1.07	79.52	81.65
SWMF 2	Tributary 3 (Sta. 3+271)	0.37	77.85	79.50	1.45	78.30	81.50
SWMF 3	Shirley's Brook Main Branch (Sta. 2+011.088)	5.71	64.61*	65.50	17.90	64.94	67.00

**Shirley's Brook and Watts Creek Phase 2 Stormwater Management Study (DRAFT) – Appendix D (AECOM, March 2013)*

10.3 Shirley's Brook Main Branch

The stormwater management facilities have been designed to ensure no changes in post-development peak flows from the KNUEA into Shirley's Brook. Since peak flows will not be increased in Shirley's Brook downstream of KNUEA, water levels will not increase.



LEGEND

- KNUEA
- DRAINAGE CHANNEL
- PROPOSED CULVERT (1.8m WIDE x 1.2m HIGH)
- PROPOSED TRIBUTARY REALIGNMENT
- RETAINED TRIBUTARY CORRIDOR
- 2375.00 HEC-RAS STATION

TRIBUTARY 2			
STATION	2-YEAR WL	5-YEAR WL	100-YEAR WL
2375.00	88.64	88.69	88.85
2200.00	87.61	87.67	87.83
1900.00	85.98	86.04	86.19
1610.00	82.24	82.33	82.55
1335.00	79.20	79.30	79.52
1039.00	78.70	78.76	78.93
808.91	77.89	77.90	77.96
514.32	76.59	76.66	76.80
266.29	74.76	74.83	75.02

TRIBUTARY 3			
STATION	2-YEAR WL	5-YEAR WL	100-YEAR WL
4112.66	89.35	89.38	89.46
3683.15	81.68	81.78	82.10
3271.49	77.81	77.97	78.31
3158.50	76.69	76.76	76.93
3005.60	74.51	74.59	74.78

NORTHWEST BRANCH (CONFLUENCE OF TRIBUTARIES 2 & 3)			
STATION	2-YEAR WL	5-YEAR WL	100-YEAR WL
206.99	74.39	74.43	74.55
0.86	71.88	71.95	72.13

KANATA NORTH
COMMUNITY DESIGN PLAN

FIGURE NO. 10.1
PROPOSED FLOODPLAIN LIMITS

DATE MAY 2016
JOB 112117
SCALE 1:10,000 (0 50 100m 200m)

NOVATECH
Engineers, Planners & Landscape Architects

M:\2012\112117\CAD\Design_EMP\MEMO (CS)\Figure 10.1 Prop Floodplain.dwg, FIG-10.1, May 26, 2016 - 1:50pm, blthurber

SHT11x17.DWG - 279mmx432mm

11.6 Water Balance

The site specific water budget for the KNUEA indicates that there will be an increase in runoff and a reduction in infiltration following development:

- No areas of significant groundwater recharge or discharge have been identified within the KNUEA
- No sensitive species have been identified that will be significantly impacted by the anticipated change to the water balance following development.

Based on the findings of the water budget, no specific targets for infiltration or baseflow have been identified, but the following design approaches are recommended:

- Infiltration best management practices and/or Low Impact Development design should be considered at the site plan / plan of subdivision stage in areas where geologic conditions and proposed land use are suitable – refer to **Section 11.7** for further guidance.
- SWM facilities should be designed to provide baseflow enhancement in the receiving watercourses.

11.7 Stormwater Management

The Environmental Management Plan has identified the recommended stormwater management strategy for the KNUEA, which consists of three (3) new end-of-pipe SWM facilities, and lot-level controls to service a portion of the southwest quadrant.

11.7.1 SWM acilities

The recommended SWM facilities are shown on **Drawing 112117-EMP**. The recommended SWM strategy has been developed to provide flexibility in the location of the ponds, and to allow flexibility to any future changes to the Land Use Plan.

The objective of the EMP is to identify the recommended SWM strategy for the KNUEA in coordination with the Master Servicing Study. The conceptual designs included in the EMP are intended to demonstrate the feasibility of implementing the recommended SWM strategy. The required storage volumes, release rates, pond footprints, and operating levels of the proposed SWM facilities are to be re-evaluated at the detailed design stage. Changes to the pond configurations will be permissible, provided the ponds meet all applicable SWM criteria as outlined in **Section 5.0**.

11.7.2 On-Site SWM Controls

Lot-level stormwater management controls are recommended for approximately 8 hectares in the southwest quadrant of the KNUEA to provide water quality treatment and quantity control.

- On-site quantity control storage could be provided using a combination of surface and underground storage.
- On-site quality control could be provided using treatment units (Stormceptor, Vortechnics, etc.) or through the use of low-impact development design.

11.7.3 Stormwater Best Management Practices (BMPs)

The majority of the KNUEA will be residential development. By implementing stormwater BMPs as part of the storm drainage design for the KNUEA, the impacts of development on the hydrologic cycle can be considerably reduced. Recommended best management practices for residential areas include:

- Perforated pipes for rearyard catchbasin leads.
- Direct roof leaders to rearyard areas.
- Direct storm runoff from rearyard areas to stream corridors and/or headwater drainage channels.

11.7.4 Low Impact Development

The City of Ottawa has recently implemented several LID pilot projects to evaluate the performance and maintenance requirements of LID designs, with the expectation that LID designs will become more prevalent in the near future.

The MOECC have indicated their intention to update the Environmental Compliance Approval (ECA) process to incorporate low impact development practices. The MOECC have stated that it is critical to consider options and opportunities for the incorporation of LID practices during the watershed and subwatershed planning process, and early in the development planning process, and not left to the preparation of the detailed stormwater management plan submission.

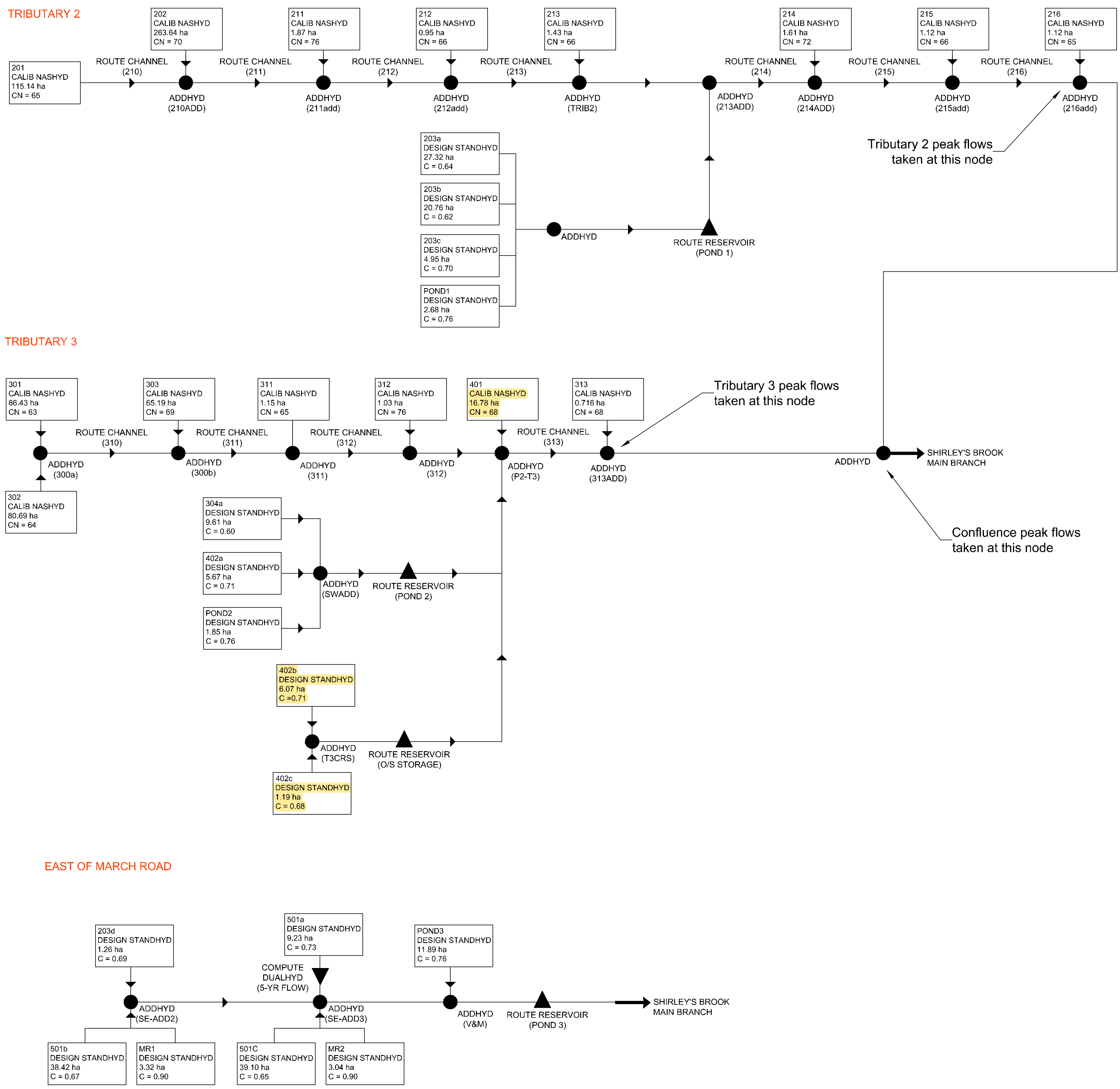
Based on the findings of the geotechnical and hydrogeological investigations and feedback from the City, there are areas within the KNUEA where LID designs should be considered. While the majority of the surficial soils within the KNUEA are underlain by clay and/or bedrock, this does not necessarily preclude the use of LIDs. For areas with tight, slow draining soils, it is recommended that any LID infrastructure be designed with overflows or subdrains to provide an engineered outlet for excess water.

East of March Road

The alluvial sand deposits east of March Road represent the most suitable areas for LID within the KNUEA. The alluvial soils are relatively shallow and underlain by clay and/or bedrock, and do not provide any significant contribution to groundwater recharge. However, these soils can provide storage and attenuation of runoff, and contribute to baseflow in Shirley's Brook.

West of March Road

The soils west of March Road generally consist of tight clays with relatively shallow depths to bedrock. While tighter soils do not preclude the use of LID measures, the presence of bedrock close to the surface will. The suitability of LID measures shall be considered in this area subject to such constraints.



M:\2012\112117\CAD\Design_EMP\112117-SWMHYMOSchem.dwg, POST, May 20, 2016 - 10:09am, kbanks

KN

KANATA NORTH

COMMUNITY DESIGN PLAN

DATE
MAY 2016

JOB
112117

SCALE
NTS

FIGURE NO. SWMHYMO-POST

SWMHYMO
POST-DEVELOPMENT
SCHEMATIC

NOVATECH
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SHT11x17.DWG - 279mmx432mm

NOVATECH Engineers, Planners & Landscape Architects

```
2     Metric units
*#******************************************************************************
*#  Project Name: [Kanata North]    Project Number: [112117]
*#  Date        : 03-30-2016
*#  Modeller    : [Kallie Auld]
*#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
*#  License #   :  5320763
*#******************************************************************************
*Shirleys Brook - Post-Development Model
*Model parameters based on original AECOM model
*See "20150911 - Shirley's Brook Modeling Parameters.xlxs"
*#******************************************************************************
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[1]
                    C25mm-4.stm
*%-----------------|-------------------------------------------------------------|
READ STORM          STORM_FILENAME=["STORM.001"]
*%-----------------|-------------------------------------------------------------|
DEFAULT VALUES      ICASEdef=[1],  read and print values
                    DEFVAL_FILENAME=["OTTAWA.DEF"]
*%-----------------|-------------------------------------------------------------|
*******************************************************************************|
*************************** FLOW TO TRIBUTARY 2 ******************************|
*******************************************************************************|
**FLOW FROM UPSTREAM AREA/ THROUGH TRIBUTARY 2 UP TO MARCH ROAD**
*%-----------------|-------------------------------------------------------------|
CALIB NASHYD        ID=[1], NHYD=["201"], DT=[5]min, AREA=[115.14](ha),
                    DWF=[0](cms), CN/C=[65], IA=[11.4](mm),
                    N=[1.1], TP=[3.42]hrs,
                    END=-1
*%-----------------|-------------------------------------------------------------|
ROUTE CHANNEL       IDout=[2], NHYD=["210"], IDin=[1],
                    RDT=[5](min),
                    CHLGTH=[557.6](m),  CHSLOPE=[0.89](%),
                                        FPSLOPE=[0.89](%),
                    SECNUM=[2096],       NSEG=[3]
                    ( SEGROUGH, SEGDIST (m))=[0.35,30.79 -0.040,51.78 0.35,96.66] NSEG times
                    ( DISTANCE (m), ELEVATION (m))=[   0.00   , 87.99 ]
                                                   [        11.43     , 86.90 ]
                                                   [        30.79     , 86.74 ]
                                                   [        34.09     , 86.37 ]
                                                   [        35.26     , 86.12 ]
                                                   [        39.56     , 86.12 ]
                                                   [        45.35     , 86.52 ]
                                                   [        51.78     , 86.75 ]
                                                   [        63.33     , 86.96 ]
                                                   [        65.76     , 86.99 ]
                                                   [        76.04     , 87.55 ]
                                                   [        96.66     , 87.99 ]
*%-----------------|-------------------------------------------------------------|
CALIB NASHYD        ID=[1], NHYD=["202"], DT=[5]min, AREA=[263.64](ha),
                    DWF=[0](cms), CN/C=[70], IA=[7.7](mm),
                    N=[1.1], TP=[5.14]hrs,
                    END=-1
*%-----------------|-------------------------------------------------------------|
ADD HYD             IDsum=[3], NHYD=["210add"], IDs to add=[1,2]
*%-----------------|-------------------------------------------------------------|
ROUTE CHANNEL       IDout=[1], NHYD=["211"], IDin=[3],
                    RDT=[5](min),
                    CHLGTH=[450](m),   CHSLOPE=[1.0](%),
                                       FPSLOPE=[1.0](%),
                    SECNUM=[1],        NSEG=[3]
                    ( SEGROUGH, SEGDIST (m))=[0.35,17.5 -0.1,22.5 0.35,40] NSEG times
                    ( DISTANCE (m), ELEVATION (m))=[    0.0   , 3.0 ]
                                                   [        17.0   , 1.0 ]
                                                   [        17.5   , 0.0 ]
                                                   [        22.5   , 0.0 ]
                                                   [        23.0   , 1.0 ]
                                                   [        40.0   , 3.0 ]
*%-----------------|-------------------------------------------------------------|
CALIB NASHYD        ID=[2], NHYD=["211"], DT=[5]min, AREA=[1.87](ha),
                    DWF=[0](cms), CN/C=[76], IA=[7.6](mm),
                    N=[1.1], TP=[1.17]hrs,
                    END=-1
*%-----------------|-------------------------------------------------------------|
ADD HYD             IDsum=[3], NHYD=["211add"], IDs to add=[1,2]
*%-----------------|-------------------------------------------------------------|
ROUTE CHANNEL       IDout=[1], NHYD=["212"], IDin=[3],
                    RDT=[5](min),
                    CHLGTH=[230](m),   CHSLOPE=[1.0](%),
                                       FPSLOPE=[1.0](%),
                    SECNUM=[1],        NSEG=[3]
                    ( SEGROUGH, SEGDIST (m))=[0.35,17.5 -0.1,22.5 0.35,40] NSEG times
                    ( DISTANCE (m), ELEVATION (m))=[     0.0    , 3.0 ]
                                                   [        17.0   , 1.0 ]
                                                   [        17.5   , 0.0 ]
                                                   [        22.5   , 0.0 ]
                                                   [        23.0   , 1.0 ]
                                                   [        40.0   , 3.0 ]
*%-----------------|-------------------------------------------------------------|
CALIB NASHYD        ID=[2], NHYD=["212"], DT=[5]min, AREA=[0.95](ha),
                    DWF=[0](cms), CN/C=[66], IA=[8.8](mm),
                    N=[1.1], TP=[0.56]hrs,
                    END=-1
*%-----------------|-------------------------------------------------------------|
ADD HYD             IDsum=[3], NHYD=["212add"], IDs to add=[1,2]
*%-----------------|-------------------------------------------------------------|
ROUTE CHANNEL       IDout=[1], NHYD=["213"], IDin=[3],
                    RDT=[5](min),
                    CHLGTH=[330](m),   CHSLOPE=[1.0](%),
                                       FPSLOPE=[1.0](%),
                    SECNUM=[1],        NSEG=[3]
                    ( SEGROUGH, SEGDIST (m))=[0.35,17.5 -0.1,22.5 0.35,40] NSEG times
                    ( DISTANCE (m), ELEVATION (m))=[    0.0    , 3.0 ]
                                                   [        17.0   , 1.0 ]
                                                   [        17.5   , 0.0 ]
                                                   [        22.5   , 0.0 ]
                                                   [        23.0   , 1.0 ]
                                                   [        40.0   , 3.0 ]
*%-----------------|-------------------------------------------------------------|
CALIB NASHYD        ID=[2], NHYD=["213"], DT=[5]min, AREA=[1.43](ha),
                    DWF=[0](cms), CN/C=[66], IA=[9.0](mm),
                    N=[1.1], TP=[0.67]hrs,
                    END=-1
*%-----------------|-------------------------------------------------------------|
*******************************************************************************|
*************Flow from upstream area in Trib 2 up to March Road****************|
*******************************************************************************|
ADD HYD             IDsum=[9], NHYD=["TRIB2"], IDs to add=[1,2]
*%-----------------|-------------------------------------------------------------|
*******************************************************************************|
******************** FLOW FROM DEVELOPMENT AREA TO POND 1 *******************|
*******************************************************************************|
*%-----------------|-------------------------------------------------------------|
DESIGN STANDHYD     ID=[1], NHYD=["203a"], DT=[5]min, AREA=[27.32](ha),
                    XIMP=[0.50], TIMP=[0.63], DWF=[0](cms),  LOSS=[1],
                    SLOPE=[2.3](%), END=-1
*%-----------------|-------------------------------------------------------------|
DESIGN STANDHYD     ID=[2], NHYD=["203b"], DT=[5]min, AREA=[20.76](ha),
                    XIMP=[0.48], TIMP=[0.60], DWF=[0](cms),  LOSS=[1],
                    SLOPE=[2.3](%), END=-1
*%-----------------|-------------------------------------------------------------|
DESIGN STANDHYD     ID=[3], NHYD=["203c"], DT=[5]min, AREA=[4.95](ha),
                    XIMP=[0.57], TIMP=[0.71], DWF=[0](cms),  LOSS=[1],
                    SLOPE=[2.3](%), END=-1
*%-----------------|-------------------------------------------------------------|
DESIGN STANDHYD     ID=[4], NHYD=["POND1"], DT=[5]min, AREA=[2.68](ha),
                    XIMP=[0.64], TIMP=[0.80], DWF=[0](cms),  LOSS=[1],
                    SLOPE=[0.1](%), END=-1
*%-----------------|-------------------------------------------------------------|
**Flow to cross under Tributary 2
ADD HYD             IDsum=[5], NHYD=["T2CRS"], IDs to add=[2,3]
*%-----------------|-------------------------------------------------------------|
```

```
*Total flow to Pond 1
ADD HYD           IDsum=[6], NHYD=["P1FLOW"], IDs to add=[1,4,5]
*%----------------|-----------------------------------------------------------|
*******************
***POND 1 SIZING***
*******************
ROUTE RESERVOIR   IDout=[1],   NHYD=["POND1"],  IDin=[6],
                   RDT=[5](min),
                        TABLE of ( OUTFLOW-STORAGE ) values
                                    (cms) - (ha-m)
                                  [ 0.000 , 0.000 ]
                                  [ 0.036 , 0.728 ]
                                  [ 0.089 , 1.182 ]
                                  [ 0.177 , 1.678 ]
                                  [ 0.346 , 3.115 ]
                                  [   -1  ,   -1  ]  (max twenty pts)
                        IDovf=[2], NHYDovf=["P1-OVF"]
******************************************************************************|
*%----------------|-----------------------------------------------------------|
**************************************
**TOTAL FLOW IN TRIB 2 AT MARCH ROAD**
**************************************
ADD HYD           IDsum=[2], NHYD=["213ADD"], IDs to add=[1,9]
*%----------------|-----------------------------------------------------------|
ROUTE CHANNEL     IDout=[1], NHYD=["214"], IDin=[2],
                  RDT=[5](min),
                  CHLGTH=[390](m),   CHSLOPE=[1.7](%),
                                     FPSLOPE=[1.7](%),
                  SECNUM=[5],        NSEG=[3]
                  ( SEGROUGH, SEGDIST (m))=[0.35,17.5 -0.1,22.5 0.35,40] NSEG times
                  ( DISTANCE (m), ELEVATION (m))=[    0.0   , 3.0 ]
                                                 [       17.0   , 1.0 ]
                                                 [       17.5   , 0.0 ]
                                                 [       22.5   , 0.0 ]
                                                 [       23.0   , 1.0 ]
                                                 [       40.0   , 3.0 ]
*%----------------|-----------------------------------------------------------|
CALIB NASHYD      ID=[3], NHYD=["214"], DT=[5]min, AREA=[1.61](ha),
                  DWF=[0](cms), CN/C=[72], IA=[8.9](mm),
                  N=[1.1], TP=[0.17]hrs,
                  END=-1
*%----------------|-----------------------------------------------------------|
ADD HYD           IDsum=[2], NHYD=["214ADD"], IDs to add=[1,3]
*%----------------|-----------------------------------------------------------|
ROUTE CHANNEL     IDout=[1], NHYD=["215"], IDin=[2],
                  RDT=[5](min),
                  CHLGTH=[260](m),   CHSLOPE=[1.4](%),
                                     FPSLOPE=[1.4](%),
                  SECNUM=[6],        NSEG=[3]
                  ( SEGROUGH, SEGDIST (m))=[0.35,17.5 -0.1,22.5 0.35,40] NSEG times
                  ( DISTANCE (m), ELEVATION (m))=[    0.0   , 3.0 ]
                                                 [       17.0   , 1.0 ]
                                                 [       17.5   , 0.0 ]
                                                 [       22.5   , 0.0 ]
                                                 [       23.0   , 1.0 ]
                                                 [       40.0   , 3.0 ]
*%----------------|-----------------------------------------------------------|
CALIB NASHYD      ID=[2], NHYD=["TRB215"], DT=[5]min, AREA=[1.12](ha),
                  DWF=[0](cms), CN/C=[66], IA=[10.6](mm),
                  N=[1.1], TP=[0.17]hrs,
                  END=-1
*%----------------|-----------------------------------------------------------|
ADD HYD           IDsum=[3], NHYD=["215ADD"], IDs to add=[1,2]
*%----------------|-----------------------------------------------------------|
ROUTE CHANNEL     IDout=[1], NHYD=["216"], IDin=[3],
                  RDT=[5](min),
                  CHLGTH=[250](m),   CHSLOPE=[0.5](%),
                                     FPSLOPE=[0.5](%),
                  SECNUM=[7],        NSEG=[3]
                  ( SEGROUGH, SEGDIST (m))=[0.35,17.5 -0.1,22.5 0.35,40] NSEG times
                  ( DISTANCE (m), ELEVATION (m))=[    0.0   , 3.0 ]
                                                 [       17.0   , 1.0 ]
                                                 [       17.5   , 0.0 ]
                                                 [       22.5   , 0.0 ]
                                                 [       23.0   , 1.0 ]
                                                 [       40.0   , 3.0 ]
*%----------------|-----------------------------------------------------------|
CALIB NASHYD      ID=[2], NHYD=["TRB216"], DT=[5]min, AREA=[1.12](ha),
                  DWF=[0](cms), CN/C=[65], IA=[11.6](mm),
                  N=[1.1], TP=[0.17]hrs,
                  END=-1
*%----------------|-----------------------------------------------------------|
****************************************
**FLOW IN TRIB 2 UPSTREAM OF CONFLUENCE**
****************************************
ADD HYD           IDsum=[10], NHYD=["T2-US"], IDs to add=[1,2]
*%----------------|-----------------------------------------------------------|
*PRINT HYD         ID=[10],   # OF PCYCLES=[3]
*%----------------|-----------------------------------------------------------|
*
*
*
******************************************************************************|
*************************PEAK FLOW TO TRIBUTARY 3****************************|
******************************************************************************|
**FLOW FROM UPSTREAM AREA/ THROUGH TRIBUTARY 3 UP TO MARCH ROAD**
*%----------------|-----------------------------------------------------------|
CALIB NASHYD      ID=[1], NHYD=["301"], DT=[5]min, AREA=[86.43](ha),
                  DWF=[0](cms), CN/C=[63], IA=[12.3](mm),
                  N=[1.1], TP=[1.24]hrs,
                  END=-1
*%----------------|-----------------------------------------------------------|
CALIB NASHYD      ID=[2], NHYD=["302"], DT=[5]min, AREA=[80.69](ha),
                  DWF=[0](cms), CN/C=[64], IA=[10.9](mm),
                  N=[1.1], TP=[1.80]hrs,
                  END=-1
*%----------------|-----------------------------------------------------------|
ADD HYD           IDsum=[3], NHYD=["300a"], IDs to add=[1,2]
*%----------------|-----------------------------------------------------------|
ROUTE CHANNEL     IDout=[1], NHYD=["310"], IDin=[3],
                  RDT=[5](min),
                  CHLGTH=[448.8](m),  CHSLOPE=[1.62](%),
                                      FPSLOPE=[1.62](%),
                  SECNUM=[4122],       NSEG=[3]
                  ( SEGROUGH, SEGDIST (m))=[0.35,36.85 -0.04,57.43 0.35,98.10] NSEG times
                  ( DISTANCE (m), ELEVATION (m))=[     0    , 85.97 ]
                                                 [       29.14     , 86.03 ]
                                                 [       35.73     , 85.88 ]
                                                 [       36.85     , 85.69 ]
                                                 [       39.63     , 85.47 ]
                                                 [       43.19     , 85.31 ]
                                                 [       47.24     , 84.78 ]
                                                 [       50.54     , 84.78 ]
                                                 [       54.28     , 84.94 ]
                                                 [       57.43     , 85.70 ]
                                                 [       65.07     , 85.80 ]
                                                 [       67.25     , 85.80 ]
                                                 [       70.81     , 85.80 ]
                                                 [       98.10     , 86.10 ]
*%----------------|-----------------------------------------------------------|
CALIB NASHYD      ID=[2], NHYD=["303"], DT=[5]min, AREA=[65.19](ha),
                  DWF=[0](cms), CN/C=[69], IA=[8.9](mm),
                  N=[1.1], TP=[1.31]hrs,
                  END=-1
*%----------------|-----------------------------------------------------------|
ADD HYD           IDsum=[3], NHYD=["300b"], IDs to add=[1,2]
*%----------------|------------------------------------------------------------|
ROUTE CHANNEL     IDout=[1], NHYD=["311"], IDin=[3],
                  RDT=[5](min),
                  CHLGTH=[270](m),  CHSLOPE=[1.17](%),
                                      FPSLOPE=[1.17](%),
                  SECNUM=[3673],       NSEG=[3]
```

```
                  ( SEGROUGH, SEGDIST (m))=[0.35,17.5 -0.1,22.5 0.35,40] NSEG times
                  ( DISTANCE (m), ELEVATION (m))=[    0.0    , 3.0 ]
                                               [        17.0    , 1.0 ]
                                               [        17.5    , 0.0 ]
                                               [        22.5    , 0.0 ]
                                               [        23.0    , 1.0 ]
                                               [        40.0    , 3.0 ]
*%-----------------|------------------------------------------------------------|
CALIB NASHYD       ID=[2], NHYD=["TRB311"], DT=[5]min, AREA=[1.15](ha),
                   DWF=[0](cms), CN/C=[65], IA=[9.3](mm),
                   N=[1.1], TP=[0.52]hrs,
                   END=-1
*%-----------------|------------------------------------------------------------|
ADD HYD            IDsum=[3], NHYD=["311ADD"], IDs to add=[1,2]
*%-----------------|-------------------------------------------------------------|
ROUTE CHANNEL      IDout=[1], NHYD=["312"], IDin=[3],
                   RDT=[5](min),
                   CHLGTH=[270](m),  CHSLOPE=[1.17](%),
                                     FPSLOPE=[1.17](%),
                   SECNUM=[3673],       NSEG=[3]
                   ( SEGROUGH, SEGDIST (m))=[0.35,17.5 -0.1,22.5 0.35,40] NSEG times
                   ( DISTANCE (m), ELEVATION (m))=[    0.0    , 3.0 ]
                                               [        17.0    , 1.0 ]
                                               [        17.5    , 0.0 ]
                                               [        22.5    , 0.0 ]
                                               [        23.0    , 1.0 ]
                                               [        40.0    , 3.0 ]
*%-----------------|------------------------------------------------------------|
CALIB NASHYD       ID=[2], NHYD=["TRB312"], DT=[5]min, AREA=[1.304](ha),
                   DWF=[0](cms), CN/C=[76], IA=[7.5](mm),
                   N=[1.1], TP=[0.64]hrs,
                   END=-1
*%-----------------|------------------------------------------------------------|
ADD HYD            IDsum=[9], NHYD=["312ADD"], IDs to add=[1,2]
*%-----------------|------------------------------------------------------------|
****************************************
**FLOW FROM DEVELOPMENT AREA TO POND 2**
****************************************
*%-----------------|------------------------------------------------------------|
DESIGN STANDHYD    ID=[1], NHYD=["304a"], DT=[5]min, AREA=[9.61](ha),
                   XIMP=[0.46], TIMP=[0.57], DWF=[0](cms),  LOSS=[1],
                   SLOPE=[1.6](%), END=-1
*%-----------------|------------------------------------------------------------|
DESIGN STANDHYD    ID=[2], NHYD=["402a"], DT=[5]min, AREA=[5.67](ha),
                   XIMP=[0.58], TIMP=[0.73], DWF=[0](cms),  LOSS=[1],
                   SLOPE=[2.1](%), END=-1
*%-----------------|------------------------------------------------------------|
DESIGN STANDHYD    ID=[3], NHYD=["POND2"], DT=[5]min, AREA=[1.85](ha),
                   XIMP=[0.64], TIMP=[0.80], DWF=[0](cms),  LOSS=[1],
                   SLOPE=[0.1](%), END=-1
*%-----------------|------------------------------------------------------------|
*****************************FLOW TO POND 2**********************************|
*%-----------------|------------------------------------------------------------|
ADD HYD            IDsum=[4], NHYD=["P2FLOW"], IDs to add=[1,2,3]
*%-----------------|------------------------------------------------------------|
***********************
***SIZING FOR POND 2***
***********************
ROUTE RESERVOIR    IDout=[1],   NHYD=["POND2"],  IDin=[4],
                    RDT=[5](min),
                         TABLE of ( OUTFLOW-STORAGE ) values
                                     (cms) - (ha-m)
                                   [ 0.000 , 0.000 ]
                                   [ 0.003 , 0.240 ]
                                   [ 0.016 , 0.398 ]
                                   [ 0.031 , 0.560 ]
                                   [ 0.084 , 1.003 ]
                                   [   -1  ,   -1  ]  (max twenty pts)
                         IDovf=[2], NHYDovf=["P2OVF"]
*%-----------------|-------------------------------------------------------------|
*************************************************
```

```
**FLOW FROM DEVELOPMENT AREA TO ON SITE STORAGE**
*************************************************
*%-----------------|------------------------------------------------------------|
DESIGN STANDHYD    ID=[2], NHYD=["402b"], DT=[5]min, AREA=[6.07](ha),
                   XIMP=[0.58], TIMP=[0.73], DWF=[0](cms),  LOSS=[1],
                   SLOPE=[2.1](%), END=-1
*%-----------------|------------------------------------------------------------|
DESIGN STANDHYD    ID=[3], NHYD=["402c"], DT=[5]min, AREA=[1.19](ha),
                   XIMP=[0.55], TIMP=[0.68], DWF=[0](cms),  LOSS=[1],
                   SLOPE=[2.1](%), END=-1
*%-----------------|------------------------------------------------------------|
**On-site storage for SouthWest area**
ADD HYD            IDsum=[4], NHYD=["400-OS"], IDs to add=[2,3]
*%-----------------|------------------------------------------------------------|
******************************
***On-Site Storage Required***
******************************
ROUTE RESERVOIR    IDout=[2],   NHYD=["OSSTOR"],  IDin=[4],
                   RDT=[5](min),
                         TABLE of ( OUTFLOW-STORAGE ) values
                                     (cms) - (ha-m)
                                   [ 0.000 , 0.000 ]
                                   [ 0.800 , 0.005 ]
                                   [ 0.816 , 0.200 ]
                                   [   -1  ,   -1  ]  (max twenty pts)
                         IDovf=[3], NHYDovf=["OSOVF"]
*%-----------------|------------------------------------------------------------|
****************************************
**FLOW FROM UPSTREAM AREA - MB CIRCLE**
****************************************
*%-----------------|------------------------------------------------------------|
CALIB NASHYD       ID=[3], NHYD=["401"], DT=[5]min, AREA=[16.78](ha),
                   DWF=[0](cms), CN/C=[68], IA=[7.0](mm),
                   N=[3.0], TP=[1.66]hrs,
                   END=-1
*%-----------------|------------------------------------------------------------|
***************************************
**TOTAL FLOW IN TRIB 3 AT MARCH ROAD**
***************************************
ADD HYD            IDsum=[4], NHYD=["P2-T3"], IDs to add=[1,2,3,9]
*%-----------------|------------------------------------------------------------|
ROUTE CHANNEL      IDout=[1], NHYD=["313"], IDin=[4],
                   RDT=[5](min),
                   CHLGTH=[423.0](m),  CHSLOPE=[1.17](%),
                                       FPSLOPE=[1.17](%),
                   SECNUM=[3673],       NSEG=[3]
                   ( SEGROUGH, SEGDIST (m))=[0.35,17.5 -0.1,22.5 0.35,40] NSEG times
                   ( DISTANCE (m), ELEVATION (m))=[    0.0    , 3.0 ]
                                               [        17.0    , 1.0 ]
                                               [        17.5    , 0.0 ]
                                               [        22.5    , 0.0 ]
                                               [        23.0    , 1.0 ]
                                               [        40.0    , 3.0 ]
*%-----------------|------------------------------------------------------------|
CALIB NASHYD       ID=[2], NHYD=["TRB313"], DT=[5]min, AREA=[0.716](ha),
                   DWF=[0](cms), CN/C=[68], IA=[8.2](mm),
                   N=[1.1], TP=[0.34]hrs,
                   END=-1
*%-----------------|------------------------------------------------------------|
**********************************************
**FLOW IN TRIBUTARY 3 UPSTREAM OF CONFLUENCE**
**********************************************
*%-----------------|------------------------------------------------------------|
ADD HYD            IDsum=[3], NHYD=["313ADD"], IDs to add=[1,2,]
*%-----------------|------------------------------------------------------------|
*PRINT HYD          ID=[3],   # OF PCYCLES=[3]
*%-----------------|------------------------------------------------------------|
CALIB NASHYD       ID=[4], NHYD=["TRB314"], DT=[5]min, AREA=[0.938](ha),
                   DWF=[0](cms), CN/C=[68], IA=[8.2](mm),
                   N=[1.1], TP=[0.46]hrs,
                   END=-1
```

```
*%-----------------|------------------------------------------------------------|
ADD HYD            IDsum=[3], NHYD=["313ADD"], IDs to add=[1,2]
*%-----------------|------------------------------------------------------------|
**************************************
*******TOTAL FLOW AT CONFLUENCE*******
**************************************
*%-----------------|------------------------------------------------------------|
CALIB NASHYD       ID=[4], NHYD=["403a"], DT=[5]min, AREA=[2.66](ha),
                   DWF=[0](cms), CN/C=[70], IA=[4.3](mm),
                   N=[1.1], TP=[0.27]hrs,
                   END=-1
*%-----------------|------------------------------------------------------------|
ADD HYD            IDsum=[1], NHYD=["CONFLU"], IDs to add=[10,3,4]
*%-----------------|------------------------------------------------------------|
*PRINT HYD          ID=[1],   # OF PCYCLES=[3]
*%-----------------|------------------------------------------------------------|
*
*
*
*
********************************************************************************|
*********************PEAK FLOW FROM EAST SIDE OF MARCH ROAD*******************|
********************************************************************************|
*%-----------------|------------------------------------------------------------|
DESIGN STANDHYD    ID=[1], NHYD=["203d"], DT=[5]min, AREA=[1.26](ha),
                   XIMP=[0.56], TIMP=[0.70], DWF=[0](cms),  LOSS=[1],
                   SLOPE=[2.3](%), END=-1
*%-----------------|------------------------------------------------------------|
DESIGN STANDHYD    ID=[2], NHYD=["501a"], DT=[5]min, AREA=[9.32](ha),
                   XIMP=[0.74], TIMP=[0.93], DWF=[0](cms),  LOSS=[1],
                   SLOPE=[0.80](%), END=-1
*%-----------------|------------------------------------------------------------|
*****************************
***5-year peak flow to pond***
*****************************
COMPUTE DUALHYD    IDin=[2], CINLET=[2.06](cms), NINLET=[1],
                   MAJID=[3], MajNHYD=["OSSTOR"],
                   MINID=[4], MinNHYD=["TOPOND"],
                   TMJSTO=[890](cu-m)
*%-----------------|------------------------------------------------------------|
DESIGN STANDHYD    ID=[5], NHYD=["501b"], DT=[5]min, AREA=[38.42](ha),
                   XIMP=[0.54], TIMP=[0.67], DWF=[0](cms),  LOSS=[1],
                   SLOPE=[2.3](%), END=-1
*%-----------------|------------------------------------------------------------|
DESIGN STANDHYD    ID=[6], NHYD=["501c"], DT=[5]min, AREA=[39.10](ha),
                   XIMP=[0.51], TIMP=[0.64], DWF=[0](cms),  LOSS=[1],
                   SLOPE=[2.3](%), END=-1
*%-----------------|------------------------------------------------------------|
DESIGN STANDHYD    ID=[7], NHYD=["MR1"], DT=[5]min, AREA=[3.32](ha),
                   XIMP=[0.80], TIMP=[0.99], DWF=[0](cms),  LOSS=[1],
                   SLOPE=[1.0](%), END=-1
*%-----------------|------------------------------------------------------------|
DESIGN STANDHYD    ID=[8], NHYD=["MR2"], DT=[5]min, AREA=[3.04](ha),
                   XIMP=[0.80], TIMP=[0.99], DWF=[0](cms),  LOSS=[1],
                   SLOPE=[1.0](%), END=-1
*%-----------------|------------------------------------------------------------|
ADD HYD            IDsum=[10], NHYD=["VALE"], IDs to add=[1,5,7]
*%-----------------|-----------------------------------------,------------------|
ADD HYD            IDsum=[9], NHYD=["MET"], IDs to add=[4,6,8]
*%-----------------|------------------------------------------------------------|
DESIGN STANDHYD    ID=[1], NHYD=["POND3"], DT=[5]min, AREA=[11.89](ha),
                   XIMP=[0.64], TIMP=[0.80], DWF=[0](cms),  LOSS=[1],
                   SLOPE=[0.1](%), END=-1
*%-----------------|------------------------------------------------------------|
ADD HYD            IDsum=[8], NHYD=["P3ADD"], IDs to add=[10,9,1]
*%-----------------|------------------------------------------------------------|
**********************
***SIZING FOR POND 3***
**********************
ROUTE RESERVOIR    IDout=[1],   NHYD=["POND3"],  IDin=[8],
                    RDT=[5](min),
```

```
                          TABLE of ( OUTFLOW-STORAGE ) values
                                      (cms) - (ha-m)
                                    [ 0.000 , 0.000 ]
                                    [ 0.058 , 1.610 ]
                                    [ 0.220 , 2.515 ]
                                    [ 0.402 , 3.488 ]
                                    [ 1.045 , 6.115 ]
                                    [   -1  ,   -1  ]  (max twenty pts)
                          IDovf=[2], NHYDovf=["E-OVF"]
*%-----------------|------------------------------------------------------------|
*********************************
**TOTAL FLOW TO SHIRLEY'S BROOK**
*********************************
*%-----------------|------------------------------------------------------------|
*PRINT HYD          ID=[1],   # OF PCYCLES=[3]
*%-----------------|------------------------------------------------------------|
*******************************************************************************|
*******************************************************************************|
*******************************************************************************|
*******************************************************************************|
*%-----------------|------------------------------------------------------------|
START              TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[2]
                   C2-4.stm
*%-----------------|------------------------------------------------------------|
START              TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[3]
                   C5-4.stm
*%-----------------|------------------------------------------------------------|
*START              TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[4]
*                   C10-4.stm
*%-----------------|------------------------------------------------------------|
START              TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[5]
                   C100-4.stm
*%-----------------|------------------------------------------------------------|
START              TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[6]
                   S12-25mm.stm
*%-----------------|------------------------------------------------------------|
START              TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[7]
                   S2-12.stm
*%-----------------|------------------------------------------------------------|
START              TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[8]
                   S5-12.stm
*%-----------------|------------------------------------------------------------|
*START              TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[9]
*                   S10-12.stm
*%-----------------|------------------------------------------------------------|
*START              TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[10]
*                   S25-12.stm
*%-----------------|------------------------------------------------------------|
*START              TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[11]
*                   S50-12.stm
*%-----------------|------------------------------------------------------------|
START              TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[12]
                   S100-12.stm
*%-----------------|------------------------------------------------------------|
START              TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[13]
                   S24-25mm.stm
*%-----------------|------------------------------------------------------------|
START              TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[14]
                   S2-24.stm
*%-----------------|------------------------------------------------------------|
START              TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[15]
                   S5-24.stm
*%-----------------|------------------------------------------------------------|
START              TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[16]
                   S100-24.stm
*%-----------------|------------------------------------------------------------|
FINISH
```

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

   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
   S      W W W  MM MM  H   H   Y Y   MM MM  O   O     9   9  9   9
   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ## 9   9  9   9   Ver  4.05
       S   W W   M   M  H   H    Y    M   M  O   O      9999   9999   Sept 2011
   SSSSS   W W   M   M  H   H    Y    M   M   OOO          9      9   =========
                                                       9   9  9   9   # 5320763
        StormWater Management HYdrologic Model          999    999    =========

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

 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++++ Licensed user: NOVATECH ENGINEERING CONSULTANTS LTD         +++++++++
 +++++++++                Nepean                 SERIAL#:5320763       +++++++++
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

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

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

:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::

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

 ***********************   S U M M A R Y   O U T P U T   **********************
 ******************************************************************************
 *         DATE: 2016-05-20     TIME: 09:55:27     RUN COUNTER: 000057         *
 ******************************************************************************
 * Input   filename: M:\2012\112117\data\CALCUL~1\swmhymo\POSTDE~1\knpost.dat  *
 * Output  filename: M:\2012\112117\data\CALCUL~1\swmhymo\POSTDE~1\knpost.out  *
 * Summary filename: M:\2012\112117\data\CALCUL~1\swmhymo\POSTDE~1\knpost.sum  *
 * User comments:                                                              *
 * 1:__________________________________________________________________________*
 * 2:__________________________________________________________________________*
 * 3:__________________________________________________________________________*
 ******************************************************************************


#******************************************************************************
#  Project Name: [Kanata North]    Project Number: [112117]
#  Date        : 03-30-2016
#  Modeller    : [Kallie Auld]
#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
```

```
#  License #   :  5320763
#******************************************************************************
#******************************************************************************
 RUN:COMMAND#
 001:0001------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   1 ]
 001:0002------------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  =
      [SDT=10.00:SDUR=   4.00:PTOT=  25.00]
 001:0003------------------------------------------------------------------------
     DEFAULT VALUES
      Filename = M:\2012\112117\data\CALCUL~1\swmhymo\POSTDE~1\OTTAWA.DEF
      ICASEdv  = 1 (read and print data)
      FileTitle= ------ ENTER YOUR COMMENTS ON THIS LINE AND THE NEXT ONE ---
                 ------ PARAMETER VALUES MUST BE ENTERD AFTER COLUMN 60 ----_
      Horton's infiltration equation parameters:
      [Fo= 76.20 mm/hr] [Fc=13.20 mm/hr] [DCAY= 4.14 /hr] [F=  .00 mm]
      Parameters for PERVIOUS surfaces in STANDHYD:
      [IAper=   4.67 mm] [LGP=40.00 m] [MNP= .250]
      Parameters for IMPERVIOUS surfaces in STANDHYD:
      [IAimp=   1.57 mm] [CLI= 1.50]   [MNI= .013]
      Parameters used in NASHYD:
      [Ia=   4.67 mm] [N= 3.00]
 001:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:201          115.14     .009 No_date    5:55    1.23 .049
      [CN= 65.0: N= 1.10]
      [Tp= 3.42:DT= 5.00]
 001:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 01:201          115.14     .009 No_date    5:55    1.23  n/a
      [RDT= 5.00] out<- 02:210          115.14     .009 No_date    6:20    1.23  n/a
      [L/S/n=  558./ .890/.040]
      {Vmax=  .423:Dmax=  .004}
 001:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:202          263.64     .027 No_date    7:25    2.37 .095
      [CN= 70.0: N= 1.10]
      [Tp= 5.14:DT= 5.00]
 001:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:202          263.64     .027 No_date    7:25    2.37  n/a
                      + 02:210          115.14     .009 No_date    6:20    1.23  n/a
      [DT= 5.00]  SUM=  03:210add       378.78     .036 No_date    7:00    2.02  n/a
 001:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:210add       378.78     .036 No_date    7:00    2.02  n/a
      [RDT= 5.00] out<- 01:211          378.78     .036 No_date    7:30    2.02  n/a
      [L/S/n=  450./1.000/.100]
      {Vmax=  .288:Dmax=  .025}
 001:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:211            1.87     .001 No_date    4:00    3.10 .124
      [CN= 76.0: N= 1.10]
      [Tp= 1.17:DT= 5.00]
 001:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:211          378.78     .036 No_date    7:30    2.02  n/a
                      + 02:211            1.87     .001 No_date    4:00    3.10  n/a
      [DT= 5.00]  SUM=  03:211add       380.65     .037 No_date    7:15    2.03  n/a
 001:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:211add       380.65     .037 No_date    7:15    2.03  n/a
      [RDT= 5.00] out<- 01:212          380.65     .037 No_date    7:30    2.03  n/a
      [L/S/n=  230./1.000/.100]
      {Vmax=  .288:Dmax=  .025}
 001:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:212             .95     .001 No_date    4:00    1.77 .071
      [CN= 66.0: N= 1.10]
      [Tp=  .56:DT= 5.00]
 001:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:212          380.65     .037 No_date    7:30    2.03  n/a
                      + 02:212             .95     .001 No_date    4:00    1.77  n/a
```

```
    [DT= 5.00]  SUM=  03:212add       381.60     .037 No_date    7:15    2.03  n/a
001:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:212add       381.60     .037 No_date    7:15    2.03  n/a
     [RDT= 5.00] out<- 01:213          381.60     .037 No_date    7:40    2.03  n/a
     [L/S/n=  330./1.000/.100]
     {Vmax=  .288:Dmax=  .026}
001:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:213            1.43     .001 No_date    4:00    1.74 .070
     [CN= 66.0: N= 1.10]
     [Tp=  .67:DT= 5.00]
001:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:213          381.60     .037 No_date    7:40    2.03  n/a
                     + 02:213            1.43     .001 No_date    4:00    1.74  n/a
     [DT= 5.00]  SUM=  09:TRIB2        383.03     .038 No_date    7:25    2.03  n/a
001:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    01:203a          27.32    2.004 No_date    1:40   13.51 .540
     [XIMP=.50:TIMP=.63]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
001:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    02:203b          20.76    1.491 No_date    1:40   12.93 .517
     [XIMP=.48:TIMP=.60]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
001:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * DESIGN STANDHYD    03:203c           4.95     .472 No_date    1:40   15.23 .609
     [XIMP=.57:TIMP=.71]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
001:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    04:POND1          2.68     .198 No_date    1:45   17.13 .685
     [XIMP=.64:TIMP=.80]
     [SLP= .10:DT= 5.00]
     [LOSS= 1 : HORTONS]
001:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            02:203b          20.76    1.491 No_date    1:40   12.93  n/a
                     + 03:203c           4.95     .472 No_date    1:40   15.23  n/a
     [DT= 5.00]  SUM=  05:T2CRS         25.71    1.963 No_date    1:40   13.37  n/a
001:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:203a          27.32    2.004 No_date    1:40   13.51  n/a
                     + 04:POND1          2.68     .198 No_date    1:45   17.13  n/a
                     + 05:T2CRS         25.71    1.963 No_date    1:40   13.37  n/a
     [DT= 5.00]  SUM=  06:P1FLOW        55.71    4.157 No_date    1:40   13.62  n/a
001:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 06:P1FLOW        55.71    4.157 No_date    1:40   13.62  n/a
     [RDT= 5.00] out<- 01:POND1         55.71     .036 No_date    4:05   13.62  n/a
            overflow <= 02:P1-OVF         .00     .000 No_date    0:00     .00  n/a
    {MxStoUsed=.7285E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
001:0024---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:POND1         55.71     .036 No_date    4:05   13.62  n/a
                     + 09:TRIB2        383.03     .038 No_date    7:25    2.03  n/a
     [DT= 5.00]  SUM=  02:213ADD       438.74     .072 No_date    6:20    3.50  n/a
001:0025---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 02:213ADD       438.74     .072 No_date    6:20    3.50  n/a
     [RDT= 5.00] out<- 01:214          438.74     .072 No_date    6:40    3.50  n/a
     [L/S/n=  390./1.700/.100]
     {Vmax=  .376:Dmax=  .038}
001:0026---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       03:214            1.61     .003 No_date    2:40    2.25 .090
     [CN= 72.0: N= 1.10]
     [Tp=  .17:DT= 5.00]
001:0027---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:214          438.74     .072 No_date    6:40    3.50  n/a
                     + 03:214            1.61     .003 No_date    2:40    2.25  n/a
     [DT= 5.00]  SUM=  02:214ADD       440.35     .073 No_date    6:25    3.50  n/a
001:0028---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 02:214ADD       440.35     .073 No_date    6:25    3.50  n/a
     [RDT= 5.00] out<- 01:215          440.35     .073 No_date    6:40    3.50  n/a
     [L/S/n=  260./1.400/.100]
     {Vmax=  .341:Dmax=  .042}
001:0029---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:TRB215         1.12     .001 No_date    2:55    1.42 .057
     [CN= 66.0: N= 1.10]
     [Tp=  .17:DT= 5.00]
001:0030---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:215          440.35     .073 No_date    6:40    3.50  n/a
                     + 02:TRB215         1.12     .001 No_date    2:55    1.42  n/a
     [DT= 5.00]  SUM=  03:215ADD       441.47     .073 No_date    6:30    3.49  n/a
001:0031---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:215ADD       441.47     .073 No_date    6:30    3.49  n/a
     [RDT= 5.00] out<- 01:216          441.47     .073 No_date    7:00    3.49  n/a
     [L/S/n=  250./ .500/.100]
     {Vmax=  .204:Dmax=  .071}
001:0032---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:TRB216         1.12     .001 No_date    3:00    1.19 .048
     [CN= 65.0: N= 1.10]
     [Tp=  .17:DT= 5.00]
001:0033---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:216          441.47     .073 No_date    7:00    3.49  n/a
                     + 02:TRB216         1.12     .001 No_date    3:00    1.19  n/a
     [DT= 5.00]  SUM=  10:T2-US        442.59     .073 No_date    6:55    3.48  n/a
001:0034---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:301           86.43     .015 No_date    4:05    1.00 .040
     [CN= 63.0: N= 1.10]
     [Tp= 1.24:DT= 5.00]
001:0035---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:302           80.69     .012 No_date    4:25    1.27 .051
     [CN= 64.0: N= 1.10]
     [Tp= 1.80:DT= 5.00]
001:0036---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:301           86.43     .015 No_date    4:05    1.00  n/a
                     + 02:302           80.69     .012 No_date    4:25    1.27  n/a
     [DT= 5.00]  SUM=  03:300a         167.12     .027 No_date    4:15    1.13  n/a
001:0037---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300a         167.12     .027 No_date    4:15    1.13  n/a
     [RDT= 5.00] out<- 01:310          167.12     .026 No_date    4:45    1.13  n/a
     [L/S/n=  449./1.620/.040]
     {Vmax=  .430:Dmax=  .015}
001:0038---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:303           65.19     .021 No_date    4:05    1.99 .080
     [CN= 69.0: N= 1.10]
     [Tp= 1.31:DT= 5.00]
001:0039---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:310          167.12     .026 No_date    4:45    1.13  n/a
                     + 02:303           65.19     .021 No_date    4:05    1.99  n/a
     [DT= 5.00]  SUM=  03:300b         232.31     .047 No_date    4:35    1.37  n/a
001:0040---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300b         232.31     .047 No_date    4:35    1.37  n/a
     [RDT= 5.00] out<- 01:311          232.31     .047 No_date    4:55    1.37  n/a
     [L/S/n=  270./1.170/.100]
     {Vmax=  .312:Dmax=  .030}
001:0041---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:TRB311         1.15     .001 No_date    4:00    1.61 .064
     [CN= 65.0: N= 1.10]
     [Tp=  .52:DT= 5.00]
001:0042---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:311          232.31     .047 No_date    4:55    1.37  n/a
                     + 02:TRB311         1.15     .001 No_date    4:00    1.61  n/a
     [DT= 5.00]  SUM=  03:311ADD       233.46     .047 No_date    4:55    1.37  n/a
001:0043---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:311ADD       233.46     .047 No_date    4:55    1.37  n/a
     [RDT= 5.00] out<- 01:312          233.46     .047 No_date    5:10    1.37  n/a
     [L/S/n=  270./1.170/.100]
     {Vmax=  .312:Dmax=  .030}
001:0044---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:TRB312         1.30     .001 No_date    4:00    3.13 .125
     [CN= 76.0: N= 1.10]
     [Tp=  .64:DT= 5.00]
001:0045---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:312          233.46     .047 No_date    5:10    1.37  n/a
                     + 02:TRB312         1.30     .001 No_date    4:00    3.13  n/a
     [DT= 5.00]  SUM=  09:312ADD       234.76     .048 No_date    5:10    1.38  n/a
```

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001:0046---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD    01:304a           9.61     .670 No_date    1:40   12.36 .495
     [XIMP=.46:TIMP=.57]
     [SLP=1.60:DT= 5.00]
     [LOSS= 1 : HORTONS]
001:0047---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD    02:402a           5.67     .547 No_date    1:40   15.57 .623
     [XIMP=.58:TIMP=.73]
     [SLP=2.10:DT= 5.00]
     [LOSS= 1 : HORTONS]
001:0048---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    03:POND2          1.85     .160 No_date    1:40   17.13 .685
     [XIMP=.64:TIMP=.80]
     [SLP= .10:DT= 5.00]
     [LOSS= 1 : HORTONS]
001:0049---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:304a           9.61     .670 No_date    1:40   12.36  n/a
                     + 02:402a           5.67     .547 No_date    1:40   15.57  n/a
                     + 03:POND2          1.85     .160 No_date    1:40   17.13  n/a
     [DT= 5.00]  SUM=  04:P2FLOW        17.13    1.378 No_date    1:40   13.94  n/a
001:0050---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 04:P2FLOW        17.13    1.378 No_date    1:40   13.94  n/a
     [RDT= 5.00] out<- 01:POND2         17.13     .003 No_date    4:15   13.94  n/a
              overflow <= 02:P2OVF        .00     .000 No_date    0:00     .00  n/a
    {MxStoUsed=.2360E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
001:0051---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD    02:402b           6.07     .584 No_date    1:40   15.57 .623
     [XIMP=.58:TIMP=.73]
     [SLP=2.10:DT= 5.00]
     [LOSS= 1 : HORTONS]
001:0052---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD    03:402c           1.19     .113 No_date    1:40   14.65 .586
     [XIMP=.55:TIMP=.68]
     [SLP=2.10:DT= 5.00]
     [LOSS= 1 : HORTONS]
001:0053---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            02:402b           6.07     .584 No_date    1:40   15.57  n/a
                     + 03:402c           1.19     .113 No_date    1:40   14.65  n/a
     [DT= 5.00]  SUM=  04:400-OS         7.26     .696 No_date    1:40   15.42  n/a
001:0054---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 04:400-OS         7.26     .696 No_date    1:40   15.42  n/a
 *   [RDT= 5.00] out<- 02:OSSTOR         7.26     .708 No_date    1:40   15.42  n/a
              overflow <= 03:OSOVF        .00     .000 No_date    0:00     .00  n/a
    {MxStoUsed=.4596E-02, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
001:0055---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       03:401           16.78     .030 No_date    3:55    2.36 .094
     [CN= 68.0: N= 3.00]
     [Tp= 1.66:DT= 5.00]
001:0056---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:POND2         17.13     .003 No_date    4:15   13.94  n/a
                     + 02:OSSTOR         7.26     .708 No_date    1:40   15.42  n/a
                     + 03:401           16.78     .030 No_date    3:55    2.36  n/a
                     + 09:312ADD       234.76     .048 No_date    5:10    1.38  n/a
     [DT= 5.00]  SUM=  04:P2-T3        275.93     .710 No_date    1:40    2.59  n/a
001:0057---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 04:P2-T3        275.93     .710 No_date    1:40    2.59  n/a
     [RDT= 5.00] out<- 01:313          275.93     .315 No_date    1:45    2.59  n/a
     [L/S/n=  423./1.170/.100]
     {Vmax=  .448:Dmax=  .291}
001:0058---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:TRB313          .72     .001 No_date    3:40    2.06 .082
     [CN= 68.0: N= 1.10]
     [Tp=  .34:DT= 5.00]
001:0059---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:313          275.93     .315 No_date    1:45    2.59  n/a
                     + 02:TRB313          .72     .001 No_date    3:40    2.06  n/a
     [DT= 5.00]  SUM=  03:313ADD       276.65     .315 No_date    1:45    2.59  n/a
001:0060---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       04:TRB314          .94     .001 No_date    4:00    2.06 .083
     [CN= 68.0: N= 1.10]
     [Tp=  .46:DT= 5.00]
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001:0061---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:313          275.93     .315 No_date    1:45    2.59  n/a
                     + 02:TRB313          .72     .001 No_date    3:40    2.06  n/a
     [DT= 5.00]  SUM=  03:313ADD       276.65     .315 No_date    1:45    2.59  n/a
001:0062---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       04:403a           2.66     .005 No_date    2:50    3.31 .132
     [CN= 70.0: N= 1.10]
     [Tp=  .27:DT= 5.00]
001:0063---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            10:T2-US        442.59     .073 No_date    6:55    3.48  n/a
                     + 03:313ADD       276.65     .315 No_date    1:45    2.59  n/a
                     + 04:403a           2.66     .005 No_date    2:50    3.31  n/a
     [DT= 5.00]  SUM=  01:CONFLU       721.90     .320 No_date    1:50    3.14  n/a
001:0064---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD    01:203d           1.26     .122 No_date    1:40   15.00 .600
     [XIMP=.56:TIMP=.70]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
001:0065---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    02:501a           9.32    1.059 No_date    1:40   20.53 .821
     [XIMP=.74:TIMP=.93]
     [SLP= .80:DT= 5.00]
     [LOSS= 1 : HORTONS]
001:0066---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    COMPUTE DUALHYD    02:501a           9.32    1.059 No_date    1:40   20.53  n/a
       Major System /  03:OSSTOR          .00     .000 No_date    0:00     .00  n/a
       Minor System \  04:TOPOND         9.32    1.059 No_date    1:40   20.53  n/a
     {MjSysSto=.0000E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
001:0067---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    05:501b          38.42    2.941 No_date    1:40   14.42 .577
     [XIMP=.54:TIMP=.67]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
001:0068---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    06:501c          39.10    2.828 No_date    1:40   13.74 .549
     [XIMP=.51:TIMP=.64]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
001:0069---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD    07:MR1            3.32     .491 No_date    1:40   23.05 .922
     [XIMP=.80:TIMP=.99]
     [SLP=1.00:DT= 5.00]
     [LOSS= 1 : HORTONS]
001:0070---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD    08:MR2            3.04     .452 No_date    1:40   23.05 .922
     [XIMP=.80:TIMP=.99]
     [SLP=1.00:DT= 5.00]
     [LOSS= 1 : HORTONS]
001:0071---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:203d           1.26     .122 No_date    1:40   15.00  n/a
                     + 05:501b          38.42    2.941 No_date    1:40   14.42  n/a
                     + 07:MR1            3.32     .491 No_date    1:40   23.05  n/a
     [DT= 5.00]  SUM=  10:VALE          43.00    3.555 No_date    1:40   15.11  n/a
001:0072---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            04:TOPOND         9.32    1.059 No_date    1:40   20.53  n/a
                     + 06:501c          39.10    2.828 No_date    1:40   13.74  n/a
                     + 08:MR2            3.04     .452 No_date    1:40   23.05  n/a
     [DT= 5.00]  SUM=  09:MET           51.46    4.339 No_date    1:40   15.52  n/a
001:0073---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    01:POND3         11.89     .753 No_date    1:45   17.13 .685
     [XIMP=.64:TIMP=.80]
     [SLP= .10:DT= 5.00]
     [LOSS= 1 : HORTONS]
001:0074---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            10:VALE          43.00    3.555 No_date    1:40   15.11  n/a
                     + 09:MET           51.46    4.339 No_date    1:40   15.52  n/a
                     + 01:POND3         11.89     .753 No_date    1:45   17.13  n/a
     [DT= 5.00]  SUM=  08:P3ADD        106.35    8.573 No_date    1:40   15.53  n/a
001:0075---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 08:P3ADD        106.35    8.573 No_date    1:40   15.53  n/a
     [RDT= 5.00] out<- 01:POND3        106.35     .058 No_date    4:10   15.53  n/a
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          overflow <= 02:E-OVF          .00     .000 No_date    0:00     .00  n/a
   {MxStoUsed=.1600E+01, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
 ** END OF RUN :   1

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



 RUN:COMMAND#
 002:0001----------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   2 ]
#*******************************************************************************
#  Project Name: [Kanata North]    Project Number: [112117]
#  Date        : 03-30-2016
#  Modeller    : [Kallie Auld]
#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
#  License #   :  5320763
#*******************************************************************************
#*******************************************************************************
 002:0002----------------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  =
      [SDT=10.00:SDUR=   4.00:PTOT=  33.89]
 002:0003----------------------------------------------------------------------------
     DEFAULT VALUES
      Filename = M:\2012\112117\data\CALCUL~1\swmhymo\POSTDE~1\OTTAWA.DEF
      ICASEdv  = 1 (read and print data)
      FileTitle= ------ ENTER YOUR COMMENTS ON THIS LINE AND THE NEXT ONE ---
                 ------ PARAMETER VALUES MUST BE ENTERD AFTER COLUMN 60 ----_
      Horton's infiltration equation parameters:
      [Fo= 76.20 mm/hr] [Fc=13.20 mm/hr] [DCAY= 4.14 /hr] [F=  .00 mm]
      Parameters for PERVIOUS surfaces in STANDHYD:
      [IAper=   4.67 mm] [LGP=40.00 m] [MNP= .250]
      Parameters for IMPERVIOUS surfaces in STANDHYD:
      [IAimp=   1.57 mm] [CLI= 1.50]   [MNI= .013]
      Parameters used in NASHYD:
      [Ia=   4.67 mm] [N= 3.00]
 002:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:201          115.14     .023 No_date     5:45    3.18 .094
      [CN= 65.0: N= 1.10]
      [Tp= 3.42:DT= 5.00]
 002:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 01:201          115.14     .023 No_date     5:45    3.18  n/a
      [RDT= 5.00] out<- 02:210          115.14     .023 No_date     6:10    3.18  n/a
      [L/S/n=  558./ .890/.040]
      {Vmax=  .423:Dmax=  .011}
 002:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:202          263.64     .058 No_date     7:15    5.08 .150
      [CN= 70.0: N= 1.10]
      [Tp= 5.14:DT= 5.00]
 002:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:202          263.64     .058 No_date     7:15    5.08  n/a
                     +  02:210          115.14     .023 No_date     6:10    3.18  n/a
      [DT= 5.00]  SUM=  03:210add       378.78     .081 No_date     6:50    4.50  n/a
 002:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:210add       378.78     .081 No_date     6:50    4.50  n/a
      [RDT= 5.00] out<- 01:211          378.78     .081 No_date     7:20    4.50  n/a
      [L/S/n=  450./1.000/.100]
      {Vmax=  .288:Dmax=  .056}
 002:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:211            1.87     .002 No_date     4:00    6.49 .191
      [CN= 76.0: N= 1.10]
      [Tp= 1.17:DT= 5.00]
 002:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
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    ADD HYD            01:211          378.78     .081 No_date     7:20    4.50  n/a
                    +  02:211            1.87     .002 No_date     4:00    6.49  n/a
     [DT= 5.00]  SUM=  03:211add       380.65     .083 No_date     7:05    4.51  n/a
002:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:211add       380.65     .083 No_date     7:05    4.51  n/a
     [RDT= 5.00] out<- 01:212          380.65     .083 No_date     7:20    4.51  n/a
     [L/S/n=  230./1.000/.100]
     {Vmax=  .288:Dmax=  .057}
002:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:212             .95     .001 No_date     4:00    4.04 .119
     [CN= 66.0: N= 1.10]
     [Tp=  .56:DT= 5.00]
002:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:212          380.65     .083 No_date     7:20    4.51  n/a
                    +  02:212             .95     .001 No_date     4:00    4.04  n/a
     [DT= 5.00]  SUM=  03:212add       381.60     .084 No_date     7:05    4.51  n/a
002:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:212add       381.60     .084 No_date     7:05    4.51  n/a
     [RDT= 5.00] out<- 01:213          381.60     .084 No_date     7:30    4.51  n/a
     [L/S/n=  330./1.000/.100]
     {Vmax=  .288:Dmax=  .057}
002:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:213            1.43     .002 No_date     4:00    3.98 .117
     [CN= 66.0: N= 1.10]
     [Tp=  .67:DT= 5.00]
002:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:213          381.60     .084 No_date     7:30    4.51  n/a
                    +  02:213            1.43     .002 No_date     4:00    3.98  n/a
     [DT= 5.00]  SUM=  09:TRIB2        383.03     .085 No_date     7:15    4.51  n/a
002:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    01:203a          27.32    2.924 No_date     1:30   19.94 .588
     [XIMP=.50:TIMP=.63]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
002:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD    02:203b          20.76    2.179 No_date     1:30   19.21 .567
     [XIMP=.48:TIMP=.60]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
002:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD    03:203c           4.95     .711 No_date     1:30   22.20 .655
     [XIMP=.57:TIMP=.71]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
002:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    04:POND1          2.68     .307 No_date     1:30   24.68 .728
     [XIMP=.64:TIMP=.80]
     [SLP= .10:DT= 5.00]
     [LOSS= 1 : HORTONS]
002:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            02:203b          20.76    2.179 No_date     1:30   19.21  n/a
                    +  03:203c           4.95     .711 No_date     1:30   22.20  n/a
     [DT= 5.00]  SUM=  05:T2CRS         25.71    2.890 No_date     1:30   19.78  n/a
002:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:203a          27.32    2.924 No_date     1:30   19.94  n/a
                    +  04:POND1          2.68     .307 No_date     1:30   24.68  n/a
                    +  05:T2CRS         25.71    2.890 No_date     1:30   19.78  n/a
     [DT= 5.00]  SUM=  06:P1FLOW        55.71    6.121 No_date     1:30   20.10  n/a
002:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 06:P1FLOW        55.71    6.121 No_date     1:30   20.10  n/a
     [RDT= 5.00] out<- 01:POND1         55.71     .075 No_date     4:05   20.10  n/a
           overflow <= 02:P1-OVF          .00     .000 No_date     0:00     .00  n/a
    {MxStoUsed=.1059E+01, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
002:0024---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:POND1         55.71     .075 No_date     4:05   20.10  n/a
                    +  09:TRIB2        383.03     .085 No_date     7:15    4.51  n/a
     [DT= 5.00]  SUM=  02:213ADD       438.74     .153 No_date     5:45    6.49  n/a
002:0025---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 02:213ADD       438.74     .153 No_date     5:45    6.49  n/a
     [RDT= 5.00] out<- 01:214          438.74     .153 No_date     6:05    6.49  n/a
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     [L/S/n=  390./1.700/.100]
     {Vmax=  .376:Dmax=  .080}
002:0026---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       03:214             1.61     .006 No_date    2:30    5.05 .149
     [CN= 72.0: N= 1.10]
     [Tp=  .17:DT= 5.00]
002:0027---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:214           438.74     .153 No_date    6:05    6.49  n/a
                    +  03:214             1.61     .006 No_date    2:30    5.05  n/a
     [DT= 5.00]  SUM=  02:214ADD        440.35     .155 No_date    5:55    6.48  n/a
002:0028---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 02:214ADD        440.35     .155 No_date    5:55    6.48  n/a
     [RDT= 5.00] out<- 01:215           440.35     .154 No_date    6:10    6.48  n/a
     [L/S/n=  260./1.400/.100]
     {Vmax=  .341:Dmax=  .089}
002:0029---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:TRB215          1.12     .003 No_date    2:40    3.52 .104
     [CN= 66.0: N= 1.10]
     [Tp=  .17:DT= 5.00]
002:0030---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:215           440.35     .154 No_date    6:10    6.48  n/a
                    +  02:TRB215          1.12     .003 No_date    2:40    3.52  n/a
     [DT= 5.00]  SUM=  03:215ADD        441.47     .155 No_date    6:05    6.48  n/a
002:0031---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:215ADD        441.47     .155 No_date    6:05    6.48  n/a
     [RDT= 5.00] out<- 01:216           441.47     .155 No_date    6:30    6.48  n/a
     [L/S/n=  250./ .500/.100]
     {Vmax=  .204:Dmax=  .150}
002:0032---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:TRB216          1.12     .003 No_date    2:40    3.12 .092
     [CN= 65.0: N= 1.10]
     [Tp=  .17:DT= 5.00]
002:0033---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:216           441.47     .155 No_date    6:30    6.48  n/a
                    +  02:TRB216          1.12     .003 No_date    2:40    3.12  n/a
     [DT= 5.00]  SUM=  10:T2-US         442.59     .155 No_date    6:25    6.47  n/a
002:0034---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:301            86.43     .040 No_date    4:05    2.73 .081
     [CN= 63.0: N= 1.10]
     [Tp= 1.24:DT= 5.00]
002:0035---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:302            80.69     .030 No_date    4:20    3.19 .094
     [CN= 64.0: N= 1.10]
     [Tp= 1.80:DT= 5.00]
002:0036---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:301            86.43     .040 No_date    4:05    2.73  n/a
                    +  02:302            80.69     .030 No_date    4:20    3.19  n/a
     [DT= 5.00]  SUM=  03:300a          167.12     .070 No_date    4:05    2.95  n/a
002:0037---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300a          167.12     .070 No_date    4:05    2.95  n/a
     [RDT= 5.00] out<- 01:310           167.12     .069 No_date    4:40    2.95  n/a
     [L/S/n=  449./1.620/.040]
     {Vmax=  .430:Dmax=  .038}
002:0038---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:303            65.19     .047 No_date    4:00    4.49 .132
     [CN= 69.0: N= 1.10]
     [Tp= 1.31:DT= 5.00]
002:0039---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:310           167.12     .069 No_date    4:40    2.95  n/a
                    +  02:303            65.19     .047 No_date    4:00    4.49  n/a
     [DT= 5.00]  SUM=  03:300b          232.31     .116 No_date    4:30    3.38  n/a
002:0040---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300b          232.31     .116 No_date    4:30    3.38  n/a
     [RDT= 5.00] out<- 01:311           232.31     .115 No_date    4:50    3.38  n/a
     [L/S/n=  270./1.170/.100]
     {Vmax=  .312:Dmax=  .073}
002:0041---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:TRB311          1.15     .002 No_date    4:00    3.75 .111
     [CN= 65.0: N= 1.10]
     [Tp=  .52:DT= 5.00]
002:0042---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:311           232.31     .115 No_date    4:50    3.38  n/a
                    +  02:TRB311          1.15     .002 No_date    4:00    3.75  n/a
     [DT= 5.00]  SUM=  03:311ADD        233.46     .117 No_date    4:50    3.39  n/a
002:0043---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:311ADD        233.46     .117 No_date    4:50    3.39  n/a
     [RDT= 5.00] out<- 01:312           233.46     .116 No_date    5:05    3.39  n/a
     [L/S/n=  270./1.170/.100]
     {Vmax=  .312:Dmax=  .074}
002:0044---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:TRB312          1.30     .003 No_date    4:00    6.53 .193
     [CN= 76.0: N= 1.10]
     [Tp=  .64:DT= 5.00]
002:0045---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:312           233.46     .116 No_date    5:05    3.39  n/a
                    +  02:TRB312          1.30     .003 No_date    4:00    6.53  n/a
     [DT= 5.00]  SUM=  09:312ADD        234.76     .118 No_date    5:05    3.40  n/a
002:0046---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD    01:304a            9.61     .988 No_date    1:30   18.49 .545
     [XIMP=.46:TIMP=.57]
     [SLP=1.60:DT= 5.00]
     [LOSS= 1 : HORTONS]
002:0047---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD    02:402a            5.67     .823 No_date    1:30   22.67 .669
     [XIMP=.58:TIMP=.73]
     [SLP=2.10:DT= 5.00]
     [LOSS= 1 : HORTONS]
002:0048---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    03:POND2           1.85     .221 No_date    1:30   24.68 .728
     [XIMP=.64:TIMP=.80]
     [SLP= .10:DT= 5.00]
     [LOSS= 1 : HORTONS]
002:0049---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:304a            9.61     .988 No_date    1:30   18.49  n/a
                    +  02:402a            5.67     .823 No_date    1:30   22.67  n/a
                    +  03:POND2           1.85     .221 No_date    1:30   24.68  n/a
     [DT= 5.00]  SUM=  04:P2FLOW         17.13    2.031 No_date    1:30   20.54  n/a
002:0050---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 04:P2FLOW         17.13    2.031 No_date    1:30   20.54  n/a
     [RDT= 5.00] out<- 01:POND2          17.13     .011 No_date    4:05   20.54  n/a
          overflow <= 02:P2OVF             .00     .000 No_date    0:00     .00  n/a
    {MxStoUsed=.3433E+00, TotOvfVol=.0000E+00, N-Ovf=     0, TotDurOvf=     0.hrs}
002:0051---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD    02:402b            6.07     .879 No_date    1:30   22.67 .669
     [XIMP=.58:TIMP=.73]
     [SLP=2.10:DT= 5.00]
     [LOSS= 1 : HORTONS]
002:0052---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD    03:402c            1.19     .170 No_date    1:30   21.42 .632
     [XIMP=.55:TIMP=.68]
     [SLP=2.10:DT= 5.00]
     [LOSS= 1 : HORTONS]
002:0053---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            02:402b            6.07     .879 No_date    1:30   22.67  n/a
                    +  03:402c            1.19     .170 No_date    1:30   21.42  n/a
     [DT= 5.00]  SUM=  04:400-OS          7.26    1.049 No_date    1:30   22.46  n/a
002:0054---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 04:400-OS          7.26    1.049 No_date    1:30   22.46  n/a
     [RDT= 5.00] out<- 02:OSSTOR          7.26     .801 No_date    1:35   22.46  n/a
          overflow <= 03:OSOVF             .00     .000 No_date    0:00     .00  n/a
    {MxStoUsed=.1404E-01, TotOvfVol=.0000E+00, N-Ovf=     0, TotDurOvf=     0.hrs}
002:0055---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       03:401            16.78     .062 No_date    3:45    4.94 .146
     [CN= 68.0: N= 3.00]
     [Tp= 1.66:DT= 5.00]
002:0056---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:POND2          17.13     .011 No_date    4:05   20.54  n/a
                    +  02:OSSTOR          7.26     .801 No_date    1:35   22.46  n/a
                    +  03:401            16.78     .062 No_date    3:45    4.94  n/a
                    +  09:312ADD        234.76     .118 No_date    5:05    3.40  n/a
     [DT= 5.00]  SUM=  04:P2-T3         275.93     .807 No_date    1:35    5.06  n/a
002:0057---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
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    ROUTE CHANNEL   -> 04:P2-T3          275.93      .807 No_date     1:35     5.06  n/a
     [RDT= 5.00] out<- 01:313            275.93      .556 No_date     1:40     5.06  n/a
     [L/S/n=  423./1.170/.100]
     {Vmax=  .490:Dmax=  .318}
002:0058---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:TRB313            .72      .002 No_date     3:20     4.54 .134
     [CN= 68.0: N= 1.10]
     [Tp=  .34:DT= 5.00]
002:0059---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:313            275.93      .556 No_date     1:40     5.06  n/a
                     + 02:TRB313            .72      .002 No_date     3:20     4.54  n/a
     [DT= 5.00]  SUM=  03:313ADD         276.65      .557 No_date     1:40     5.06  n/a
002:0060---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       04:TRB314            .94      .002 No_date     4:00     4.54 .134
     [CN= 68.0: N= 1.10]
     [Tp=  .46:DT= 5.00]
002:0061---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:313            275.93      .556 No_date     1:40     5.06  n/a
                     + 02:TRB313            .72      .002 No_date     3:20     4.54  n/a
     [DT= 5.00]  SUM=  03:313ADD         276.65      .557 No_date     1:40     5.06  n/a
002:0062---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       04:403a             2.66      .009 No_date     2:50     6.33 .187
     [CN= 70.0: N= 1.10]
     [Tp=  .27:DT= 5.00]
002:0063---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            10:T2-US          442.59      .155 No_date     6:25     6.47  n/a
                     + 03:313ADD         276.65      .557 No_date     1:40     5.06  n/a
                     + 04:403a             2.66      .009 No_date     2:50     6.33  n/a
     [DT= 5.00]  SUM=  01:CONFLU         721.90      .569 No_date     1:40     5.93  n/a
002:0064---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * DESIGN STANDHYD    01:203d             1.26      .185 No_date     1:30    21.90 .646
     [XIMP=.56:TIMP=.70]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
002:0065---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    02:501a             9.32     1.537 No_date     1:30    28.94 .854
     [XIMP=.74:TIMP=.93]
     [SLP= .80:DT= 5.00]
     [LOSS= 1 : HORTONS]
002:0066---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    COMPUTE DUALHYD    02:501a             9.32     1.537 No_date     1:30    28.94  n/a
       Major System /  03:OSSTOR            .00      .000 No_date     0:00      .00  n/a
       Minor System \  04:TOPOND           9.32     1.537 No_date     1:30    28.94  n/a
     {MjSysSto=.0000E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
002:0067---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    05:501b            38.42     4.266 No_date     1:30    21.12 .623
     [XIMP=.54:TIMP=.67]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
002:0068---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    06:501c            39.10     4.131 No_date     1:30    20.22 .597
     [XIMP=.51:TIMP=.64]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
002:0069---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * DESIGN STANDHYD    07:MR1              3.32      .656 No_date     1:30    31.93 .942
     [XIMP=.80:TIMP=.99]
     [SLP=1.00:DT= 5.00]
     [LOSS= 1 : HORTONS]
002:0070---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * DESIGN STANDHYD    08:MR2              3.04      .603 No_date     1:30    31.93 .942
     [XIMP=.80:TIMP=.99]
     [SLP=1.00:DT= 5.00]
     [LOSS= 1 : HORTONS]
002:0071---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:203d             1.26      .185 No_date     1:30    21.90  n/a
                     + 05:501b            38.42     4.266 No_date     1:30    21.12  n/a
                     + 07:MR1              3.32      .656 No_date     1:30    31.93  n/a
     [DT= 5.00]  SUM=  10:VALE            43.00     5.107 No_date     1:30    21.98  n/a
002:0072---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            04:TOPOND           9.32     1.537 No_date     1:30    28.94  n/a
                     + 06:501c            39.10     4.131 No_date     1:30    20.22  n/a
                     + 08:MR2              3.04      .603 No_date     1:30    31.93  n/a
     [DT= 5.00]  SUM=  09:MET             51.46     6.271 No_date     1:30    22.50  n/a
002:0073---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    01:POND3           11.89     1.050 No_date     1:35    24.68 .728
     [XIMP=.64:TIMP=.80]
     [SLP= .10:DT= 5.00]
     [LOSS= 1 : HORTONS]
002:0074---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            10:VALE            43.00     5.107 No_date     1:30    21.98  n/a
                     + 09:MET             51.46     6.271 No_date     1:30    22.50  n/a
                     + 01:POND3           11.89     1.050 No_date     1:35    24.68  n/a
     [DT= 5.00]  SUM=  08:P3ADD          106.35    12.330 No_date     1:30    22.53  n/a
002:0075---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 08:P3ADD          106.35    12.330 No_date     1:30    22.53  n/a
     [RDT= 5.00] out<- 01:POND3          106.35      .175 No_date     4:05    22.53  n/a
           overflow <= 02:E-OVF             .00      .000 No_date     0:00      .00  n/a
    {MxStoUsed=.2262E+01, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
 ** END OF RUN :    2

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




 RUN:COMMAND#
 003:0001-----------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   3 ]
#******************************************************************************
#  Project Name: [Kanata North]    Project Number: [112117]
#  Date        : 03-30-2016
#  Modeller    : [Kallie Auld]
#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
#  License #   :  5320763
#******************************************************************************
#******************************************************************************
 003:0002-----------------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  =
      [SDT=10.00:SDUR=   4.00:PTOT=  45.18]
 003:0003-----------------------------------------------------------------------------
     DEFAULT VALUES
      Filename = M:\2012\112117\data\CALCUL~1\swmhymo\POSTDE~1\OTTAWA.DEF
      ICASEdv  = 1 (read and print data)
      FileTitle= ------ ENTER YOUR COMMENTS ON THIS LINE AND THE NEXT ONE ---
                 ------ PARAMETER VALUES MUST BE ENTERD AFTER COLUMN 60 ----_
      Horton's infiltration equation parameters:
      [Fo= 76.20 mm/hr] [Fc=13.20 mm/hr] [DCAY= 4.14 /hr] [F=  .00 mm]
      Parameters for PERVIOUS surfaces in STANDHYD:
      [IAper=   4.67 mm] [LGP=40.00 m] [MNP= .250]
      Parameters for IMPERVIOUS surfaces in STANDHYD:
      [IAimp=   1.57 mm] [CLI= 1.50]   [MNI= .013]
      Parameters used in NASHYD:
      [Ia=   4.67 mm] [N= 3.00]
 003:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:201           115.14      .049 No_date     5:45     6.69 .148
      [CN= 65.0: N= 1.10]
      [Tp= 3.42:DT= 5.00]
 003:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 01:201           115.14      .049 No_date     5:45     6.69  n/a
      [RDT= 5.00] out<- 02:210           115.14      .049 No_date     6:10     6.69  n/a
      [L/S/n=  558./ .890/.040]
      {Vmax=  .423:Dmax=  .023}
 003:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:202           263.64      .110 No_date     7:20     9.60 .212
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     [CN= 70.0: N= 1.10]
     [Tp= 5.14:DT= 5.00]
003:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           01:202          263.64     .110 No_date    7:20    9.60  n/a
                    + 02:210          115.14     .049 No_date    6:10    6.69  n/a
     [DT= 5.00]  SUM=  03:210add       378.78     .159 No_date    6:50    8.71  n/a
003:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:210add       378.78     .159 No_date    6:50    8.71  n/a
     [RDT= 5.00] out<- 01:211          378.78     .159 No_date    7:20    8.71  n/a
     [L/S/n=  450./1.000/.100]
     {Vmax=  .288:Dmax=  .109}
003:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD      02:211            1.87     .004 No_date    4:00   11.99 .265
     [CN= 76.0: N= 1.10]
     [Tp= 1.17:DT= 5.00]
003:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           01:211          378.78     .159 No_date    7:20    8.71  n/a
                    + 02:211            1.87     .004 No_date    4:00   11.99  n/a
     [DT= 5.00]  SUM=  03:211add       380.65     .162 No_date    7:05    8.73  n/a
003:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:211add       380.65     .162 No_date    7:05    8.73  n/a
     [RDT= 5.00] out<- 01:212          380.65     .162 No_date    7:20    8.73  n/a
     [L/S/n=  230./1.000/.100]
     {Vmax=  .288:Dmax=  .111}
003:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD      02:212             .95     .003 No_date    4:00    7.91 .175
     [CN= 66.0: N= 1.10]
     [Tp=  .56:DT= 5.00]
003:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           01:212          380.65     .162 No_date    7:20    8.73  n/a
                    + 02:212             .95     .003 No_date    4:00    7.91  n/a
     [DT= 5.00]  SUM=  03:212add       381.60     .164 No_date    7:05    8.73  n/a
003:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:212add       381.60     .164 No_date    7:05    8.73  n/a
     [RDT= 5.00] out<- 01:213          381.60     .164 No_date    7:30    8.73  n/a
     [L/S/n=  330./1.000/.100]
     {Vmax=  .288:Dmax=  .112}
003:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD      02:213            1.43     .003 No_date    4:00    7.83 .173
     [CN= 66.0: N= 1.10]
     [Tp=  .67:DT= 5.00]
003:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           01:213          381.60     .164 No_date    7:30    8.73  n/a
                    + 02:213            1.43     .003 No_date    4:00    7.83  n/a
     [DT= 5.00]  SUM=  09:TRIB2        383.03     .166 No_date    7:15    8.72  n/a
003:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD   01:203a          27.32    4.933 No_date    1:40   29.52 .653
     [XIMP=.50:TIMP=.63]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
003:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD   02:203b          20.76    3.707 No_date    1:40   28.61 .633
     [XIMP=.48:TIMP=.60]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
003:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD   03:203c           4.95    1.053 No_date    1:40   32.10 .711
     [XIMP=.57:TIMP=.71]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
003:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD   04:POND1          2.68     .445 No_date    1:40   35.07 .776
     [XIMP=.64:TIMP=.80]
     [SLP= .10:DT= 5.00]
     [LOSS= 1 : HORTONS]
003:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           02:203b          20.76    3.707 No_date    1:40   28.61  n/a
                    + 03:203c           4.95    1.053 No_date    1:40   32.10  n/a
     [DT= 5.00]  SUM=  05:T2CRS         25.71    4.760 No_date    1:40   29.28  n/a
003:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           01:203a          27.32    4.933 No_date    1:40   29.52  n/a
                    + 04:POND1          2.68     .445 No_date    1:40   35.07  n/a
                    + 05:T2CRS         25.71    4.760 No_date    1:40   29.28  n/a
     [DT= 5.00]  SUM=  06:P1FLOW        55.71   10.138 No_date    1:40   29.68  n/a
003:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 06:P1FLOW        55.71   10.138 No_date    1:40   29.68  n/a
     [RDT= 5.00] out<- 01:POND1         55.71     .152 No_date    4:00   29.68  n/a
           overflow <= 02:P1-OVF          .00     .000 No_date    0:00     .00  n/a
    {MxStoUsed=.1536E+01, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
003:0024---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           01:POND1         55.71     .152 No_date    4:00   29.68  n/a
                    + 09:TRIB2        383.03     .166 No_date    7:15    8.72  n/a
     [DT= 5.00]  SUM=  02:213ADD       438.74     .300 No_date    5:25   11.38  n/a
003:0025---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 02:213ADD       438.74     .300 No_date    5:25   11.38  n/a
     [RDT= 5.00] out<- 01:214          438.74     .299 No_date    5:45   11.38  n/a
     [L/S/n=  390./1.700/.100]
     {Vmax=  .376:Dmax=  .157}
003:0026---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD      03:214            1.61     .012 No_date    2:30    9.74 .216
     [CN= 72.0: N= 1.10]
     [Tp=  .17:DT= 5.00]
003:0027---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           01:214          438.74     .299 No_date    5:45   11.38  n/a
                    + 03:214            1.61     .012 No_date    2:30    9.74  n/a
     [DT= 5.00]  SUM=  02:214ADD       440.35     .303 No_date    5:35   11.38  n/a
003:0028---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 02:214ADD       440.35     .303 No_date    5:35   11.38  n/a
     [RDT= 5.00] out<- 01:215          440.35     .303 No_date    5:50   11.38  n/a
     [L/S/n=  260./1.400/.100]
     {Vmax=  .347:Dmax=  .166}
003:0029---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD      02:TRB215         1.12     .006 No_date    2:30    7.23 .160
     [CN= 66.0: N= 1.10]
     [Tp=  .17:DT= 5.00]
003:0030---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           01:215          440.35     .303 No_date    5:50   11.38  n/a
                    + 02:TRB215         1.12     .006 No_date    2:30    7.23  n/a
     [DT= 5.00]  SUM=  03:215ADD       441.47     .304 No_date    5:45   11.37  n/a
003:0031---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:215ADD       441.47     .304 No_date    5:45   11.37  n/a
     [RDT= 5.00] out<- 01:216          441.47     .304 No_date    6:00   11.37  n/a
     [L/S/n=  250./ .500/.100]
     {Vmax=  .238:Dmax=  .220}
003:0032---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD      02:TRB216         1.12     .006 No_date    2:30    6.62 .146
     [CN= 65.0: N= 1.10]
     [Tp=  .17:DT= 5.00]
003:0033---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           01:216          441.47     .304 No_date    6:00   11.37  n/a
                    + 02:TRB216         1.12     .006 No_date    2:30    6.62  n/a
     [DT= 5.00]  SUM=  10:T2-US        442.59     .306 No_date    5:55   11.36  n/a
003:0034---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD      01:301           86.43     .086 No_date    4:00    5.94 .131
     [CN= 63.0: N= 1.10]
     [Tp= 1.24:DT= 5.00]
003:0035---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD      02:302           80.69     .063 No_date    4:20    6.63 .147
     [CN= 64.0: N= 1.10]
     [Tp= 1.80:DT= 5.00]
003:0036---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           01:301           86.43     .086 No_date    4:00    5.94  n/a
                    + 02:302           80.69     .063 No_date    4:20    6.63  n/a
     [DT= 5.00]  SUM=  03:300a         167.12     .150 No_date    4:05    6.27  n/a
003:0037---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300a         167.12     .150 No_date    4:05    6.27  n/a
     [RDT= 5.00] out<- 01:310          167.12     .149 No_date    4:35    6.27  n/a
     [L/S/n=  449./1.620/.040]
     {Vmax=  .449:Dmax=  .069}
003:0038---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD      02:303           65.19     .091 No_date    4:00    8.75 .194
     [CN= 69.0: N= 1.10]
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     [Tp= 1.31:DT= 5.00]
003:0039---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD          01:310          167.12     .149 No_date    4:35    6.27  n/a
                   + 02:303           65.19     .091 No_date    4:00    8.75  n/a
     [DT= 5.00]  SUM= 03:300b        232.31     .239 No_date    4:25    6.97  n/a
003:0040---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300b       232.31     .239 No_date    4:25    6.97  n/a
     [RDT= 5.00] out<- 01:311        232.31     .238 No_date    4:45    6.97  n/a
     [L/S/n=  270./1.170/.100]
     {Vmax=  .312:Dmax=  .151}
003:0041---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD     02:TRB311         1.15     .003 No_date    4:00    7.45 .165
     [CN= 65.0: N= 1.10]
     [Tp=  .52:DT= 5.00]
003:0042---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD          01:311          232.31     .238 No_date    4:45    6.97  n/a
                   + 02:TRB311         1.15     .003 No_date    4:00    7.45  n/a
     [DT= 5.00]  SUM= 03:311ADD      233.46     .241 No_date    4:45    6.97  n/a
003:0043---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:311ADD     233.46     .241 No_date    4:45    6.97  n/a
     [RDT= 5.00] out<- 01:312        233.46     .240 No_date    5:00    6.97  n/a
     [L/S/n=  270./1.170/.100]
     {Vmax=  .312:Dmax=  .152}
003:0044---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD     02:TRB312         1.30     .005 No_date    4:00   12.04 .267
     [CN= 76.0: N= 1.10]
     [Tp=  .64:DT= 5.00]
003:0045---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD          01:312          233.46     .240 No_date    5:00    6.97  n/a
                   + 02:TRB312         1.30     .005 No_date    4:00   12.04  n/a
     [DT= 5.00]  SUM= 09:312ADD      234.76     .244 No_date    5:00    7.00  n/a
003:0046---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * DESIGN STANDHYD   01:304a          9.61    1.683 No_date    1:40   27.75 .614
     [XIMP=.46:TIMP=.57]
     [SLP=1.60:DT= 5.00]
     [LOSS= 1 : HORTONS]
003:0047---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * DESIGN STANDHYD   02:402a          5.67    1.215 No_date    1:40   32.68 .723
     [XIMP=.58:TIMP=.73]
     [SLP=2.10:DT= 5.00]
     [LOSS= 1 : HORTONS]
003:0048---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD   03:POND2         1.85     .316 No_date    1:40   35.07 .776
     [XIMP=.64:TIMP=.80]
     [SLP= .10:DT= 5.00]
     [LOSS= 1 : HORTONS]
003:0049---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD          01:304a           9.61    1.683 No_date    1:40   27.75  n/a
                   + 02:402a           5.67    1.215 No_date    1:40   32.68  n/a
                   + 03:POND2          1.85     .316 No_date    1:40   35.07  n/a
     [DT= 5.00]  SUM= 04:P2FLOW       17.13    3.214 No_date    1:40   30.18  n/a
003:0050---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 04:P2FLOW      17.13    3.214 No_date    1:40   30.18  n/a
     [RDT= 5.00] out<- 01:POND2       17.13     .025 No_date    4:05   30.17  n/a
           overflow <= 02:P2OVF         .00     .000 No_date    0:00     .00  n/a
    {MxStoUsed=.4981E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
003:0051---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * DESIGN STANDHYD   02:402b          6.07    1.297 No_date    1:40   32.68 .723
     [XIMP=.58:TIMP=.73]
     [SLP=2.10:DT= 5.00]
     [LOSS= 1 : HORTONS]
003:0052---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * DESIGN STANDHYD   03:402c          1.19     .253 No_date    1:40   31.21 .691
     [XIMP=.55:TIMP=.68]
     [SLP=2.10:DT= 5.00]
     [LOSS= 1 : HORTONS]
003:0053---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD          02:402b           6.07    1.297 No_date    1:40   32.68  n/a
                   + 03:402c           1.19     .253 No_date    1:40   31.21  n/a
     [DT= 5.00]  SUM= 04:400-OS        7.26    1.550 No_date    1:40   32.44  n/a
003:0054---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 04:400-OS       7.26    1.550 No_date    1:40   32.44  n/a
     [RDT= 5.00] out<- 02:OSSTOR       7.26     .803 No_date    1:50   32.44  n/a
           overflow <= 03:OSOVF         .00     .000 No_date    0:00     .00  n/a
    {MxStoUsed=.3891E-01, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
003:0055---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD     03:401           16.78     .119 No_date    3:45    9.24 .205
     [CN= 68.0: N= 3.00]
     [Tp= 1.66:DT= 5.00]
003:0056---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD          01:POND2         17.13     .025 No_date    4:05   30.17  n/a
                   + 02:OSSTOR         7.26     .803 No_date    1:50   32.44  n/a
                   + 03:401           16.78     .119 No_date    3:45    9.24  n/a
                   + 09:312ADD       234.76     .244 No_date    5:00    7.00  n/a
     [DT= 5.00]  SUM= 04:P2-T3       275.93     .868 No_date    2:00    9.24  n/a
003:0057---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 04:P2-T3      275.93     .868 No_date    2:00    9.24  n/a
     [RDT= 5.00] out<- 01:313        275.93     .785 No_date    2:00    9.24  n/a
     [L/S/n=  423./1.170/.100]
     {Vmax=  .499:Dmax=  .331}
003:0058---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD     02:TRB313          .72     .003 No_date    3:10    8.73 .193
     [CN= 68.0: N= 1.10]
     [Tp=  .34:DT= 5.00]
003:0059---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD          01:313          275.93     .785 No_date    2:00    9.24  n/a
                   + 02:TRB313          .72     .003 No_date    3:10    8.73  n/a
     [DT= 5.00]  SUM= 03:313ADD      276.65     .788 No_date    2:00    9.24  n/a
003:0060---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD     04:TRB314          .94     .003 No_date    3:45    8.73 .193
     [CN= 68.0: N= 1.10]
     [Tp=  .46:DT= 5.00]
003:0061---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD          01:313          275.93     .785 No_date    2:00    9.24  n/a
                   + 02:TRB313          .72     .003 No_date    3:10    8.73  n/a
     [DT= 5.00]  SUM= 03:313ADD      276.65     .788 No_date    2:00    9.24  n/a
003:0062---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD     04:403a           2.66     .017 No_date    2:45   11.16 .247
     [CN= 70.0: N= 1.10]
     [Tp=  .27:DT= 5.00]
003:0063---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD          10:T2-US        442.59     .306 No_date    5:55   11.36  n/a
                   + 03:313ADD       276.65     .788 No_date    2:00    9.24  n/a
                   + 04:403a           2.66     .017 No_date    2:45   11.16  n/a
     [DT= 5.00]  SUM= 01:CONFLU      721.90     .827 No_date    2:00   10.54  n/a
003:0064---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * DESIGN STANDHYD   01:203d          1.26     .274 No_date    1:40   31.77 .703
     [XIMP=.56:TIMP=.70]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
003:0065---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * DESIGN STANDHYD   02:501a          9.32    2.193 No_date    1:40   39.94 .884
     [XIMP=.74:TIMP=.93]
     [SLP= .80:DT= 5.00]
     [LOSS= 1 : HORTONS]
003:0066---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    COMPUTE DUALHYD   02:501a          9.32    2.193 No_date    1:40   39.94  n/a
       Major System /  03:OSSTOR        .00     .000 No_date    0:00     .00  n/a
       Minor System \  04:TOPOND       9.32    2.060 No_date    1:40   41.58  n/a
     {MjSysSto=.3980E+02, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
003:0067---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD   05:501b         38.42    7.060 No_date    1:40   30.88 .684
     [XIMP=.54:TIMP=.67]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
003:0068---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD   06:501c         39.10    6.947 No_date    1:40   29.85 .661
     [XIMP=.51:TIMP=.64]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
003:0069---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * DESIGN STANDHYD   07:MR1           3.32     .908 No_date    1:40   43.21 .956
```

```
     [XIMP=.80:TIMP=.99]
     [SLP=1.00:DT= 5.00]
     [LOSS= 1 : HORTONS]
 003:0070---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  DESIGN STANDHYD    08:MR2            3.04     .834 No_date    1:40   43.21 .956
     [XIMP=.80:TIMP=.99]
     [SLP=1.00:DT= 5.00]
     [LOSS= 1 : HORTONS]
 003:0071---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:203d           1.26     .274 No_date    1:40   31.77  n/a
                     + 05:501b          38.42    7.060 No_date    1:40   30.88  n/a
                     + 07:MR1            3.32     .908 No_date    1:40   43.21  n/a
     [DT= 5.00]  SUM=  10:VALE          43.00    8.242 No_date    1:40   31.86  n/a
 003:0072---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            04:TOPOND         9.32    2.060 No_date    1:40   41.58  n/a
                     + 06:501c          39.10    6.947 No_date    1:40   29.85  n/a
                     + 08:MR2            3.04     .834 No_date    1:40   43.21  n/a
     [DT= 5.00]  SUM=  09:MET           51.46    9.841 No_date    1:40   32.76  n/a
 003:0073---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    01:POND3         11.89    1.543 No_date    1:45   35.07 .776
     [XIMP=.64:TIMP=.80]
     [SLP= .10:DT= 5.00]
     [LOSS= 1 : HORTONS]
 003:0074---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            10:VALE          43.00    8.242 No_date    1:40   31.86  n/a
                     + 09:MET           51.46    9.841 No_date    1:40   32.76  n/a
                     + 01:POND3         11.89    1.543 No_date    1:45   35.07  n/a
     [DT= 5.00]  SUM=  08:P3ADD        106.35   19.492 No_date    1:40   32.66  n/a
 003:0075---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 08:P3ADD        106.35   19.492 No_date    1:40   32.66  n/a
     [RDT= 5.00] out<- 01:POND3        106.35     .349 No_date    4:00   32.66  n/a
           overflow <= 02:E-OVF           .00     .000 No_date    0:00     .00  n/a
    {MxStoUsed=.3205E+01, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
  ** END OF RUN :   4

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




 RUN:COMMAND#
 005:0001------------------------------------------------------------------------
    START
     [TZERO =    .00 hrs on        0]
     [METOUT=   2    (1=imperial, 2=metric output)]
     [NSTORM=   1 ]
     [NRUN  =   5 ]
#******************************************************************************
#  Project Name: [Kanata North]    Project Number: [112117]
#  Date        : 03-30-2016
#  Modeller    : [Kallie Auld]
#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
#  License #   :  5320763
#******************************************************************************
#******************************************************************************
 005:0002------------------------------------------------------------------------
    READ STORM
     Filename = STORM.001
     Comment  =
     [SDT=10.00:SDUR=   4.00:PTOT=  76.02]
 005:0003------------------------------------------------------------------------
    DEFAULT VALUES
     Filename = M:\2012\112117\data\CALCUL~1\swmhymo\POSTDE~1\OTTAWA.DEF
     ICASEdv  = 1 (read and print data)
     FileTitle= ------ ENTER YOUR COMMENTS ON THIS LINE AND THE NEXT ONE ---
                ------ PARAMETER VALUES MUST BE ENTERD AFTER COLUMN 60 ----_
     Horton's infiltration equation parameters:
     [Fo= 76.20 mm/hr] [Fc=13.20 mm/hr] [DCAY= 4.14 /hr] [F=  .00 mm]
     Parameters for PERVIOUS surfaces in STANDHYD:
     [IAper=   4.67 mm] [LGP=40.00 m] [MNP= .250]
     Parameters for IMPERVIOUS surfaces in STANDHYD:
     [IAimp=   1.57 mm] [CLI= 1.50]   [MNI= .013]
     Parameters used in NASHYD:
     [Ia=   4.67 mm] [N= 3.00]
 005:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:201          115.14     .152 No_date    5:35   20.74 .273
     [CN= 65.0: N= 1.10]
     [Tp= 3.42:DT= 5.00]
 005:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 01:201          115.14     .152 No_date    5:35   20.74  n/a
     [RDT= 5.00] out<- 02:210          115.14     .152 No_date    6:05   20.74  n/a
     [L/S/n=  558./ .890/.040]
     {Vmax=  .423:Dmax=  .070}
 005:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:202          263.64     .301 No_date    7:15   26.35 .347
     [CN= 70.0: N= 1.10]
     [Tp= 5.14:DT= 5.00]
 005:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:202          263.64     .301 No_date    7:15   26.35  n/a
                     + 02:210          115.14     .152 No_date    6:05   20.74  n/a
     [DT= 5.00]  SUM=  03:210add       378.78     .453 No_date    6:40   24.64  n/a
 005:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:210add       378.78     .453 No_date    6:40   24.64  n/a
     [RDT= 5.00] out<- 01:211          378.78     .453 No_date    7:00   24.64  n/a
     [L/S/n=  450./1.000/.100]
     {Vmax=  .343:Dmax=  .228}
 005:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:211            1.87     .010 No_date    4:00   31.50 .414
     [CN= 76.0: N= 1.10]
     [Tp= 1.17:DT= 5.00]
 005:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:211          378.78     .453 No_date    7:00   24.64  n/a
                     + 02:211            1.87     .010 No_date    4:00   31.50  n/a
     [DT= 5.00]  SUM=  03:211add       380.65     .462 No_date    6:45   24.67  n/a
 005:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:211add       380.65     .462 No_date    6:45   24.67  n/a
     [RDT= 5.00] out<- 01:212          380.65     .462 No_date    6:55   24.67  n/a
     [L/S/n=  230./1.000/.100]
     {Vmax=  .345:Dmax=  .230}
 005:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:212             .95     .007 No_date    3:50   22.81 .300
     [CN= 66.0: N= 1.10]
     [Tp=  .56:DT= 5.00]
 005:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:212          380.65     .462 No_date    6:55   24.67  n/a
                     + 02:212             .95     .007 No_date    3:50   22.81  n/a
     [DT= 5.00]  SUM=  03:212add       381.60     .467 No_date    6:35   24.67  n/a
 005:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:212add       381.60     .467 No_date    6:35   24.67  n/a
     [RDT= 5.00] out<- 01:213          381.60     .467 No_date    6:20   24.67  n/a
     [L/S/n=  330./1.000/.100]
     {Vmax=  .347:Dmax=  .232}
 005:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:213            1.43     .009 No_date    4:00   22.70 .299
     [CN= 66.0: N= 1.10]
     [Tp=  .67:DT= 5.00]
 005:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:213          381.60     .467 No_date    6:20   24.67  n/a
                     + 02:213            1.43     .009 No_date    4:00   22.70  n/a
     [DT= 5.00]  SUM=  09:TRIB2        383.03     .474 No_date    6:20   24.66  n/a
 005:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  DESIGN STANDHYD    01:203a          27.32    9.900 No_date    1:40   57.11 .751
     [XIMP=.50:TIMP=.63]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
 005:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  DESIGN STANDHYD    02:203b          20.76    7.490 No_date    1:40   55.97 .736
     [XIMP=.48:TIMP=.60]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
 005:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
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 *  DESIGN STANDHYD    03:203c           4.95    2.148 No_date    1:40   60.48 .795
     [XIMP=.57:TIMP=.71]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
005:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD    04:POND1          2.68     .853 No_date    1:40   64.18 .844
     [XIMP=.64:TIMP=.80]
     [SLP= .10:DT= 5.00]
     [LOSS= 1 : HORTONS]
005:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            02:203b          20.76    7.490 No_date    1:40   55.97  n/a
                     + 03:203c           4.95    2.148 No_date    1:40   60.48  n/a
     [DT= 5.00]  SUM=  05:T2CRS         25.71    9.638 No_date    1:40   56.84  n/a
005:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:203a          27.32    9.900 No_date    1:40   57.11  n/a
                     + 04:POND1          2.68     .853 No_date    1:40   64.18  n/a
                     + 05:T2CRS         25.71    9.638 No_date    1:40   56.84  n/a
     [DT= 5.00]  SUM=  06:P1FLOW        55.71   20.391 No_date    1:40   57.33  n/a
005:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 06:P1FLOW        55.71   20.391 No_date    1:40   57.33  n/a
     [RDT= 5.00] out<- 01:POND1         55.71     .324 No_date    3:50   57.32  n/a
           overflow <= 02:P1-OVF          .00     .000 No_date    0:00     .00  n/a
    {MxStoUsed=.2929E+01, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
005:0024---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:POND1         55.71     .324 No_date    3:50   57.32  n/a
                     + 09:TRIB2        383.03     .474 No_date    6:20   24.66  n/a
     [DT= 5.00]  SUM=  02:213ADD       438.74     .777 No_date    5:10   28.81  n/a
005:0025---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 02:213ADD       438.74     .777 No_date    5:10   28.81  n/a
     [RDT= 5.00] out<- 01:214          438.74     .776 No_date    5:30   28.81  n/a
     [L/S/n=  390./1.700/.100]
     {Vmax=  .509:Dmax=  .272}
005:0026---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       03:214            1.61     .036 No_date    2:20   27.16 .357
     [CN= 72.0: N= 1.10]
     [Tp=  .17:DT= 5.00]
005:0027---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:214          438.74     .776 No_date    5:30   28.81  n/a
                     + 03:214            1.61     .036 No_date    2:20   27.16  n/a
     [DT= 5.00]  SUM=  02:214ADD       440.35     .789 No_date    5:10   28.80  n/a
005:0028---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 02:214ADD       440.35     .789 No_date    5:10   28.80  n/a
     [RDT= 5.00] out<- 01:215          440.35     .790 No_date    4:55   28.80  n/a
     [L/S/n=  260./1.400/.100]
     {Vmax=  .496:Dmax=  .294}
005:0029---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:TRB215         1.12     .020 No_date    2:20   21.81 .287
     [CN= 66.0: N= 1.10]
     [Tp=  .17:DT= 5.00]
005:0030---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:215          440.35     .790 No_date    4:55   28.80  n/a
                     + 02:TRB215         1.12     .020 No_date    2:20   21.81  n/a
     [DT= 5.00]  SUM=  03:215ADD       441.47     .798 No_date    4:55   28.79  n/a
005:0031---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:215ADD       441.47     .798 No_date    4:55   28.79  n/a
     [RDT= 5.00] out<- 01:216          441.47     .797 No_date    5:00   28.79  n/a
     [L/S/n=  250./ .500/.100]
     {Vmax=  .365:Dmax=  .403}
005:0032---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:TRB216         1.12     .019 No_date    2:20   20.63 .271
     [CN= 65.0: N= 1.10]
     [Tp=  .17:DT= 5.00]
005:0033---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:216          441.47     .797 No_date    5:00   28.79  n/a
                     + 02:TRB216         1.12     .019 No_date    2:20   20.63  n/a
     [DT= 5.00]  SUM=  10:T2-US        442.59     .805 No_date    5:00   28.77  n/a
005:0034---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:301           86.43     .277 No_date    4:00   19.07 .251
     [CN= 63.0: N= 1.10]
     [Tp= 1.24:DT= 5.00]
005:0035---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
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    CALIB NASHYD       02:302           80.69     .194 No_date    4:15   20.39 .268
     [CN= 64.0: N= 1.10]
     [Tp= 1.80:DT= 5.00]
005:0036---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:301           86.43     .277 No_date    4:00   19.07  n/a
                     + 02:302           80.69     .194 No_date    4:15   20.39  n/a
     [DT= 5.00]  SUM=  03:300a         167.12     .472 No_date    4:00   19.71  n/a
005:0037---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300a         167.12     .472 No_date    4:00   19.71  n/a
     [RDT= 5.00] out<- 01:310          167.12     .470 No_date    4:20   19.71  n/a
     [L/S/n=  449./1.620/.040]
     {Vmax=  .655:Dmax=  .130}
005:0038---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:303           65.19     .259 No_date    4:00   24.86 .327
     [CN= 69.0: N= 1.10]
     [Tp= 1.31:DT= 5.00]
005:0039---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:310          167.12     .470 No_date    4:20   19.71  n/a
                     + 02:303           65.19     .259 No_date    4:00   24.86  n/a
     [DT= 5.00]  SUM=  03:300b         232.31     .728 No_date    4:15   21.15  n/a
005:0040---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300b         232.31     .728 No_date    4:15   21.15  n/a
     [RDT= 5.00] out<- 01:311          232.31     .728 No_date    4:20   21.15  n/a
     [L/S/n=  270./1.170/.100]
     {Vmax=  .456:Dmax=  .296}
005:0041---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:TRB311         1.15     .009 No_date    3:40   21.88 .288
     [CN= 65.0: N= 1.10]
     [Tp=  .52:DT= 5.00]
005:0042---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:311          232.31     .728 No_date    4:20   21.15  n/a
                     + 02:TRB311         1.15     .009 No_date    3:40   21.88  n/a
     [DT= 5.00]  SUM=  03:311ADD       233.46     .736 No_date    4:15   21.16  n/a
005:0043---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:311ADD       233.46     .736 No_date    4:15   21.16  n/a
     [RDT= 5.00] out<- 01:312          233.46     .736 No_date    4:15   21.16  n/a
     [L/S/n=  270./1.170/.100]
     {Vmax=  .460:Dmax=  .299}
005:0044---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:TRB312         1.30     .012 No_date    4:00   31.57 .415
     [CN= 76.0: N= 1.10]
     [Tp=  .64:DT= 5.00]
005:0045---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:312          233.46     .736 No_date    4:15   21.16  n/a
                     + 02:TRB312         1.30     .012 No_date    4:00   31.57  n/a
     [DT= 5.00]  SUM=  09:312ADD       234.76     .748 No_date    4:15   21.22  n/a
005:0046---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD    01:304a           9.61    3.414 No_date    1:40   54.79 .721
     [XIMP=.46:TIMP=.57]
     [SLP=1.60:DT= 5.00]
     [LOSS= 1 : HORTONS]
005:0047---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD    02:402a           5.67    2.462 No_date    1:40   61.23 .805
     [XIMP=.58:TIMP=.73]
     [SLP=2.10:DT= 5.00]
     [LOSS= 1 : HORTONS]
005:0048---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD    03:POND2          1.85     .626 No_date    1:40   64.18 .844
     [XIMP=.64:TIMP=.80]
     [SLP= .10:DT= 5.00]
     [LOSS= 1 : HORTONS]
005:0049---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:304a           9.61    3.414 No_date    1:40   54.79  n/a
                     + 02:402a           5.67    2.462 No_date    1:40   61.23  n/a
                     + 03:POND2          1.85     .626 No_date    1:40   64.18  n/a
     [DT= 5.00]  SUM=  04:P2FLOW        17.13    6.502 No_date    1:40   57.94  n/a
005:0050---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 04:P2FLOW        17.13    6.502 No_date    1:40   57.94  n/a
     [RDT= 5.00] out<- 01:POND2         17.13     .076 No_date    4:00   57.93  n/a
           overflow <= 02:P2OVF           .00     .000 No_date    0:00     .00  n/a
    {MxStoUsed=.9335E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
```

```
005:0051---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD    02:402b           6.07    2.631 No_date    1:40   61.23 .805
     [XIMP=.58:TIMP=.73]
     [SLP=2.10:DT= 5.00]
     [LOSS= 1 : HORTONS]
005:0052---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD    03:402c           1.19     .519 No_date    1:40   59.28 .780
     [XIMP=.55:TIMP=.68]
     [SLP=2.10:DT= 5.00]
     [LOSS= 1 : HORTONS]
005:0053---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            02:402b           6.07    2.631 No_date    1:40   61.23  n/a
                     + 03:402c           1.19     .519 No_date    1:40   59.28  n/a
     [DT= 5.00]  SUM=  04:400-OS         7.26    3.150 No_date    1:40   60.91  n/a
005:0054---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 04:400-OS         7.26    3.150 No_date    1:40   60.91  n/a
     [RDT= 5.00] out<- 02:OSSTOR         7.26     .813 No_date    1:55   60.92  n/a
            overflow <= 03:OSOVF          .00     .000 No_date    0:00     .00  n/a
    {MxStoUsed=.1611E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
005:0055---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       03:401           16.78     .329 No_date    3:40   25.27 .332
     [CN= 68.0: N= 3.00]
     [Tp= 1.66:DT= 5.00]
005:0056---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:POND2         17.13     .076 No_date    4:00   57.93  n/a
                     + 02:OSSTOR         7.26     .813 No_date    1:55   60.92  n/a
                     + 03:401           16.78     .329 No_date    3:40   25.27  n/a
                     + 09:312ADD       234.76     .748 No_date    4:15   21.22  n/a
     [DT= 5.00]  SUM=  04:P2-T3        275.93    1.618 No_date    2:40   24.79  n/a
005:0057---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 04:P2-T3        275.93    1.618 No_date    2:40   24.79  n/a
     [RDT= 5.00] out<- 01:313          275.93    1.537 No_date    2:40   24.79  n/a
     [L/S/n=  423./1.170/.100]
     {Vmax=  .636:Dmax=  .482}
005:0058---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:TRB313          .72     .009 No_date    3:00   24.55 .323
     [CN= 68.0: N= 1.10]
     [Tp=  .34:DT= 5.00]
005:0059---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:313          275.93    1.537 No_date    2:40   24.79  n/a
                     + 02:TRB313          .72     .009 No_date    3:00   24.55  n/a
     [DT= 5.00]  SUM=  03:313ADD       276.65    1.545 No_date    2:40   24.78  n/a
005:0060---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       04:TRB314          .94     .009 No_date    3:25   24.55 .323
     [CN= 68.0: N= 1.10]
     [Tp=  .46:DT= 5.00]
005:0061---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:313          275.93    1.537 No_date    2:40   24.79  n/a
                     + 02:TRB313          .72     .009 No_date    3:00   24.55  n/a
     [DT= 5.00]  SUM=  03:313ADD       276.65    1.545 No_date    2:40   24.78  n/a
005:0062---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       04:403a           2.66     .044 No_date    2:40   28.49 .375
     [CN= 70.0: N= 1.10]
     [Tp=  .27:DT= 5.00]
005:0063---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            10:T2-US        442.59     .805 No_date    5:00   28.77  n/a
                     + 03:313ADD       276.65    1.545 No_date    2:40   24.78  n/a
                     + 04:403a           2.66     .044 No_date    2:40   28.49  n/a
     [DT= 5.00]  SUM=  01:CONFLU       721.90    1.974 No_date    4:05   27.24  n/a
005:0064---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD    01:203d           1.26     .556 No_date    1:40   60.03 .790
     [XIMP=.56:TIMP=.70]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
005:0065---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD    02:501a           9.32    3.992 No_date    1:40   70.35 .925
     [XIMP=.74:TIMP=.93]
     [SLP= .80:DT= 5.00]
     [LOSS= 1 : HORTONS]
005:0066---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    COMPUTE DUALHYD    02:501a           9.32    3.992 No_date    1:40   70.35  n/a
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       Major System /  03:OSSTOR          .15     .315 No_date    1:45   70.35  n/a
       Minor System \  04:TOPOND         9.17    2.060 No_date    2:05   73.73  n/a
     {MjSysSto=.8900E+03, TotOvfVol=.1037E+03, N-Ovf=    1, TotDurOvf=    0.hrs}
005:0067---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD    05:501b          38.42   14.036 No_date    1:40   58.84 .774
     [XIMP=.54:TIMP=.67]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
005:0068---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD    06:501c          39.10   13.973 No_date    1:40   57.56 .757
     [XIMP=.51:TIMP=.64]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
005:0069---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD    07:MR1            3.32    1.596 No_date    1:40   74.05 .974
     [XIMP=.80:TIMP=.99]
     [SLP=1.00:DT= 5.00]
     [LOSS= 1 : HORTONS]
005:0070---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD    08:MR2            3.04    1.464 No_date    1:40   74.05 .974
     [XIMP=.80:TIMP=.99]
     [SLP=1.00:DT= 5.00]
     [LOSS= 1 : HORTONS]
005:0071---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:203d           1.26     .556 No_date    1:40   60.03  n/a
                     + 05:501b          38.42   14.036 No_date    1:40   58.84  n/a
                     + 07:MR1            3.32    1.596 No_date    1:40   74.05  n/a
     [DT= 5.00]  SUM=  10:VALE          43.00   16.188 No_date    1:40   60.05  n/a
005:0072---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            04:TOPOND         9.17    2.060 No_date    2:05   73.73  n/a
                     + 06:501c          39.10   13.973 No_date    1:40   57.56  n/a
                     + 08:MR2            3.04    1.464 No_date    1:40   74.05  n/a
     [DT= 5.00]  SUM=  09:MET           51.31   17.497 No_date    1:40   61.43  n/a
005:0073---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    01:POND3         11.89    3.139 No_date    1:45   64.18 .844
     [XIMP=.64:TIMP=.80]
     [SLP= .10:DT= 5.00]
     [LOSS= 1 : HORTONS]
005:0074---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            10:VALE          43.00   16.188 No_date    1:40   60.05  n/a
                     + 09:MET           51.31   17.497 No_date    1:40   61.43  n/a
                     + 01:POND3         11.89    3.139 No_date    1:45   64.18  n/a
     [DT= 5.00]  SUM=  08:P3ADD        106.20   36.560 No_date    1:40   61.18  n/a
005:0075---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 08:P3ADD        106.20   36.560 No_date    1:40   61.18  n/a
     [RDT= 5.00] out<- 01:POND3        106.20     .962 No_date    3:20   61.18  n/a
           overflow <= 02:E-OVF           .00     .000 No_date    0:00     .00  n/a
    {MxStoUsed=.5776E+01, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
 ** END OF RUN :    5

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



 RUN:COMMAND#
 006:0001------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on       0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   6 ]
#*****************************************************************************
#  Project Name: [Kanata North]    Project Number: [112117]
#  Date        : 03-30-2016
#  Modeller    : [Kallie Auld]
#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
#  License #   :  5320763
#*****************************************************************************
#*****************************************************************************
```

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006:0002------------------------------------------------------------------------------
    READ STORM
     Filename = STORM.001
     Comment  =
     [SDT=30.00:SDUR=  12.00:PTOT=  25.00]
006:0003------------------------------------------------------------------------------
    DEFAULT VALUES
     Filename = M:\2012\112117\data\CALCUL~1\swmhymo\POSTDE~1\OTTAWA.DEF
     ICASEdv  = 1 (read and print data)
     FileTitle= ------ ENTER YOUR COMMENTS ON THIS LINE AND THE NEXT ONE ---
                ------ PARAMETER VALUES MUST BE ENTERD AFTER COLUMN 60 ----_
     Horton's infiltration equation parameters:
     [Fo= 76.20 mm/hr] [Fc=13.20 mm/hr] [DCAY= 4.14 /hr] [F=  .00 mm]
     Parameters for PERVIOUS surfaces in STANDHYD:
     [IAper=   4.67 mm] [LGP=40.00 m] [MNP= .250]
     Parameters for IMPERVIOUS surfaces in STANDHYD:
     [IAimp=   1.57 mm] [CLI= 1.50]   [MNI= .013]
     Parameters used in NASHYD:
     [Ia=   4.67 mm] [N= 3.00]
006:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:201          115.14     .009 No_date   12:25    1.23 .049
     [CN= 65.0: N= 1.10]
     [Tp= 3.42:DT= 5.00]
006:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 01:201          115.14     .009 No_date   12:25    1.23  n/a
     [RDT= 5.00] out<- 02:210          115.14     .009 No_date   13:05    1.23  n/a
     [L/S/n=  558./ .890/.040]
     {Vmax=  .423:Dmax=  .004}
006:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:202          263.64     .027 No_date   13:20    2.37 .095
     [CN= 70.0: N= 1.10]
     [Tp= 5.14:DT= 5.00]
006:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:202          263.64     .027 No_date   13:20    2.37  n/a
                    +  02:210          115.14     .009 No_date   13:05    1.23  n/a
     [DT= 5.00]  SUM=  03:210add       378.78     .036 No_date   13:10    2.03  n/a
006:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:210add       378.78     .036 No_date   13:10    2.03  n/a
     [RDT= 5.00] out<- 01:211          378.78     .036 No_date   13:50    2.03  n/a
     [L/S/n=  450./1.000/.100]
     {Vmax=  .288:Dmax=  .025}
006:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:211            1.87     .001 No_date   12:00    3.10 .124
     [CN= 76.0: N= 1.10]
     [Tp= 1.17:DT= 5.00]
006:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:211          378.78     .036 No_date   13:50    2.03  n/a
                    +  02:211            1.87     .001 No_date   12:00    3.10  n/a
     [DT= 5.00]  SUM=  03:211add       380.65     .037 No_date   13:40    2.03  n/a
006:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:211add       380.65     .037 No_date   13:40    2.03  n/a
     [RDT= 5.00] out<- 01:212          380.65     .037 No_date   13:55    2.03  n/a
     [L/S/n=  230./1.000/.100]
     {Vmax=  .288:Dmax=  .025}
006:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:212             .95     .000 No_date    9:20    1.78 .071
     [CN= 66.0: N= 1.10]
     [Tp=  .56:DT= 5.00]
006:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:212          380.65     .037 No_date   13:55    2.03  n/a
                    +  02:212             .95     .000 No_date    9:20    1.78  n/a
     [DT= 5.00]  SUM=  03:212add       381.60     .037 No_date   13:50    2.03  n/a
006:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:212add       381.60     .037 No_date   13:50    2.03  n/a
     [RDT= 5.00] out<- 01:213          381.60     .037 No_date   14:15    2.03  n/a
     [L/S/n=  330./1.000/.100]
     {Vmax=  .288:Dmax=  .025}
006:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:213            1.43     .001 No_date   10:30    1.74 .070
     [CN= 66.0: N= 1.10]
     [Tp=  .67:DT= 5.00]
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006:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:213          381.60     .037 No_date   14:15    2.03  n/a
                    +  02:213            1.43     .001 No_date   10:30    1.74  n/a
     [DT= 5.00]  SUM=  09:TRIB2        383.03     .037 No_date   14:05    2.03  n/a
006:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    01:203a          27.32     .778 No_date    6:00   11.76 .470
     [XIMP=.50:TIMP=.63]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
006:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * DESIGN STANDHYD    02:203b          20.76     .573 No_date    6:00   11.25 .450
     [XIMP=.48:TIMP=.60]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
006:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    03:203c           4.95     .168 No_date    6:00   13.60 .544
     [XIMP=.57:TIMP=.71]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
006:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    04:POND1          2.68     .094 No_date    6:00   15.80 .632
     [XIMP=.64:TIMP=.80]
     [SLP= .10:DT= 5.00]
     [LOSS= 1 : HORTONS]
006:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            02:203b          20.76     .573 No_date    6:00   11.25  n/a
                    +  03:203c           4.95     .168 No_date    6:00   13.60  n/a
     [DT= 5.00]  SUM=  05:T2CRS         25.71     .741 No_date    6:00   11.70  n/a
006:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:203a          27.32     .778 No_date    6:00   11.76  n/a
                    +  04:POND1          2.68     .094 No_date    6:00   15.80  n/a
                    +  05:T2CRS         25.71     .741 No_date    6:00   11.70  n/a
     [DT= 5.00]  SUM=  06:P1FLOW        55.71    1.613 No_date    6:00   11.93  n/a
006:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 06:P1FLOW        55.71    1.613 No_date    6:00   11.93  n/a
     [RDT= 5.00] out<- 01:POND1         55.71     .030 No_date   12:05   11.93  n/a
           overflow <= 02:P1-OVF          .00     .000 No_date    0:00     .00  n/a
    {MxStoUsed=.5992E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
006:0024---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:POND1         55.71     .030 No_date   12:05   11.93  n/a
                    +  09:TRIB2        383.03     .037 No_date   14:05    2.03  n/a
     [DT= 5.00]  SUM=  02:213ADD       438.74     .066 No_date   13:25    3.29  n/a
006:0025---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 02:213ADD       438.74     .066 No_date   13:25    3.29  n/a
     [RDT= 5.00] out<- 01:214          438.74     .066 No_date   13:45    3.29  n/a
     [L/S/n=  390./1.700/.100]
     {Vmax=  .376:Dmax=  .035}
006:0026---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       03:214            1.61     .002 No_date    7:00    2.25 .090
     [CN= 72.0: N= 1.10]
     [Tp=  .17:DT= 5.00]
006:0027---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:214          438.74     .066 No_date   13:45    3.29  n/a
                    +  03:214            1.61     .002 No_date    7:00    2.25  n/a
     [DT= 5.00]  SUM=  02:214ADD       440.35     .066 No_date   13:30    3.28  n/a
006:0028---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 02:214ADD       440.35     .066 No_date   13:30    3.28  n/a
     [RDT= 5.00] out<- 01:215          440.35     .066 No_date   13:45    3.28  n/a
     [L/S/n=  260./1.400/.100]
     {Vmax=  .341:Dmax=  .038}
006:0029---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:TRB215         1.12     .001 No_date    7:00    1.42 .057
     [CN= 66.0: N= 1.10]
     [Tp=  .17:DT= 5.00]
006:0030---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:215          440.35     .066 No_date   13:45    3.28  n/a
                    +  02:TRB215         1.12     .001 No_date    7:00    1.42  n/a
     [DT= 5.00]  SUM=  03:215ADD       441.47     .067 No_date   13:40    3.28  n/a
006:0031---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:215ADD       441.47     .067 No_date   13:40    3.28  n/a
     [RDT= 5.00] out<- 01:216          441.47     .067 No_date   14:05    3.28  n/a
```

```
      [L/S/n=  250./ .500/.100]
      {Vmax=  .204:Dmax=  .064}
 006:0032---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:TRB216         1.12     .001 No_date    7:30    1.19 .048
      [CN= 65.0: N= 1.10]
      [Tp=  .17:DT= 5.00]
 006:0033---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:216          441.47     .067 No_date   14:05    3.28  n/a
                     +  02:TRB216         1.12     .001 No_date    7:30    1.19  n/a
      [DT= 5.00]  SUM=  10:T2-US        442.59     .067 No_date   14:00    3.27  n/a
 006:0034---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:301           86.43     .013 No_date   12:00    1.00 .040
      [CN= 63.0: N= 1.10]
      [Tp= 1.24:DT= 5.00]
 006:0035---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:302           80.69     .011 No_date   12:00    1.27 .051
      [CN= 64.0: N= 1.10]
      [Tp= 1.80:DT= 5.00]
 006:0036---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:301           86.43     .013 No_date   12:00    1.00  n/a
                     +  02:302           80.69     .011 No_date   12:00    1.27  n/a
      [DT= 5.00]  SUM=  03:300a         167.12     .024 No_date   12:00    1.13  n/a
 006:0037---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:300a         167.12     .024 No_date   12:00    1.13  n/a
      [RDT= 5.00] out<- 01:310          167.12     .024 No_date   12:15    1.13  n/a
      [L/S/n=  449./1.620/.040]
      {Vmax=  .430:Dmax=  .013}
 006:0038---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:303           65.19     .018 No_date   12:00    1.99 .080
      [CN= 69.0: N= 1.10]
      [Tp= 1.31:DT= 5.00]
 006:0039---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:310          167.12     .024 No_date   12:15    1.13  n/a
                     +  02:303           65.19     .018 No_date   12:00    1.99  n/a
      [DT= 5.00]  SUM=  03:300b         232.31     .043 No_date   12:05    1.37  n/a
 006:0040---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:300b         232.31     .043 No_date   12:05    1.37  n/a
      [RDT= 5.00] out<- 01:311          232.31     .043 No_date   12:20    1.37  n/a
      [L/S/n=  270./1.170/.100]
      {Vmax=  .312:Dmax=  .027}
 006:0041---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:TRB311         1.15     .000 No_date    9:10    1.61 .064
      [CN= 65.0: N= 1.10]
      [Tp=  .52:DT= 5.00]
 006:0042---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:311          232.31     .043 No_date   12:20    1.37  n/a
                     +  02:TRB311         1.15     .000 No_date    9:10    1.61  n/a
      [DT= 5.00]  SUM=  03:311ADD       233.46     .043 No_date   12:20    1.37  n/a
 006:0043---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:311ADD       233.46     .043 No_date   12:20    1.37  n/a
      [RDT= 5.00] out<- 01:312          233.46     .043 No_date   12:30    1.37  n/a
      [L/S/n=  270./1.170/.100]
      {Vmax=  .312:Dmax=  .027}
 006:0044---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:TRB312         1.30     .001 No_date    9:25    3.13 .125
      [CN= 76.0: N= 1.10]
      [Tp=  .64:DT= 5.00]
 006:0045---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:312          233.46     .043 No_date   12:30    1.37  n/a
                     +  02:TRB312         1.30     .001 No_date    9:25    3.13  n/a
      [DT= 5.00]  SUM=  09:312ADD       234.76     .044 No_date   12:30    1.38  n/a
 006:0046---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  DESIGN STANDHYD    01:304a           9.61     .259 No_date    6:00   10.78 .431
      [XIMP=.46:TIMP=.57]
      [SLP=1.60:DT= 5.00]
      [LOSS= 1 : HORTONS]
 006:0047---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     DESIGN STANDHYD    02:402a           5.67     .196 No_date    6:00   13.96 .558
      [XIMP=.58:TIMP=.73]
      [SLP=2.10:DT= 5.00]
      [LOSS= 1 : HORTONS]
```

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 006:0048---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     DESIGN STANDHYD    03:POND2          1.85     .066 No_date    6:00   15.80 .632
      [XIMP=.64:TIMP=.80]
      [SLP= .10:DT= 5.00]
      [LOSS= 1 : HORTONS]
 006:0049---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:304a           9.61     .259 No_date    6:00   10.78  n/a
                     +  02:402a           5.67     .196 No_date    6:00   13.96  n/a
                     +  03:POND2          1.85     .066 No_date    6:00   15.80  n/a
      [DT= 5.00]  SUM=  04:P2FLOW        17.13     .521 No_date    6:00   12.37  n/a
 006:0050---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 04:P2FLOW        17.13     .521 No_date    6:00   12.37  n/a
      [RDT= 5.00] out<- 01:POND2         17.13     .003 No_date   12:10   12.37  n/a
             overflow <= 02:P2OVF          .00     .000 No_date    0:00     .00  n/a
     {MxStoUsed=.2063E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
 006:0051---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     DESIGN STANDHYD    02:402b           6.07     .209 No_date    6:00   13.96 .558
      [XIMP=.58:TIMP=.73]
      [SLP=2.10:DT= 5.00]
      [LOSS= 1 : HORTONS]
 006:0052---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  DESIGN STANDHYD    03:402c           1.19     .039 No_date    6:00   13.00 .520
      [XIMP=.55:TIMP=.68]
      [SLP=2.10:DT= 5.00]
      [LOSS= 1 : HORTONS]
 006:0053---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            02:402b           6.07     .209 No_date    6:00   13.96  n/a
                     +  03:402c           1.19     .039 No_date    6:00   13.00  n/a
      [DT= 5.00]  SUM=  04:400-OS         7.26     .248 No_date    6:00   13.80  n/a
 006:0054---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 04:400-OS         7.26     .248 No_date    6:00   13.80  n/a
      [RDT= 5.00] out<- 02:OSSTOR         7.26     .248 No_date    6:00   13.80  n/a
             overflow <= 03:OSOVF          .00     .000 No_date    0:00     .00  n/a
     {MxStoUsed=.1554E-02, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
 006:0055---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       03:401           16.78     .022 No_date    8:10    2.36 .094
      [CN= 68.0: N= 3.00]
      [Tp= 1.66:DT= 5.00]
 006:0056---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:POND2         17.13     .003 No_date   12:10   12.37  n/a
                     +  02:OSSTOR         7.26     .248 No_date    6:00   13.80  n/a
                     +  03:401           16.78     .022 No_date    8:10    2.36  n/a
                     +  09:312ADD       234.76     .044 No_date   12:30    1.38  n/a
      [DT= 5.00]  SUM=  04:P2-T3        275.93     .252 No_date    6:00    2.45  n/a
 006:0057---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 04:P2-T3        275.93     .252 No_date    6:00    2.45  n/a
      [RDT= 5.00] out<- 01:313          275.93     .177 No_date    6:05    2.45  n/a
      [L/S/n=  423./1.170/.100]
      {Vmax=  .312:Dmax=  .158}
 006:0058---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:TRB313          .72     .001 No_date    8:00    2.06 .082
      [CN= 68.0: N= 1.10]
      [Tp=  .34:DT= 5.00]
 006:0059---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:313          275.93     .177 No_date    6:05    2.45  n/a
                     +  02:TRB313          .72     .001 No_date    8:00    2.06  n/a
      [DT= 5.00]  SUM=  03:313ADD       276.65     .177 No_date    6:05    2.45  n/a
 006:0060---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       04:TRB314          .94     .001 No_date    9:00    2.06 .083
      [CN= 68.0: N= 1.10]
      [Tp=  .46:DT= 5.00]
 006:0061---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:313          275.93     .177 No_date    6:05    2.45  n/a
                     +  02:TRB313          .72     .001 No_date    8:00    2.06  n/a
      [DT= 5.00]  SUM=  03:313ADD       276.65     .177 No_date    6:05    2.45  n/a
 006:0062---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       04:403a           2.66     .004 No_date    7:00    3.31 .132
      [CN= 70.0: N= 1.10]
      [Tp=  .27:DT= 5.00]
 006:0063---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            10:T2-US        442.59     .067 No_date   14:00    3.27  n/a
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                 + 03:313ADD       276.65     .177 No_date     6:05    2.45  n/a
                 + 04:403a           2.66     .004 No_date     7:00    3.31  n/a
     [DT= 5.00]  SUM=  01:CONFLU    721.90     .186 No_date     6:05    2.96  n/a
 006:0064---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  DESIGN STANDHYD    01:203d           1.26     .042 No_date     6:00   13.34 .534
     [XIMP=.56:TIMP=.70]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
 006:0065---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    02:501a           9.32     .464 No_date     6:00   19.69 .788
     [XIMP=.74:TIMP=.93]
     [SLP= .80:DT= 5.00]
     [LOSS= 1 : HORTONS]
 006:0066---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    COMPUTE DUALHYD    02:501a           9.32     .464 No_date     6:00   19.69  n/a
       Major System /  03:OSSTOR          .00     .000 No_date     0:00     .00  n/a
       Minor System \  04:TOPOND         9.32     .464 No_date     6:00   19.69  n/a
     {MjSysSto=.0000E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
 006:0067---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    05:501b          38.42    1.166 No_date     6:00   12.76 .510
     [XIMP=.54:TIMP=.67]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
 006:0068---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    06:501c          39.10    1.119 No_date     6:00   12.01 .480
     [XIMP=.51:TIMP=.64]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
 006:0069---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    07:MR1            3.32     .192 No_date     6:00   22.21 .889
     [XIMP=.80:TIMP=.99]
     [SLP=1.00:DT= 5.00]
     [LOSS= 1 : HORTONS]
 006:0070---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    08:MR2            3.04     .176 No_date     6:00   22.21 .889
     [XIMP=.80:TIMP=.99]
     [SLP=1.00:DT= 5.00]
     [LOSS= 1 : HORTONS]
 006:0071---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:203d           1.26     .042 No_date     6:00   13.34  n/a
                 +     05:501b          38.42    1.166 No_date     6:00   12.76  n/a
                 +     07:MR1            3.32     .192 No_date     6:00   22.21  n/a
     [DT= 5.00]  SUM=  10:VALE          43.00    1.400 No_date     6:00   13.50  n/a
 006:0072---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            04:TOPOND         9.32     .464 No_date     6:00   19.69  n/a
                 +     06:501c          39.10    1.119 No_date     6:00   12.01  n/a
                 +     08:MR2            3.04     .176 No_date     6:00   22.21  n/a
     [DT= 5.00]  SUM=  09:MET           51.46    1.759 No_date     6:00   14.01  n/a
 006:0073---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    01:POND3         11.89     .346 No_date     6:05   15.80 .632
     [XIMP=.64:TIMP=.80]
     [SLP= .10:DT= 5.00]
     [LOSS= 1 : HORTONS]
 006:0074---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            10:VALE          43.00    1.400 No_date     6:00   13.50  n/a
                 +     09:MET           51.46    1.759 No_date     6:00   14.01  n/a
                 +     01:POND3         11.89     .346 No_date     6:05   15.80  n/a
     [DT= 5.00]  SUM=  08:P3ADD        106.35    3.488 No_date     6:00   14.00  n/a
 006:0075---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 08:P3ADD        106.35    3.488 No_date     6:00   14.00  n/a
     [RDT= 5.00] out<- 01:POND3        106.35     .050 No_date    12:10   14.00  n/a
           overflow <= 02:E-OVF           .00     .000 No_date     0:00     .00  n/a
    {MxStoUsed=.1380E+01, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
  ** END OF RUN :    6

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

```
 RUN:COMMAND#
 007:0001------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   7 ]
#******************************************************************************
#  Project Name: [Kanata North]    Project Number: [112117]
#  Date        : 03-30-2016
#  Modeller    : [Kallie Auld]
#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
#  License #   :  5320763
#******************************************************************************
#******************************************************************************
 007:0002------------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  =
      [SDT=30.00:SDUR=  12.00:PTOT=  42.34]
 007:0003------------------------------------------------------------------------
     DEFAULT VALUES
      Filename = M:\2012\112117\data\CALCUL~1\swmhymo\POSTDE~1\OTTAWA.DEF
      ICASEdv  = 1 (read and print data)
      FileTitle= ------ ENTER YOUR COMMENTS ON THIS LINE AND THE NEXT ONE ---
                 ------ PARAMETER VALUES MUST BE ENTERD AFTER COLUMN 60 ----_
      Horton's infiltration equation parameters:
      [Fo= 76.20 mm/hr] [Fc=13.20 mm/hr] [DCAY= 4.14 /hr] [F=  .00 mm]
      Parameters for PERVIOUS surfaces in STANDHYD:
      [IAper=   4.67 mm] [LGP=40.00 m] [MNP= .250]
      Parameters for IMPERVIOUS surfaces in STANDHYD:
      [IAimp=   1.57 mm] [CLI= 1.50]   [MNI= .013]
      Parameters used in NASHYD:
      [Ia=   4.67 mm] [N= 3.00]
 007:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:201          115.14     .041 No_date   12:10    5.71 .135
      [CN= 65.0: N= 1.10]
      [Tp= 3.42:DT= 5.00]
 007:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 01:201          115.14     .041 No_date   12:10    5.71  n/a
      [RDT= 5.00] out<- 02:210          115.14     .041 No_date   12:50    5.71  n/a
      [L/S/n=  558./ .890/.040]
      {Vmax=  .423:Dmax=  .019}
 007:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:202          263.64     .095 No_date   13:05    8.36 .197
      [CN= 70.0: N= 1.10]
      [Tp= 5.14:DT= 5.00]
 007:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:202          263.64     .095 No_date   13:05    8.36  n/a
                  +     02:210          115.14     .041 No_date   12:50    5.71  n/a
      [DT= 5.00]  SUM=  03:210add       378.78     .136 No_date   12:55    7.55  n/a
 007:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:210add       378.78     .136 No_date   12:55    7.55  n/a
      [RDT= 5.00] out<- 01:211          378.78     .136 No_date   13:35    7.55  n/a
      [L/S/n=  450./1.000/.100]
      {Vmax=  .288:Dmax=  .093}
 007:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:211            1.87     .003 No_date   10:50   10.49 .248
      [CN= 76.0: N= 1.10]
      [Tp= 1.17:DT= 5.00]
 007:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:211          378.78     .136 No_date   13:35    7.55  n/a
                  +     02:211            1.87     .003 No_date   10:50   10.49  n/a
      [DT= 5.00]  SUM=  03:211add       380.65     .139 No_date   13:25    7.57  n/a
 007:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:211add       380.65     .139 No_date   13:25    7.57  n/a
      [RDT= 5.00] out<- 01:212          380.65     .139 No_date   13:40    7.57  n/a
      [L/S/n=  230./1.000/.100]
      {Vmax=  .288:Dmax=  .095}
 007:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:212             .95     .002 No_date    9:00    6.83 .161
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     [CN= 66.0: N= 1.10]
     [Tp=  .56:DT= 5.00]
007:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           01:212          380.65     .139 No_date   13:40     7.57  n/a
                    + 02:212             .95     .002 No_date    9:00     6.83  n/a
     [DT= 5.00]  SUM=  03:212add       381.60     .140 No_date   13:35     7.57  n/a
007:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:212add       381.60     .140 No_date   13:35     7.57  n/a
     [RDT= 5.00] out<- 01:213          381.60     .140 No_date   14:00     7.57  n/a
     [L/S/n=  330./1.000/.100]
     {Vmax=  .288:Dmax=  .095}
007:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD      02:213            1.43     .002 No_date    9:00     6.76 .160
     [CN= 66.0: N= 1.10]
     [Tp=  .67:DT= 5.00]
007:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           01:213          381.60     .140 No_date   14:00     7.57  n/a
                    + 02:213            1.43     .002 No_date    9:00     6.76  n/a
     [DT= 5.00]  SUM=  09:TRIB2        383.03     .141 No_date   13:55     7.56  n/a
007:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD   01:203a          27.32    1.734 No_date    6:00    24.30 .574
     [XIMP=.50:TIMP=.63]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
007:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD   02:203b          20.76    1.259 No_date    6:00    23.23 .549
     [XIMP=.48:TIMP=.60]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
007:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * DESIGN STANDHYD   03:203c           4.95     .375 No_date    6:00    27.22 .643
     [XIMP=.57:TIMP=.71]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
007:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD   04:POND1          2.68     .182 No_date    6:00    30.58 .722
     [XIMP=.64:TIMP=.80]
     [SLP= .10:DT= 5.00]
     [LOSS= 1 : HORTONS]
007:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           02:203b          20.76    1.259 No_date    6:00    23.23  n/a
                    + 03:203c           4.95     .375 No_date    6:00    27.22  n/a
     [DT= 5.00]  SUM=  05:T2CRS         25.71    1.634 No_date    6:00    24.00  n/a
007:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           01:203a          27.32    1.734 No_date    6:00    24.30  n/a
                    + 04:POND1          2.68     .182 No_date    6:00    30.58  n/a
                    + 05:T2CRS         25.71    1.634 No_date    6:00    24.00  n/a
     [DT= 5.00]  SUM=  06:P1FLOW        55.71    3.549 No_date    6:00    24.46  n/a
007:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 06:P1FLOW        55.71    3.549 No_date    6:00    24.46  n/a
     [RDT= 5.00] out<- 01:POND1         55.71     .089 No_date   10:35    24.46  n/a
            overflow <= 02:P1-OVF          .00     .000 No_date    0:00      .00  n/a
    {MxStoUsed=.1181E+01, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
007:0024---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           01:POND1         55.71     .089 No_date   10:35    24.46  n/a
                    + 09:TRIB2        383.03     .141 No_date   13:55     7.56  n/a
     [DT= 5.00]  SUM=  02:213ADD       438.74     .225 No_date   12:50     9.71  n/a
007:0025---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 02:213ADD       438.74     .225 No_date   12:50     9.71  n/a
     [RDT= 5.00] out<- 01:214          438.74     .224 No_date   13:10     9.71  n/a
     [L/S/n=  390./1.700/.100]
     {Vmax=  .376:Dmax=  .118}
007:0026---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD      03:214            1.61     .008 No_date    6:30     8.45 .200
     [CN= 72.0: N= 1.10]
     [Tp=  .17:DT= 5.00]
007:0027---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           01:214          438.74     .224 No_date   13:10     9.71  n/a
                    + 03:214            1.61     .008 No_date    6:30     8.45  n/a
     [DT= 5.00]  SUM=  02:214ADD       440.35     .226 No_date   13:00     9.70  n/a
007:0028---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
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    ROUTE CHANNEL   -> 02:214ADD       440.35     .226 No_date   13:00     9.70  n/a
     [RDT= 5.00] out<- 01:215          440.35     .226 No_date   13:10     9.70  n/a
     [L/S/n=  260./1.400/.100]
     {Vmax=  .341:Dmax=  .131}
007:0029---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD      02:TRB215         1.12     .004 No_date    6:40     6.19 .146
     [CN= 66.0: N= 1.10]
     [Tp=  .17:DT= 5.00]
007:0030---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           01:215          440.35     .226 No_date   13:10     9.70  n/a
                    + 02:TRB215         1.12     .004 No_date    6:40     6.19  n/a
     [DT= 5.00]  SUM=  03:215ADD       441.47     .227 No_date   13:05     9.69  n/a
007:0031---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:215ADD       441.47     .227 No_date   13:05     9.69  n/a
     [RDT= 5.00] out<- 01:216          441.47     .226 No_date   13:20     9.69  n/a
     [L/S/n=  250./ .500/.100]
     {Vmax=  .218:Dmax=  .186}
007:0032---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD      02:TRB216         1.12     .004 No_date    7:00     5.64 .133
     [CN= 65.0: N= 1.10]
     [Tp=  .17:DT= 5.00]
007:0033---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           01:216          441.47     .226 No_date   13:20     9.69  n/a
                    + 02:TRB216         1.12     .004 No_date    7:00     5.64  n/a
     [DT= 5.00]  SUM=  10:T2-US        442.59     .227 No_date   13:15     9.68  n/a
007:0034---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD      01:301           86.43     .064 No_date   12:00     5.03 .119
     [CN= 63.0: N= 1.10]
     [Tp= 1.24:DT= 5.00]
007:0035---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD      02:302           80.69     .050 No_date   12:00     5.67 .134
     [CN= 64.0: N= 1.10]
     [Tp= 1.80:DT= 5.00]
007:0036---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           01:301           86.43     .064 No_date   12:00     5.03  n/a
                    + 02:302           80.69     .050 No_date   12:00     5.67  n/a
     [DT= 5.00]  SUM=  03:300a        167.12     .114 No_date   12:00     5.34  n/a
007:0037---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300a        167.12     .114 No_date   12:00     5.34  n/a
     [RDT= 5.00] out<- 01:310         167.12     .114 No_date   12:05     5.34  n/a
     [L/S/n=  449./1.620/.040]
     {Vmax=  .431:Dmax=  .061}
007:0038---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD      02:303           65.19     .069 No_date   12:00     7.58 .179
     [CN= 69.0: N= 1.10]
     [Tp= 1.31:DT= 5.00]
007:0039---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           01:310          167.12     .114 No_date   12:05     5.34  n/a
                    + 02:303           65.19     .069 No_date   12:00     7.58  n/a
     [DT= 5.00]  SUM=  03:300b        232.31     .183 No_date   12:00     5.97  n/a
007:0040---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300b        232.31     .183 No_date   12:00     5.97  n/a
     [RDT= 5.00] out<- 01:311         232.31     .183 No_date   12:10     5.97  n/a
     [L/S/n=  270./1.170/.100]
     {Vmax=  .312:Dmax=  .116}
007:0041---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD      02:TRB311         1.15     .002 No_date    9:00     6.42 .152
     [CN= 65.0: N= 1.10]
     [Tp=  .52:DT= 5.00]
007:0042---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           01:311          232.31     .183 No_date   12:10     5.97  n/a
                    + 02:TRB311         1.15     .002 No_date    9:00     6.42  n/a
     [DT= 5.00]  SUM=  03:311ADD       233.46     .184 No_date   12:05     5.97  n/a
007:0043---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:311ADD       233.46     .184 No_date   12:05     5.97  n/a
     [RDT= 5.00] out<- 01:312          233.46     .184 No_date   12:20     5.97  n/a
     [L/S/n=  270./1.170/.100]
     {Vmax=  .312:Dmax=  .117}
007:0044---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD      02:TRB312         1.30     .003 No_date    9:00    10.54 .249
     [CN= 76.0: N= 1.10]
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      [Tp=  .64:DT= 5.00]
 007:0045---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:312          233.46     .184 No_date   12:20    5.97  n/a
                      + 02:TRB312         1.30     .003 No_date    9:00   10.54  n/a
      [DT= 5.00]  SUM=  09:312ADD       234.76     .187 No_date   12:15    6.00  n/a
 007:0046---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     DESIGN STANDHYD    01:304a           9.61     .557 No_date    6:00   22.29 .527
      [XIMP=.46:TIMP=.57]
      [SLP=1.60:DT= 5.00]
      [LOSS= 1 : HORTONS]
 007:0047---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  DESIGN STANDHYD    02:402a           5.67     .438 No_date    6:00   27.85 .658
      [XIMP=.58:TIMP=.73]
      [SLP=2.10:DT= 5.00]
      [LOSS= 1 : HORTONS]
 007:0048---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     DESIGN STANDHYD    03:POND2          1.85     .127 No_date    6:00   30.58 .722
      [XIMP=.64:TIMP=.80]
      [SLP= .10:DT= 5.00]
      [LOSS= 1 : HORTONS]
 007:0049---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:304a           9.61     .557 No_date    6:00   22.29  n/a
                      + 02:402a           5.67     .438 No_date    6:00   27.85  n/a
                      + 03:POND2          1.85     .127 No_date    6:00   30.58  n/a
      [DT= 5.00]  SUM=  04:P2FLOW        17.13    1.122 No_date    6:00   25.03  n/a
 007:0050---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 04:P2FLOW        17.13    1.122 No_date    6:00   25.03  n/a
      [RDT= 5.00] out<- 01:POND2         17.13     .016 No_date   12:00   25.03  n/a
            overflow <= 02:P2OVF           .00     .000 No_date    0:00     .00  n/a
     {MxStoUsed=.3975E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
 007:0051---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  DESIGN STANDHYD    02:402b           6.07     .469 No_date    6:00   27.85 .658
      [XIMP=.58:TIMP=.73]
      [SLP=2.10:DT= 5.00]
      [LOSS= 1 : HORTONS]
 007:0052---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  DESIGN STANDHYD    03:402c           1.19     .088 No_date    6:00   26.27 .621
      [XIMP=.55:TIMP=.68]
      [SLP=2.10:DT= 5.00]
      [LOSS= 1 : HORTONS]
 007:0053---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            02:402b           6.07     .469 No_date    6:00   27.85  n/a
                      + 03:402c           1.19     .088 No_date    6:00   26.27  n/a
      [DT= 5.00]  SUM=  04:400-OS         7.26     .557 No_date    6:00   27.59  n/a
 007:0054---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 04:400-OS         7.26     .557 No_date    6:00   27.59  n/a
      [RDT= 5.00] out<- 02:OSSTOR         7.26     .552 No_date    6:00   27.59  n/a
            overflow <= 03:OSOVF           .00     .000 No_date    0:00     .00  n/a
     {MxStoUsed=.3518E-02, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
 007:0055---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       03:401           16.78     .079 No_date    8:00    8.06 .190
      [CN= 68.0: N= 3.00]
      [Tp= 1.66:DT= 5.00]
 007:0056---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:POND2         17.13     .016 No_date   12:00   25.03  n/a
                      + 02:OSSTOR         7.26     .552 No_date    6:00   27.59  n/a
                      + 03:401           16.78     .079 No_date    8:00    8.06  n/a
                      + 09:312ADD       234.76     .187 No_date   12:15    6.00  n/a
      [DT= 5.00]  SUM=  04:P2-T3        275.93     .570 No_date    6:00    7.87  n/a
 007:0057---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 04:P2-T3        275.93     .570 No_date    6:00    7.87  n/a
      [RDT= 5.00] out<- 01:313          275.93     .408 No_date    6:05    7.87  n/a
      [L/S/n=  423./1.170/.100]
      {Vmax=  .396:Dmax=  .251}
 007:0058---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:TRB313          .72     .002 No_date    7:30    7.57 .179
      [CN= 68.0: N= 1.10]
      [Tp=  .34:DT= 5.00]
 007:0059---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:313          275.93     .408 No_date    6:05    7.87  n/a
                      + 02:TRB313          .72     .002 No_date    7:30    7.57  n/a
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      [DT= 5.00]  SUM=  03:313ADD       276.65     .410 No_date    6:05    7.87  n/a
 007:0060---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       04:TRB314          .94     .002 No_date    8:00    7.58 .179
      [CN= 68.0: N= 1.10]
      [Tp=  .46:DT= 5.00]
 007:0061---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:313          275.93     .408 No_date    6:05    7.87  n/a
                      + 02:TRB313          .72     .002 No_date    7:30    7.57  n/a
      [DT= 5.00]  SUM=  03:313ADD       276.65     .410 No_date    6:05    7.87  n/a
 007:0062---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       04:403a           2.66     .012 No_date    7:00    9.85 .233
      [CN= 70.0: N= 1.10]
      [Tp=  .27:DT= 5.00]
 007:0063---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            10:T2-US        442.59     .227 No_date   13:15    9.68  n/a
                      + 03:313ADD       276.65     .410 No_date    6:05    7.87  n/a
                      + 04:403a           2.66     .012 No_date    7:00    9.85  n/a
      [DT= 5.00]  SUM=  01:CONFLU       721.90     .474 No_date   10:35    8.99  n/a
 007:0064---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  DESIGN STANDHYD    01:203d           1.26     .095 No_date    6:00   26.84 .634
      [XIMP=.56:TIMP=.70]
      [SLP=2.30:DT= 5.00]
      [LOSS= 1 : HORTONS]
 007:0065---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     DESIGN STANDHYD    02:501a           9.32     .858 No_date    6:00   35.29 .834
      [XIMP=.74:TIMP=.93]
      [SLP= .80:DT= 5.00]
      [LOSS= 1 : HORTONS]
 007:0066---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     COMPUTE DUALHYD    02:501a           9.32     .858 No_date    6:00   35.29  n/a
        Major System /  03:OSSTOR          .00     .000 No_date    0:00     .00  n/a
        Minor System \  04:TOPOND         9.32     .858 No_date    6:00   35.29  n/a
      {MjSysSto=.0000E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
 007:0067---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     DESIGN STANDHYD    05:501b          38.42    2.546 No_date    6:00   25.88 .611
      [XIMP=.54:TIMP=.67]
      [SLP=2.30:DT= 5.00]
      [LOSS= 1 : HORTONS]
 007:0068---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     DESIGN STANDHYD    06:501c          39.10    2.474 No_date    6:00   24.70 .583
      [XIMP=.51:TIMP=.64]
      [SLP=2.30:DT= 5.00]
      [LOSS= 1 : HORTONS]
 007:0069---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  DESIGN STANDHYD    07:MR1            3.32     .330 No_date    6:00   39.40 .931
      [XIMP=.80:TIMP=.99]
      [SLP=1.00:DT= 5.00]
      [LOSS= 1 : HORTONS]
 007:0070---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  DESIGN STANDHYD    08:MR2            3.04     .302 No_date    6:00   39.40 .931
      [XIMP=.80:TIMP=.99]
      [SLP=1.00:DT= 5.00]
      [LOSS= 1 : HORTONS]
 007:0071---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:203d           1.26     .095 No_date    6:00   26.84  n/a
                      + 05:501b          38.42    2.546 No_date    6:00   25.88  n/a
                      + 07:MR1            3.32     .330 No_date    6:00   39.40  n/a
      [DT= 5.00]  SUM=  10:VALE          43.00    2.971 No_date    6:00   26.95  n/a
 007:0072---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            04:TOPOND         9.32     .858 No_date    6:00   35.29  n/a
                      + 06:501c          39.10    2.474 No_date    6:00   24.70  n/a
                      + 08:MR2            3.04     .302 No_date    6:00   39.40  n/a
      [DT= 5.00]  SUM=  09:MET           51.46    3.634 No_date    6:00   27.48  n/a
 007:0073---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     DESIGN STANDHYD    01:POND3         11.89     .707 No_date    6:05   30.58 .722
      [XIMP=.64:TIMP=.80]
      [SLP= .10:DT= 5.00]
      [LOSS= 1 : HORTONS]
 007:0074---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            10:VALE          43.00    2.971 No_date    6:00   26.95  n/a
                      + 09:MET           51.46    3.634 No_date    6:00   27.48  n/a
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              + 01:POND3        11.89     .707 No_date    6:05   30.58  n/a
     [DT= 5.00]  SUM=  08:P3ADD       106.35    7.300 No_date    6:00   27.61  n/a
 007:0075--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 08:P3ADD       106.35    7.300 No_date    6:00   27.61  n/a
     [RDT= 5.00] out<- 01:POND3       106.35     .220 No_date    9:30   27.61  n/a
           overflow <= 02:E-OVF          .00     .000 No_date    0:00     .00  n/a
    {MxStoUsed=.2515E+01, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
  ** END OF RUN :   7

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



 RUN:COMMAND#
 008:0001---------------------------------------------------------------------------
    START
     [TZERO =    .00 hrs on        0]
     [METOUT=   2    (1=imperial, 2=metric output)]
     [NSTORM=   1 ]
     [NRUN  =   8 ]
#******************************************************************************
#  Project Name: [Kanata North]    Project Number: [112117]
#  Date        : 03-30-2016
#  Modeller    : [Kallie Auld]
#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
#  License #   :  5320763
#******************************************************************************
#******************************************************************************
 008:0002---------------------------------------------------------------------------
    READ STORM
     Filename = STORM.001
     Comment  =
     [SDT=30.00:SDUR=  12.00:PTOT=  56.18]
 008:0003---------------------------------------------------------------------------
    DEFAULT VALUES
     Filename = M:\2012\112117\data\CALCUL~1\swmhymo\POSTDE~1\OTTAWA.DEF
     ICASEdv  = 1 (read and print data)
     FileTitle= ------ ENTER YOUR COMMENTS ON THIS LINE AND THE NEXT ONE ---
                ------ PARAMETER VALUES MUST BE ENTERD AFTER COLUMN 60 ----_
     Horton's infiltration equation parameters:
     [Fo= 76.20 mm/hr] [Fc=13.20 mm/hr] [DCAY= 4.14 /hr] [F=  .00 mm]
     Parameters for PERVIOUS surfaces in STANDHYD:
     [IAper=   4.67 mm] [LGP=40.00 m] [MNP= .250]
     Parameters for IMPERVIOUS surfaces in STANDHYD:
     [IAimp=   1.57 mm] [CLI= 1.50]   [MNI= .013]
     Parameters used in NASHYD:
     [Ia=   4.67 mm] [N= 3.00]
 008:0004--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:201         115.14     .080 No_date   12:05   11.05 .197
     [CN= 65.0: N= 1.10]
     [Tp= 3.42:DT= 5.00]
 008:0005--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 01:201         115.14     .080 No_date   12:05   11.05  n/a
     [RDT= 5.00] out<- 02:210         115.14     .080 No_date   12:45   11.05  n/a
     [L/S/n=  558./ .890/.040]
     {Vmax=  .423:Dmax=  .037}
 008:0006--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:202         263.64     .170 No_date   13:00   14.94 .266
     [CN= 70.0: N= 1.10]
     [Tp= 5.14:DT= 5.00]
 008:0007--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:202         263.64     .170 No_date   13:00   14.94  n/a
                     + 02:210         115.14     .080 No_date   12:45   11.05  n/a
     [DT= 5.00]  SUM=  03:210add      378.78     .249 No_date   12:50   13.75  n/a
 008:0008--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:210add      378.78     .249 No_date   12:50   13.75  n/a
     [RDT= 5.00] out<- 01:211         378.78     .249 No_date   13:25   13.75  n/a
     [L/S/n=  450./1.000/.100]
     {Vmax=  .292:Dmax=  .164}
 008:0009--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:211           1.87     .005 No_date   10:30   18.32 .326
     [CN= 76.0: N= 1.10]
     [Tp= 1.17:DT= 5.00]
 008:0010--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:211         378.78     .249 No_date   13:25   13.75  n/a
                     + 02:211           1.87     .005 No_date   10:30   18.32  n/a
     [DT= 5.00]  SUM=  03:211add      380.65     .254 No_date   13:15   13.78  n/a
 008:0011--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:211add      380.65     .254 No_date   13:15   13.78  n/a
     [RDT= 5.00] out<- 01:212         380.65     .254 No_date   13:25   13.78  n/a
     [L/S/n=  230./1.000/.100]
     {Vmax=  .293:Dmax=  .165}
 008:0012--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:212            .95     .003 No_date    9:00   12.59 .224
     [CN= 66.0: N= 1.10]
     [Tp=  .56:DT= 5.00]
 008:0013--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:212         380.65     .254 No_date   13:25   13.78  n/a
                     + 02:212            .95     .003 No_date    9:00   12.59  n/a
     [DT= 5.00]  SUM=  03:212add      381.60     .256 No_date   13:15   13.77  n/a
 008:0014--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:212add      381.60     .256 No_date   13:15   13.77  n/a
     [RDT= 5.00] out<- 01:213         381.60     .256 No_date   13:40   13.77  n/a
     [L/S/n=  330./1.000/.100]
     {Vmax=  .293:Dmax=  .166}
 008:0015--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:213           1.43     .004 No_date    9:00   12.50 .223
     [CN= 66.0: N= 1.10]
     [Tp=  .67:DT= 5.00]
 008:0016--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:213         381.60     .256 No_date   13:40   13.77  n/a
                     + 02:213           1.43     .004 No_date    9:00   12.50  n/a
     [DT= 5.00]  SUM=  09:TRIB2       383.03     .259 No_date   13:35   13.77  n/a
 008:0017--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    01:203a         27.32    2.754 No_date    6:00   35.54 .633
     [XIMP=.50:TIMP=.63]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
 008:0018--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    02:203b         20.76    2.048 No_date    6:00   34.32 .611
     [XIMP=.48:TIMP=.60]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
 008:0019--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * DESIGN STANDHYD    03:203c          4.95     .561 No_date    6:00   39.04 .695
     [XIMP=.57:TIMP=.71]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
 008:0020--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    04:POND1         2.68     .263 No_date    6:00   42.73 .761
     [XIMP=.64:TIMP=.80]
     [SLP= .10:DT= 5.00]
     [LOSS= 1 : HORTONS]
 008:0021--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            02:203b         20.76    2.048 No_date    6:00   34.32  n/a
                     + 03:203c          4.95     .561 No_date    6:00   39.04  n/a
     [DT= 5.00]  SUM=  05:T2CRS        25.71    2.609 No_date    6:00   35.23  n/a
 008:0022--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:203a         27.32    2.754 No_date    6:00   35.54  n/a
                     + 04:POND1         2.68     .263 No_date    6:00   42.73  n/a
                     + 05:T2CRS        25.71    2.609 No_date    6:00   35.23  n/a
     [DT= 5.00]  SUM=  06:P1FLOW       55.71    5.626 No_date    6:00   35.74  n/a
 008:0023--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 06:P1FLOW       55.71    5.626 No_date    6:00   35.74  n/a
     [RDT= 5.00] out<- 01:POND1        55.71     .177 No_date    9:05   35.74  n/a
           overflow <= 02:P1-OVF         .00     .000 No_date    0:00     .00  n/a
    {MxStoUsed=.1677E+01, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
 008:0024--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:POND1        55.71     .177 No_date    9:05   35.74  n/a
                     + 09:TRIB2       383.03     .259 No_date   13:35   13.77  n/a
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     [DT= 5.00]  SUM=  02:213ADD       438.74     .417 No_date   12:15   16.56  n/a
008:0025---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 02:213ADD       438.74     .417 No_date   12:15   16.56  n/a
     [RDT= 5.00] out<- 01:214          438.74     .416 No_date   12:30   16.56  n/a
     [L/S/n=  390./1.700/.100]
     {Vmax=  .401:Dmax=  .186}
008:0026---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       03:214            1.61     .016 No_date    6:30   15.30 .272
     [CN= 72.0: N= 1.10]
     [Tp=  .17:DT= 5.00]
008:0027---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:214          438.74     .416 No_date   12:30   16.56  n/a
                     + 03:214            1.61     .016 No_date    6:30   15.30  n/a
     [DT= 5.00]  SUM=  02:214ADD       440.35     .420 No_date   12:20   16.55  n/a
008:0028---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 02:214ADD       440.35     .420 No_date   12:20   16.55  n/a
     [RDT= 5.00] out<- 01:215          440.35     .420 No_date   12:25   16.55  n/a
     [L/S/n=  260./1.400/.100]
     {Vmax=  .374:Dmax=  .197}
008:0029---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:TRB215         1.12     .008 No_date    6:30   11.77 .210
     [CN= 66.0: N= 1.10]
     [Tp=  .17:DT= 5.00]
008:0030---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:215          440.35     .420 No_date   12:25   16.55  n/a
                     + 02:TRB215         1.12     .008 No_date    6:30   11.77  n/a
     [DT= 5.00]  SUM=  03:215ADD       441.47     .422 No_date   12:20   16.54  n/a
008:0031---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:215ADD       441.47     .422 No_date   12:20   16.54  n/a
     [RDT= 5.00] out<- 01:216          441.47     .422 No_date   12:30   16.54  n/a
     [L/S/n=  250./ .500/.100]
     {Vmax=  .276:Dmax=  .272}
008:0032---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:TRB216         1.12     .007 No_date    6:30   10.96 .195
     [CN= 65.0: N= 1.10]
     [Tp=  .17:DT= 5.00]
008:0033---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:216          441.47     .422 No_date   12:30   16.54  n/a
                     + 02:TRB216         1.12     .007 No_date    6:30   10.96  n/a
     [DT= 5.00]  SUM=  10:T2-US        442.59     .424 No_date   12:30   16.53  n/a
008:0034---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:301           86.43     .126 No_date   11:50    9.97 .178
     [CN= 63.0: N= 1.10]
     [Tp= 1.24:DT= 5.00]
008:0035---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:302           80.69     .096 No_date   12:00   10.90 .194
     [CN= 64.0: N= 1.10]
     [Tp= 1.80:DT= 5.00]
008:0036---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:301           86.43     .126 No_date   11:50    9.97  n/a
                     + 02:302           80.69     .096 No_date   12:00   10.90  n/a
     [DT= 5.00]  SUM=  03:300a         167.12     .222 No_date   12:00   10.42  n/a
008:0037---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300a         167.12     .222 No_date   12:00   10.42  n/a
     [RDT= 5.00] out<- 01:310          167.12     .222 No_date   12:00   10.42  n/a
     [L/S/n=  449./1.620/.040]
     {Vmax=  .491:Dmax=  .084}
008:0038---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:303           65.19     .126 No_date   11:05   13.85 .247
     [CN= 69.0: N= 1.10]
     [Tp= 1.31:DT= 5.00]
008:0039---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:310          167.12     .222 No_date   12:00   10.42  n/a
                     + 02:303           65.19     .126 No_date   11:05   13.85  n/a
     [DT= 5.00]  SUM=  03:300b         232.31     .348 No_date   12:00   11.38  n/a
008:0040---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300b         232.31     .348 No_date   12:00   11.38  n/a
     [RDT= 5.00] out<- 01:311          232.31     .348 No_date   12:05   11.38  n/a
     [L/S/n=  270./1.170/.100]
     {Vmax=  .333:Dmax=  .186}
008:0041---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
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    CALIB NASHYD       02:TRB311         1.15     .004 No_date    8:10   11.96 .213
     [CN= 65.0: N= 1.10]
     [Tp=  .52:DT= 5.00]
008:0042---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:311          232.31     .348 No_date   12:05   11.38  n/a
                     + 02:TRB311         1.15     .004 No_date    8:10   11.96  n/a
     [DT= 5.00]  SUM=  03:311ADD       233.46     .351 No_date   12:00   11.38  n/a
008:0043---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:311ADD       233.46     .351 No_date   12:00   11.38  n/a
     [RDT= 5.00] out<- 01:312          233.46     .350 No_date   12:05   11.39  n/a
     [L/S/n=  270./1.170/.100]
     {Vmax=  .334:Dmax=  .187}
008:0044---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:TRB312         1.30     .006 No_date    9:00   18.38 .327
     [CN= 76.0: N= 1.10]
     [Tp=  .64:DT= 5.00]
008:0045---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:312          233.46     .350 No_date   12:05   11.39  n/a
                     + 02:TRB312         1.30     .006 No_date    9:00   18.38  n/a
     [DT= 5.00]  SUM=  09:312ADD       234.76     .355 No_date   12:05   11.42  n/a
008:0046---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    01:304a           9.61     .918 No_date    6:00   33.13 .590
     [XIMP=.46:TIMP=.57]
     [SLP=1.60:DT= 5.00]
     [LOSS= 1 : HORTONS]
008:0047---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD    02:402a           5.67     .638 No_date    6:00   39.76 .708
     [XIMP=.58:TIMP=.73]
     [SLP=2.10:DT= 5.00]
     [LOSS= 1 : HORTONS]
008:0048---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    03:POND2          1.85     .190 No_date    6:00   42.73 .761
     [XIMP=.64:TIMP=.80]
     [SLP= .10:DT= 5.00]
     [LOSS= 1 : HORTONS]
008:0049---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:304a           9.61     .918 No_date    6:00   33.13  n/a
                     + 02:402a           5.67     .638 No_date    6:00   39.76  n/a
                     + 03:POND2          1.85     .190 No_date    6:00   42.73  n/a
     [DT= 5.00]  SUM=  04:P2FLOW        17.13    1.746 No_date    6:00   36.36  n/a
008:0050---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 04:P2FLOW        17.13    1.746 No_date    6:00   36.36  n/a
     [RDT= 5.00] out<- 01:POND2         17.13     .031 No_date   10:50   36.36  n/a
           overflow <= 02:P2OVF           .00     .000 No_date    0:00     .00  n/a
    {MxStoUsed=.5598E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
008:0051---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD    02:402b           6.07     .683 No_date    6:00   39.76 .708
     [XIMP=.58:TIMP=.73]
     [SLP=2.10:DT= 5.00]
     [LOSS= 1 : HORTONS]
008:0052---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD    03:402c           1.19     .133 No_date    6:00   37.86 .674
     [XIMP=.55:TIMP=.68]
     [SLP=2.10:DT= 5.00]
     [LOSS= 1 : HORTONS]
008:0053---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            02:402b           6.07     .683 No_date    6:00   39.76  n/a
                     + 03:402c           1.19     .133 No_date    6:00   37.86  n/a
     [DT= 5.00]  SUM=  04:400-OS         7.26     .816 No_date    6:00   39.45  n/a
008:0054---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 04:400-OS         7.26     .816 No_date    6:00   39.45  n/a
     [RDT= 5.00] out<- 02:OSSTOR         7.26     .800 No_date    6:00   39.45  n/a
           overflow <= 03:OSOVF           .00     .000 No_date    0:00     .00  n/a
    {MxStoUsed=.5466E-02, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
008:0055---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       03:401           16.78     .144 No_date    7:55   14.34 .255
     [CN= 68.0: N= 3.00]
     [Tp= 1.66:DT= 5.00]
008:0056---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:POND2         17.13     .031 No_date   10:50   36.36  n/a
                     + 02:OSSTOR         7.26     .800 No_date    6:00   39.45  n/a
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                + 03:401          16.78     .144 No_date    7:55   14.34  n/a
                + 09:312ADD      234.76     .355 No_date   12:05   11.42  n/a
   [DT= 5.00]  SUM=  04:P2-T3    275.93     .847 No_date    6:00   13.88  n/a
008:0057---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  ROUTE CHANNEL   -> 04:P2-T3        275.93     .847 No_date    6:00   13.88  n/a
   [RDT= 5.00] out<- 01:313          275.93     .680 No_date    6:05   13.88  n/a
   [L/S/n=  423./1.170/.100]
   {Vmax=  .496:Dmax=  .327}
008:0058---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  CALIB NASHYD      02:TRB313           .72     .004 No_date    7:10   13.74 .245
   [CN= 68.0: N= 1.10]
   [Tp=  .34:DT= 5.00]
008:0059---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  ADD HYD           01:313           275.93     .680 No_date    6:05   13.88  n/a
                + 02:TRB313             .72     .004 No_date    7:10   13.74  n/a
   [DT= 5.00]  SUM=  03:313ADD       276.65     .682 No_date    6:05   13.88  n/a
008:0060---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  CALIB NASHYD      04:TRB314           .94     .004 No_date    8:00   13.74 .245
   [CN= 68.0: N= 1.10]
   [Tp=  .46:DT= 5.00]
008:0061---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  ADD HYD           01:313           275.93     .680 No_date    6:05   13.88  n/a
                + 02:TRB313             .72     .004 No_date    7:10   13.74  n/a
   [DT= 5.00]  SUM=  03:313ADD       276.65     .682 No_date    6:05   13.88  n/a
008:0062---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  CALIB NASHYD      04:403a            2.66     .020 No_date    7:00   16.74 .298
   [CN= 70.0: N= 1.10]
   [Tp=  .27:DT= 5.00]
008:0063---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  ADD HYD           10:T2-US         442.59     .424 No_date   12:30   16.53  n/a
                + 03:313ADD          276.65     .682 No_date    6:05   13.88  n/a
                + 04:403a              2.66     .020 No_date    7:00   16.74  n/a
   [DT= 5.00]  SUM=  01:CONFLU       721.90     .898 No_date   10:30   15.52  n/a
008:0064---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD  01:203d            1.26     .143 No_date    6:00   38.59 .687
   [XIMP=.56:TIMP=.70]
   [SLP=2.30:DT= 5.00]
   [LOSS= 1 : HORTONS]
008:0065---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  DESIGN STANDHYD   02:501a            9.32    1.162 No_date    6:00   47.91 .853
   [XIMP=.74:TIMP=.93]
   [SLP= .80:DT= 5.00]
   [LOSS= 1 : HORTONS]
008:0066---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  COMPUTE DUALHYD   02:501a            9.32    1.162 No_date    6:00   47.91  n/a
     Major System /  03:OSSTOR          .00     .000 No_date    0:00     .00  n/a
     Minor System \  04:TOPOND         9.32    1.162 No_date    6:00   47.91  n/a
   {MjSysSto=.0000E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
008:0067---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  DESIGN STANDHYD   05:501b           38.42    3.980 No_date    6:00   37.40 .666
   [XIMP=.54:TIMP=.67]
   [SLP=2.30:DT= 5.00]
   [LOSS= 1 : HORTONS]
008:0068---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  DESIGN STANDHYD   06:501c           39.10    3.939 No_date    6:00   36.01 .641
   [XIMP=.51:TIMP=.64]
   [SLP=2.30:DT= 5.00]
   [LOSS= 1 : HORTONS]
008:0069---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD  07:MR1             3.32     .439 No_date    6:00   53.21 .947
   [XIMP=.80:TIMP=.99]
   [SLP=1.00:DT= 5.00]
   [LOSS= 1 : HORTONS]
008:0070---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD  08:MR2             3.04     .402 No_date    6:00   53.21 .947
   [XIMP=.80:TIMP=.99]
   [SLP=1.00:DT= 5.00]
   [LOSS= 1 : HORTONS]
008:0071---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  ADD HYD           01:203d            1.26     .143 No_date    6:00   38.59  n/a
                + 05:501b             38.42    3.980 No_date    6:00   37.40  n/a
                + 07:MR1               3.32     .439 No_date    6:00   53.21  n/a
   [DT= 5.00]  SUM=  10:VALE          43.00    4.563 No_date    6:00   38.66  n/a
008:0072---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  ADD HYD           04:TOPOND          9.32    1.162 No_date    6:00   47.91  n/a
                + 06:501c             39.10    3.939 No_date    6:00   36.01  n/a
                + 08:MR2               3.04     .402 No_date    6:00   53.21  n/a
   [DT= 5.00]  SUM=  09:MET           51.46    5.503 No_date    6:00   39.18  n/a
008:0073---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  DESIGN STANDHYD   01:POND3          11.89    1.031 No_date    6:05   42.73 .761
   [XIMP=.64:TIMP=.80]
   [SLP= .10:DT= 5.00]
   [LOSS= 1 : HORTONS]
008:0074---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  ADD HYD           10:VALE           43.00    4.563 No_date    6:00   38.66  n/a
                + 09:MET              51.46    5.503 No_date    6:00   39.18  n/a
                + 01:POND3            11.89    1.031 No_date    6:05   42.73  n/a
   [DT= 5.00]  SUM=  08:P3ADD        106.35   11.074 No_date    6:00   39.36  n/a
008:0075---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  ROUTE RESERVOIR -> 08:P3ADD        106.35   11.074 No_date    6:00   39.36  n/a
   [RDT= 5.00] out<- 01:POND3        106.35     .402 No_date    9:05   39.36  n/a
         overflow <= 02:E-OVF           .00     .000 No_date    0:00     .00  n/a
  {MxStoUsed=.3489E+01, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
 ** END OF RUN :  11

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




 RUN:COMMAND#
 012:0001----------------------------------------------------------------------------
    START
     [TZERO =    .00 hrs on        0]
     [METOUT=   2    (1=imperial, 2=metric output)]
     [NSTORM=   1 ]
     [NRUN  =  12 ]
#******************************************************************************
#  Project Name: [Kanata North]    Project Number: [112117]
#  Date        : 03-30-2016
#  Modeller    : [Kallie Auld]
#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
#  License #   :  5320763
#******************************************************************************
#******************************************************************************
 012:0002----------------------------------------------------------------------------
    READ STORM
     Filename = STORM.001
     Comment  =
     [SDT=10.00:SDUR=  12.00:PTOT=  93.91]
 012:0003----------------------------------------------------------------------------
    DEFAULT VALUES
     Filename = M:\2012\112117\data\CALCUL~1\swmhymo\POSTDE~1\OTTAWA.DEF
     ICASEdv  = 1 (read and print data)
     FileTitle= ------ ENTER YOUR COMMENTS ON THIS LINE AND THE NEXT ONE ---
               ------ PARAMETER VALUES MUST BE ENTERD AFTER COLUMN 60 ----_
     Horton's infiltration equation parameters:
     [Fo= 76.20 mm/hr] [Fc=13.20 mm/hr] [DCAY= 4.14 /hr] [F=  .00 mm]
     Parameters for PERVIOUS surfaces in STANDHYD:
     [IAper=   4.67 mm] [LGP=40.00 m] [MNP= .250]
     Parameters for IMPERVIOUS surfaces in STANDHYD:
     [IAimp=   1.57 mm] [CLI= 1.50]   [MNI= .013]
     Parameters used in NASHYD:
     [Ia=   4.67 mm] [N= 3.00]
 012:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD      01:201          115.14     .224 No_date   12:00   31.04 .331
     [CN= 65.0: N= 1.10]
     [Tp= 3.42:DT= 5.00]
 012:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 01:201          115.14     .224 No_date   12:00   31.04  n/a
     [RDT= 5.00] out<- 02:210          115.14     .224 No_date   12:35   31.04  n/a
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     [L/S/n=  558./ .890/.040]
     {Vmax=  .432:Dmax=  .094}
012:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:202         263.64     .433 No_date   12:50   38.10 .406
     [CN= 70.0: N= 1.10]
     [Tp= 5.14:DT= 5.00]
012:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:202         263.64     .433 No_date   12:50   38.10  n/a
                     + 02:210         115.14     .224 No_date   12:35   31.04  n/a
     [DT= 5.00]  SUM=  03:210add      378.78     .656 No_date   12:40   35.95  n/a
012:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:210add      378.78     .656 No_date   12:40   35.95  n/a
     [RDT= 5.00] out<- 01:211         378.78     .657 No_date   12:35   35.95  n/a
     [L/S/n=  450./1.000/.100]
     {Vmax=  .415:Dmax=  .291}
012:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:211           1.87     .013 No_date   10:30   44.73 .476
     [CN= 76.0: N= 1.10]
     [Tp= 1.17:DT= 5.00]
012:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:211         378.78     .657 No_date   12:35   35.95  n/a
                     + 02:211           1.87     .013 No_date   10:30   44.73  n/a
     [DT= 5.00]  SUM=  03:211add      380.65     .669 No_date   12:35   36.00  n/a
012:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:211add      380.65     .669 No_date   12:35   36.00  n/a
     [RDT= 5.00] out<- 01:212         380.65     .669 No_date   12:40   36.00  n/a
     [L/S/n=  230./1.000/.100]
     {Vmax=  .420:Dmax=  .295}
012:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:212            .95     .008 No_date    8:00   33.54 .357
     [CN= 66.0: N= 1.10]
     [Tp=  .56:DT= 5.00]
012:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:212         380.65     .669 No_date   12:40   36.00  n/a
                     + 02:212            .95     .008 No_date    8:00   33.54  n/a
     [DT= 5.00]  SUM=  03:212add      381.60     .675 No_date   12:40   35.99  n/a
012:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:212add      381.60     .675 No_date   12:40   35.99  n/a
     [RDT= 5.00] out<- 01:213         381.60     .676 No_date   12:45   35.99  n/a
     [L/S/n=  330./1.000/.100]
     {Vmax=  .423:Dmax=  .297}
012:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:213           1.43     .011 No_date    9:00   33.41 .356
     [CN= 66.0: N= 1.10]
     [Tp=  .67:DT= 5.00]
012:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:213         381.60     .676 No_date   12:45   35.99  n/a
                     + 02:213           1.43     .011 No_date    9:00   33.41  n/a
     [DT= 5.00]  SUM=  09:TRIB2       383.03     .685 No_date   12:45   35.98  n/a
012:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    01:203a         27.32    5.412 No_date    6:00   66.29 .706
     [XIMP=.50:TIMP=.63]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
012:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  DESIGN STANDHYD    02:203b         20.76    4.089 No_date    6:00   64.96 .692
     [XIMP=.48:TIMP=.60]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
012:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  DESIGN STANDHYD    03:203c          4.95    1.025 No_date    6:00   70.45 .750
     [XIMP=.57:TIMP=.71]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
012:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    04:POND1          2.68     .501 No_date    6:00   75.32 .802
     [XIMP=.64:TIMP=.80]
     [SLP= .10:DT= 5.00]
     [LOSS= 1 : HORTONS]
012:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            02:203b         20.76    4.089 No_date    6:00   64.96  n/a
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                     + 03:203c          4.95    1.025 No_date    6:00   70.45  n/a
     [DT= 5.00]  SUM=  05:T2CRS        25.71    5.114 No_date    6:00   66.02  n/a
012:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:203a         27.32    5.412 No_date    6:00   66.29  n/a
                     + 04:POND1         2.68     .501 No_date    6:00   75.32  n/a
                     + 05:T2CRS        25.71    5.114 No_date    6:00   66.02  n/a
     [DT= 5.00]  SUM=  06:P1FLOW       55.71   11.026 No_date    6:00   66.60  n/a
012:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 06:P1FLOW       55.71   11.026 No_date    6:00   66.60  n/a
     [RDT= 5.00] out<- 01:POND1        55.71     .346 No_date    8:10   66.59  n/a
          overflow <= 02:P1-OVF          .00     .000 No_date    0:00     .00  n/a
    {MxStoUsed=.3114E+01, TotOvfVol=.0000E+00, N-Ovf=     0, TotDurOvf=     0.hrs}
012:0024---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:POND1        55.71     .346 No_date    8:10   66.59  n/a
                     + 09:TRIB2       383.03     .685 No_date   12:45   35.98  n/a
     [DT= 5.00]  SUM=  02:213ADD      438.74    1.006 No_date   12:05   39.87  n/a
012:0025---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 02:213ADD      438.74    1.006 No_date   12:05   39.87  n/a
     [RDT= 5.00] out<- 01:214         438.74    1.005 No_date   12:15   39.87  n/a
     [L/S/n=  390./1.700/.100]
     {Vmax=  .595:Dmax=  .324}
012:0026---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       03:214           1.61     .042 No_date    6:30   39.32 .419
     [CN= 72.0: N= 1.10]
     [Tp=  .17:DT= 5.00]
012:0027---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:214         438.74    1.005 No_date   12:15   39.87  n/a
                     + 03:214           1.61     .042 No_date    6:30   39.32  n/a
     [DT= 5.00]  SUM=  02:214ADD      440.35    1.014 No_date   12:10   39.87  n/a
012:0028---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 02:214ADD      440.35    1.014 No_date   12:10   39.87  n/a
     [RDT= 5.00] out<- 01:215         440.35    1.013 No_date   12:20   39.86  n/a
     [L/S/n=  260./1.400/.100]
     {Vmax=  .555:Dmax=  .343}
012:0029---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:TRB215        1.12     .024 No_date    6:30   32.40 .345
     [CN= 66.0: N= 1.10]
     [Tp=  .17:DT= 5.00]
012:0030---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:215         440.35    1.013 No_date   12:20   39.86  n/a
                     + 02:TRB215        1.12     .024 No_date    6:30   32.40  n/a
     [DT= 5.00]  SUM=  03:215ADD      441.47    1.019 No_date   12:15   39.85  n/a
012:0031---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:215ADD      441.47    1.019 No_date   12:15   39.85  n/a
     [RDT= 5.00] out<- 01:216         441.47    1.018 No_date   12:20   39.85  n/a
     [L/S/n=  250./ .500/.100]
     {Vmax=  .411:Dmax=  .472}
012:0032---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:TRB216        1.12     .023 No_date    6:30   30.92 .329
     [CN= 65.0: N= 1.10]
     [Tp=  .17:DT= 5.00]
012:0033---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:216         441.47    1.018 No_date   12:20   39.85  n/a
                     + 02:TRB216        1.12     .023 No_date    6:30   30.92  n/a
     [DT= 5.00]  SUM=  10:T2-US       442.59    1.023 No_date   12:15   39.82  n/a
012:0034---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:301          86.43     .363 No_date   10:40   28.86 .307
     [CN= 63.0: N= 1.10]
     [Tp= 1.24:DT= 5.00]
012:0035---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:302          80.69     .268 No_date   12:00   30.50 .325
     [CN= 64.0: N= 1.10]
     [Tp= 1.80:DT= 5.00]
012:0036---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:301          86.43     .363 No_date   10:40   28.86  n/a
                     + 02:302          80.69     .268 No_date   12:00   30.50  n/a
     [DT= 5.00]  SUM=  03:300a        167.12     .629 No_date   11:20   29.65  n/a
012:0037---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300a        167.12     .629 No_date   11:20   29.65  n/a
     [RDT= 5.00] out<- 01:310         167.12     .629 No_date   11:30   29.65  n/a
     [L/S/n=  449./1.620/.040]
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     {Vmax=  .705:Dmax=  .149}
012:0038---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:303            65.19     .330 No_date    10:35   36.29 .386
     [CN= 69.0: N= 1.10]
     [Tp= 1.31:DT= 5.00]
012:0039---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:310           167.12     .629 No_date    11:30   29.65  n/a
                     + 02:303            65.19     .330 No_date    10:35   36.29  n/a
     [DT= 5.00]  SUM=  03:300b          232.31     .958 No_date    11:05   31.51  n/a
012:0040---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300b          232.31     .958 No_date    11:05   31.51  n/a
     [RDT= 5.00] out<- 01:311           232.31     .958 No_date    11:15   31.51  n/a
     [L/S/n=  270./1.170/.100]
     {Vmax=  .512:Dmax=  .349}
012:0041---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:TRB311          1.15     .010 No_date     8:00   32.33 .344
     [CN= 65.0: N= 1.10]
     [Tp=  .52:DT= 5.00]
012:0042---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:311           232.31     .958 No_date    11:15   31.51  n/a
                     + 02:TRB311          1.15     .010 No_date     8:00   32.33  n/a
     [DT= 5.00]  SUM=  03:311ADD        233.46     .966 No_date    11:10   31.52  n/a
012:0043---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:311ADD        233.46     .966 No_date    11:10   31.52  n/a
     [RDT= 5.00] out<- 01:312           233.46     .966 No_date    11:20   31.52  n/a
     [L/S/n=  270./1.170/.100]
     {Vmax=  .514:Dmax=  .351}
012:0044---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:TRB312          1.30     .014 No_date     8:00   44.81 .477
     [CN= 76.0: N= 1.10]
     [Tp=  .64:DT= 5.00]
012:0045---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:312           233.46     .966 No_date    11:20   31.52  n/a
                     + 02:TRB312          1.30     .014 No_date     8:00   44.81  n/a
     [DT= 5.00]  SUM=  09:312ADD        234.76     .979 No_date    11:15   31.59  n/a
012:0046---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * DESIGN STANDHYD    01:304a            9.61    1.869 No_date     6:00   63.63 .678
     [XIMP=.46:TIMP=.57]
     [SLP=1.60:DT= 5.00]
     [LOSS= 1 : HORTONS]
012:0047---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * DESIGN STANDHYD    02:402a            5.67    1.177 No_date     6:00   71.32 .760
     [XIMP=.58:TIMP=.73]
     [SLP=2.10:DT= 5.00]
     [LOSS= 1 : HORTONS]
012:0048---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    03:POND2           1.85     .348 No_date     6:00   75.32 .802
     [XIMP=.64:TIMP=.80]
     [SLP= .10:DT= 5.00]
     [LOSS= 1 : HORTONS]
012:0049---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:304a            9.61    1.869 No_date     6:00   63.63  n/a
                     + 02:402a            5.67    1.177 No_date     6:00   71.32  n/a
                     + 03:POND2           1.85     .348 No_date     6:00   75.32  n/a
     [DT= 5.00]  SUM=  04:P2FLOW         17.13    3.394 No_date     6:00   67.44  n/a
012:0050---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 04:P2FLOW         17.13    3.394 No_date     6:00   67.44  n/a
     [RDT= 5.00] out<- 01:POND2          17.13     .084 No_date     9:05   67.43  n/a
            overflow <= 02:P2OVF           .00     .000 No_date     0:00     .00  n/a
    {MxStoUsed=.1002E+01, TotOvfVol=.0000E+00, N-Ovf=     0, TotDurOvf=     0.hrs}
012:0051---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * DESIGN STANDHYD    02:402b            6.07    1.259 No_date     6:00   71.32 .760
     [XIMP=.58:TIMP=.73]
     [SLP=2.10:DT= 5.00]
     [LOSS= 1 : HORTONS]
012:0052---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * DESIGN STANDHYD    03:402c            1.19     .246 No_date     6:00   69.12 .736
     [XIMP=.55:TIMP=.68]
     [SLP=2.10:DT= 5.00]
     [LOSS= 1 : HORTONS]
012:0053---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            02:402b            6.07    1.259 No_date     6:00   71.32  n/a
                     + 03:402c            1.19     .246 No_date     6:00   69.12  n/a
     [DT= 5.00]  SUM=  04:400-OS          7.26    1.505 No_date     6:00   70.96  n/a
012:0054---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 04:400-OS          7.26    1.505 No_date     6:00   70.96  n/a
     [RDT= 5.00] out<- 02:OSSTOR          7.26     .808 No_date     6:05   71.11  n/a
            overflow <= 03:OSOVF           .00     .000 No_date     0:00     .00  n/a
    {MxStoUsed=.9819E-01, TotOvfVol=.0000E+00, N-Ovf=     0, TotDurOvf=     0.hrs}
012:0055---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       03:401            16.78     .379 No_date     7:50   36.59 .390
     [CN= 68.0: N= 3.00]
     [Tp= 1.66:DT= 5.00]
012:0056---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:POND2          17.13     .084 No_date     9:05   67.43  n/a
                     + 02:OSSTOR          7.26     .808 No_date     6:05   71.11  n/a
                     + 03:401            16.78     .379 No_date     7:50   36.59  n/a
                     + 09:312ADD        234.76     .979 No_date    11:15   31.59  n/a
     [DT= 5.00]  SUM=  04:P2-T3         275.93    1.671 No_date     6:40   35.16  n/a
012:0057---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 04:P2-T3         275.93    1.671 No_date     6:40   35.16  n/a
     [RDT= 5.00] out<- 01:313           275.93    1.581 No_date     6:45   35.16  n/a
     [L/S/n=  423./1.170/.100]
     {Vmax=  .642:Dmax=  .491}
012:0058---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:TRB313           .72     .010 No_date     7:00   35.79 .381
     [CN= 68.0: N= 1.10]
     [Tp=  .34:DT= 5.00]
012:0059---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:313           275.93    1.581 No_date     6:45   35.16  n/a
                     + 02:TRB313           .72     .010 No_date     7:00   35.79  n/a
     [DT= 5.00]  SUM=  03:313ADD        276.65    1.591 No_date     6:45   35.16  n/a
012:0060---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       04:TRB314           .94     .010 No_date     7:30   35.79 .381
     [CN= 68.0: N= 1.10]
     [Tp=  .46:DT= 5.00]
012:0061---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:313           275.93    1.581 No_date     6:45   35.16  n/a
                     + 02:TRB313           .72     .010 No_date     7:00   35.79  n/a
     [DT= 5.00]  SUM=  03:313ADD        276.65    1.591 No_date     6:45   35.16  n/a
012:0062---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       04:403a            2.66     .051 No_date     6:45   40.46 .431
     [CN= 70.0: N= 1.10]
     [Tp=  .27:DT= 5.00]
012:0063---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            10:T2-US         442.59    1.023 No_date    12:15   39.82  n/a
                     + 03:313ADD        276.65    1.591 No_date     6:45   35.16  n/a
                     + 04:403a            2.66     .051 No_date     6:45   40.46  n/a
     [DT= 5.00]  SUM=  01:CONFLU        721.90    2.367 No_date     9:00   38.04  n/a
012:0064---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * DESIGN STANDHYD    01:203d            1.26     .262 No_date     6:00   69.86 .744
     [XIMP=.56:TIMP=.70]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
012:0065---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    02:501a            9.32    2.009 No_date     6:00   83.38 .888
     [XIMP=.74:TIMP=.93]
     [SLP= .80:DT= 5.00]
     [LOSS= 1 : HORTONS]
012:0066---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    COMPUTE DUALHYD    02:501a            9.32    2.009 No_date     6:00   83.38  n/a
       Major System /  03:OSSTOR           .00     .000 No_date     0:00     .00  n/a
       Minor System \  04:TOPOND          9.32    2.009 No_date     6:00   83.38  n/a
     {MjSysSto=.0000E+00, TotOvfVol=.0000E+00, N-Ovf=     0, TotDurOvf=     0.hrs}
012:0067---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    05:501b           38.42    7.538 No_date     6:00   68.56 .730
     [XIMP=.54:TIMP=.67]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
012:0068---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    06:501c           39.10    7.579 No_date     6:00   66.85 .712
     [XIMP=.51:TIMP=.64]
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      [SLP=2.30:DT= 5.00]
      [LOSS= 1 : HORTONS]
 012:0069---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  DESIGN STANDHYD    07:MR1            3.32     .739 No_date    6:00   90.88 .968
      [XIMP=.80:TIMP=.99]
      [SLP=1.00:DT= 5.00]
      [LOSS= 1 : HORTONS]
 012:0070---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  DESIGN STANDHYD    08:MR2            3.04     .677 No_date    6:00   90.88 .968
      [XIMP=.80:TIMP=.99]
      [SLP=1.00:DT= 5.00]
      [LOSS= 1 : HORTONS]
 012:0071---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:203d           1.26     .262 No_date    6:00   69.86  n/a
                    +  05:501b           38.42    7.538 No_date    6:00   68.56  n/a
                    +  07:MR1             3.32     .739 No_date    6:00   90.88  n/a
      [DT= 5.00]  SUM=  10:VALE          43.00    8.539 No_date    6:00   70.32  n/a
 012:0072---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            04:TOPOND         9.32    2.009 No_date    6:00   83.38  n/a
                    +  06:501c           39.10    7.579 No_date    6:00   66.85  n/a
                    +  08:MR2             3.04     .677 No_date    6:00   90.88  n/a
      [DT= 5.00]  SUM=  09:MET           51.46   10.265 No_date    6:00   71.26  n/a
 012:0073---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     DESIGN STANDHYD    01:POND3         11.89    2.029 No_date    6:00   75.32 .802
      [XIMP=.64:TIMP=.80]
      [SLP= .10:DT= 5.00]
      [LOSS= 1 : HORTONS]
 012:0074---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            10:VALE          43.00    8.539 No_date    6:00   70.32  n/a
                    +  09:MET           51.46   10.265 No_date    6:00   71.26  n/a
                    +  01:POND3         11.89    2.029 No_date    6:00   75.32  n/a
      [DT= 5.00]  SUM=  08:P3ADD        106.35   20.833 No_date    6:00   71.34  n/a
 012:0075---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 08:P3ADD        106.35   20.833 No_date    6:00   71.34  n/a
      [RDT= 5.00] out<- 01:POND3        106.35    1.043 No_date    7:35   71.33  n/a
            overflow <= 02:E-OVF           .00     .000 No_date    0:00     .00  n/a
     {MxStoUsed=.6107E+01, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
  ** END OF RUN :  12

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 RUN:COMMAND#
 013:0001------------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =  13 ]
#******************************************************************************
#  Project Name: [Kanata North]    Project Number: [112117]
#  Date        : 03-30-2016
#  Modeller    : [Kallie Auld]
#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
#  License #   :  5320763
#******************************************************************************
#******************************************************************************
 013:0002------------------------------------------------------------------------------
     READ STORM

      Filename = STORM.001
      Comment  =
      [SDT=60.00:SDUR=  24.00:PTOT=  25.05]
 013:0003------------------------------------------------------------------------------
     DEFAULT VALUES
      Filename = M:\2012\112117\data\CALCUL~1\swmhymo\POSTDE~1\OTTAWA.DEF
      ICASEdv  = 1 (read and print data)
      FileTitle= ------ ENTER YOUR COMMENTS ON THIS LINE AND THE NEXT ONE ---
                ------ PARAMETER VALUES MUST BE ENTERD AFTER COLUMN 60 ----_
      Horton's infiltration equation parameters:
      [Fo= 76.20 mm/hr] [Fc=13.20 mm/hr] [DCAY= 4.14 /hr] [F=  .00 mm]
      Parameters for PERVIOUS surfaces in STANDHYD:
      [IAper=   4.67 mm] [LGP=40.00 m] [MNP= .250]
      Parameters for IMPERVIOUS surfaces in STANDHYD:
      [IAimp=   1.57 mm] [CLI= 1.50]   [MNI= .013]
      Parameters used in NASHYD:
      [Ia=   4.67 mm] [N= 3.00]
 013:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:201          115.14     .008 No_date   24:00    1.24 .049
      [CN= 65.0: N= 1.10]
      [Tp= 3.42:DT= 5.00]
 013:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 01:201          115.14     .008 No_date   24:00    1.24  n/a
      [RDT= 5.00] out<- 02:210          115.14     .008 No_date   24:25    1.24  n/a
      [L/S/n=  558./ .890/.040]
      {Vmax=  .423:Dmax=  .004}
 013:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:202          263.64     .026 No_date   24:00    2.39 .095
      [CN= 70.0: N= 1.10]
      [Tp= 5.14:DT= 5.00]
 013:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:202          263.64     .026 No_date   24:00    2.39  n/a
                    +  02:210          115.14     .008 No_date   24:25    1.24  n/a
      [DT= 5.00]  SUM=  03:210add       378.78     .035 No_date   24:15    2.04  n/a
 013:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:210add       378.78     .035 No_date   24:15    2.04  n/a
      [RDT= 5.00] out<- 01:211          378.78     .035 No_date   24:50    2.04  n/a
      [L/S/n=  450./1.000/.100]
      {Vmax=  .288:Dmax=  .024}
 013:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:211            1.87     .001 No_date   18:05    3.11 .124
      [CN= 76.0: N= 1.10]
      [Tp= 1.17:DT= 5.00]
 013:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:211          378.78     .035 No_date   24:50    2.04  n/a
                    +  02:211            1.87     .001 No_date   18:05    3.11  n/a
      [DT= 5.00]  SUM=  03:211add       380.65     .035 No_date   24:45    2.04  n/a
 013:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:211add       380.65     .035 No_date   24:45    2.04  n/a
      [RDT= 5.00] out<- 01:212          380.65     .035 No_date   25:00    2.04  n/a
      [L/S/n=  230./1.000/.100]
      {Vmax=  .288:Dmax=  .024}
 013:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:212             .95     .000 No_date   16:00    1.78 .071
      [CN= 66.0: N= 1.10]
      [Tp=  .56:DT= 5.00]
 013:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:212          380.65     .035 No_date   25:00    2.04  n/a
                    +  02:212             .95     .000 No_date   16:00    1.78  n/a
      [DT= 5.00]  SUM=  03:212add       381.60     .036 No_date   24:55    2.04  n/a
 013:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:212add       381.60     .036 No_date   24:55    2.04  n/a
      [RDT= 5.00] out<- 01:213          381.60     .035 No_date   25:20    2.04  n/a
      [L/S/n=  330./1.000/.100]
      {Vmax=  .288:Dmax=  .024}
 013:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:213            1.43     .000 No_date   18:00    1.74 .070
      [CN= 66.0: N= 1.10]
      [Tp=  .67:DT= 5.00]
 013:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:213          381.60     .035 No_date   25:20    2.04  n/a
                    +  02:213            1.43     .000 No_date   18:00    1.74  n/a
      [DT= 5.00]  SUM=  09:TRIB2        383.03     .036 No_date   25:15    2.04  n/a
 013:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  DESIGN STANDHYD    01:203a          27.32     .403 No_date   12:00   11.74 .469
      [XIMP=.50:TIMP=.63]
      [SLP=2.30:DT= 5.00]
      [LOSS= 1 : HORTONS]
 013:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
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 *  DESIGN STANDHYD    02:203b          20.76     .295 No_date   12:00   11.27 .450
     [XIMP=.48:TIMP=.60]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
013:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD    03:203c           4.95     .084 No_date   12:00   13.38 .534
     [XIMP=.57:TIMP=.71]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
013:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    04:POND1          2.68     .050 No_date   12:00   15.11 .603
     [XIMP=.64:TIMP=.80]
     [SLP= .10:DT= 5.00]
     [LOSS= 1 : HORTONS]
013:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            02:203b          20.76     .295 No_date   12:00   11.27  n/a
                     + 03:203c           4.95     .084 No_date   12:00   13.38  n/a
     [DT= 5.00]  SUM=  05:T2CRS         25.71     .379 No_date   12:00   11.68  n/a
013:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:203a          27.32     .403 No_date   12:00   11.74  n/a
                     + 04:POND1          2.68     .050 No_date   12:00   15.11  n/a
                     + 05:T2CRS         25.71     .379 No_date   12:00   11.68  n/a
     [DT= 5.00]  SUM=  06:P1FLOW        55.71     .832 No_date   12:00   11.87  n/a
013:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 06:P1FLOW        55.71     .832 No_date   12:00   11.87  n/a
     [RDT= 5.00] out<- 01:POND1         55.71     .027 No_date   21:10   11.87  n/a
           overflow <= 02:P1-OVF          .00     .000 No_date    0:00     .00  n/a
    {MxStoUsed=.5459E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
013:0024---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:POND1         55.71     .027 No_date   21:10   11.87  n/a
                     + 09:TRIB2        383.03     .036 No_date   25:15    2.04  n/a
     [DT= 5.00]  SUM=  02:213ADD       438.74     .062 No_date   24:35    3.29  n/a
013:0025---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 02:213ADD       438.74     .062 No_date   24:35    3.29  n/a
     [RDT= 5.00] out<- 01:214          438.74     .062 No_date   24:55    3.29  n/a
     [L/S/n=  390./1.700/.100]
     {Vmax=  .376:Dmax=  .033}
013:0026---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       03:214            1.61     .002 No_date   13:00    2.27 .090
     [CN= 72.0: N= 1.10]
     [Tp=  .17:DT= 5.00]
013:0027---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:214          438.74     .062 No_date   24:55    3.29  n/a
                     + 03:214            1.61     .002 No_date   13:00    2.27  n/a
     [DT= 5.00]  SUM=  02:214ADD       440.35     .062 No_date   24:45    3.28  n/a
013:0028---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 02:214ADD       440.35     .062 No_date   24:45    3.28  n/a
     [RDT= 5.00] out<- 01:215          440.35     .062 No_date   24:55    3.28  n/a
     [L/S/n=  260./1.400/.100]
     {Vmax=  .341:Dmax=  .036}
013:0029---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:TRB215         1.12     .001 No_date   13:00    1.43 .057
     [CN= 66.0: N= 1.10]
     [Tp=  .17:DT= 5.00]
013:0030---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:215          440.35     .062 No_date   24:55    3.28  n/a
                     + 02:TRB215         1.12     .001 No_date   13:00    1.43  n/a
     [DT= 5.00]  SUM=  03:215ADD       441.47     .062 No_date   24:50    3.28  n/a
013:0031---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:215ADD       441.47     .062 No_date   24:50    3.28  n/a
     [RDT= 5.00] out<- 01:216          441.47     .062 No_date   25:10    3.28  n/a
     [L/S/n=  250./ .500/.100]
     {Vmax=  .204:Dmax=  .060}
013:0032---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:TRB216         1.12     .000 No_date   13:05    1.20 .048
     [CN= 65.0: N= 1.10]
     [Tp=  .17:DT= 5.00]
013:0033---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:216          441.47     .062 No_date   25:10    3.28  n/a
                     + 02:TRB216         1.12     .000 No_date   13:05    1.20  n/a
     [DT= 5.00]  SUM=  10:T2-US        442.59     .062 No_date   25:05    3.27  n/a
```

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013:0034---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:301           86.43     .010 No_date   22:00    1.00 .040
     [CN= 63.0: N= 1.10]
     [Tp= 1.24:DT= 5.00]
013:0035---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:302           80.69     .010 No_date   24:00    1.28 .051
     [CN= 64.0: N= 1.10]
     [Tp= 1.80:DT= 5.00]
013:0036---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:301           86.43     .010 No_date   22:00    1.00  n/a
                     + 02:302           80.69     .010 No_date   24:00    1.28  n/a
     [DT= 5.00]  SUM=  03:300a         167.12     .020 No_date   22:50    1.13  n/a
013:0037---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300a         167.12     .020 No_date   22:50    1.13  n/a
     [RDT= 5.00] out<- 01:310          167.12     .020 No_date   23:15    1.13  n/a
     [L/S/n=  449./1.620/.040]
     {Vmax=  .430:Dmax=  .011}
013:0038---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:303           65.19     .015 No_date   21:00    2.00 .080
     [CN= 69.0: N= 1.10]
     [Tp= 1.31:DT= 5.00]
013:0039---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:310          167.12     .020 No_date   23:15    1.13  n/a
                     + 02:303           65.19     .015 No_date   21:00    2.00  n/a
     [DT= 5.00]  SUM=  03:300b         232.31     .035 No_date   22:00    1.38  n/a
013:0040---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300b         232.31     .035 No_date   22:00    1.38  n/a
     [RDT= 5.00] out<- 01:311          232.31     .035 No_date   22:10    1.38  n/a
     [L/S/n=  270./1.170/.100]
     {Vmax=  .312:Dmax=  .022}
013:0041---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:TRB311         1.15     .000 No_date   16:00    1.62 .065
     [CN= 65.0: N= 1.10]

     [Tp=  .52:DT= 5.00]
013:0042---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:311          232.31     .035 No_date   22:10    1.38  n/a
                     + 02:TRB311         1.15     .000 No_date   16:00    1.62  n/a
     [DT= 5.00]  SUM=  03:311ADD       233.46     .035 No_date   22:05    1.38  n/a
013:0043---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:311ADD       233.46     .035 No_date   22:05    1.38  n/a
     [RDT= 5.00] out<- 01:312          233.46     .035 No_date   22:20    1.38  n/a
     [L/S/n=  270./1.170/.100]
     {Vmax=  .312:Dmax=  .022}
013:0044---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:TRB312         1.30     .001 No_date   16:00    3.14 .125
     [CN= 76.0: N= 1.10]
     [Tp=  .64:DT= 5.00]
013:0045---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:312          233.46     .035 No_date   22:20    1.38  n/a
                     + 02:TRB312         1.30     .001 No_date   16:00    3.14  n/a
     [DT= 5.00]  SUM=  09:312ADD       234.76     .036 No_date   22:15    1.39  n/a
013:0046---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD    01:304a           9.61     .131 No_date   12:00   10.80 .431
     [XIMP=.46:TIMP=.57]
     [SLP=1.60:DT= 5.00]
     [LOSS= 1 : HORTONS]
013:0047---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD    02:402a           5.67     .098 No_date   12:00   13.62 .544
     [XIMP=.58:TIMP=.73]
     [SLP=2.10:DT= 5.00]
     [LOSS= 1 : HORTONS]
013:0048---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    03:POND2          1.85     .035 No_date   12:00   15.11 .603
     [XIMP=.64:TIMP=.80]
     [SLP= .10:DT= 5.00]
     [LOSS= 1 : HORTONS]
013:0049---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:304a           9.61     .131 No_date   12:00   10.80  n/a
                     + 02:402a           5.67     .098 No_date   12:00   13.62  n/a
                     + 03:POND2          1.85     .035 No_date   12:00   15.11  n/a
```

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   [DT= 5.00]  SUM=  04:P2FLOW        17.13     .263 No_date   12:00   12.20  n/a
013:0050---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 04:P2FLOW       17.13     .263 No_date   12:00   12.20  n/a
     [RDT= 5.00] out<- 01:POND2        17.13     .002 No_date   24:10   12.20  n/a
           overflow <= 02:P2OVF          .00     .000 No_date    0:00     .00  n/a
    {MxStoUsed=.1982E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
013:0051---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD    02:402b          6.07     .105 No_date   12:00   13.62 .544
     [XIMP=.58:TIMP=.73]
     [SLP=2.10:DT= 5.00]
     [LOSS= 1 : HORTONS]
013:0052---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD    03:402c          1.19     .019 No_date   11:55   12.91 .516
     [XIMP=.55:TIMP=.68]
     [SLP=2.10:DT= 5.00]
     [LOSS= 1 : HORTONS]
013:0053---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            02:402b          6.07     .105 No_date   12:00   13.62  n/a
                     + 03:402c          1.19     .019 No_date   11:55   12.91  n/a
     [DT= 5.00]  SUM=  04:400-OS        7.26     .124 No_date   12:00   13.50  n/a
013:0054---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 04:400-OS        7.26     .124 No_date   12:00   13.50  n/a
     [RDT= 5.00] out<- 02:OSSTOR        7.26     .124 No_date   12:00   13.50  n/a
           overflow <= 03:OSOVF          .00     .000 No_date    0:00     .00  n/a
    {MxStoUsed=.7753E-03, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
013:0055---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       03:401          16.78     .017 No_date   14:05    2.37 .095
     [CN= 68.0: N= 3.00]
     [Tp= 1.66:DT= 5.00]
013:0056---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:POND2        17.13     .002 No_date   24:10   12.20  n/a
                     + 02:OSSTOR        7.26     .124 No_date   12:00   13.50  n/a
                     + 03:401          16.78     .017 No_date   14:05    2.37  n/a
                     + 09:312ADD      234.76     .036 No_date   22:15    1.39  n/a
     [DT= 5.00]  SUM=  04:P2-T3       275.93     .130 No_date   12:00    2.44  n/a
013:0057---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 04:P2-T3       275.93     .130 No_date   12:00    2.44  n/a
     [RDT= 5.00] out<- 01:313         275.93     .115 No_date   12:05    2.44  n/a
     [L/S/n=  423./1.170/.100]
     {Vmax=  .312:Dmax=  .082}
013:0058---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:TRB313         .72     .000 No_date   14:00    2.07 .083
     [CN= 68.0: N= 1.10]
     [Tp=  .34:DT= 5.00]
013:0059---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:313         275.93     .115 No_date   12:05    2.44  n/a
                     + 02:TRB313         .72     .000 No_date   14:00    2.07  n/a
     [DT= 5.00]  SUM=  03:313ADD      276.65     .115 No_date   12:05    2.44  n/a
013:0060---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       04:TRB314         .94     .000 No_date   14:20    2.07 .083
     [CN= 68.0: N= 1.10]
     [Tp=  .46:DT= 5.00]
013:0061---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:313         275.93     .115 No_date   12:05    2.44  n/a
                     + 02:TRB313         .72     .000 No_date   14:00    2.07  n/a
     [DT= 5.00]  SUM=  03:313ADD      276.65     .115 No_date   12:05    2.44  n/a
013:0062---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       04:403a          2.66     .003 No_date   13:00    3.32 .133
     [CN= 70.0: N= 1.10]
     [Tp=  .27:DT= 5.00]
013:0063---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            10:T2-US       442.59     .062 No_date   25:05    3.27  n/a
                     + 03:313ADD      276.65     .115 No_date   12:05    2.44  n/a
                     + 04:403a          2.66     .003 No_date   13:00    3.32  n/a
     [DT= 5.00]  SUM=  01:CONFLU      721.90     .127 No_date   12:05    2.95  n/a
013:0064---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD    01:203d          1.26     .021 No_date   11:55   13.15 .525
     [XIMP=.56:TIMP=.70]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
013:0065---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    02:501a          9.32     .240 No_date   12:00   19.01 .759
     [XIMP=.74:TIMP=.93]
     [SLP= .80:DT= 5.00]
     [LOSS= 1 : HORTONS]
013:0066---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    COMPUTE DUALHYD    02:501a          9.32     .240 No_date   12:00   19.01  n/a
       Major System /  03:OSSTOR         .00     .000 No_date    0:00     .00  n/a
       Minor System \  04:TOPOND        9.32     .240 No_date   12:00   19.01  n/a
     {MjSysSto=.0000E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
013:0067---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD    05:501b         38.42     .608 No_date   12:00   12.68 .506
     [XIMP=.54:TIMP=.67]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
013:0068---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD    06:501c         39.10     .584 No_date   12:00   11.97 .478
     [XIMP=.51:TIMP=.64]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
013:0069---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    07:MR1           3.32     .097 No_date   12:00   21.53 .859
     [XIMP=.80:TIMP=.99]
     [SLP=1.00:DT= 5.00]
     [LOSS= 1 : HORTONS]
013:0070---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    08:MR2           3.04     .089 No_date   12:00   21.53 .859
     [XIMP=.80:TIMP=.99]
     [SLP=1.00:DT= 5.00]
     [LOSS= 1 : HORTONS]
013:0071---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:203d          1.26     .021 No_date   11:55   13.15  n/a
                     + 05:501b         38.42     .608 No_date   12:00   12.68  n/a
                     + 07:MR1           3.32     .097 No_date   12:00   21.53  n/a
     [DT= 5.00]  SUM=  10:VALE         43.00     .726 No_date   12:00   13.38  n/a
013:0072---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            04:TOPOND        9.32     .240 No_date   12:00   19.01  n/a
                     + 06:501c         39.10     .584 No_date   12:00   11.97  n/a
                     + 08:MR2           3.04     .089 No_date   12:00   21.53  n/a
     [DT= 5.00]  SUM=  09:MET          51.46     .913 No_date   12:00   13.81  n/a
013:0073---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    01:POND3        11.89     .201 No_date   12:05   15.11 .603
     [XIMP=.64:TIMP=.80]
     [SLP= .10:DT= 5.00]
     [LOSS= 1 : HORTONS]
013:0074---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            10:VALE         43.00     .726 No_date   12:00   13.38  n/a
                     + 09:MET          51.46     .913 No_date   12:00   13.81  n/a
                     + 01:POND3        11.89     .201 No_date   12:05   15.11  n/a
     [DT= 5.00]  SUM=  08:P3ADD       106.35    1.840 No_date   12:00   13.78  n/a
013:0075---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 08:P3ADD       106.35    1.840 No_date   12:00   13.78  n/a
     [RDT= 5.00] out<- 01:POND3       106.35     .046 No_date   22:15   13.78  n/a
           overflow <= 02:E-OVF          .00     .000 No_date    0:00     .00  n/a
    {MxStoUsed=.1264E+01, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
 ** END OF RUN :  13

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




 RUN:COMMAND#
 014:0001----------------------------------------------------------------------
    START
     [TZERO =    .00 hrs on        0]
     [METOUT=   2    (1=imperial, 2=metric output)]
     [NSTORM=   1 ]
     [NRUN  =  14 ]
#******************************************************************************
#  Project Name: [Kanata North]    Project Number: [112117]
```

```
#  Date        : 03-30-2016
#  Modeller    : [Kallie Auld]
#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
#  License #   :  5320763
#******************************************************************************
#******************************************************************************
 014:0002-----------------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  =
      [SDT=60.00:SDUR=  24.00:PTOT=  48.02]
 014:0003-----------------------------------------------------------------------------
     DEFAULT VALUES
      Filename = M:\2012\112117\data\CALCUL~1\swmhymo\POSTDE~1\OTTAWA.DEF
      ICASEdv  = 1 (read and print data)
      FileTitle= ------ ENTER YOUR COMMENTS ON THIS LINE AND THE NEXT ONE ---
                 ------ PARAMETER VALUES MUST BE ENTERD AFTER COLUMN 60 ----_
      Horton's infiltration equation parameters:
      [Fo= 76.20 mm/hr] [Fc=13.20 mm/hr] [DCAY= 4.14 /hr] [F=  .00 mm]
      Parameters for PERVIOUS surfaces in STANDHYD:
      [IAper=   4.67 mm] [LGP=40.00 m] [MNP= .250]
      Parameters for IMPERVIOUS surfaces in STANDHYD:
      [IAimp=   1.57 mm] [CLI= 1.50]   [MNI= .013]
      Parameters used in NASHYD:
      [Ia=   4.67 mm] [N= 3.00]
 014:0004--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:201          115.14     .052 No_date   24:00    7.73 .161
      [CN= 65.0: N= 1.10]
      [Tp= 3.42:DT= 5.00]
 014:0005--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 01:201          115.14     .052 No_date   24:00    7.73  n/a
      [RDT= 5.00] out<- 02:210          115.14     .052 No_date   24:15    7.73  n/a
      [L/S/n=  558./ .890/.040]
      {Vmax=  .423:Dmax=  .024}
 014:0006--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:202          263.64     .120 No_date   24:00   10.90 .227
      [CN= 70.0: N= 1.10]
      [Tp= 5.14:DT= 5.00]
 014:0007--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:202          263.64     .120 No_date   24:00   10.90  n/a
                     +  02:210          115.14     .052 No_date   24:15    7.73  n/a
      [DT= 5.00]  SUM=  03:210add       378.78     .172 No_date   24:05    9.94  n/a
 014:0008--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:210add       378.78     .172 No_date   24:05    9.94  n/a
      [RDT= 5.00] out<- 01:211          378.78     .172 No_date   24:35    9.94  n/a
      [L/S/n=  450./1.000/.100]
      {Vmax=  .288:Dmax=  .117}
 014:0009--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:211            1.87     .003 No_date   18:00   13.54 .282
      [CN= 76.0: N= 1.10]
      [Tp= 1.17:DT= 5.00]
 014:0010--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:211          378.78     .172 No_date   24:35    9.94  n/a
                     +  02:211            1.87     .003 No_date   18:00   13.54  n/a
      [DT= 5.00]  SUM=  03:211add       380.65     .174 No_date   24:30    9.95  n/a
 014:0011--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:211add       380.65     .174 No_date   24:30    9.95  n/a
      [RDT= 5.00] out<- 01:212          380.65     .174 No_date   24:45    9.95  n/a
      [L/S/n=  230./1.000/.100]
      {Vmax=  .288:Dmax=  .119}
 014:0012--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:212             .95     .002 No_date   14:00    9.03 .188
      [CN= 66.0: N= 1.10]
      [Tp=  .56:DT= 5.00]
 014:0013--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:212          380.65     .174 No_date   24:45    9.95  n/a
                     +  02:212             .95     .002 No_date   14:00    9.03  n/a
      [DT= 5.00]  SUM=  03:212add       381.60     .175 No_date   24:40    9.95  n/a
 014:0014--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:212add       381.60     .175 No_date   24:40    9.95  n/a
      [RDT= 5.00] out<- 01:213          381.60     .175 No_date   25:00    9.95  n/a
      [L/S/n=  330./1.000/.100]
      {Vmax=  .288:Dmax=  .120}
 014:0015--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:213            1.43     .002 No_date   15:00    8.96 .187
      [CN= 66.0: N= 1.10]
      [Tp=  .67:DT= 5.00]
 014:0016--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:213          381.60     .175 No_date   25:00    9.95  n/a
                     +  02:213            1.43     .002 No_date   15:00    8.96  n/a
      [DT= 5.00]  SUM=  09:TRIB2        383.03     .176 No_date   24:55    9.95  n/a
 014:0017--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     DESIGN STANDHYD    01:203a          27.32    1.005 No_date   12:00   26.23 .546
      [XIMP=.50:TIMP=.63]
      [SLP=2.30:DT= 5.00]
      [LOSS= 1 : HORTONS]
 014:0018--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     DESIGN STANDHYD    02:203b          20.76     .730 No_date   12:00   25.11 .523
      [XIMP=.48:TIMP=.60]
      [SLP=2.30:DT= 5.00]
      [LOSS= 1 : HORTONS]
 014:0019--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     DESIGN STANDHYD    03:203c           4.95     .212 No_date   12:00   29.74 .619
      [XIMP=.57:TIMP=.71]
      [SLP=2.30:DT= 5.00]
      [LOSS= 1 : HORTONS]
 014:0020--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     DESIGN STANDHYD    04:POND1          2.68     .113 No_date   12:00   33.72 .702
      [XIMP=.64:TIMP=.80]
      [SLP= .10:DT= 5.00]
      [LOSS= 1 : HORTONS]
 014:0021--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            02:203b          20.76     .730 No_date   12:00   25.11  n/a
                     +  03:203c           4.95     .212 No_date   12:00   29.74  n/a
      [DT= 5.00]  SUM=  05:T2CRS         25.71     .941 No_date   12:00   26.00  n/a
 014:0022--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:203a          27.32    1.005 No_date   12:00   26.23  n/a
                     +  04:POND1          2.68     .113 No_date   12:00   33.72  n/a
                     +  05:T2CRS         25.71     .941 No_date   12:00   26.00  n/a
      [DT= 5.00]  SUM=  06:P1FLOW        55.71    2.059 No_date   12:00   26.48  n/a
 014:0023--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 06:P1FLOW        55.71    2.059 No_date   12:00   26.48  n/a
      [RDT= 5.00] out<- 01:POND1         55.71     .088 No_date   16:15   26.48  n/a
            overflow <= 02:P1-OVF          .00     .000 No_date    0:00     .00  n/a
     {MxStoUsed=.1170E+01, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
 014:0024--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:POND1         55.71     .088 No_date   16:15   26.48  n/a
                     +  09:TRIB2        383.03     .176 No_date   24:55    9.95  n/a
      [DT= 5.00]  SUM=  02:213ADD       438.74     .254 No_date   24:05   12.05  n/a
 014:0025--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 02:213ADD       438.74     .254 No_date   24:05   12.05  n/a
      [RDT= 5.00] out<- 01:214          438.74     .254 No_date   24:15   12.05  n/a
      [L/S/n=  390./1.700/.100]
      {Vmax=  .376:Dmax=  .133}
 014:0026--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       03:214            1.61     .009 No_date   13:00   11.10 .231
      [CN= 72.0: N= 1.10]
      [Tp=  .17:DT= 5.00]
 014:0027--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:214          438.74     .254 No_date   24:15   12.05  n/a
                     +  03:214            1.61     .009 No_date   13:00   11.10  n/a
      [DT= 5.00]  SUM=  02:214ADD       440.35     .255 No_date   24:00   12.04  n/a
 014:0028--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 02:214ADD       440.35     .255 No_date   24:00   12.04  n/a
      [RDT= 5.00] out<- 01:215          440.35     .255 No_date   24:10   12.04  n/a
      [L/S/n=  260./1.400/.100]
      {Vmax=  .341:Dmax=  .147}
 014:0029--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:TRB215         1.12     .004 No_date   13:00    8.32 .173
      [CN= 66.0: N= 1.10]
      [Tp=  .17:DT= 5.00]
 014:0030--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
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    ADD HYD           01:215         440.35     .255 No_date   24:10   12.04  n/a
                    + 02:TRB215        1.12     .004 No_date   13:00    8.32  n/a
     [DT= 5.00]  SUM=  03:215ADD     441.47     .255 No_date   24:00   12.03  n/a
014:0031---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:215ADD     441.47     .255 No_date   24:00   12.03  n/a
     [RDT= 5.00] out<- 01:216        441.47     .255 No_date   24:10   12.03  n/a
     [L/S/n=  250./ .500/.100]
     {Vmax=  .225:Dmax=  .199}
014:0032---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD      02:TRB216        1.12     .004 No_date   13:00    7.65 .159
     [CN= 65.0: N= 1.10]
     [Tp=  .17:DT= 5.00]
014:0033---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           01:216         441.47     .255 No_date   24:10   12.03  n/a
                    + 02:TRB216        1.12     .004 No_date   13:00    7.65  n/a
     [DT= 5.00]  SUM=  10:T2-US      442.59     .256 No_date   24:05   12.02  n/a
014:0034---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD      01:301          86.43     .072 No_date   18:00    6.90 .144
     [CN= 63.0: N= 1.10]
     [Tp= 1.24:DT= 5.00]
014:0035---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD      02:302          80.69     .058 No_date   21:00    7.66 .159
     [CN= 64.0: N= 1.10]
     [Tp= 1.80:DT= 5.00]
014:0036---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           01:301          86.43     .072 No_date   18:00    6.90  n/a
                    + 02:302          80.69     .058 No_date   21:00    7.66  n/a
     [DT= 5.00]  SUM=  03:300a       167.12     .128 No_date   19:00    7.27  n/a
014:0037---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300a       167.12     .128 No_date   19:00    7.27  n/a
     [RDT= 5.00] out<- 01:310        167.12     .128 No_date   19:05    7.27  n/a
     [L/S/n=  449./1.620/.040]
     {Vmax=  .438:Dmax=  .064}
014:0038---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD      02:303          65.19     .076 No_date   18:00    9.99 .208
     [CN= 69.0: N= 1.10]
     [Tp= 1.31:DT= 5.00]
014:0039---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           01:310         167.12     .128 No_date   19:05    7.27  n/a
                    + 02:303          65.19     .076 No_date   18:00    9.99  n/a
     [DT= 5.00]  SUM=  03:300b       232.31     .204 No_date   18:30    8.03  n/a
014:0040---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300b       232.31     .204 No_date   18:30    8.03  n/a
     [RDT= 5.00] out<- 01:311        232.31     .204 No_date   18:55    8.03  n/a
     [L/S/n=  270./1.170/.100]
     {Vmax=  .312:Dmax=  .129}
014:0041---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD      02:TRB311        1.15     .002 No_date   14:00    8.54 .178
     [CN= 65.0: N= 1.10]
     [Tp=  .52:DT= 5.00]
014:0042---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           01:311         232.31     .204 No_date   18:55    8.03  n/a
                    + 02:TRB311        1.15     .002 No_date   14:00    8.54  n/a
     [DT= 5.00]  SUM=  03:311ADD     233.46     .206 No_date   18:50    8.03  n/a
014:0043---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:311ADD     233.46     .206 No_date   18:50    8.03  n/a
     [RDT= 5.00] out<- 01:312        233.46     .205 No_date   19:05    8.03  n/a
     [L/S/n=  270./1.170/.100]
     {Vmax=  .312:Dmax=  .130}
014:0044---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD      02:TRB312        1.30     .004 No_date   14:05   13.59 .283
     [CN= 76.0: N= 1.10]
     [Tp=  .64:DT= 5.00]
014:0045---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           01:312         233.46     .205 No_date   19:05    8.03  n/a
                    + 02:TRB312        1.30     .004 No_date   14:05   13.59  n/a
     [DT= 5.00]  SUM=  09:312ADD     234.76     .208 No_date   19:05    8.06  n/a
014:0046---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD   01:304a          9.61     .320 No_date   12:00   23.99 .500
     [XIMP=.46:TIMP=.57]
     [SLP=1.60:DT= 5.00]
     [LOSS= 1 : HORTONS]
014:0047---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD   02:402a          5.67     .248 No_date   12:00   30.47 .634
     [XIMP=.58:TIMP=.73]
     [SLP=2.10:DT= 5.00]
     [LOSS= 1 : HORTONS]
014:0048---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD   03:POND2         1.85     .079 No_date   12:00   33.72 .702
     [XIMP=.64:TIMP=.80]
     [SLP= .10:DT= 5.00]
     [LOSS= 1 : HORTONS]
014:0049---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           01:304a          9.61     .320 No_date   12:00   23.99  n/a
                    + 02:402a          5.67     .248 No_date   12:00   30.47  n/a
                    + 03:POND2         1.85     .079 No_date   12:00   33.72  n/a
     [DT= 5.00]  SUM=  04:P2FLOW      17.13     .647 No_date   12:00   27.18  n/a
014:0050---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 04:P2FLOW      17.13     .647 No_date   12:00   27.18  n/a
     [RDT= 5.00] out<- 01:POND2       17.13     .016 No_date   21:05   27.18  n/a
           overflow <= 02:P2OVF         .00     .000 No_date    0:00     .00  n/a
    {MxStoUsed=.4018E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
014:0051---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD   02:402b          6.07     .266 No_date   12:00   30.47 .634
     [XIMP=.58:TIMP=.73]
     [SLP=2.10:DT= 5.00]
     [LOSS= 1 : HORTONS]
014:0052---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD   03:402c          1.19     .049 No_date   12:00   28.56 .595
     [XIMP=.55:TIMP=.68]
     [SLP=2.10:DT= 5.00]
     [LOSS= 1 : HORTONS]
014:0053---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           02:402b          6.07     .266 No_date   12:00   30.47  n/a
                    + 03:402c          1.19     .049 No_date   12:00   28.56  n/a
     [DT= 5.00]  SUM=  04:400-OS       7.26     .315 No_date   12:00   30.15  n/a
014:0054---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 04:400-OS       7.26     .315 No_date   12:00   30.15  n/a
     [RDT= 5.00] out<- 02:OSSTOR       7.26     .314 No_date   12:00   30.15  n/a
           overflow <= 03:OSOVF         .00     .000 No_date    0:00     .00  n/a
    {MxStoUsed=.1978E-02, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
014:0055---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD      03:401          16.78     .085 No_date   13:50   10.48 .218
     [CN= 68.0: N= 3.00]
     [Tp= 1.66:DT= 5.00]
014:0056---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           01:POND2        17.13     .016 No_date   21:05   27.18  n/a
                    + 02:OSSTOR        7.26     .314 No_date   12:00   30.15  n/a
                    + 03:401          16.78     .085 No_date   13:50   10.48  n/a
                    + 09:312ADD      234.76     .208 No_date   19:05    8.06  n/a
     [DT= 5.00]  SUM=  04:P2-T3      275.93     .370 No_date   12:00    9.98  n/a
014:0057---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 04:P2-T3      275.93     .370 No_date   12:00    9.98  n/a
     [RDT= 5.00] out<- 01:313        275.93     .305 No_date   12:05    9.98  n/a
     [L/S/n=  423./1.170/.100]
     {Vmax=  .338:Dmax=  .193}
014:0058---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD      02:TRB313         .72     .002 No_date   13:00    9.94 .207
     [CN= 68.0: N= 1.10]
     [Tp=  .34:DT= 5.00]
014:0059---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           01:313         275.93     .305 No_date   12:05    9.98  n/a
                    + 02:TRB313         .72     .002 No_date   13:00    9.94  n/a
     [DT= 5.00]  SUM=  03:313ADD     276.65     .307 No_date   12:05    9.98  n/a
014:0060---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD      04:TRB314         .94     .002 No_date   14:00    9.94 .207
     [CN= 68.0: N= 1.10]
     [Tp=  .46:DT= 5.00]
014:0061---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           01:313         275.93     .305 No_date   12:05    9.98  n/a
                    + 02:TRB313         .72     .002 No_date   13:00    9.94  n/a
     [DT= 5.00]  SUM=  03:313ADD     276.65     .307 No_date   12:05    9.98  n/a
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014:0062---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD      04:403a           2.66     .013 No_date   13:00   12.53 .261
     [CN= 70.0: N= 1.10]
     [Tp=  .27:DT= 5.00]
014:0063---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           10:T2-US        442.59     .256 No_date   24:05   12.02  n/a
                    + 03:313ADD       276.65     .307 No_date   12:05    9.98  n/a
                    + 04:403a           2.66     .013 No_date   13:00   12.53  n/a
     [DT= 5.00]  SUM= 01:CONFLU       721.90     .509 No_date   18:05   11.24  n/a
014:0064---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD   01:203d           1.26     .054 No_date   12:00   29.26 .609
     [XIMP=.56:TIMP=.70]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
014:0065---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD   02:501a           9.32     .498 No_date   12:00   39.23 .817
     [XIMP=.74:TIMP=.93]
     [SLP= .80:DT= 5.00]
     [LOSS= 1 : HORTONS]
014:0066---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    COMPUTE DUALHYD   02:501a           9.32     .498 No_date   12:00   39.23  n/a
       Major System / 03:OSSTOR          .00     .000 No_date    0:00     .00  n/a
       Minor System \ 04:TOPOND         9.32     .498 No_date   12:00   39.23  n/a
     {MjSysSto=.0000E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
014:0067---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD   05:501b          38.42    1.494 No_date   12:00   28.10 .585
     [XIMP=.54:TIMP=.67]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
014:0068---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD   06:501c          39.10    1.453 No_date   12:00   26.70 .556
     [XIMP=.51:TIMP=.64]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
014:0069---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD   07:MR1            3.32     .188 No_date   12:00   43.77 .912
     [XIMP=.80:TIMP=.99]
     [SLP=1.00:DT= 5.00]
     [LOSS= 1 : HORTONS]
014:0070---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD   08:MR2            3.04     .172 No_date   12:00   43.77 .912
     [XIMP=.80:TIMP=.99]
     [SLP=1.00:DT= 5.00]
     [LOSS= 1 : HORTONS]
014:0071---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           01:203d           1.26     .054 No_date   12:00   29.26  n/a
                    + 05:501b          38.42    1.494 No_date   12:00   28.10  n/a
                    + 07:MR1            3.32     .188 No_date   12:00   43.77  n/a
     [DT= 5.00]  SUM= 10:VALE          43.00    1.736 No_date   12:00   29.34  n/a
014:0072---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           04:TOPOND         9.32     .498 No_date   12:00   39.23  n/a
                    + 06:501c          39.10    1.453 No_date   12:00   26.70  n/a
                    + 08:MR2            3.04     .172 No_date   12:00   43.77  n/a
     [DT= 5.00]  SUM= 09:MET           51.46    2.123 No_date   12:00   29.98  n/a
014:0073---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD   01:POND3         11.89     .471 No_date   12:00   33.72 .702
     [XIMP=.64:TIMP=.80]
     [SLP= .10:DT= 5.00]
     [LOSS= 1 : HORTONS]
014:0074---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD           10:VALE          43.00    1.736 No_date   12:00   29.34  n/a
                    + 09:MET           51.46    2.123 No_date   12:00   29.98  n/a
                    + 01:POND3         11.89     .471 No_date   12:00   33.72  n/a
     [DT= 5.00]  SUM= 08:P3ADD        106.35    4.330 No_date   12:00   30.14  n/a
014:0075---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 08:P3ADD       106.35    4.330 No_date   12:00   30.14  n/a
     [RDT= 5.00] out<- 01:POND3       106.35     .220 No_date   16:05   30.14  n/a
           overflow <= 02:E-OVF          .00     .000 No_date    0:00     .00  n/a
    {MxStoUsed=.2517E+01, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
 ** END OF RUN :  14
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*******************************************************************************



 RUN:COMMAND#
 015:0001------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =  15 ]
#******************************************************************************
#  Project Name: [Kanata North]    Project Number: [112117]
#  Date        : 03-30-2016
#  Modeller    : [Kallie Auld]
#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
#  License #   :  5320763
#******************************************************************************
#******************************************************************************
 015:0002------------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  =
      [SDT=60.00:SDUR=  24.00:PTOT=  61.92]
 015:0003------------------------------------------------------------------------
     DEFAULT VALUES
      Filename = M:\2012\112117\data\CALCUL~1\swmhymo\POSTDE~1\OTTAWA.DEF
      ICASEdv  = 1 (read and print data)
      FileTitle= ------ ENTER YOUR COMMENTS ON THIS LINE AND THE NEXT ONE ---
                 ------ PARAMETER VALUES MUST BE ENTERD AFTER COLUMN 60 ----_
      Horton's infiltration equation parameters:
      [Fo= 76.20 mm/hr] [Fc=13.20 mm/hr] [DCAY= 4.14 /hr] [F=  .00 mm]
      Parameters for PERVIOUS surfaces in STANDHYD:
      [IAper=   4.67 mm] [LGP=40.00 m] [MNP= .250]
      Parameters for IMPERVIOUS surfaces in STANDHYD:
      [IAimp=   1.57 mm] [CLI= 1.50]   [MNI= .013]
      Parameters used in NASHYD:
      [Ia=   4.67 mm] [N= 3.00]
 015:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD      01:201          115.14     .091 No_date   24:00   13.63 .220
      [CN= 65.0: N= 1.10]
      [Tp= 3.42:DT= 5.00]
 015:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 01:201          115.14     .091 No_date   24:00   13.63  n/a
      [RDT= 5.00] out<- 02:210          115.14     .091 No_date   24:10   13.63  n/a
      [L/S/n=  558./ .890/.040]
      {Vmax=  .423:Dmax=  .042}
 015:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD      01:202          263.64     .198 No_date   24:00   18.03 .291
      [CN= 70.0: N= 1.10]
      [Tp= 5.14:DT= 5.00]
 015:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD           01:202          263.64     .198 No_date   24:00   18.03  n/a
                     + 02:210          115.14     .091 No_date   24:10   13.63  n/a
      [DT= 5.00]  SUM= 03:210add       378.78     .289 No_date   24:00   16.69  n/a
 015:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:210add       378.78     .289 No_date   24:00   16.69  n/a
      [RDT= 5.00] out<- 01:211          378.78     .289 No_date   24:25   16.69  n/a
      [L/S/n=  450./1.000/.100]
      {Vmax=  .301:Dmax=  .176}
 015:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD      02:211            1.87     .005 No_date   16:20   21.93 .354
      [CN= 76.0: N= 1.10]
      [Tp= 1.17:DT= 5.00]
 015:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD           01:211          378.78     .289 No_date   24:25   16.69  n/a
                     + 02:211            1.87     .005 No_date   16:20   21.93  n/a
      [DT= 5.00]  SUM= 03:211add       380.65     .293 No_date   24:25   16.72  n/a
 015:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
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     ROUTE CHANNEL   -> 03:211add       380.65     .293 No_date   24:25   16.72  n/a
      [RDT= 5.00] out<- 01:212          380.65     .293 No_date   24:35   16.72  n/a
      [L/S/n=  230./1.000/.100]
      {Vmax=  .302:Dmax=  .177}
 015:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:212             .95     .003 No_date   14:00   15.33 .248
      [CN= 66.0: N= 1.10]
      [Tp=  .56:DT= 5.00]
 015:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:212          380.65     .293 No_date   24:35   16.72  n/a
                     +  02:212             .95     .003 No_date   14:00   15.33  n/a
      [DT= 5.00]  SUM=  03:212add       381.60     .295 No_date   24:30   16.71  n/a
 015:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:212add       381.60     .295 No_date   24:30   16.71  n/a
      [RDT= 5.00] out<- 01:213          381.60     .295 No_date   24:45   16.71  n/a
      [L/S/n=  330./1.000/.100]
      {Vmax=  .302:Dmax=  .178}
 015:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:213            1.43     .004 No_date   14:20   15.23 .246
      [CN= 66.0: N= 1.10]
      [Tp=  .67:DT= 5.00]
 015:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:213          381.60     .295 No_date   24:45   16.71  n/a
                     +  02:213            1.43     .004 No_date   14:20   15.23  n/a
      [DT= 5.00]  SUM=  09:TRIB2        383.03     .297 No_date   24:40   16.71  n/a
 015:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     DESIGN STANDHYD    01:203a          27.32    1.537 No_date   12:00   37.07 .599
      [XIMP=.50:TIMP=.63]
      [SLP=2.30:DT= 5.00]
      [LOSS= 1 : HORTONS]
 015:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     DESIGN STANDHYD    02:203b          20.76    1.136 No_date   12:00   35.67 .576
      [XIMP=.48:TIMP=.60]
      [SLP=2.30:DT= 5.00]
      [LOSS= 1 : HORTONS]
 015:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  DESIGN STANDHYD    03:203c           4.95     .305 No_date   12:00   41.02 .663
      [XIMP=.57:TIMP=.71]
      [SLP=2.30:DT= 5.00]
      [LOSS= 1 : HORTONS]
 015:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     DESIGN STANDHYD    04:POND1          2.68     .161 No_date   12:00   45.30 .732
      [XIMP=.64:TIMP=.80]
      [SLP= .10:DT= 5.00]
      [LOSS= 1 : HORTONS]
 015:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            02:203b          20.76    1.136 No_date   12:00   35.67  n/a
                     +  03:203c           4.95     .305 No_date   12:00   41.02  n/a
      [DT= 5.00]  SUM=  05:T2CRS         25.71    1.441 No_date   12:00   36.70  n/a
 015:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:203a          27.32    1.537 No_date   12:00   37.07  n/a
                     +  04:POND1          2.68     .161 No_date   12:00   45.30  n/a
                     +  05:T2CRS         25.71    1.441 No_date   12:00   36.70  n/a
      [DT= 5.00]  SUM=  06:P1FLOW        55.71    3.138 No_date   12:00   37.29  n/a
 015:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 06:P1FLOW        55.71    3.138 No_date   12:00   37.29  n/a
      [RDT= 5.00] out<- 01:POND1         55.71     .166 No_date   14:20   37.29  n/a
            overflow <= 02:P1-OVF          .00     .000 No_date    0:00     .00  n/a
     {MxStoUsed=.1614E+01, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
 015:0024---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:POND1         55.71     .166 No_date   14:20   37.29  n/a
                     +  09:TRIB2        383.03     .297 No_date   24:40   16.71  n/a
      [DT= 5.00]  SUM=  02:213ADD       438.74     .427 No_date   21:40   19.32  n/a
 015:0025---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 02:213ADD       438.74     .427 No_date   21:40   19.32  n/a
      [RDT= 5.00] out<- 01:214          438.74     .427 No_date   21:55   19.32  n/a
      [L/S/n=  390./1.700/.100]
      {Vmax=  .403:Dmax=  .188}
 015:0026---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       03:214            1.61     .015 No_date   13:00   18.52 .299
      [CN= 72.0: N= 1.10]
      [Tp=  .17:DT= 5.00]
 015:0027---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:214          438.74     .427 No_date   21:55   19.32  n/a
                     +  03:214            1.61     .015 No_date   13:00   18.52  n/a
      [DT= 5.00]  SUM=  02:214ADD       440.35     .429 No_date   21:55   19.32  n/a
 015:0028---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 02:214ADD       440.35     .429 No_date   21:55   19.32  n/a
      [RDT= 5.00] out<- 01:215          440.35     .429 No_date   22:00   19.32  n/a
      [L/S/n=  260./1.400/.100]
      {Vmax=  .376:Dmax=  .199}
 015:0029---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:TRB215         1.12     .008 No_date   13:00   14.45 .233
      [CN= 66.0: N= 1.10]
      [Tp=  .17:DT= 5.00]
 015:0030---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:215          440.35     .429 No_date   22:00   19.32  n/a
                     +  02:TRB215         1.12     .008 No_date   13:00   14.45  n/a
      [DT= 5.00]  SUM=  03:215ADD       441.47     .430 No_date   22:00   19.30  n/a
 015:0031---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:215ADD       441.47     .430 No_date   22:00   19.30  n/a
      [RDT= 5.00] out<- 01:216          441.47     .431 No_date   22:05   19.30  n/a
      [L/S/n=  250./ .500/.100]
      {Vmax=  .279:Dmax=  .276}
 015:0032---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:TRB216         1.12     .007 No_date   13:00   13.53 .219
      [CN= 65.0: N= 1.10]
      [Tp=  .17:DT= 5.00]
 015:0033---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:216          441.47     .431 No_date   22:05   19.30  n/a
                     +  02:TRB216         1.12     .007 No_date   13:00   13.53  n/a
      [DT= 5.00]  SUM=  10:T2-US        442.59     .432 No_date   22:05   19.29  n/a
 015:0034---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:301           86.43     .130 No_date   18:00   12.39 .200
      [CN= 63.0: N= 1.10]
      [Tp= 1.24:DT= 5.00]
 015:0035---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:302           80.69     .101 No_date   21:00   13.42 .217
      [CN= 64.0: N= 1.10]
      [Tp= 1.80:DT= 5.00]
 015:0036---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:301           86.43     .130 No_date   18:00   12.39  n/a
                     +  02:302           80.69     .101 No_date   21:00   13.42  n/a
      [DT= 5.00]  SUM=  03:300a         167.12     .230 No_date   18:05   12.89  n/a
 015:0037---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:300a         167.12     .230 No_date   18:05   12.89  n/a
      [RDT= 5.00] out<- 01:310          167.12     .230 No_date   18:30   12.89  n/a
      [L/S/n=  449./1.620/.040]
      {Vmax=  .496:Dmax=  .086}
 015:0038---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:303           65.19     .129 No_date   18:00   16.82 .272
      [CN= 69.0: N= 1.10]
      [Tp= 1.31:DT= 5.00]
 015:0039---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:310          167.12     .230 No_date   18:30   12.89  n/a
                     +  02:303           65.19     .129 No_date   18:00   16.82  n/a
      [DT= 5.00]  SUM=  03:300b         232.31     .359 No_date   18:10   13.99  n/a
 015:0040---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:300b         232.31     .359 No_date   18:10   13.99  n/a
      [RDT= 5.00] out<- 01:311          232.31     .358 No_date   18:25   13.99  n/a
      [L/S/n=  270./1.170/.100]
      {Vmax=  .336:Dmax=  .189}
 015:0041---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:TRB311         1.15     .004 No_date   14:00   14.61 .236
      [CN= 65.0: N= 1.10]
      [Tp=  .52:DT= 5.00]
 015:0042---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:311          232.31     .358 No_date   18:25   13.99  n/a
                     +  02:TRB311         1.15     .004 No_date   14:00   14.61  n/a
      [DT= 5.00]  SUM=  03:311ADD       233.46     .361 No_date   18:25   13.99  n/a
 015:0043---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:311ADD       233.46     .361 No_date   18:25   13.99  n/a
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     [RDT= 5.00] out<- 01:312          233.46     .361 No_date   18:40   13.99  n/a
     [L/S/n=  270./1.170/.100]
     {Vmax=  .336:Dmax=  .190}
015:0044---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:TRB312          1.30     .006 No_date   14:00   21.99 .355
     [CN= 76.0: N= 1.10]
     [Tp=  .64:DT= 5.00]
015:0045---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:312           233.46     .361 No_date   18:40   13.99  n/a
                    +  02:TRB312          1.30     .006 No_date   14:00   21.99  n/a
     [DT= 5.00]  SUM=  09:312ADD        234.76     .366 No_date   18:35   14.04  n/a
015:0046---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    01:304a            9.61     .507 No_date   12:00   34.23 .553
     [XIMP=.46:TIMP=.57]
     [SLP=1.60:DT= 5.00]
     [LOSS= 1 : HORTONS]
015:0047---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    02:402a            5.67     .354 No_date   12:00   41.82 .675
     [XIMP=.58:TIMP=.73]
     [SLP=2.10:DT= 5.00]
     [LOSS= 1 : HORTONS]
015:0048---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    03:POND2           1.85     .111 No_date   12:00   45.30 .732
     [XIMP=.64:TIMP=.80]
     [SLP= .10:DT= 5.00]
     [LOSS= 1 : HORTONS]
015:0049---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:304a            9.61     .507 No_date   12:00   34.23  n/a
                    +  02:402a            5.67     .354 No_date   12:00   41.82  n/a
                    +  03:POND2           1.85     .111 No_date   12:00   45.30  n/a
     [DT= 5.00]  SUM=  04:P2FLOW         17.13     .972 No_date   12:00   37.94  n/a
015:0050---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 04:P2FLOW         17.13     .972 No_date   12:00   37.94  n/a
     [RDT= 5.00] out<- 01:POND2          17.13     .030 No_date   18:05   37.93  n/a
           overflow <= 02:P2OVF            .00     .000 No_date    0:00     .00  n/a
    {MxStoUsed=.5445E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
015:0051---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    02:402b            6.07     .379 No_date   12:00   41.82 .675
     [XIMP=.58:TIMP=.73]
     [SLP=2.10:DT= 5.00]
     [LOSS= 1 : HORTONS]
015:0052---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * DESIGN STANDHYD    03:402c            1.19     .072 No_date   12:00   39.70 .641
     [XIMP=.55:TIMP=.68]
     [SLP=2.10:DT= 5.00]
     [LOSS= 1 : HORTONS]
015:0053---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            02:402b            6.07     .379 No_date   12:00   41.82  n/a
                    +  03:402c            1.19     .072 No_date   12:00   39.70  n/a
     [DT= 5.00]  SUM=  04:400-OS          7.26     .451 No_date   12:00   41.47  n/a
015:0054---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 04:400-OS          7.26     .451 No_date   12:00   41.47  n/a
     [RDT= 5.00] out<- 02:OSSTOR          7.26     .450 No_date   12:00   41.47  n/a
           overflow <= 03:OSOVF            .00     .000 No_date    0:00     .00  n/a
    {MxStoUsed=.2824E-02, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
015:0055---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       03:401            16.78     .144 No_date   13:45   17.29 .279
     [CN= 68.0: N= 3.00]
     [Tp= 1.66:DT= 5.00]
015:0056---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:POND2          17.13     .030 No_date   18:05   37.93  n/a
                    +  02:OSSTOR          7.26     .450 No_date   12:00   41.47  n/a
                    +  03:401            16.78     .144 No_date   13:45   17.29  n/a
                    +  09:312ADD        234.76     .366 No_date   18:35   14.04  n/a
     [DT= 5.00]  SUM=  04:P2-T3         275.93     .566 No_date   12:00   16.44  n/a
015:0057---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 04:P2-T3         275.93     .566 No_date   12:00   16.44  n/a
     [RDT= 5.00] out<- 01:313           275.93     .502 No_date   14:45   16.44  n/a
     [L/S/n=  423./1.170/.100]
     {Vmax=  .394:Dmax=  .250}
015:0058---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:TRB313           .72     .004 No_date   13:00   16.65 .269
     [CN= 68.0: N= 1.10]
     [Tp=  .34:DT= 5.00]
015:0059---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:313           275.93     .502 No_date   14:45   16.44  n/a
                    +  02:TRB313           .72     .004 No_date   13:00   16.65  n/a
     [DT= 5.00]  SUM=  03:313ADD        276.65     .505 No_date   14:45   16.44  n/a
015:0060---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       04:TRB314           .94     .004 No_date   13:55   16.65 .269
     [CN= 68.0: N= 1.10]
     [Tp=  .46:DT= 5.00]
015:0061---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:313           275.93     .502 No_date   14:45   16.44  n/a
                    +  02:TRB313           .72     .004 No_date   13:00   16.65  n/a
     [DT= 5.00]  SUM=  03:313ADD        276.65     .505 No_date   14:45   16.44  n/a
015:0062---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       04:403a            2.66     .020 No_date   13:00   19.94 .322
     [CN= 70.0: N= 1.10]
     [Tp=  .27:DT= 5.00]
015:0063---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            10:T2-US         442.59     .432 No_date   22:05   19.29  n/a
                    +  03:313ADD        276.65     .505 No_date   14:45   16.44  n/a
                    +  04:403a            2.66     .020 No_date   13:00   19.94  n/a
     [DT= 5.00]  SUM=  01:CONFLU        721.90     .895 No_date   16:00   18.20  n/a
015:0064---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * DESIGN STANDHYD    01:203d            1.26     .077 No_date   12:00   40.48 .654
     [XIMP=.56:TIMP=.70]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
015:0065---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    02:501a            9.32     .658 No_date   12:00   51.52 .832
     [XIMP=.74:TIMP=.93]
     [SLP= .80:DT= 5.00]
     [LOSS= 1 : HORTONS]
015:0066---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    COMPUTE DUALHYD    02:501a            9.32     .658 No_date   12:00   51.52  n/a
       Major System /  03:OSSTOR           .00     .000 No_date    0:00     .00  n/a
       Minor System \  04:TOPOND          9.32     .658 No_date   12:00   51.52  n/a
     {MjSysSto=.0000E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
015:0067---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    05:501b           38.42    2.229 No_date   12:00   39.17 .633
     [XIMP=.54:TIMP=.67]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
015:0068---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    06:501c           39.10    2.208 No_date   12:00   37.60 .607
     [XIMP=.51:TIMP=.64]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
015:0069---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    07:MR1             3.32     .245 No_date   12:00   57.57 .930
     [XIMP=.80:TIMP=.99]
     [SLP=1.00:DT= 5.00]
     [LOSS= 1 : HORTONS]
015:0070---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    08:MR2             3.04     .224 No_date   12:00   57.57 .930
     [XIMP=.80:TIMP=.99]
     [SLP=1.00:DT= 5.00]
     [LOSS= 1 : HORTONS]
015:0071---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:203d            1.26     .077 No_date   12:00   40.48  n/a
                    +  05:501b           38.42    2.229 No_date   12:00   39.17  n/a
                    +  07:MR1             3.32     .245 No_date   12:00   57.57  n/a
     [DT= 5.00]  SUM=  10:VALE           43.00    2.551 No_date   12:00   40.63  n/a
015:0072---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            04:TOPOND          9.32     .658 No_date   12:00   51.52  n/a
                    +  06:501c           39.10    2.208 No_date   12:00   37.60  n/a
                    +  08:MR2             3.04     .224 No_date   12:00   57.57  n/a
     [DT= 5.00]  SUM=  09:MET            51.46    3.091 No_date   12:00   41.30  n/a
015:0073---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    01:POND3          11.89     .670 No_date   12:00   45.30 .732
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      [XIMP=.64:TIMP=.80]
      [SLP= .10:DT= 5.00]
      [LOSS= 1 : HORTONS]
 015:0074---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            10:VALE          43.00    2.551 No_date   12:00   40.63  n/a
                      + 09:MET           51.46    3.091 No_date   12:00   41.30  n/a
                      + 01:POND3         11.89     .670 No_date   12:00   45.30  n/a
      [DT= 5.00]  SUM=  08:P3ADD        106.35    6.312 No_date   12:00   41.47  n/a
 015:0075---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 08:P3ADD        106.35    6.312 No_date   12:00   41.47  n/a
      [RDT= 5.00] out<- 01:POND3        106.35     .383 No_date   14:20   41.47  n/a
            overflow <= 02:E-OVF           .00     .000 No_date    0:00     .00  n/a
     {MxStoUsed=.3389E+01, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
  ** END OF RUN :  15

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




 RUN:COMMAND#
 016:0001----------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =  16 ]
#******************************************************************************
#  Project Name: [Kanata North]    Project Number: [112117]
#  Date         : 03-30-2016
#  Modeller     : [Kallie Auld]
#  Company      : NOVATECH ENGINEERING CONSULTANTS LTD
#  License #    :  5320763
#******************************************************************************
#******************************************************************************
 016:0002----------------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  =
      [SDT=60.00:SDUR=  24.00:PTOT= 105.74]
 016:0003----------------------------------------------------------------------------
     DEFAULT VALUES
      Filename = M:\2012\112117\data\CALCUL~1\swmhymo\POSTDE~1\OTTAWA.DEF
      ICASEdv  = 1 (read and print data)
      FileTitle= ------ ENTER YOUR COMMENTS ON THIS LINE AND THE NEXT ONE ---
                 ------ PARAMETER VALUES MUST BE ENTERD AFTER COLUMN 60 ----_
      Horton's infiltration equation parameters:
      [Fo= 76.20 mm/hr] [Fc=13.20 mm/hr] [DCAY= 4.14 /hr] [F=  .00 mm]
      Parameters for PERVIOUS surfaces in STANDHYD:
      [IAper=   4.67 mm] [LGP=40.00 m] [MNP= .250]
      Parameters for IMPERVIOUS surfaces in STANDHYD:
      [IAimp=   1.57 mm] [CLI= 1.50]   [MNI= .013]
      Parameters used in NASHYD:
      [Ia=   4.67 mm] [N= 3.00]
 016:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:201          115.14     .257 No_date   24:00   38.51 .364
      [CN= 65.0: N= 1.10]
      [Tp= 3.42:DT= 5.00]
 016:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 01:201          115.14     .257 No_date   24:00   38.51  n/a
      [RDT= 5.00] out<- 02:210          115.14     .257 No_date   24:05   38.51  n/a
      [L/S/n=  558./ .890/.040]
      {Vmax=  .442:Dmax=  .101}
 016:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:202          263.64     .510 No_date   24:00   46.46 .439
      [CN= 70.0: N= 1.10]
      [Tp= 5.14:DT= 5.00]
 016:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:202          263.64     .510 No_date   24:00   46.46  n/a
                      + 02:210          115.14     .257 No_date   24:05   38.51  n/a
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      [DT= 5.00]  SUM=  03:210add       378.78     .766 No_date   24:00   44.04  n/a
 016:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:210add       378.78     .766 No_date   24:00   44.04  n/a
      [RDT= 5.00] out<- 01:211          378.78     .766 No_date   24:10   44.04  n/a
      [L/S/n=  450./1.000/.100]
      {Vmax=  .456:Dmax=  .323}
 016:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:211            1.87     .013 No_date   16:00   54.00 .511
      [CN= 76.0: N= 1.10]
      [Tp= 1.17:DT= 5.00]
 016:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:211          378.78     .766 No_date   24:10   44.04  n/a
                      + 02:211            1.87     .013 No_date   16:00   54.00  n/a
      [DT= 5.00]  SUM=  03:211add       380.65     .777 No_date   24:10   44.09  n/a
 016:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:211add       380.65     .777 No_date   24:10   44.09  n/a
      [RDT= 5.00] out<- 01:212          380.65     .776 No_date   24:15   44.09  n/a
      [L/S/n=  230./1.000/.100]
      {Vmax=  .457:Dmax=  .325}
 016:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:212             .95     .009 No_date   14:00   41.25 .390
      [CN= 66.0: N= 1.10]
      [Tp=  .56:DT= 5.00]
 016:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:212          380.65     .776 No_date   24:15   44.09  n/a
                      + 02:212             .95     .009 No_date   14:00   41.25  n/a
      [DT= 5.00]  SUM=  03:212add       381.60     .780 No_date   24:15   44.08  n/a
 016:0014---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:212add       381.60     .780 No_date   24:15   44.08  n/a
      [RDT= 5.00] out<- 01:213          381.60     .780 No_date   24:25   44.08  n/a
      [L/S/n=  330./1.000/.100]
      {Vmax=  .458:Dmax=  .326}
 016:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:213            1.43     .012 No_date   14:00   41.12 .389
      [CN= 66.0: N= 1.10]
      [Tp=  .67:DT= 5.00]
 016:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:213          381.60     .780 No_date   24:25   44.08  n/a
                      + 02:213            1.43     .012 No_date   14:00   41.12  n/a
      [DT= 5.00]  SUM=  09:TRIB2        383.03     .786 No_date   24:20   44.07  n/a
 016:0017---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     DESIGN STANDHYD    01:203a          27.32    3.051 No_date   12:00   70.88 .670
      [XIMP=.50:TIMP=.63]
      [SLP=2.30:DT= 5.00]
      [LOSS= 1 : HORTONS]
 016:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     DESIGN STANDHYD    02:203b          20.76    2.296 No_date   12:00   69.11 .654
      [XIMP=.48:TIMP=.60]
      [SLP=2.30:DT= 5.00]
      [LOSS= 1 : HORTONS]
 016:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  DESIGN STANDHYD    03:203c           4.95     .572 No_date   12:00   76.34 .722
      [XIMP=.57:TIMP=.71]
      [SLP=2.30:DT= 5.00]
      [LOSS= 1 : HORTONS]
 016:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     DESIGN STANDHYD    04:POND1          2.68     .299 No_date   12:00   82.03 .776
      [XIMP=.64:TIMP=.80]
      [SLP= .10:DT= 5.00]
      [LOSS= 1 : HORTONS]
 016:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            02:203b          20.76    2.296 No_date   12:00   69.11  n/a
                      + 03:203c           4.95     .572 No_date   12:00   76.34  n/a
      [DT= 5.00]  SUM=  05:T2CRS         25.71    2.868 No_date   12:00   70.50  n/a
 016:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:203a          27.32    3.051 No_date   12:00   70.88  n/a
                      + 04:POND1          2.68     .299 No_date   12:00   82.03  n/a
                      + 05:T2CRS         25.71    2.868 No_date   12:00   70.50  n/a
      [DT= 5.00]  SUM=  06:P1FLOW        55.71    6.218 No_date   12:00   71.24  n/a
 016:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 06:P1FLOW        55.71    6.218 No_date   12:00   71.24  n/a
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     [RDT= 5.00] out<- 01:POND1          55.71     .344 No_date   14:05   71.24  n/a
           overflow <= 02:P1-OVF           .00     .000 No_date    0:00     .00  n/a
    {MxStoUsed=.3100E+01, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
016:0024---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD              01:POND1          55.71     .344 No_date   14:05   71.24  n/a
                     +   09:TRIB2         383.03     .786 No_date   24:20   44.07  n/a
     [DT= 5.00]  SUM=  02:213ADD         438.74    1.068 No_date   22:00   47.52  n/a
016:0025---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL    -> 02:213ADD        438.74    1.068 No_date   22:00   47.52  n/a
     [RDT= 5.00] out<- 01:214            438.74    1.068 No_date   22:05   47.52  n/a
     [L/S/n=  390./1.700/.100]
     {Vmax=  .604:Dmax=  .335}
016:0026---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       03:214              1.61     .041 No_date   12:10   47.94 .453
     [CN= 72.0: N= 1.10]
     [Tp=  .17:DT= 5.00]
016:0027---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD              01:214            438.74    1.068 No_date   22:05   47.52  n/a
                     +   03:214              1.61     .041 No_date   12:10   47.94  n/a
     [DT= 5.00]  SUM=  02:214ADD         440.35    1.073 No_date   21:15   47.52  n/a
016:0028---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL    -> 02:214ADD        440.35    1.073 No_date   21:15   47.52  n/a
     [RDT= 5.00] out<- 01:215            440.35    1.073 No_date   21:30   47.52  n/a
     [L/S/n=  260./1.400/.100]
     {Vmax=  .565:Dmax=  .354}
016:0029---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:TRB215           1.12     .023 No_date   12:15   40.05 .379
     [CN= 66.0: N= 1.10]
     [Tp=  .17:DT= 5.00]
016:0030---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD              01:215            440.35    1.073 No_date   21:30   47.52  n/a
                     +   02:TRB215           1.12     .023 No_date   12:15   40.05  n/a
     [DT= 5.00]  SUM=  03:215ADD         441.47    1.077 No_date   21:25   47.50  n/a
016:0031---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL    -> 03:215ADD        441.47    1.077 No_date   21:25   47.50  n/a
     [RDT= 5.00] out<- 01:216            441.47    1.077 No_date   21:35   47.50  n/a
     [L/S/n=  250./ .500/.100]
     {Vmax=  .418:Dmax=  .487}
016:0032---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:TRB216           1.12     .022 No_date   12:15   38.38 .363
     [CN= 65.0: N= 1.10]
     [Tp=  .17:DT= 5.00]
016:0033---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD              01:216            441.47    1.077 No_date   21:35   47.50  n/a
                     +   02:TRB216           1.12     .022 No_date   12:15   38.38  n/a
     [DT= 5.00]  SUM=  10:T2-US          442.59    1.080 No_date   21:35   47.48  n/a
016:0034---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:301             86.43     .383 No_date   18:00   35.99 .340
     [CN= 63.0: N= 1.10]
     [Tp= 1.24:DT= 5.00]
016:0035---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:302             80.69     .287 No_date   18:25   37.84 .358
     [CN= 64.0: N= 1.10]
     [Tp= 1.80:DT= 5.00]
016:0036---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD              01:301             86.43     .383 No_date   18:00   35.99  n/a
                     +   02:302             80.69     .287 No_date   18:25   37.84  n/a
     [DT= 5.00]  SUM=  03:300a           167.12     .670 No_date   18:00   36.88  n/a
016:0037---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL    -> 03:300a          167.12     .670 No_date   18:00   36.88  n/a
     [RDT= 5.00] out<- 01:310            167.12     .669 No_date   18:05   36.88  n/a
     [L/S/n=  449./1.620/.040]
     {Vmax=  .720:Dmax=  .154}
016:0038---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:303             65.19     .346 No_date   17:40   44.45 .420
     [CN= 69.0: N= 1.10]
     [Tp= 1.31:DT= 5.00]
016:0039---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD              01:310            167.12     .669 No_date   18:05   36.88  n/a
                     +   02:303             65.19     .346 No_date   17:40   44.45  n/a
     [DT= 5.00]  SUM=  03:300b           232.31    1.015 No_date   18:00   39.01  n/a
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016:0040---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL    -> 03:300b          232.31    1.015 No_date   18:00   39.01  n/a
     [RDT= 5.00] out<- 01:311            232.31    1.014 No_date   18:05   39.01  n/a
     [L/S/n=  270./1.170/.100]
     {Vmax=  .522:Dmax=  .361}
016:0041---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:TRB311           1.15     .011 No_date   14:00   39.88 .377
     [CN= 65.0: N= 1.10]
     [Tp=  .52:DT= 5.00]
016:0042---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD              01:311            232.31    1.014 No_date   18:05   39.01  n/a
                     +   02:TRB311           1.15     .011 No_date   14:00   39.88  n/a
     [DT= 5.00]  SUM=  03:311ADD         233.46    1.022 No_date   18:05   39.01  n/a
016:0043---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL    -> 03:311ADD        233.46    1.022 No_date   18:05   39.01  n/a
     [RDT= 5.00] out<- 01:312            233.46    1.022 No_date   18:10   39.01  n/a
     [L/S/n=  270./1.170/.100]
     {Vmax=  .523:Dmax=  .363}
016:0044---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:TRB312           1.30     .015 No_date   14:00   54.08 .511
     [CN= 76.0: N= 1.10]
     [Tp=  .64:DT= 5.00]
016:0045---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD              01:312            233.46    1.022 No_date   18:10   39.01  n/a
                     +   02:TRB312           1.30     .015 No_date   14:00   54.08  n/a
     [DT= 5.00]  SUM=  09:312ADD         234.76    1.034 No_date   18:10   39.09  n/a
016:0046---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    01:304a             9.61    1.049 No_date   12:00   67.31 .637
     [XIMP=.46:TIMP=.57]
     [SLP=1.60:DT= 5.00]
     [LOSS= 1 : HORTONS]
016:0047---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * DESIGN STANDHYD    02:402a             5.67     .660 No_date   12:00   77.35 .732
     [XIMP=.58:TIMP=.73]
     [SLP=2.10:DT= 5.00]
     [LOSS= 1 : HORTONS]
016:0048---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    03:POND2            1.85     .207 No_date   12:00   82.03 .776
     [XIMP=.64:TIMP=.80]
     [SLP= .10:DT= 5.00]
     [LOSS= 1 : HORTONS]
016:0049---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD              01:304a             9.61    1.049 No_date   12:00   67.31  n/a
                     +   02:402a             5.67     .660 No_date   12:00   77.35  n/a
                     +   03:POND2            1.85     .207 No_date   12:00   82.03  n/a
     [DT= 5.00]  SUM=  04:P2FLOW          17.13    1.916 No_date   12:00   72.22  n/a
016:0050---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 04:P2FLOW          17.13    1.916 No_date   12:00   72.22  n/a
     [RDT= 5.00] out<- 01:POND2           17.13     .083 No_date   15:00   72.21  n/a
           overflow <= 02:P2OVF             .00     .000 No_date    0:00     .00  n/a
    {MxStoUsed=.9986E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
016:0051---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * DESIGN STANDHYD    02:402b             6.07     .706 No_date   12:00   77.35 .732
     [XIMP=.58:TIMP=.73]
     [SLP=2.10:DT= 5.00]
     [LOSS= 1 : HORTONS]
016:0052---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * DESIGN STANDHYD    03:402c             1.19     .137 No_date   12:00   74.58 .705
     [XIMP=.55:TIMP=.68]
     [SLP=2.10:DT= 5.00]
     [LOSS= 1 : HORTONS]
016:0053---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD              02:402b             6.07     .706 No_date   12:00   77.35  n/a
                     +   03:402c             1.19     .137 No_date   12:00   74.58  n/a
     [DT= 5.00]  SUM=  04:400-OS           7.26     .843 No_date   12:00   76.90  n/a
016:0054---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 04:400-OS           7.26     .843 No_date   12:00   76.90  n/a
     [RDT= 5.00] out<- 02:OSSTOR           7.26     .800 No_date   12:00   76.90  n/a
           overflow <= 03:OSOVF             .00     .000 No_date    0:00     .00  n/a
    {MxStoUsed=.1074E-01, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
016:0055---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
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    CALIB NASHYD       03:401           16.78     .386 No_date   13:40   44.67 .422
     [CN= 68.0: N= 3.00]
     [Tp= 1.66:DT= 5.00]
016:0056---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:POND2         17.13     .083 No_date   15:00   72.21  n/a
                     + 02:OSSTOR         7.26     .800 No_date   12:00   76.90  n/a
                     + 03:401           16.78     .386 No_date   13:40   44.67  n/a
                     + 09:312ADD       234.76    1.034 No_date   18:10   39.09  n/a
     [DT= 5.00]  SUM=  04:P2-T3        275.93    1.449 No_date   14:00   42.48  n/a
016:0057---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 04:P2-T3        275.93    1.449 No_date   14:00   42.48  n/a
     [RDT= 5.00] out<- 01:313          275.93    1.443 No_date   14:05   42.48  n/a
     [L/S/n=  423./1.170/.100]
     {Vmax=  .604:Dmax=  .450}
016:0058---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:TRB313          .72     .011 No_date   13:00   43.82 .414
     [CN= 68.0: N= 1.10]
     [Tp=  .34:DT= 5.00]
016:0059---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:313          275.93    1.443 No_date   14:05   42.48  n/a
                     + 02:TRB313          .72     .011 No_date   13:00   43.82  n/a
     [DT= 5.00]  SUM=  03:313ADD       276.65    1.452 No_date   14:05   42.48  n/a
016:0060---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       04:TRB314          .94     .011 No_date   13:10   43.82 .414
     [CN= 68.0: N= 1.10]
     [Tp=  .46:DT= 5.00]
016:0061---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:313          275.93    1.443 No_date   14:05   42.48  n/a
                     + 02:TRB313          .72     .011 No_date   13:00   43.82  n/a
     [DT= 5.00]  SUM=  03:313ADD       276.65    1.452 No_date   14:05   42.48  n/a
016:0062---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       04:403a           2.66     .051 No_date   13:00   48.93 .463
     [CN= 70.0: N= 1.10]
     [Tp=  .27:DT= 5.00]
016:0063---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            10:T2-US        442.59    1.080 No_date   21:35   47.48  n/a
                     + 03:313ADD       276.65    1.452 No_date   14:05   42.48  n/a
                     + 04:403a           2.66     .051 No_date   13:00   48.93  n/a
     [DT= 5.00]  SUM=  01:CONFLU       721.90    2.457 No_date   14:50   45.57  n/a
016:0064---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD    01:203d           1.26     .146 No_date   12:00   75.60 .715
     [XIMP=.56:TIMP=.70]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
016:0065---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    02:501a           9.32    1.153 No_date   12:00   91.14 .862
     [XIMP=.74:TIMP=.93]
     [SLP= .80:DT= 5.00]
     [LOSS= 1 : HORTONS]
016:0066---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    COMPUTE DUALHYD    02:501a           9.32    1.153 No_date   12:00   91.14  n/a
       Major System /  03:OSSTOR          .00     .000 No_date    0:00     .00  n/a
       Minor System \  04:TOPOND         9.32    1.153 No_date   12:00   91.14  n/a
     {MjSysSto=.0000E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
016:0067---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    05:501b          38.42    4.345 No_date   12:00   73.84 .698
     [XIMP=.54:TIMP=.67]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
016:0068---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    06:501c          39.10    4.372 No_date   12:00   71.62 .677
     [XIMP=.51:TIMP=.64]
     [SLP=2.30:DT= 5.00]
     [LOSS= 1 : HORTONS]
016:0069---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD    07:MR1            3.32     .420 No_date   12:00  101.30 .958
     [XIMP=.80:TIMP=.99]
     [SLP=1.00:DT= 5.00]
     [LOSS= 1 : HORTONS]
016:0070---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  DESIGN STANDHYD    08:MR2            3.04     .385 No_date   12:00  101.30 .958
     [XIMP=.80:TIMP=.99]
     [SLP=1.00:DT= 5.00]
     [LOSS= 1 : HORTONS]
016:0071---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:203d           1.26     .146 No_date   12:00   75.60  n/a
                     + 05:501b          38.42    4.345 No_date   12:00   73.84  n/a
                     + 07:MR1            3.32     .420 No_date   12:00  101.30  n/a
     [DT= 5.00]  SUM=  10:VALE          43.00    4.911 No_date   12:00   76.01  n/a
016:0072---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            04:TOPOND         9.32    1.153 No_date   12:00   91.14  n/a
                     + 06:501c          39.10    4.372 No_date   12:00   71.62  n/a
                     + 08:MR2            3.04     .385 No_date   12:00  101.30  n/a
     [DT= 5.00]  SUM=  09:MET           51.46    5.909 No_date   12:00   76.91  n/a
016:0073---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    DESIGN STANDHYD    01:POND3         11.89    1.279 No_date   12:00   82.03 .776
     [XIMP=.64:TIMP=.80]
     [SLP= .10:DT= 5.00]
     [LOSS= 1 : HORTONS]
016:0074---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            10:VALE          43.00    4.911 No_date   12:00   76.01  n/a
                     + 09:MET           51.46    5.909 No_date   12:00   76.91  n/a
                     + 01:POND3         11.89    1.279 No_date   12:00   82.03  n/a
     [DT= 5.00]  SUM=  08:P3ADD        106.35   12.099 No_date   12:00   77.12  n/a
016:0075---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 08:P3ADD        106.35   12.099 No_date   12:00   77.12  n/a
     [RDT= 5.00] out<- 01:POND3        106.35    1.044 No_date   13:35   77.12  n/a
            overflow <= 02:E-OVF          .00     .000 No_date    0:00     .00  n/a
    {MxStoUsed=.6111E+01, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs}
016:0002-----------------------------------------------------------------------------
     FINISH
-------------------------------------------------------------------------------------
*************************************************************************************
    WARNINGS / ERRORS / NOTES
    -------------------------
001:0019 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
001:0046 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
001:0047 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
001:0051 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
001:0052 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
001:0054 ROUTE RESERVOIR
     *** WARNING: Inflow peak was not reduced!
                  Check OUTFLOW/STORAGE table or reduce DT.
001:0064 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
001:0069 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
001:0070 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0018 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0019 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0046 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0047 DESIGN STANDHYD
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     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0051 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0052 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0064 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0069 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0070 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
003:0017 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
003:0018 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
003:0019 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
003:0046 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
003:0047 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
003:0051 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
003:0052 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
003:0064 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
003:0065 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
003:0069 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
003:0070 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
005:0017 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
005:0018 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
005:0019 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
005:0020 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
005:0046 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
005:0047 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
005:0048 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
005:0051 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
005:0052 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
005:0064 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
005:0065 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
005:0067 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
005:0068 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
005:0069 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
005:0070 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
006:0018 DESIGN STANDHYD
     *** NOTE: The pervious area has no runoff.
006:0046 DESIGN STANDHYD
     *** NOTE: The pervious area has no runoff.
006:0052 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
006:0064 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
007:0019 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
007:0047 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
007:0051 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
007:0052 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
007:0064 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
007:0069 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
007:0070 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
008:0019 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
008:0047 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
008:0051 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
008:0052 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
008:0064 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
008:0069 DESIGN STANDHYD
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     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
008:0070 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
012:0018 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
012:0019 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
012:0046 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
012:0047 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
012:0051 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
012:0052 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
012:0064 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
012:0069 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
012:0070 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
013:0017 DESIGN STANDHYD
     *** NOTE: The pervious area has no runoff.
013:0018 DESIGN STANDHYD
     *** NOTE: The pervious area has no runoff.
013:0019 DESIGN STANDHYD
     *** NOTE: The pervious area has no runoff.
013:0046 DESIGN STANDHYD
     *** NOTE: The pervious area has no runoff.
013:0047 DESIGN STANDHYD
     *** NOTE: The pervious area has no runoff.
013:0051 DESIGN STANDHYD
     *** NOTE: The pervious area has no runoff.
013:0052 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
     *** NOTE: The pervious area has no runoff.
013:0064 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
     *** NOTE: The pervious area has no runoff.
013:0067 DESIGN STANDHYD
     *** NOTE: The pervious area has no runoff.
013:0068 DESIGN STANDHYD
     *** NOTE: The pervious area has no runoff.
014:0052 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
014:0064 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
015:0019 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
015:0052 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
015:0064 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
016:0019 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
016:0047 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
016:0051 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
016:0052 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
016:0064 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
016:0069 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
016:0070 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
  Simulation ended on 2016-05-20     at 09:55:43
=====================================================================================
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Kanata North Community Design Plan

Pre vs. Post-Development Peak Flows

SWMHYMO Model Results

NOVATECH
Engineers, Planners & Landscape Architects

Storm Distribution ->		Chicago 4-Hour				SCS 12-Hour				SCS 24-Hour			
Return Period ->		**25mm**	**2 year**	**5 year**	**100 year**	**25mm**	**2 year**	**5 year**	**100 year**	**25mm**	**2 year**	**5 year**	**100 year**
Shirley's Brook Northwest Branch													
Tributary 2	*Pre*	0.082	0.167	0.338	0.977	0.063	0.229	0.417	1.129	0.057	0.266	0.441	1.144
	Post	0.073	0.155	0.306	0.805	0.121	0.227	0.424	1.023	0.062	0.256	0.432	1.080
Tributary 3	*Pre*	0.063	0.147	0.298	0.883	0.055	0.222	0.416	1.126	0.044	0.245	0.426	1.180
	Post	0.315	0.486	0.788	1.392	0.168	0.383	0.649	1.591	0.114	0.299	0.505	1.451
Confluence of Tributaries 2 & 3	*Pre*	0.155	0.343	0.683	1.943	0.132	0.495	0.900	2.345	0.110	0.549	0.929	2.481
	Post	0.319	0.501	0.827	1.967	0.176	0.474	0.898	2.367	0.125	0.509	0.895	2.457
Flows from East Pond (to Shirley's Brook Main Branch)	*Pre*	0.076	0.167	0.323	0.892	0.058	0.220	0.402	1.045	0.045	0.237	0.407	1.102
	Post	0.058	0.174	0.349	0.962	0.050	0.220	0.402	1.043	0.046	0.220	0.383	1.044

KNCDP
SWM FACILITY DESIGN - Pond 2

NOVATECH
Engineers, Planners & Landscape Architects

Required storage Volumes (Quality)

Drainage Area	**17.6**	ha
% Impervious:	**41%**	
Enhanced protection (80% TSS removal):		
Treatment Volume	149	m3/ha
Extended Detention Storage:	40	m3/ha required
	704	m3 required
	901	m3 provided
	51.2	m3/ha provided
Perm Pool:	109	m3/ha required
	1,918	m3 required
	1,991	m3 provided
	113.1	m3/ha provided
Extended Detention:	20.85	L/s average
	52.13	L/s max (2.5 x avg)

(% impervious was calculated as the average imperviousness for the drainage areas tributary to the SWM facility)

Required Forebay Length and width

Parameters:

Length to width ratio of forebay, r =	3.0:1	
Peak outflow rate during 25 mm storm, (	0.030	m^3/s (24hr ext. det)
Target particle size =	150	mm
Settling velocity, V_s =	0.0003	m/s

Forebay Settling Length, Dist

$$Dist = \sqrt{\frac{rQ_P}{V_S}}$$

= 17 m

Check Dispersion Length, Dist$_2$

Desired velocity in forebay, V_f =	0.4	m/s
Inlet flow rate , Q_{10yr} =	2.205	m^3/s
Depth in forebay, d =	1.0	m

$$Dist_2 = \frac{8Q}{dV_f}$$

= 44 m

Therefore, the dispersion length of 44 m governs the design.

Required Length	**= 44 m**
Provided Length	**= 48 m**

Minimum Forebay width:

Length of Forebay, L =	44	m
Minimum width, W =	L/3	
W =	14.7	m

Required Width	**= 14.7 m**
Provided Width	**= 15.0 m**

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19/05/2016

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SWM FACILITY DESIGN - Pond 2

Sediment Loading Estimate

Table 6.3 - MOE SWM Planning & Design Manual

Catchment Imperviousness	Annual Loading (kg/ha)	Wet Density (kg/m³)	Annual Loading (m³/ha)
	50	1,230	0.05
35%	770	1,230	0.6
55%	2,300	1,230	1.9
70%	3,495	1,230	2.8
85%	4,680	1,230	3.8

Catchment Area:	17.60	ha
% Impervious:	41%	
Annual Sediment Loading:	1,229	kg/ha/yr
	1.00	m^3/ha/yr
	17.6	m^3/yr

Sediment Removal Efficiency:	80%	
	14.07	m^3/yr

Sediment Accumulation:		
10yrs	141	m^3

Forebay Volume:	502	m^3
@ depth:	0.80	m

(Depth to top of Forebay Berm)

City of Ottawa-average precipitation and TSS data

Drainage Area:	17.6	ha
Runoff Coefficient:	0.49	
Estimate Influent TSS Level (max):	250	mg/L
(Long-term average):	150	mg/L
Sediment Density:	1,230	kg/m^3
Total Annual Precipitation:	907	mm
Total Annual Rain (Ice Free Period):	686	mm
Total Annual Runoff:	77,741	m^3
Runoff during Ice-free period:	58,798	m^3
Max Annual TSS Loading:	19,435	kg
(total precipitation)	15.8	m^3/yr
Max Annual TSS Loading:	14,700	kg
(precipitation during ice-free period)	12.0	m^3/yr
Average Annual TSS Loading:	11,661	kg
(total precipitation)	9.5	m^3/yr
Average Annual TSS Loading:	8,820	kg
(precipitation during ice-free period)	7.2	m^3/yr

Target 80% TSS Removal:		
Max:	12.6	m^3/yr
Min:	5.7	m^3/yr

Sediment Accumulation:		
10yrs	126	m^3

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19/05/2016

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SWM FACILITY DESIGN - Pond 2

NOVATECH Engineers, Planners & Landscape Architects

SWM Facility - Outlet Calculations

Orifice (Extended Detention) **Allowable = 3.00 L/s (max)** *25mm allowable

C	0.62	
Dia	55.00	mm
Area	0.0024	m^2
Invert	79.50	m
C/L	79.53	m

For Elevation = 079.75 m

Q orifice = $C \times A \times (2 \times g \times H)^{(1/2)}$

Q orifice = 1000 L/m^3 x 0.62 x 0.0024 m^2 x (2 x 9.81 x (79.75 m - 79.53 m)) $^{(1/2)}$

Q orifice = 3.08 L/s

Second Orifice

C	0.62	
Dia	100.00	mm
Area	0.0079	m^2
Invert	80.40	m
C/L	80.45	m

For Elevation = 81.50 m

Q orifice = $C \times A \times (2 \times g \times H)^{(1/2)}$

Q orifice = 1000 L/m^3 x 0.62 x 0.0079 m^2 x (2 x 9.81 x (81.50 m - 80.45 m)) $^{(1/2)}$

Q orifice = 22.10 L/s

Triangular Weir

Q (m^3/s) = $C_{ws} \times \tan(\theta/2) \times H^{(5/2)}$

Side Weir Coefficeint (C_{ws})	1.45	(ranges from 1.35 to 1.55)
Angle (θ - degrees)	40.0	
Bottom Width (L - m)	0.0	
Bottom of Weir Elevation (m)	81.20	

Water Level Elevation	**Flow Rate Over Weir**	
(m)	**(m^3/s)**	**(L/s)**
81.20	0.000	0.0
81.30	0.002	1.7
81.40	0.009	9.4
81.50	0.026	26.0
81.60	0.053	53.4
81.70	0.093	93.3
81.80	0.147	147.2

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SWM FACILITY DESIGN - Pond 2

Engineers, Planners & Landscape Architects

SWM Facility - Stage-Storage

Stage	Elevation	Area	Volume		Outflow		
	(m)	m^2	Stage m^3	Total m^3	Orifice l/s	Weir l/s	Total l/s
Permanent Pool				**1990.5**			
Pond Bottom	78.50	1494	0	0			
Permanent Pool	79.50	2487	1991	1991	0	0	0
Extended Detention	79.75	4719	901	2891	3	0	3
	80.00	5150	1234	4125	4	0	4
2-year	80.50	6042	2798	6923	11	0	11
5-year	80.80	6596	1896	8819	20	0	20
	81.00	6973	1357	10175	24	0	24
100yr	81.50	7944	3729	13905	31	26	57
	81.80	11913	2979	16883	35	147	182

Required Storage Volume Check		
Storm Event	Active Volume (m^3)	Total Volume (m^3)
25mm	2,400	5,022
2-year	3,980	6,602
5-year	5,600	8,222
100-year	10,030	12,652

Allowable Outlet Flow	
Storm Event	Flow (L/s)
25mm	3.0
2-year	16.0
5-year	32.0
100-year	84.0

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SWM FACILITY DESIGN - Pond 2A

Engineers, Planners & Landscape Architects

Required storage Volumes (Quality)

Drainage Area	**17.6**	ha
% Impervious:	**41%**	
Enhanced protection (80% TSS removal):		
Treatment Volume	149	m3/ha
Extended Detention Storage:	40	m3/ha required
	704	m3 required
	842	m3 provided
	47.9	m3/ha provided
Perm Pool:	109	m3/ha required
	1,918	m3 required
	2,106	m3 provided
	119.7	m3/ha provided
Extended Detention:	19.50	L/s average
	48.75	L/s max (2.5 x avg)

(% impervious was calculated as the average imperviousness
for the drainage areas tributary to the SWM facility)

Required Forebay Length and width

Parameters:

Length to width ratio of forebay, r =	6.0:1	
Peak outflow rate during 25 mm storm, (	0.030	m^3/s (24hr ext. det)
Target particle size =	150	mm
Settling velocity, V_s =	0.0003	m/s

Forebay Settling Length, Dist

$$Dist = \sqrt{\frac{rQ_P}{V_S}}$$

= 24 m

Check Dispersion Length, Dist$_2$

Desired velocity in forebay, V_f =	0.4	m/s
Inlet flow rate , Q_{10yr} =	2.205	m^3/s
Depth in forebay, d =	1.0	m

$$Dist_2 = \frac{8Q}{dV_f}$$

= 44 m

Therefore, the dispersion length of 44 m governs the design.

Required Length	**= 44 m**
Provided Length	**= 68 m**

Minimum Forebay width:

Length of Forebay, L = 44 m

Minimum width, W = L/6

W = 7.4 m

Required Width	**= 7.4 m**
Provided Width	**= 8.0 m**

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19/05/2016

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SWM FACILITY DESIGN - Pond 2A

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Sediment Loading Estimate

Table 6.3 - MOE SWM Planning & Design Manual

Catchment Imperviousness	Annual Loading (kg/ha)	Wet Density (kg/m³)	Annual Loading (m³/ha)
	50	1,230	0.05
35%	770	1,230	0.6
55%	2,300	1,230	1.9
70%	3,495	1,230	2.8
85%	4,680	1,230	3.8

Catchment Area:	17.60	ha
% Impervious:	41%	
Annual Sediment Loading:	1,229	kg/ha/yr
	1.00	m^3/ha/yr
	17.6	m^3/yr

Sediment Removal Efficiency:	70%	
	12.31	m^3/yr

Sediment Accumulation:		
10yrs	123	m^3

Forebay Volume:	804	m^3
@ depth:	0.80	m

(Depth to top of Forebay Berm)

City of Ottawa-average precipitation and TSS data

Drainage Area:	17.6	ha
Runoff Coefficient:	0.49	
Estimate Influent TSS Level (max):	250	mg/L
(Long-term average):	150	mg/L
Sediment Density:	1,230	kg/m^3
Total Annual Precipitation:	907	mm
Total Annual Rain (Ice Free Period):	686	mm
Total Annual Runoff:	77,741	m^3
Runoff during Ice-free period:	58,798	m^3
Max Annual TSS Loading:	19,435	kg
(total precipitation)	15.8	m^3/yr
Max Annual TSS Loading:	14,700	kg
(precipitation during ice-free period)	12.0	m^3/yr
Average Annual TSS Loading:	11,661	kg
(total precipitation)	9.5	m^3/yr
Average Annual TSS Loading:	8,820	kg
(precipitation during ice-free period)	7.2	m^3/yr

Target 0% TSS Removal:		
Max:	12.6	m^3/yr
Min:	5.7	m^3/yr

Sediment Accumulation:		
10yrs	126	m^3

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SWM FACILITY DESIGN - Pond 2A

SWM Facility - Outlet Calculations

Orifice (Extended Detention) **Allowable = 3.00 L/s (max)** *25mm allowable

C	0.62	
Dia	55.00	mm
Area	0.0024	m^2
Invert	79.50	m
C/L	79.53	m

For Elevation = 79.75 m
Q orifice = $C \times A \times (2 \times g \times H)^{(1/2)}$
Q orifice = $1000\ L/m^3 \times 0.62 \times 0.0024\ m^2 \times (2 \times 9.81 \times (79.75\ m - 79.53\ m))^{(1/2)}$
Q orifice = 3.08 L/s

Second Orifice

C	0.62	
Dia	100.00	mm
Area	0.0079	m^2
Invert	80.40	m
C/L	80.45	m

For Elevation = 81.50 m
Q orifice = $C \times A \times (2 \times g \times H)^{(1/2)}$
Q orifice = $1000\ L/m^3 \times 0.62 \times 0.0079\ m^2 \times (2 \times 9.81 \times (81.50\ m - 80.45\ m))^{(1/2)}$
Q orifice = 22.10 L/s

Triangular Weir
$Q\ (m^3/s) = C_{ws} \times \tan(\theta/2) \times H^{(5/2)}$

Side Weir Coefficeint (C_{ws})	1.45	(ranges from 1.35 to 1.55)
Angle (θ - degrees)	40.0	
Bottom Width (L - m)	0.0	
Bottom of Weir Elevation (m)	81.20	

Water Level Elevation	**Flow Rate Over Weir**	
(m)	**(m^3/s)**	**(L/s)**
81.20	0.000	0.0
81.30	0.002	1.7
81.40	0.009	9.4
81.50	0.026	26.0
81.60	0.053	53.4
81.70	0.093	93.3
81.80	0.147	147.2

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SWM FACILITY DESIGN - Pond 2A

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SWM Facility - Stage-Storage

Stage	Elevation (m)	Area m^2	Volume		Outflow		
			Stage m^3	Total m^3	Orifice l/s	Weir l/s	Total l/s
Permanent Pool				**2106.0**			
Pond Bottom	78.50	1568	0	0			
Permanent Pool	79.50	2644	2106	2106	0	0	0
Extended Detention	79.75	4095	842	2948	3	0	3
	80.00	4586	1085	4034	4	0	4
	80.50	6367	2738	6772	11	0	11
2-year	80.55	6447	320	7092	13	0	13
5-year	80.85	6936	2007	9100	21	0	21
	81.00	7185	1059	10159	24	0	24
100yr	81.50	8043	3807	13966	31	26	57
	81.80	11805	2977	16943	35	147	182

Required Storage Volume Check		
Storm Event	Active Volume (m^3)	Total Volume (m^3)
25mm	2,400	5,022
2-year	3,980	6,602
5-year	5,600	8,222
100-year	10,030	12,652

Allowable Outlet Flow	
Storm Event	Flow (L/s)
25mm	3.0
2-year	16.0
5-year	31.0
100-year	84.0

KANATA NORTH
COMMUNITY DESIGN PLAN

FIGURE NO. H-2

PROPOSED CONDITIONS
HEC-RAS MODEL
SCHEMATIC

DATE
MAY 2016

JOB
112117

SCALE
NTS

NOVATECH
Engineers, Planners & Landscape Architects

M:\2012\112117\CAD\Design_EMP\MEMO (CS)\HECRAS Figs.dwg, H-2 PropCond, Apr 04, 2016 - 11:46am, bthurber

SHT11x17.DWG - 279mmx432mm

HEC-RAS Output: Proposed Conditions

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary 3	4112.66	100yr-24hrSCS	1.02	89.22	89.46	89.46	89.53	0.024009	1.14	0.9	7.04	1
Tributary 3	4112.66	5yr-24hrSCS	0.36	89.22	89.38	89.38	89.42	0.027988	0.9	0.4	4.88	1
Tributary 3	4112.66	2yr-24hrSCS	0.2	89.22	89.35	89.35	89.38	0.034006	0.84	0.24	3.81	1.06
Tributary 3	4103.10*	100yr-24hrSCS	1.02	88.98	89.22	89.23	89.3	0.029996	1.23	0.82	6.33	1.09
Tributary 3	4103.10*	5yr-24hrSCS	0.36	88.98	89.13	89.14	89.19	0.042138	1.08	0.33	4.03	1.2
Tributary 3	4103.10*	2yr-24hrSCS	0.2	88.98	89.07	89.11	89.17	0.111662	1.35	0.15	2.7	1.83
Tributary 3	4093.54*	100yr-24hrSCS	1.02	88.74	88.98	88.98	89.05	0.029316	1.19	0.85	6.26	1.03
Tributary 3	4093.54*	5yr-24hrSCS	0.36	88.74	88.83	88.89	88.99	0.16652	1.78	0.2	2.98	2.18
Tributary 3	4093.54*	2yr-24hrSCS	0.2	88.74	88.86	88.84	88.88	0.023697	0.75	0.27	3.38	0.85
Tributary 3	4083.98*	100yr-24hrSCS	1.02	88.49	88.72	88.72	88.79	0.030322	1.19	0.85	6.17	1.02
Tributary 3	4083.98*	5yr-24hrSCS	0.36	88.49	88.63	88.63	88.67	0.024898	0.86	0.42	4.21	0.88
Tributary 3	4083.98*	2yr-24hrSCS	0.2	88.49	88.59	88.58	88.62	0.037467	0.85	0.24	3.39	1.02
Tributary 3	4074.43	100yr-24hrSCS	1.02	88.25	88.48	88.46	88.53	0.019666	1.02	0.99	6.28	0.82
Tributary 3	4074.43	5yr-24hrSCS	0.36	88.25	88.31	88.36	88.51	0.312704	1.98	0.18	3.39	2.73
Tributary 3	4074.43	2yr-24hrSCS	0.2	88.25	88.35		88.37	0.022489	0.67	0.3	3.96	0.78
Tributary 3	4063.93*	100yr-24hrSCS	1.02	88.07	88.3		88.35	0.019318	1.01	1.01	6.43	0.81
Tributary 3	4063.93*	5yr-24hrSCS	0.36	88.07	88.2	88.17	88.23	0.019243	0.75	0.48	4.79	0.75
Tributary 3	4063.93*	2yr-24hrSCS	0.2	88.07	88.17		88.19	0.017504	0.61	0.34	4.23	0.69
Tributary 3	4053.43*	100yr-24hrSCS	1.02	87.89	88.11		88.16	0.021806	1.04	0.97	6.47	0.86
Tributary 3	4053.43*	5yr-24hrSCS	0.36	87.89	88.02		88.05	0.021099	0.76	0.47	4.89	0.78
Tributary 3	4053.43*	2yr-24hrSCS	0.2	87.89	87.98	87.97	88	0.024054	0.67	0.31	4.25	0.8
Tributary 3	4042.93*	100yr-24hrSCS	1.02	87.71	87.93		87.98	0.020161	1	1.01	6.75	0.82
Tributary 3	4042.93*	5yr-24hrSCS	0.36	87.71	87.84		87.86	0.018774	0.72	0.5	5.12	0.74
Tributary 3	4042.93*	2yr-24hrSCS	0.2	87.71	87.81		87.82	0.017458	0.59	0.35	4.56	0.68
Tributary 3	4032.43*	100yr-24hrSCS	1.02	87.54	87.74		87.79	0.021034	1	1.01	6.92	0.84
Tributary 3	4032.43*	5yr-24hrSCS	0.36	87.54	87.65		87.68	0.021793	0.75	0.48	5.21	0.79
Tributary 3	4032.43*	2yr-24hrSCS	0.2	87.54	87.62		87.64	0.021686	0.63	0.33	4.65	0.75
Tributary 3	4021.93*	100yr-24hrSCS	1.02	87.36	87.56	87.53	87.61	0.018768	0.95	1.07	7.29	0.79
Tributary 3	4021.93*	5yr-24hrSCS	0.36	87.36	87.47		87.5	0.018209	0.7	0.52	5.5	0.72
Tributary 3	4021.93*	2yr-24hrSCS	0.2	87.36	87.44		87.46	0.018519	0.58	0.35	4.9	0.7
Tributary 3	4011.43*	100yr-24hrSCS	1.02	87.18	87.36	87.35	87.42	0.024375	1.04	0.98	7.1	0.89
Tributary 3	4011.43*	5yr-24hrSCS	0.36	87.18	87.29		87.31	0.022961	0.74	0.48	5.55	0.8
Tributary 3	4011.43*	2yr-24hrSCS	0.2	87.18	87.26		87.28	0.022573	0.61	0.33	5	0.76
Tributary 3	4000.94	100yr-24hrSCS	1.02	87	87.21	87.17	87.24	0.014455	0.85	1.19	7.87	0.7
Tributary 3	4000.94	5yr-24hrSCS	0.36	87	87.11	87.09	87.14	0.016568	0.66	0.55	5.94	0.69
Tributary 3	4000.94	2yr-24hrSCS	0.2	87	87.08	87.07	87.1	0.01715	0.55	0.37	5.32	0.67
Tributary 3	3990.29*	100yr-24hrSCS	1.02	86.84	87.06	87.03	87.1	0.014019	0.88	1.15	7.29	0.71
Tributary 3	3990.29*	5yr-24hrSCS	0.36	86.84	86.97	86.94	86.99	0.014411	0.66	0.54	5.38	0.67
Tributary 3	3990.29*	2yr-24hrSCS	0.2	86.84	86.93	86.91	86.95	0.014683	0.56	0.36	4.74	0.65
Tributary 3	3979.64*	100yr-24hrSCS	1.02	86.68	86.93	86.88	86.97	0.014041	0.91	1.12	6.84	0.72
Tributary 3	3979.64*	5yr-24hrSCS	0.36	86.68	86.82	86.79	86.85	0.013983	0.69	0.52	4.81	0.67
Tributary 3	3979.64*	2yr-24hrSCS	0.2	86.68	86.78	86.76	86.8	0.017435	0.63	0.32	4.05	0.71
Tributary 3	3969.00*	100yr-24hrSCS	1.02	86.52	86.79	86.75	86.84	0.013564	0.93	1.09	6.48	0.72
Tributary 3	3969.00*	5yr-24hrSCS	0.36	86.52	86.68	86.64	86.7	0.013826	0.73	0.49	4.24	0.69
Tributary 3	3969.00*	2yr-24hrSCS	0.2	86.52	86.63	86.61	86.65	0.014418	0.64	0.32	3.54	0.67
Tributary 3	3958.35*	100yr-24hrSCS	1.02	86.36	86.66	86.62	86.71	0.013369	0.96	1.06	6.19	0.74
Tributary 3	3958.35*	5yr-24hrSCS	0.36	86.36	86.53	86.51	86.56	0.015541	0.82	0.44	3.64	0.75
Tributary 3	3958.35*	2yr-24hrSCS	0.2	86.36	86.48	86.46	86.51	0.016148	0.72	0.28	2.94	0.74
Tributary 3	3947.71*	100yr-24hrSCS	1.02	86.2	86.54	86.5	86.59	0.012245	0.94	1.08	6.26	0.73
Tributary 3	3947.71*	5yr-24hrSCS	0.36	86.2	86.41	86.37	86.44	0.012188	0.8	0.45	3.36	0.69
Tributary 3	3947.71*	2yr-24hrSCS	0.2	86.2	86.35	86.32	86.38	0.013172	0.72	0.28	2.59	0.7
Tributary 3	3937.06*	100yr-24hrSCS	1.02	86.04	86.42	86.38	86.47	0.012871	0.94	1.08	6.62	0.74
Tributary 3	3937.06*	5yr-24hrSCS	0.36	86.04	86.3	86.25	86.33	0.010533	0.76	0.47	3.33	0.65
Tributary 3	3937.06*	2yr-24hrSCS	0.2	86.04	86.23	86.19	86.26	0.011065	0.7	0.29	2.39	0.65
Tributary 3	3926.42	100yr-24hrSCS	1.02	85.88	86.32	86.27	86.35	0.010838	0.85	1.2	7.79	0.69
Tributary 3	3926.42	5yr-24hrSCS	0.36	85.88	86.2	86.14	86.23	0.010532	0.71	0.51	4.18	0.65
Tributary 3	3926.42	2yr-24hrSCS	0.2	85.88	86.14	86.09	86.16	0.009054	0.68	0.3	2.36	0.6
Tributary 3	3916.75*	100yr-24hrSCS	1.02	85.84	86.22	86.17	86.26	0.009327	0.8	1.26	7.95	0.64
Tributary 3	3916.75*	5yr-24hrSCS	0.36	85.84	86.11	86.06	86.13	0.010078	0.68	0.53	4.52	0.63
Tributary 3	3916.75*	2yr-24hrSCS	0.2	85.84	86.05	86.01	86.07	0.009508	0.62	0.33	3.09	0.6

HEC-RAS Output: Proposed Conditions

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary 3	3907.08*	100yr-24hrSCS	1.02	85.79	86.16	86.08	86.19	0.005698	0.69	1.46	7.95	0.52
Tributary 3	3907.08*	5yr-24hrSCS	0.36	85.79	86.04	85.98	86.05	0.006317	0.56	0.64	5.13	0.51
Tributary 3	3907.08*	2yr-24hrSCS	0.2	85.79	85.99	85.93	86	0.006141	0.49	0.41	3.97	0.49
Tributary 3	3897.42	100yr-24hrSCS	1.02	85.75	86.03	86.01	86.1	0.014119	1.15	0.9	5.83	0.82
Tributary 3	3897.42	5yr-24hrSCS	0.36	85.75	85.92	85.9	85.96	0.015938	0.87	0.41	3.44	0.8
Tributary 3	3897.42	2yr-24hrSCS	0.2	85.75	85.88	85.86	85.91	0.016005	0.74	0.27	2.93	0.77
Tributary 3	3888.47*	100yr-24hrSCS	1.02	85.63	85.9	85.88	85.97	0.016256	1.13	0.9	4.9	0.85
Tributary 3	3888.47*	5yr-24hrSCS	0.36	85.63	85.79	85.77	85.83	0.015594	0.83	0.43	3.71	0.77
Tributary 3	3888.47*	2yr-24hrSCS	0.2	85.63	85.76	85.74	85.78	0.0142	0.67	0.31	3.35	0.71
Tributary 3	3879.53*	100yr-24hrSCS	1.02	85.5	85.76	85.74	85.82	0.015532	1.09	0.93	5.03	0.81
Tributary 3	3879.53*	5yr-24hrSCS	0.36	85.5	85.67	85.64	85.7	0.012816	0.72	0.5	4.31	0.68
Tributary 3	3879.53*	2yr-24hrSCS	0.2	85.5	85.63	85.61	85.65	0.01449	0.63	0.33	3.86	0.69
Tributary 3	3870.59*	100yr-24hrSCS	1.02	85.38	85.63	85.6	85.69	0.015769	1.04	0.98	5.54	0.79
Tributary 3	3870.59*	5yr-24hrSCS	0.36	85.38	85.54	85.52	85.57	0.015293	0.71	0.5	4.87	0.71
Tributary 3	3870.59*	2yr-24hrSCS	0.2	85.38	85.51	85.48	85.52	0.015038	0.59	0.34	4.35	0.67
Tributary 3	3861.65*	100yr-24hrSCS	1.02	85.26	85.52	85.48	85.56	0.012095	0.9	1.13	6.22	0.67
Tributary 3	3861.65*	5yr-24hrSCS	0.36	85.26	85.42	85.39	85.44	0.012336	0.63	0.57	5.54	0.62
Tributary 3	3861.65*	2yr-24hrSCS	0.2	85.26	85.39	85.36	85.4	0.012505	0.52	0.39	4.99	0.6
Tributary 3	3852.71	100yr-24hrSCS	1.02	85.13	85.36	85.34	85.41	0.022055	1.04	0.98	6.58	0.86
Tributary 3	3852.71	5yr-24hrSCS	0.36	85.13	85.29	85.27	85.31	0.016658	0.65	0.55	6.11	0.69
Tributary 3	3852.71	2yr-24hrSCS	0.2	85.13	85.26	85.24	85.27	0.017898	0.56	0.36	5.29	0.68
Tributary 3	3841.15*	100yr-24hrSCS	1.02	84.96	85.14	85.13	85.19	0.024849	1.02	1	7.86	0.91
Tributary 3	3841.15*	5yr-24hrSCS	0.36	84.96	85.07	85.06	85.1	0.029187	0.77	0.47	6.36	0.9
Tributary 3	3841.15*	2yr-24hrSCS	0.2	84.96	85.04	85.04	85.06	0.025561	0.61	0.33	5.78	0.81
Tributary 3	3829.60*	100yr-24hrSCS	1.02	84.78	84.95	84.93	84.99	0.017927	0.88	1.16	9.34	0.79
Tributary 3	3829.60*	5yr-24hrSCS	0.36	84.78	84.89	84.86	84.9	0.014229	0.58	0.62	7.73	0.66
Tributary 3	3829.60*	2yr-24hrSCS	0.2	84.78	84.86	84.84	84.87	0.017096	0.51	0.4	6.91	0.68
Tributary 3	3818.05*	100yr-24hrSCS	1.02	84.6	84.74	84.73	84.79	0.024642	0.95	1.07	10.04	0.93
Tributary 3	3818.05*	5yr-24hrSCS	0.36	84.6	84.68	84.67	84.7	0.032311	0.74	0.49	8.25	0.97
Tributary 3	3818.05*	2yr-24hrSCS	0.2	84.6	84.66	84.65	84.68	0.023636	0.55	0.37	7.72	0.8
Tributary 3	3806.50*	100yr-24hrSCS	1.02	84.43	84.56	84.54	84.59	0.015534	0.79	1.28	11.67	0.76
Tributary 3	3806.50*	5yr-24hrSCS	0.36	84.43	84.51		84.52	0.011969	0.51	0.7	10.02	0.62
Tributary 3	3806.50*	2yr-24hrSCS	0.2	84.43	84.48	84.46	84.49	0.01489	0.45	0.45	9.24	0.65
Tributary 3	3794.95	100yr-24hrSCS	1.02	84.25	84.35	84.35	84.4	0.030386	0.95	1.06	12.69	1.05
Tributary 3	3794.95	5yr-24hrSCS	0.36	84.25	84.3	84.3	84.33	0.035795	0.71	0.51	10.68	1.04
Tributary 3	3794.95	2yr-24hrSCS	0.2	84.25	84.29	84.29	84.31	0.027992	0.54	0.38	10.17	0.88
Tributary 3	3785.62*	100yr-24hrSCS	1.02	83.91	84.01	84.02	84.07	0.042848	1.12	0.91	11.02	1.24
Tributary 3	3785.62*	5yr-24hrSCS	0.36	83.91	83.97	83.97	84	0.037369	0.77	0.47	9.07	1.08
Tributary 3	3785.62*	2yr-24hrSCS	0.2	83.91	83.95	83.95	83.97	0.047784	0.69	0.3	8.16	1.15
Tributary 3	3776.29*	100yr-24hrSCS	1.02	83.56	83.7	83.7	83.75	0.030524	1.02	0.99	10.74	1.07
Tributary 3	3776.29*	5yr-24hrSCS	0.36	83.56	83.64	83.64	83.67	0.034525	0.79	0.45	7.92	1.05
Tributary 3	3776.29*	2yr-24hrSCS	0.2	83.56	83.62	83.62	83.64	0.028554	0.62	0.33	7.05	0.92
Tributary 3	3766.96*	100yr-24hrSCS	1.02	83.22	83.37	83.38	83.43	0.040884	1.15	0.88	9.96	1.23
Tributary 3	3766.96*	5yr-24hrSCS	0.36	83.22	83.3	83.31	83.36	0.067696	1.05	0.34	6.44	1.45
Tributary 3	3766.96*	2yr-24hrSCS	0.2	83.22	83.29	83.29	83.32	0.044412	0.77	0.26	5.74	1.15
Tributary 3	3757.64	100yr-24hrSCS	1.02	82.88	83.06	83.06	83.11	0.030704	1.04	0.97	10.2	1.08
Tributary 3	3757.64	5yr-24hrSCS	0.36	82.88	82.92	83	85.74	12.46491	7.44	0.05	2.4	16.75
Tributary 3	3757.64	2yr-24hrSCS	0.2	82.88	82.88	82.97	1869.84	90489.85	187.29	0	0.33	1045.75
Tributary 3	3748.27*	100yr-24hrSCS	1.02	82.62	82.81	82.81	82.86	0.026995	0.95	1.06	11.6	1.01
Tributary 3	3748.27*	5yr-24hrSCS	0.36	82.62	82.73	82.75	82.79	0.067894	1.05	0.34	6.49	1.45
Tributary 3	3748.27*	2yr-24hrSCS	0.2	82.62	82.72	82.72	82.75	0.040296	0.75	0.27	5.78	1.1
Tributary 3	3738.91*	100yr-24hrSCS	1.02	82.37	82.55	82.55	82.6	0.031819	1.02	1	11.14	1.09
Tributary 3	3738.91*	5yr-24hrSCS	0.36	82.37	82.42	82.5	83.62	3.878616	4.85	0.07	2.92	9.73
Tributary 3	3738.91*	2yr-24hrSCS	0.2	82.37	82.38	82.47	188.9	2245.341	45.73	0	0.72	185.18
Tributary 3	3729.54*	100yr-24hrSCS	1.02	82.11	82.28	82.29	82.34	0.041135	1.12	0.91	10.68	1.23
Tributary 3	3729.54*	5yr-24hrSCS	0.36	82.11	82.22	82.22	82.26	0.044103	0.87	0.41	7.39	1.18
Tributary 3	3729.54*	2yr-24hrSCS	0.2	82.11	82.16	82.21	82.7	2.199217	3.27	0.06	2.92	7.12
Tributary 3	3720.18	100yr-24hrSCS	1.02	81.86	82.13	82.03	82.14	0.002084	0.38	2.65	16.67	0.31
Tributary 3	3720.18	5yr-24hrSCS	0.36	81.86	81.9	81.96	82.36	1.397973	3.01	0.12	4.5	5.89
Tributary 3	3720.18	2yr-24hrSCS	0.2	81.86	81.9	81.94	82.09	0.643645	1.93	0.11	4.33	3.94

HEC-RAS Output: Proposed Conditions

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary 3	3710.92*	100yr-24hrSCS	1.02	81.74	82.12		82.12	0.001311	0.34	2.98	15.11	0.24
Tributary 3	3710.92*	5yr-24hrSCS	0.36	81.74	81.88	81.88	81.91	0.02159	0.77	0.47	5.68	0.86
Tributary 3	3710.92*	2yr-24hrSCS	0.2	81.74	81.85	81.84	81.87	0.017747	0.62	0.33	4.71	0.76
Tributary 3	3701.66*	100yr-24hrSCS	1.02	81.62	82.11		82.12	0.000549	0.27	3.74	13.29	0.16
Tributary 3	3701.66*	5yr-24hrSCS	0.36	81.62	81.8	81.72	81.81	0.005234	0.49	0.73	5.82	0.44
Tributary 3	3701.66*	2yr-24hrSCS	0.2	81.62	81.72		81.74	0.013654	0.59	0.35	4.27	0.66
Tributary 3	3692.41*	100yr-24hrSCS	1.45	81.49	82.11		82.11	0.000497	0.31	4.66	11.94	0.16
Tributary 3	3692.41*	5yr-24hrSCS	0.57	81.49	81.78		81.78	0.001585	0.37	1.53	7.19	0.26
Tributary 3	3692.41*	2yr-24hrSCS	0.37	81.49	81.69		81.69	0.002834	0.4	0.92	5.93	0.33
Tributary 3	3683.15*	100yr-24hrSCS	1.45	81.37	82.1	81.57	82.11	0.000238	0.25	5.7	10.88	0.11
Tributary 3	3683.15*	5yr-24hrSCS	0.57	81.37	81.78	81.48	81.78	0.000334	0.22	2.59	8.04	0.12
Tributary 3	3683.15*	2yr-24hrSCS	0.37	81.37	81.68	81.45	81.68	0.00036	0.2	1.88	7.25	0.12
Tributary 3	3676		Culvert									
Tributary 3	3664.25*	100yr-24hrSCS	1.45	81.25	81.49		81.49	0.001528	0.36	3.99	17.48	0.24
Tributary 3	3664.25*	5yr-24hrSCS	0.57	81.25	81.37		81.37	0.002392	0.29	1.95	16.86	0.27
Tributary 3	3664.25*	2yr-24hrSCS	0.37	81.25	81.34		81.35	0.002117	0.24	1.56	16.74	0.25
Tributary 3	3654.60*	100yr-24hrSCS	1.45	81.25	81.48		81.48	0.000638	0.23	6.24	27.86	0.16
Tributary 3	3654.60*	5yr-24hrSCS	0.57	81.25	81.35		81.35	0.00155	0.21	2.68	26.98	0.21
Tributary 3	3654.60*	2yr-24hrSCS	0.37	81.25	81.33		81.33	0.001548	0.18	2.07	26.82	0.2
Tributary 3	3644.95*	100yr-24hrSCS	1.45	81.25	81.48		81.48	0.000352	0.17	8.46	38.28	0.12
Tributary 3	3644.95*	5yr-24hrSCS	0.57	81.25	81.34		81.34	0.001272	0.18	3.23	37.11	0.19
Tributary 3	3644.95*	2yr-24hrSCS	0.37	81.25	81.32		81.32	0.001405	0.15	2.43	36.91	0.19
Tributary 3	3635.31	100yr-24hrSCS	1.45	81.25	81.47		81.48	0.000223	0.14	10.69	48.74	0.09
Tributary 3	3635.31	5yr-24hrSCS	0.57	81.25	81.32		81.32	0.001439	0.17	3.43	47.18	0.2
Tributary 3	3635.31	2yr-24hrSCS	0.37	81.25	81.28		81.28	0.010286	0.25	1.47	46.7	0.45
Tributary 3	3625.37*	100yr-24hrSCS	1.45	81.19	81.47		81.47	0.000169	0.14	10.32	37.6	0.09
Tributary 3	3625.37*	5yr-24hrSCS	0.57	81.19	81.32		81.32	0.000361	0.12	4.6	36.11	0.11
Tributary 3	3625.37*	2yr-24hrSCS	0.37	81.19	81.27		81.27	0.000804	0.13	2.79	35.67	0.15
Tributary 3	3615.43*	100yr-24hrSCS	1.45	81.12	81.47		81.47	0.000183	0.17	8.66	26.72	0.09
Tributary 3	3615.43*	5yr-24hrSCS	0.57	81.12	81.31		81.32	0.000209	0.12	4.62	25.15	0.09
Tributary 3	3615.43*	2yr-24hrSCS	0.37	81.12	81.26		81.26	0.000259	0.11	3.33	24.7	0.1
Tributary 3	3605.49*	100yr-24hrSCS	1.45	81.06	81.47		81.47	0.00034	0.25	5.72	16.37	0.14
Tributary 3	3605.49*	5yr-24hrSCS	0.57	81.06	81.31		81.31	0.000273	0.17	3.32	14.63	0.11
Tributary 3	3605.49*	2yr-24hrSCS	0.37	81.06	81.26		81.26	0.000254	0.14	2.58	14	0.11
Tributary 3	3595.55	100yr-24hrSCS	1.45	81	81.38		81.45	0.01233	1.18	1.23	5.3	0.79
Tributary 3	3595.55	5yr-24hrSCS	0.57	81	81.26		81.3	0.011479	0.87	0.65	4.28	0.71
Tributary 3	3595.55	2yr-24hrSCS	0.37	81	81.22		81.25	0.011362	0.77	0.48	3.74	0.69
Tributary 3	3585.28*	100yr-24hrSCS	1.45	80.9	81.28		81.34	0.010685	1.02	1.42	6.69	0.7
Tributary 3	3585.28*	5yr-24hrSCS	0.57	80.9	81.17		81.2	0.009785	0.76	0.74	5.04	0.63
Tributary 3	3585.28*	2yr-24hrSCS	0.37	80.9	81.13		81.15	0.009512	0.68	0.54	4.28	0.61
Tributary 3	3575.02*	100yr-24hrSCS	1.45	80.8	81.18		81.23	0.010873	0.94	1.54	7.67	0.67
Tributary 3	3575.02*	5yr-24hrSCS	0.57	80.8	81.06		81.09	0.010826	0.73	0.77	5.55	0.63
Tributary 3	3575.02*	2yr-24hrSCS	0.37	80.8	81.02		81.04	0.010707	0.66	0.56	4.58	0.61
Tributary 3	3564.75*	100yr-24hrSCS	1.45	80.71	81.1	81.01	81.13	0.008199	0.79	1.82	9.07	0.57
Tributary 3	3564.75*	5yr-24hrSCS	0.57	80.71	80.98	80.91	81	0.007259	0.6	0.94	6.52	0.5
Tributary 3	3564.75*	2yr-24hrSCS	0.37	80.71	80.94		80.96	0.007002	0.54	0.69	5.47	0.48
Tributary 3	3554.49	100yr-24hrSCS	1.45	80.61	80.91	80.91	80.98	0.029812	1.23	1.18	7.77	1
Tributary 3	3554.49	5yr-24hrSCS	0.57	80.61	80.81	80.81	80.86	0.032698	1.04	0.54	4.88	1
Tributary 3	3554.49	2yr-24hrSCS	0.37	80.61	80.76	80.76	80.82	0.037403	1.03	0.36	3.67	1.04
Tributary 3	3548.69*	100yr-24hrSCS	1.45	80.55	80.91	80.71	80.92	0.001624	0.4	3.64	14.58	0.25
Tributary 3	3548.69*	5yr-24hrSCS	0.57	80.55	80.73	80.64	80.74	0.003559	0.41	1.39	9.7	0.34
Tributary 3	3548.69*	2yr-24hrSCS	0.37	80.55	80.67	80.63	80.68	0.006965	0.44	0.84	8.58	0.45
Tributary 3	3542.89	100yr-24hrSCS	1.45	80.5	80.92		80.92	0.000293	0.21	7.03	20.95	0.11
Tributary 3	3542.89	5yr-24hrSCS	0.57	80.5	80.73		80.73	0.000408	0.17	3.31	16.76	0.12
Tributary 3	3542.89	2yr-24hrSCS	0.37	80.5	80.67		80.67	0.000521	0.16	2.31	15.6	0.13
Tributary 3	3534.04	100yr-24hrSCS	1.45	80.25	80.79	80.77	80.9	0.018139	1.48	0.98	3.93	0.95
Tributary 3	3534.04	5yr-24hrSCS	0.57	80.25	80.66	80.61	80.71	0.012886	1.05	0.54	2.76	0.76
Tributary 3	3534.04	2yr-24hrSCS	0.37	80.25	80.61	80.55	80.65	0.010096	0.87	0.42	2.41	0.66

HEC-RAS Output: Proposed Conditions

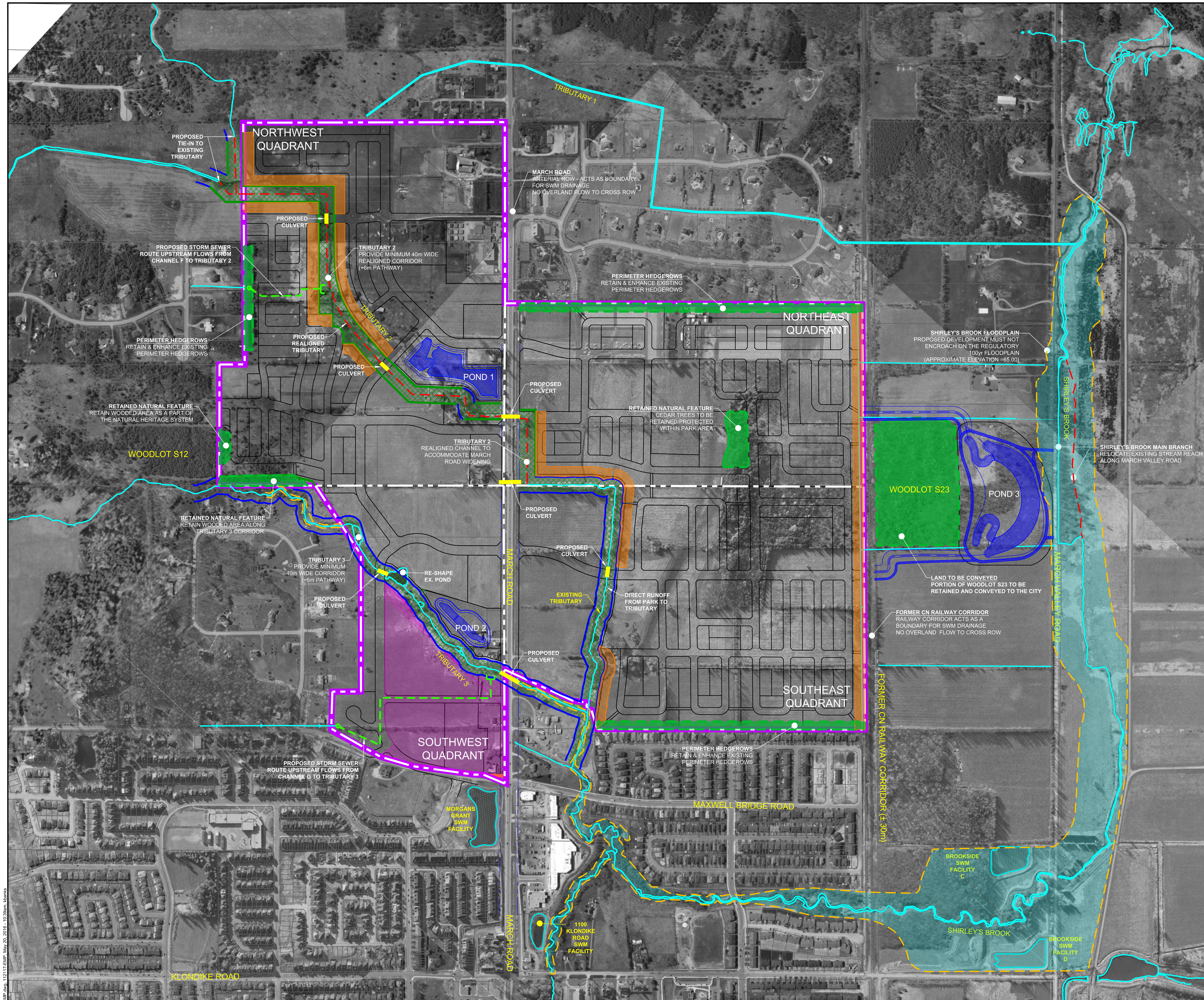
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary 3	3526.39*	100yr-24hrSCS	1.45	80.2	80.64	80.64	80.75	0.020125	1.5	0.97	4.19	1
Tributary 3	3526.39*	5yr-24hrSCS	0.57	80.2	80.51	80.51	80.58	0.02328	1.19	0.48	3.28	1
Tributary 3	3526.39*	2yr-24hrSCS	0.37	80.2	80.46	80.46	80.53	0.028861	1.17	0.32	2.64	1.07
Tributary 3	3518.74	100yr-24hrSCS	1.45	80.16	80.58	80.49	80.64	0.006869	1.05	1.39	4.59	0.61
Tributary 3	3518.74	5yr-24hrSCS	0.57	80.16	80.43	80.36	80.46	0.006952	0.78	0.73	3.82	0.57
Tributary 3	3518.74	2yr-24hrSCS	0.37	80.16	80.26	80.33	80.52	0.29102	2.26	0.16	2.91	3.04
Tributary 3	3509.46*	100yr-24hrSCS	1.45	80.09	80.52		80.58	0.006688	1.03	1.41	4.72	0.6
Tributary 3	3509.46*	5yr-24hrSCS	0.57	80.09	80.37		80.4	0.006664	0.76	0.74	3.88	0.56
Tributary 3	3509.46*	2yr-24hrSCS	0.37	80.09	80.32	80.26	80.34	0.006812	0.67	0.55	3.61	0.55
Tributary 3	3500.18*	100yr-24hrSCS	1.45	80.02	80.47		80.52	0.006195	0.99	1.47	4.92	0.58
Tributary 3	3500.18*	5yr-24hrSCS	0.57	80.02	80.31		80.34	0.005854	0.73	0.78	3.98	0.53
Tributary 3	3500.18*	2yr-24hrSCS	0.37	80.02	80.26		80.28	0.005978	0.64	0.58	3.67	0.51
Tributary 3	3490.90*	100yr-24hrSCS	1.45	79.96	80.42		80.47	0.005331	0.92	1.57	5.23	0.54
Tributary 3	3490.90*	5yr-24hrSCS	0.57	79.96	80.27		80.3	0.00432	0.65	0.87	4.22	0.46
Tributary 3	3490.90*	2yr-24hrSCS	0.37	79.96	80.22		80.24	0.00399	0.55	0.67	3.87	0.43
Tributary 3	3481.62*	100yr-24hrSCS	1.45	79.89	80.38		80.42	0.004321	0.82	1.76	5.93	0.48
Tributary 3	3481.62*	5yr-24hrSCS	0.57	79.89	80.25		80.26	0.002657	0.54	1.05	4.65	0.36
Tributary 3	3481.62*	2yr-24hrSCS	0.37	79.89	80.2		80.21	0.002119	0.44	0.84	4.28	0.32
Tributary 3	3472.34*	100yr-24hrSCS	1.45	79.82	80.36		80.38	0.003069	0.69	2.11	7.3	0.41
Tributary 3	3472.34*	5yr-24hrSCS	0.57	79.82	80.23		80.24	0.001484	0.43	1.32	5.37	0.28
Tributary 3	3472.34*	2yr-24hrSCS	0.37	79.82	80.19		80.2	0.001046	0.34	1.1	4.95	0.23
Tributary 3	3463.06*	100yr-24hrSCS	1.45	79.76	80.35		80.36	0.001777	0.54	2.69	8.89	0.31
Tributary 3	3463.06*	5yr-24hrSCS	0.57	79.76	80.23		80.23	0.00082	0.32	1.75	7.02	0.21
Tributary 3	3463.06*	2yr-24hrSCS	0.37	79.76	80.19		80.19	0.000541	0.25	1.48	6.37	0.17
Tributary 3	3453.78*	100yr-24hrSCS	1.45	79.69	80.34		80.35	0.001099	0.39	3.67	13.6	0.24
Tributary 3	3453.78*	5yr-24hrSCS	0.57	79.69	80.22		80.23	0.000394	0.24	2.4	8.92	0.14
Tributary 3	3453.78*	2yr-24hrSCS	0.37	79.69	80.19		80.19	0.000251	0.18	2.06	8.22	0.11
Tributary 3	3444.51	100yr-24hrSCS	1.45	79.62	80.33		80.34	0.000449	0.27	5.44	18.57	0.16
Tributary 3	3444.51	5yr-24hrSCS	0.57	79.62	80.22		80.22	0.000201	0.16	3.57	14.48	0.1
Tributary 3	3444.51	2yr-24hrSCS	0.37	79.62	80.18		80.18	0.000126	0.12	3.03	12.87	0.08
Tributary 3	3435.9*	100yr-24hrSCS	1.45	79.81	80.33		80.33	0.00092	0.36	4.07	15.37	0.22
Tributary 3	3435.9*	5yr-24hrSCS	0.57	79.81	80.22		80.22	0.000498	0.22	2.55	12.4	0.16
Tributary 3	3435.9*	2yr-24hrSCS	0.37	79.81	80.18		80.18	0.000336	0.18	2.11	10.89	0.13
Tributary 3	3427.29	100yr-24hrSCS	1.45	80	80.3		80.32	0.003656	0.6	2.47	14.78	0.42
Tributary 3	3427.29	5yr-24hrSCS	0.57	80	80.2		80.21	0.003168	0.43	1.33	9.74	0.37
Tributary 3	3427.29	2yr-24hrSCS	0.37	80	80.17		80.18	0.002768	0.36	1.02	8.59	0.34
Tributary 3	3419.8*	100yr-24hrSCS	1.45	80	80.28		80.29	0.003394	0.55	2.64	15.39	0.4
Tributary 3	3419.8*	5yr-24hrSCS	0.57	80	80.18		80.19	0.002798	0.39	1.45	11.04	0.34
Tributary 3	3419.8*	2yr-24hrSCS	0.37	80	80.15		80.16	0.002433	0.33	1.12	9.94	0.31
Tributary 3	3412.31*	100yr-24hrSCS	1.45	80	80.25		80.26	0.003403	0.52	2.77	15.75	0.4
Tributary 3	3412.31*	5yr-24hrSCS	0.57	80	80.16		80.17	0.002771	0.37	1.52	12.34	0.34
Tributary 3	3412.31*	2yr-24hrSCS	0.37	80	80.13		80.14	0.002421	0.31	1.18	11.29	0.31
Tributary 3	3404.82*	100yr-24hrSCS	1.45	80	80.22		80.24	0.003644	0.52	2.8	16.99	0.41
Tributary 3	3404.82*	5yr-24hrSCS	0.57	80	80.14		80.15	0.003258	0.38	1.5	13.51	0.36
Tributary 3	3404.82*	2yr-24hrSCS	0.37	80	80.11		80.12	0.002911	0.32	1.17	12.49	0.33
Tributary 3	3397.33	100yr-24hrSCS	1.45	80	80.19		80.21	0.005105	0.56	2.57	17.71	0.47
Tributary 3	3397.33	5yr-24hrSCS	0.57	80	80.09		80.1	0.01316	0.58	0.98	13.21	0.68
Tributary 3	3397.33	2yr-24hrSCS	0.37	80	80.07		80.08	0.011061	0.47	0.78	12.55	0.6
Tributary 3	3387.68*	100yr-24hrSCS	1.45	79.85	80.17		80.18	0.001262	0.38	3.78	16.24	0.25
Tributary 3	3387.68*	5yr-24hrSCS	0.57	79.85	79.94		79.97	0.017637	0.71	0.8	9.81	0.8
Tributary 3	3387.68*	2yr-24hrSCS	0.37	79.85	79.92	79.92	79.94	0.02047	0.64	0.58	9.27	0.82
Tributary 3	3378.03*	100yr-24hrSCS	1.45	79.7	80.17		80.17	0.000599	0.32	4.55	14.73	0.18
Tributary 3	3378.03*	5yr-24hrSCS	0.57	79.7	79.92		79.93	0.001367	0.34	1.68	9.32	0.25
Tributary 3	3378.03*	2yr-24hrSCS	0.37	79.7	79.71	79.79	83.18	55.98469	8.25	0.04	5.91	30.24
Tributary 3	3368.39*	100yr-24hrSCS	1.45	79.55	80.16		80.17	0.000446	0.31	4.75	13.09	0.16
Tributary 3	3368.39*	5yr-24hrSCS	0.57	79.55	79.92		79.92	0.000459	0.25	2.23	8.23	0.16
Tributary 3	3368.39*	2yr-24hrSCS	0.37	79.55	79.83	79.63	79.84	0.000516	0.23	1.58	7.18	0.16
Tributary 3	3358.74*	100yr-24hrSCS	1.45	79.4	80.16		80.16	0.000504	0.33	4.33	11.34	0.17
Tributary 3	3358.74*	5yr-24hrSCS	0.57	79.4	79.91		79.92	0.00035	0.25	2.24	6.74	0.14
Tributary 3	3358.74*	2yr-24hrSCS	0.37	79.4	79.83		79.83	0.000305	0.22	1.71	5.85	0.13

HEC-RAS Output: Proposed Conditions

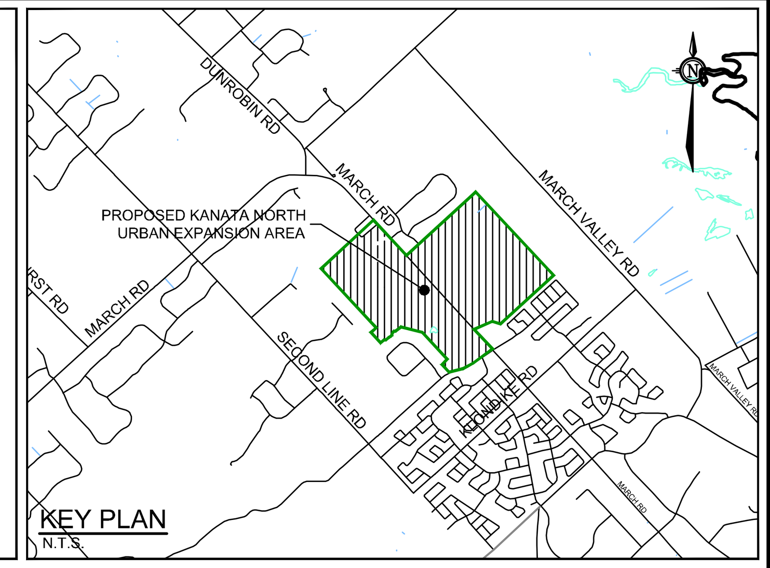
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary 3	3349.1	100yr-24hrSCS	1.45	79.25	80.15		80.16	0.001041	0.45	3.25	9.43	0.24
Tributary 3	3349.1	5yr-24hrSCS	0.57	79.25	79.91		79.91	0.000655	0.34	1.65	4.94	0.19
Tributary 3	3349.1	2yr-24hrSCS	0.37	79.25	79.82		79.83	0.00055	0.29	1.27	4.25	0.17
Tributary 3	3342.86*	100yr-24hrSCS	1.45	79.33	80.13		80.15	0.001665	0.58	2.49	6.88	0.31
Tributary 3	3342.86*	5yr-24hrSCS	0.57	79.33	79.89		79.91	0.001684	0.48	1.17	4.28	0.29
Tributary 3	3342.86*	2yr-24hrSCS	0.37	79.33	79.81		79.82	0.001498	0.43	0.86	3.42	0.27
Tributary 3	3336.63	100yr-24hrSCS	1.45	79.4	79.96	79.96	80.11	0.019774	1.74	0.83	2.71	1
Tributary 3	3336.63	5yr-24hrSCS	0.57	79.4	79.77	79.77	79.87	0.022949	1.43	0.39	1.93	1.01
Tributary 3	3336.63	2yr-24hrSCS	0.37	79.4	79.71	79.71	79.79	0.02348	1.29	0.29	1.68	1
Tributary 3	3327.51*	100yr-24hrSCS	1.45	79.24	79.65	79.71	79.87	0.035047	2.1	0.69	2.64	1.31
Tributary 3	3327.51*	5yr-24hrSCS	0.57	79.24	79.51	79.53	79.63	0.031877	1.56	0.36	2.03	1.18
Tributary 3	3327.51*	2yr-24hrSCS	0.37	79.24	79.46	79.48	79.56	0.031123	1.38	0.27	1.77	1.13
Tributary 3	3318.4*	100yr-24hrSCS	1.45	79.07	79.46	79.47	79.61	0.022379	1.73	0.84	3.03	1.05
Tributary 3	3318.4*	5yr-24hrSCS	0.57	79.07	79.3	79.31	79.4	0.027193	1.42	0.4	2.26	1.08
Tributary 3	3318.4*	2yr-24hrSCS	0.37	79.07	79.23	79.25	79.33	0.037791	1.4	0.26	1.99	1.23
Tributary 3	3309.28*	100yr-24hrSCS	1.45	78.91	79.21	79.25	79.39	0.029461	1.85	0.79	3.19	1.19
Tributary 3	3309.28*	5yr-24hrSCS	0.57	78.91	79.11	79.1	79.18	0.018948	1.18	0.48	2.77	0.91
Tributary 3	3309.28*	2yr-24hrSCS	0.37	78.91	78.97	79.05	79.37	0.437216	2.8	0.13	2.26	3.71
Tributary 3	3300.17	100yr-24hrSCS	1.45	78.75	79.04	79.04	79.16	0.021442	1.58	0.92	3.74	1.02
Tributary 3	3300.17	5yr-24hrSCS	0.57	78.75	78.91	78.91	78.98	0.025303	1.21	0.47	3.25	1.02
Tributary 3	3300.17	2yr-24hrSCS	0.37	78.75	78.87	78.87	78.93	0.026094	1.05	0.35	3.13	1
Tributary 3	3291.61*	100yr-24hrSCS	1.45	78.38	78.6	78.68	78.87	0.058997	2.29	0.63	3.22	1.65
Tributary 3	3291.61*	5yr-24hrSCS	0.57	78.38	78.5	78.54	78.65	0.062588	1.68	0.34	2.87	1.57
Tributary 3	3291.61*	2yr-24hrSCS	0.37	78.38	78.47	78.52	78.58	0.070128	1.5	0.25	2.76	1.6
Tributary 3	3283.05	100yr-24hrSCS	1.45	78	78.28	78.32	78.46	0.034769	1.91	0.76	3.41	1.29
Tributary 3	3283.05	5yr-24hrSCS	0.57	78	78.16	78.18	78.26	0.031699	1.37	0.41	2.88	1.15
Tributary 3	3283.05	2yr-24hrSCS	0.37	78	78.13	78.14	78.2	0.028891	1.15	0.32	2.73	1.07
Tributary 3	3277.27*	100yr-24hrSCS	1.45	77.87	78.3	78.16	78.35	0.004884	0.91	1.59	5.03	0.52
Tributary 3	3277.27*	5yr-24hrSCS	0.57	77.87	78.02	78.04	78.11	0.03242	1.3	0.43	3.34	1.15
Tributary 3	3277.27*	2yr-24hrSCS	0.37	77.87	77.98	78	78.06	0.039662	1.2	0.31	3.12	1.22
Tributary 3	3271.49	100yr-24hrSCS	1.45	77.75	78.31		78.32	0.001286	0.55	2.63	6.47	0.28
Tributary 3	3271.49	5yr-24hrSCS	0.57	77.75	77.97	77.9	78	0.006179	0.71	0.8	4.37	0.53
Tributary 3	3271.49	2yr-24hrSCS	0.37	77.75	77.81	77.86	77.99	0.179642	1.85	0.2	3.32	2.41
Tributary 3	3261.21*	100yr-24hrSCS	1.45	77.64	78.3		78.31	0.000706	0.44	3.26	7.03	0.21
Tributary 3	3261.21*	5yr-24hrSCS	0.57	77.64	77.95		77.96	0.001969	0.49	1.16	4.78	0.31
Tributary 3	3261.21*	2yr-24hrSCS	0.37	77.64	77.85	77.75	77.87	0.003248	0.51	0.73	4.12	0.38
Tributary 3	3250.94*	100yr-24hrSCS	1.45	77.52	78.3	77.81	78.31	0.000415	0.37	3.96	7.63	0.16
Tributary 3	3250.94*	5yr-24hrSCS	0.51	77.52	77.95	77.67	77.95	0.000585	0.31	1.64	5.36	0.18
Tributary 3	3250.94*	2yr-24hrSCS	0.31	77.52	77.85	77.63	77.85	0.000595	0.27	1.15	4.71	0.17
Tributary 3	3246.09		Culvert									
Tributary 3	3209.85*	100yr-24hrSCS	1.45	77.07	77.47		77.54	0.010651	1.18	1.24	4.76	0.74
Tributary 3	3209.85*	5yr-24hrSCS	0.51	77.07	77.31		77.35	0.010865	0.9	0.56	3.29	0.69
Tributary 3	3209.85*	2yr-24hrSCS	0.31	77.07	77.25		77.28	0.011134	0.82	0.38	2.58	0.68
Tributary 3	3199.58*	100yr-24hrSCS	1.45	76.95	77.38		77.45	0.010707	1.17	1.24	4.79	0.74
Tributary 3	3199.58*	5yr-24hrSCS	0.51	76.95	77.21		77.25	0.010877	0.9	0.56	3.25	0.69
Tributary 3	3199.58*	2yr-24hrSCS	0.31	76.95	77.14		77.18	0.01118	0.83	0.37	2.43	0.68
Tributary 3	3189.31*	100yr-24hrSCS	1.45	76.84	77.28		77.35	0.010708	1.17	1.24	4.84	0.74
Tributary 3	3189.31*	5yr-24hrSCS	0.51	76.84	77.11		77.15	0.010765	0.9	0.56	3.22	0.69
Tributary 3	3189.31*	2yr-24hrSCS	0.31	76.84	77.04		77.08	0.011256	0.86	0.36	2.27	0.69
Tributary 3	3179.04*	100yr-24hrSCS	1.45	76.73	77.19		77.25	0.010434	1.14	1.27	4.99	0.72
Tributary 3	3179.04*	5yr-24hrSCS	0.51	76.73	77.02		77.06	0.010531	0.89	0.57	3.24	0.68
Tributary 3	3179.04*	2yr-24hrSCS	0.31	76.73	76.94		76.98	0.010664	0.86	0.36	2.14	0.67
Tributary 3	3168.77*	100yr-24hrSCS	1.45	76.61	77.1		77.16	0.009089	1.06	1.37	5.47	0.67
Tributary 3	3168.77*	5yr-24hrSCS	0.51	76.61	76.94		76.97	0.008322	0.8	0.63	3.51	0.61
Tributary 3	3168.77*	2yr-24hrSCS	0.31	76.61	76.86		76.89	0.008334	0.77	0.4	2.33	0.6
Tributary 3	3158.5	100yr-24hrSCS	1.45	76.5	76.93	76.93	77.03	0.021911	1.41	1.03	5.15	1.01
Tributary 3	3158.5	5yr-24hrSCS	0.51	76.5	76.76	76.76	76.85	0.023249	1.31	0.39	2.17	0.99
Tributary 3	3158.5	2yr-24hrSCS	0.31	76.5	76.69	76.69	76.76	0.025089	1.2	0.26	1.76	1

HEC-RAS Output: Proposed Conditions

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary 3	3150.03*	100yr-24hrSCS	1.45	76.31	76.72	76.74	76.84	0.026998	1.53	0.95	4.93	1.11
Tributary 3	3150.03*	5yr-24hrSCS	0.51	76.31	76.57	76.57	76.65	0.023773	1.29	0.39	2.31	1.01
Tributary 3	3150.03*	2yr-24hrSCS	0.31	76.31	76.49	76.5	76.57	0.032898	1.32	0.23	1.71	1.14
Tributary 3	3141.57*	100yr-24hrSCS	1.45	76.13	76.53	76.55	76.65	0.027329	1.52	0.95	5.08	1.12
Tributary 3	3141.57*	5yr-24hrSCS	0.51	76.13	76.37	76.37	76.46	0.024517	1.32	0.38	2.25	1.03
Tributary 3	3141.57*	2yr-24hrSCS	0.31	76.13	76.26	76.31	76.41	0.06763	1.69	0.18	1.58	1.6
Tributary 3	3133.10*	100yr-24hrSCS	1.45	75.94	76.34	76.35	76.46	0.027718	1.53	0.95	5.04	1.13
Tributary 3	3133.10*	5yr-24hrSCS	0.51	75.94	76.18	76.18	76.27	0.023248	1.33	0.38	2.15	1.01
Tributary 3	3133.10*	2yr-24hrSCS	0.31	75.94	76.12	76.12	76.19	0.024857	1.18	0.26	1.84	1.01
Tributary 3	3124.64	100yr-24hrSCS	1.45	75.75	76.21	76.18	76.27	0.015168	1.15	1.27	6.59	0.84
Tributary 3	3124.64	5yr-24hrSCS	0.51	75.75	76.05	75.98	76.1	0.014203	0.97	0.52	3.24	0.78
Tributary 3	3124.64	2yr-24hrSCS	0.31	75.75	75.97	75.93	76.02	0.012242	0.95	0.32	1.84	0.72
Tributary 3	3115.64*	100yr-24hrSCS	1.45	75.67	76.08		76.14	0.013057	1.08	1.35	6.97	0.78
Tributary 3	3115.64*	5yr-24hrSCS	0.51	75.67	75.94		75.98	0.012068	0.87	0.58	3.87	0.72
Tributary 3	3115.64*	2yr-24hrSCS	0.31	75.67	75.88		75.91	0.010568	0.82	0.37	2.43	0.67
Tributary 3	3106.64*	100yr-24hrSCS	1.45	75.58	75.98		76.03	0.011812	1.01	1.43	7.6	0.74
Tributary 3	3106.64*	5yr-24hrSCS	0.51	75.58	75.85		75.88	0.010137	0.77	0.66	4.66	0.65
Tributary 3	3106.64*	2yr-24hrSCS	0.31	75.58	75.79		75.82	0.010481	0.73	0.42	3.33	0.65
Tributary 3	3097.65*	100yr-24hrSCS	1.45	75.5	75.88		75.92	0.010757	0.94	1.54	8.48	0.71
Tributary 3	3097.65*	5yr-24hrSCS	0.51	75.5	75.75		75.78	0.010325	0.74	0.68	5.2	0.65
Tributary 3	3097.65*	2yr-24hrSCS	0.31	75.5	75.7		75.72	0.010853	0.71	0.44	3.71	0.66
Tributary 3	3088.65*	100yr-24hrSCS	1.45	75.42	75.79		75.83	0.010383	0.89	1.63	9.61	0.69
Tributary 3	3088.65*	5yr-24hrSCS	0.51	75.42	75.67		75.7	0.008901	0.67	0.75	6.03	0.6
Tributary 3	3088.65*	2yr-24hrSCS	0.31	75.42	75.59		75.62	0.010973	0.77	0.4	2.99	0.67
Tributary 3	3079.65*	100yr-24hrSCS	1.45	75.33	75.71		75.74	0.008246	0.77	1.89	12.02	0.61
Tributary 3	3079.65*	5yr-24hrSCS	0.51	75.33	75.59		75.61	0.010389	0.69	0.73	6.34	0.64
Tributary 3	3079.65*	2yr-24hrSCS	0.31	75.33	75.51		75.54	0.009001	0.72	0.43	3.05	0.62
Tributary 3	3070.66	100yr-24hrSCS	1.45	75.25	75.59		75.63	0.019075	0.96	1.51	12.58	0.88
Tributary 3	3070.66	5yr-24hrSCS	0.51	75.25	75.44		75.5	0.015499	1.03	0.49	3.1	0.82
Tributary 3	3070.66	2yr-24hrSCS	0.31	75.25	75.4		75.44	0.013143	0.83	0.37	2.85	0.73
Tributary 3	3062.05*	100yr-24hrSCS	1.45	75.15	75.45		75.49	0.016228	0.91	1.59	12.57	0.82
Tributary 3	3062.05*	5yr-24hrSCS	0.51	75.15	75.33		75.37	0.015006	0.88	0.58	4.56	0.79
Tributary 3	3062.05*	2yr-24hrSCS	0.31	75.15	75.29		75.32	0.013015	0.72	0.42	4.02	0.71
Tributary 3	3053.45*	100yr-24hrSCS	1.45	75.05	75.32		75.36	0.015759	0.89	1.63	13.14	0.81
Tributary 3	3053.45*	5yr-24hrSCS	0.51	75.05	75.22		75.25	0.013527	0.77	0.66	5.85	0.73
Tributary 3	3053.45*	2yr-24hrSCS	0.31	75.05	75.18		75.2	0.014576	0.69	0.44	4.96	0.74
Tributary 3	3044.84*	100yr-24hrSCS	1.45	74.95	75.2		75.23	0.014216	0.84	1.73	14.13	0.77
Tributary 3	3044.84*	5yr-24hrSCS	0.51	74.95	75.11		75.13	0.013814	0.67	0.75	8.35	0.72
Tributary 3	3044.84*	2yr-24hrSCS	0.31	74.95	75.08		75.09	0.012503	0.61	0.5	6.07	0.67
Tributary 3	3036.24*	100yr-24hrSCS	1.45	74.85	75.08		75.11	0.013134	0.8	1.82	15.18	0.73
Tributary 3	3036.24*	5yr-24hrSCS	0.51	74.85	75		75.02	0.012938	0.61	0.83	10.18	0.68
Tributary 3	3036.24*	2yr-24hrSCS	0.31	74.85	74.97		74.99	0.010987	0.52	0.6	8.33	0.62
Tributary 3	3027.64	100yr-24hrSCS	1.45	74.75	74.95		74.99	0.016253	0.84	1.72	15.4	0.81
Tributary 3	3027.64	5yr-24hrSCS	0.51	74.75	74.88		74.9	0.017241	0.65	0.77	10.61	0.77
Tributary 3	3027.64	2yr-24hrSCS	0.31	74.75	74.85		74.87	0.020217	0.62	0.5	8.44	0.81
Tributary 3	3020.29*	100yr-24hrSCS	1.45	74.55	74.84		74.88	0.011347	0.92	1.58	9.5	0.72
Tributary 3	3020.29*	5yr-24hrSCS	0.51	74.55	74.69	74.69	74.74	0.027932	0.99	0.51	5.37	1.03
Tributary 3	3020.29*	2yr-24hrSCS	0.31	74.55	74.66	74.66	74.7	0.029062	0.87	0.35	4.68	1.01
Tributary 3	3012.94*	100yr-24hrSCS	1.45	74.35	74.81		74.83	0.00417	0.71	2.04	8.47	0.46
Tributary 3	3012.94*	5yr-24hrSCS	0.51	74.35	74.6	74.53	74.62	0.005977	0.65	0.77	4.76	0.52
Tributary 3	3012.94*	2yr-24hrSCS	0.31	74.35	74.43	74.48	74.64	0.228356	1.99	0.15	2.76	2.69
Tributary 3	3005.6	100yr-24hrSCS	1.45	74.15	74.78		74.8	0.002776	0.64	2.28	8.13	0.38
Tributary 3	3005.6	5yr-24hrSCS	0.51	74.15	74.59		74.6	0.001318	0.42	1.19	4.48	0.26
Tributary 3	3005.6	2yr-24hrSCS	0.31	74.15	74.51	74.32	74.51	0.001194	0.36	0.86	3.89	0.24



NORTH



KEY PLAN
N.T.S.

LEGEND

- KNUEA
- KNUEA QUADRANT BOUNDARY
- DRAINAGE CHANNEL
- FLOODPLAIN LIMITS (APPROXIMATE)
- PROPOSED REALIGNED TRIBUTARY / SHIRLEY'S BROOK
- RETAINED AREA (WOODLOT / HEDGEROW)
- POND 1 — PROPOSED STORMWATER MANAGEMENT FACILITY
- AREA SERVICED WITH ON-SITE STORMWATER CONTROLS
- REAR-YARD AREAS DIRECTED TO TRIBUTARIES
- PROPOSED TRIBUTARY REALIGNMENT
- RETAINED TRIBUTARY CORRIDOR
- PROPOSED CULVERT (1.8m WIDE X 1.2m HIGH)
- PROPOSED STORM SEWER SERVICING EXTERNAL AREA
- PROPOSED STORMWATER CONVEYANCE CHANNEL
- EXISTING SWM FACILITY

GENERAL NOTES

PROPOSED TURTLE HABITAT FEATURES PER QUADRANT

NORTHWEST QUADRANT
15m x 45m DEEP POOLS: 2
10m x 30m ARTIFICIAL NESTING AREAS: 2
10m x 60m SHALLOW PANS/SHALLOW POOLS: 3
5m DIA. DEEP CHANNEL POCKETS: 5

SOUTHWEST QUADRANT
15m x 45m DEEP POOLS: 1
10m x 30m ARTIFICIAL NESTING AREAS: 1
10m x 60m SHALLOW PANS/SHALLOW POOLS: 1
5m DIA. DEEP CHANNEL POCKETS: 3

NORTHEAST QUADRANT
15m x 45m DEEP POOLS: 0
10m x 30m ARTIFICIAL NESTING AREAS: 0
10m x 60m SHALLOW PANS/SHALLOW POOLS: 2
5m DIA. DEEP CHANNEL POCKETS: 2

SOUTHEAST QUADRANT
15m x 45m DEEP POOLS: 1
10m x 30m ARTIFICIAL NESTING AREAS: 1
10m x 60m SHALLOW PANS/SHALLOW POOLS: 2
5m DIA. DEEP CHANNEL POCKETS: 4

PROPOSED (ALL QUADRANTS)
- AMPHIBIAN COMPENSATION WITHIN RIPARIAN CORRIDORS
- WHERE FEASIBLE, THE PRESERVATION OF INDIVIDUAL HEALTHY TREES AND CLUSTERS OF WOODY VEGETATION SHOULD BE CONSIDERED ON A CASE-BY-CASE BASIS

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

No.	REVISION	DATE	BY
3.	SUBMITTED FOR CITY REVIEW WITH FINAL EMP	05/24/2016	KJA
2.	SUBMITTED FOR CITY REVIEW WITH FINAL DRAFT EMP	04/04/2016	KJA
1.	SUBMITTED FOR CITY REVIEW WITH DRAFT EMP	02/29/2016	KJA

SCALE 1:4000
1:4000 — 0 40 80 120 160

DESIGN	KJA
CHECKED	MJP
DRAWN	BET
CHECKED	CMS
APPROVED	MJP

FOR REVIEW ONLY

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Ottawa, Ontario, Canada K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

LOCATION
CITY OF OTTAWA
KANATA NORTH URBAN EXPANSION AREA

DRAWING NAME
RECOMMENDED ENVIRONMENTAL MANAGEMENT PLAN

PROJECT No. 112117
REV # 3
DRAWING No. 112117-EMP

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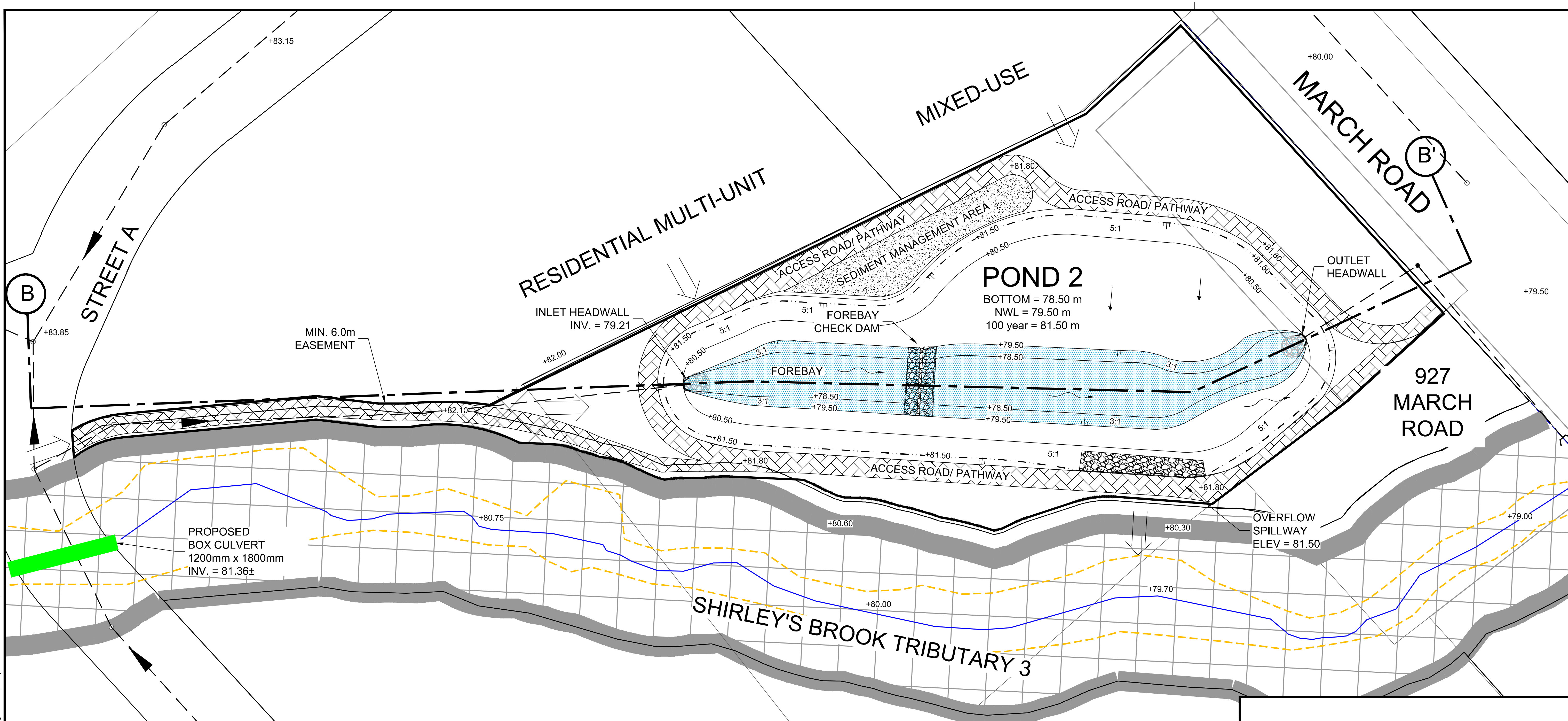
PLANB1.DWG - 1000mmx707mm



LEGEND

- RIGHT OF WAYS
- POND BLOCK
- EXISTING CREEK CORRIDOR
- PERMANENT POOL
- ACCESS ROAD/PATHWAY
- ROCK WALL CHECK DAM
- MAJOR OVERLAND FLOW DIRECTION
- FLOODPLAIN LIMITS (APPROXIMATE)

LEGEND

- DIRECTION OF POND FLOW
- HEADWALL C/W RIPRAP
- +81.50 PROPOSED GRADE
- 3:1 TERRACING (MAX. SLOPE)
- 100YR WATER LEVEL

KN

KANATA NORTH
COMMUNITY DESIGN PLAN

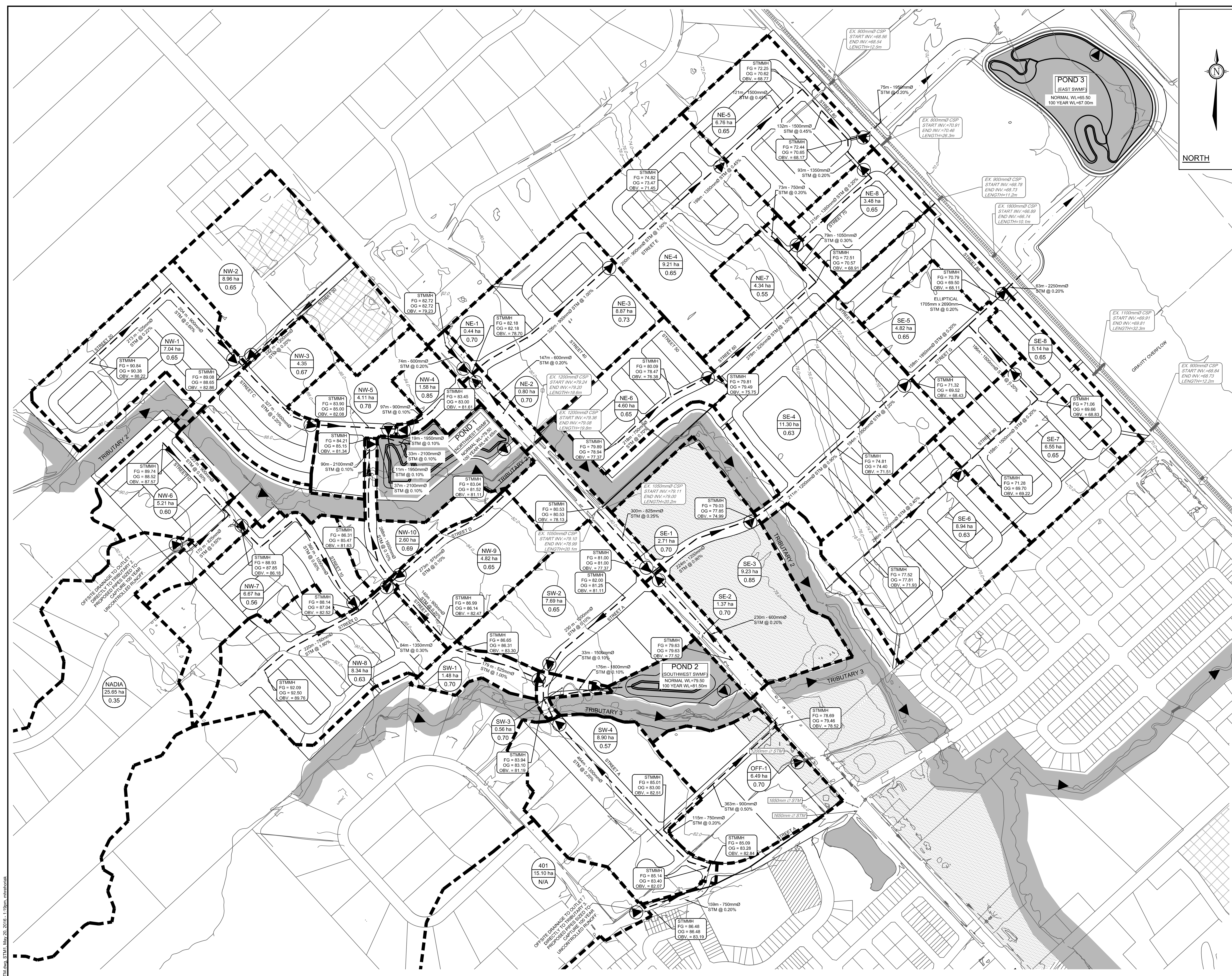
FIGURE NO. 9.2
POND 2 CONCEPTUAL LAYOUT

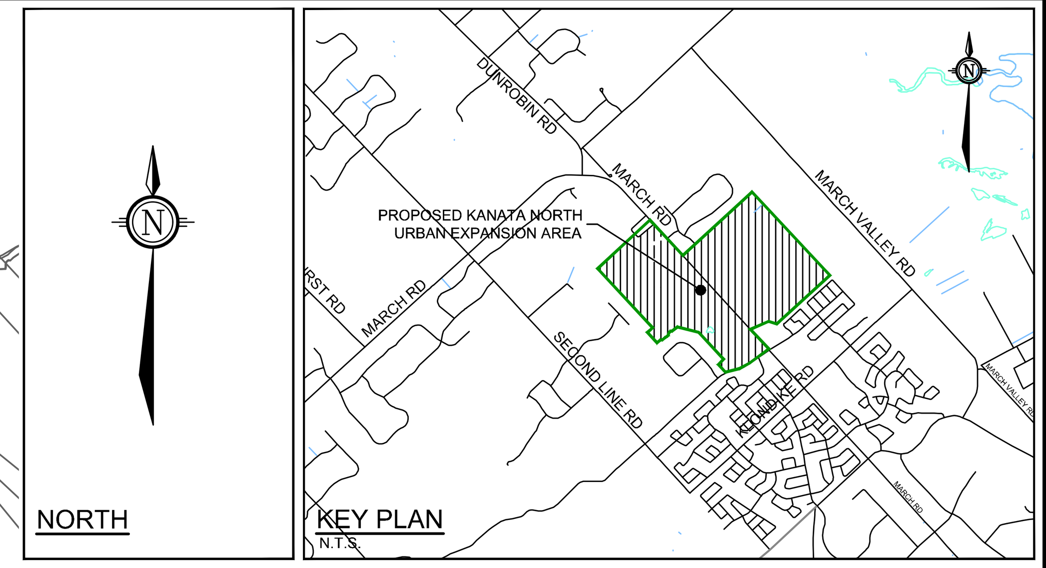
DATE MAY 2016
JOB 112117
SCALE 1:1000
0 5m 10m 20m

NOVATECH
Engineers, Planners & Landscape Architects

M:\2012\112117\CAD\Design_EMP\MEMO (KJA)\Figure 9.2 Pond 2 Functional.dwg, Figure 9.2, May 18, 2016 - 10:44am, kbanks

SHT11x17.DWG - 279mmx432mm





LEGEND

- A-10 — AREA ID
- 1.14 ha — AREA IN HECTARES
- 0.40 — RUNOFF COEFFICIENT
- DRAINAGE AREA
- DRAINAGE AREA OUTLET
- STMMH — STM ID
- FG = 71.69 — FINISHED GROUND ELEVATION
- OG = 69.52 — ORIGINAL GROUND ELEVATION
- OBV. = 68.22 — OBVERT ELEVATION
- CREEK CORRIDOR
- PROPOSED OUTLET DITCH
- PROPOSED STORM SEWER & FLOW DIRECTION
- *EXISTING STORM SEWER & FLOW DIRECTION*

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

No.	REVISION	DATE	BY
3.	ISSUED WITH DRAFT MASTER SERVICING STUDY	MAY 20/16	JLS
2.	ISSUED WITH DRAFT MASTER SERVICING STUDY	APR 4/16	JLS
1.	ISSUED WITH DRAFT MASTER SERVICING STUDY	FEB 26/16	JLS

SCALE 1:3000

1:3000 — 0 30 60 90 120

DESIGN ARM / TB
CHECKED ARM
DRAWN TB
CHECKED CJR
APPROVED JLS

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Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

LOCATION
KANATA NORTH URBAN EXPANSION AREA
COMMUNITY DESIGN PLAN

DRAWING NAME
STORM DRAINAGE AREA PLAN
MINOR SYSTEM DRAINAGE

PROJECT No. 112117-04
REV REV # 3
DRAWING No. 112117-STM1

PLANB1.DWG - 1000mmx707mm

LEGEND

M1.1	MAJOR SYSTEM SUBCATCMENT ID
	MAJOR SYSTEM SUBCATCMENT BOUNDARY
	PIPED MAJOR SYSTEM
	DRAINAGE AREA OUTLET
Q 100 = 1.27 cu.m/s D 100 = 0.17 m	100yr PEAK OVERLAND FLOW RATE 100yr DEPTH
	CREEK CORRIDOR / SWMF
	DIRECTION OF OVERLAND FLOW

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

No.	REVISION	DATE	BY
4.	ISSUED WITH DRAFT MASTER SERVICING STUDY	JUN 28/16	JLS
3.	ISSUED WITH DRAFT MASTER SERVICING STUDY	MAY 20/16	JLS
2.	ISSUED WITH DRAFT MASTER SERVICING STUDY	APR 4/16	JLS
1.	ISSUED WITH DRAFT MASTER SERVICING STUDY	FEB 26/16	JLS

SCALE 1:3000

1:3000
0 30 60 90 120

DESIGN ARM / TB
CHECKED ARM
DRAWN TB
CHECKED CJR
APPROVED JLS

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Ottawa, Ontario, Canada K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

LOCATION
KANATA NORTH
COMMUNITY DESIGN PLAN

DRAWING NAME
STORM DRAINAGE AREA PLAN
MAJOR SYSTEM DRAINAGE

PROJECT No. 112117-04
REV REV # 4
DRAWING No. 112117-STM2

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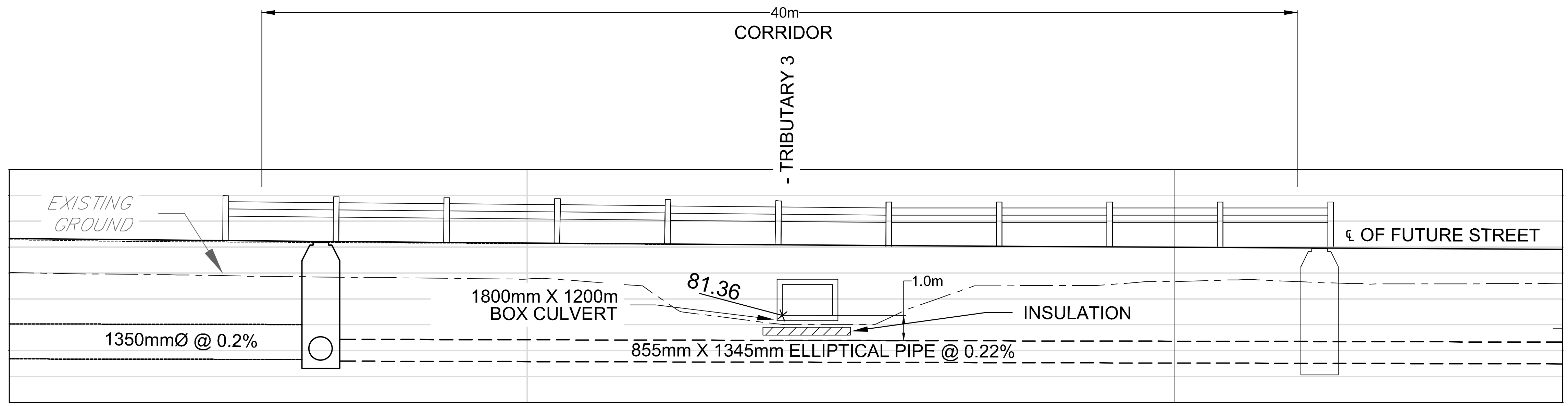
PLANB1.DWG - 1000mmx707mm



TRIBUTARY 3 CROSSING DETAIL

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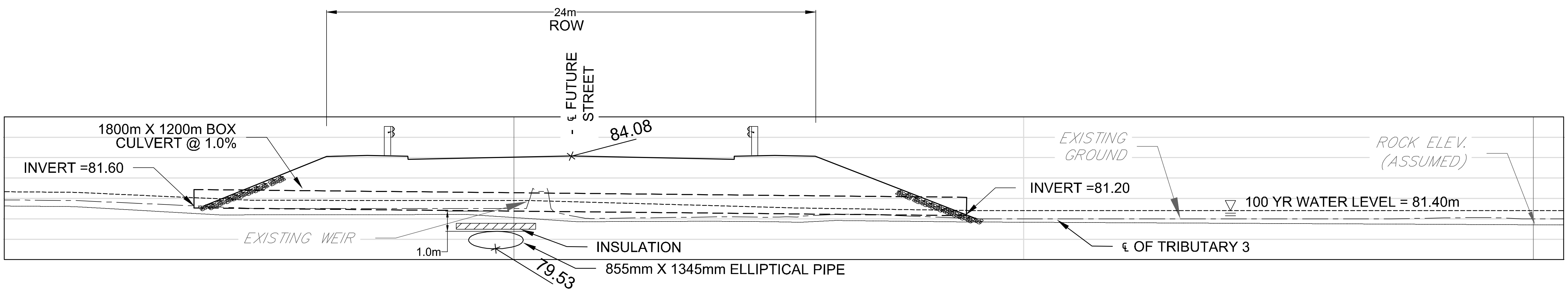

TRIBUTARY 3 CULVERT DETAIL

SCALE: 1:200

KN

KANATA NORTH

COMMUNITY DESIGN PLAN

FIGURE NO. E2

TRIBUTARY 3
CROSSING DETAILS

DATE
MAY 2016

JOB
112117

SCALE
AS NOTED

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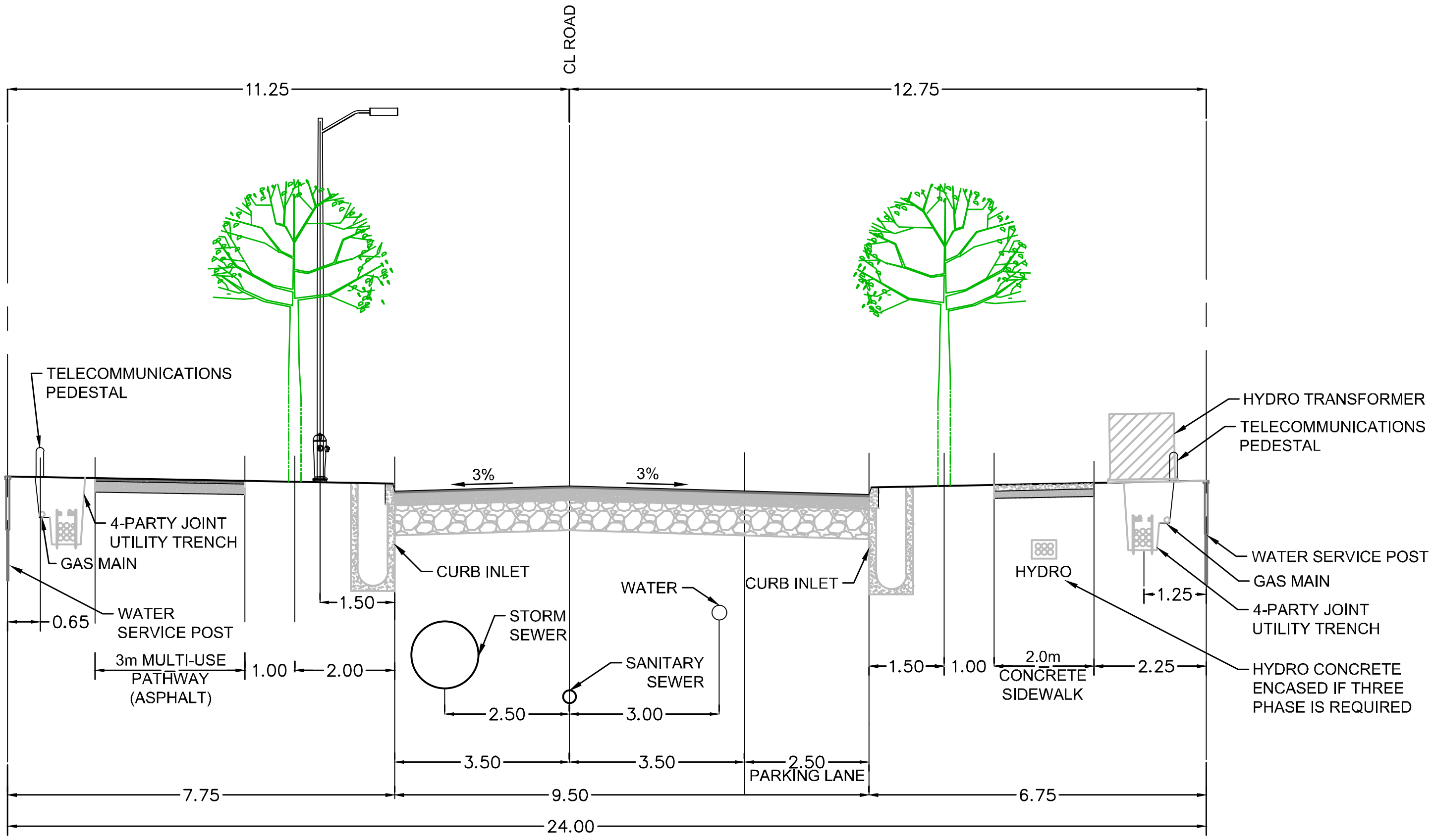

M:\2012\112117\CAD\Design\Figures\Traffic\TMP\FINAL\112117 - FIG-24mROW-MUP (1-150).dwg, TYPICAL 1 (TMP), Feb 23, 2016 - 1:14pm, tbrooks

KANATA NORTH
COMMUNITY DESIGN PLAN

DATE
FEB 2016

JOB
112117

SCALE
1:150

0 1m 2m 4m

FIGURE NO. 25

COLLECTOR ROAD -
TYPICAL CROSS SECTION 1

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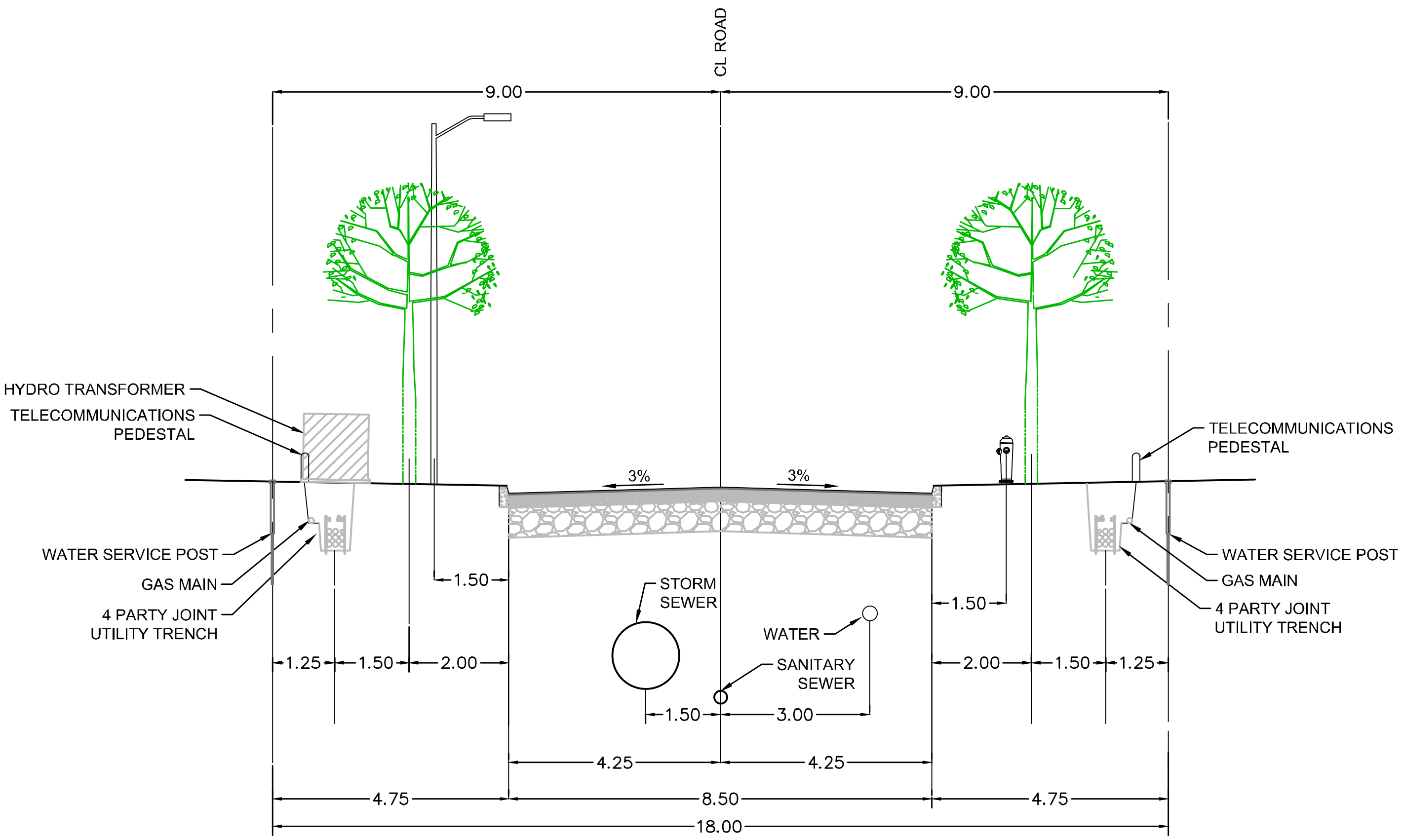
SHT8x11.DWG - 216mmx279mm



M:\2012\112117\CAD\Design\Figures\Traffic\TMP\FINAL\112117 - FIG-18m-LOCAL (1-150).dwg, LOCAL (TMP), Mar 02, 2016 - 10:45am, tbrooks

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KANATA NORTH
COMMUNITY DESIGN PLAN

DATE
FEB 2016

JOB
112117

SCALE
1:150

0 1m 2m 4m

FIGURE NO. 30
LOCAL ROAD
- TYPICAL 18m ROW
CROSS SECTION

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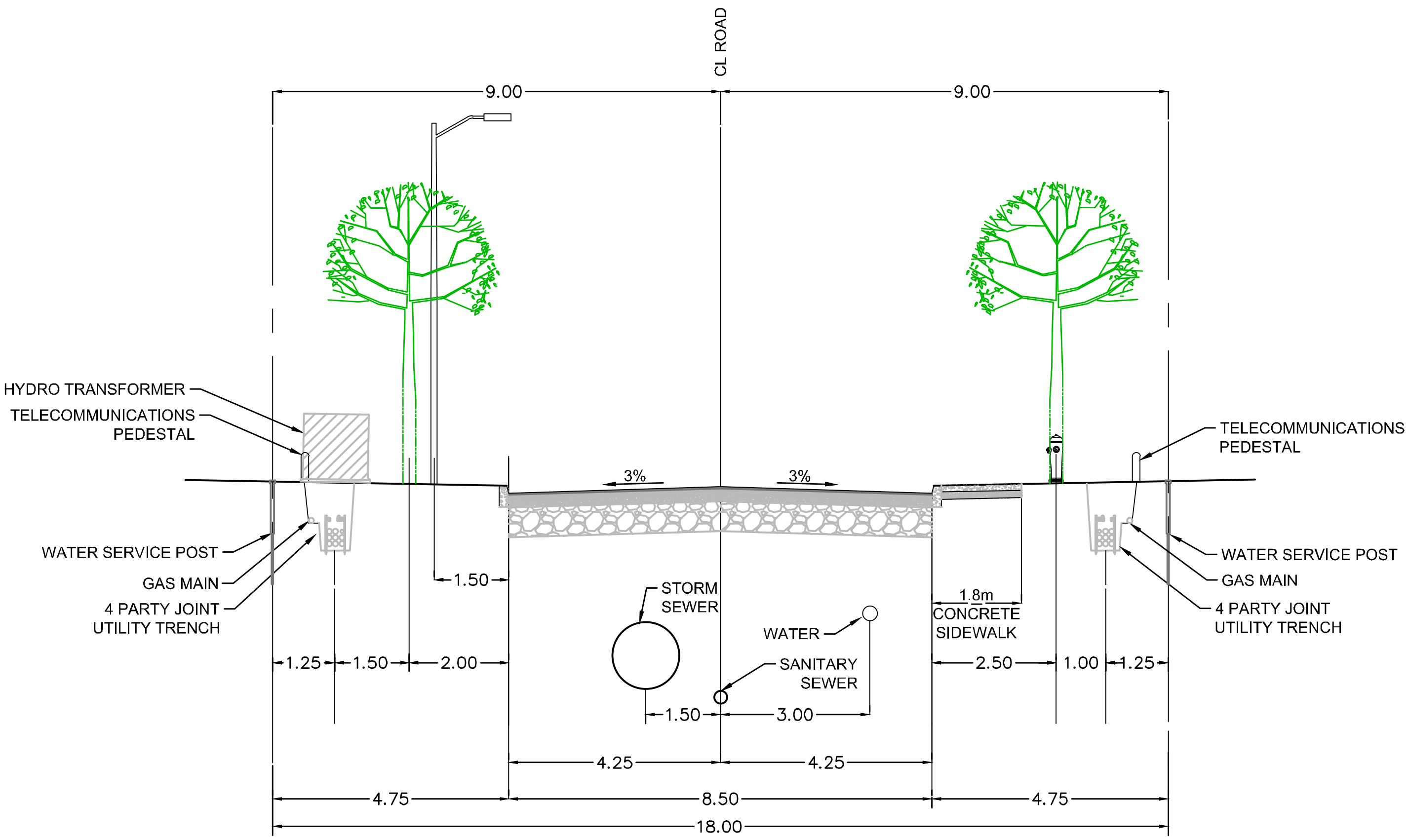
SHT8x11.DWG - 216mmx279mm



KANATA NORTH

COMMUNITY DESIGN PLAN

DATE
FEB 2016

JOB
112117

SCALE
1:150

0 1m 2m 4m

FIGURE NO. 31

LOCAL ROAD
- TYPICAL 18m ROW CROSS SECTION WITH SIDEWALK

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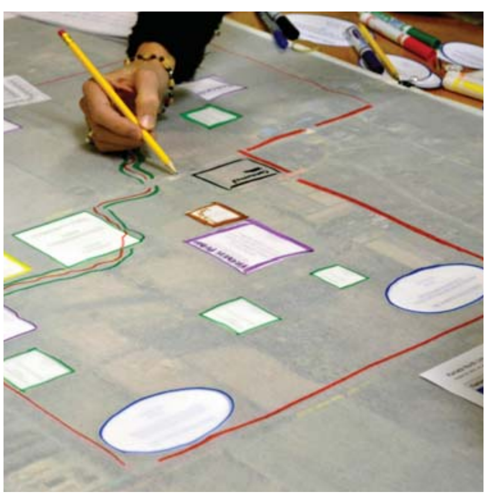
KANATA NORTH
COMMUNITY DESIGN PLAN

MASTER SERVICING STUDY **REPORT**



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JUNE 28, 2016

Ottawa

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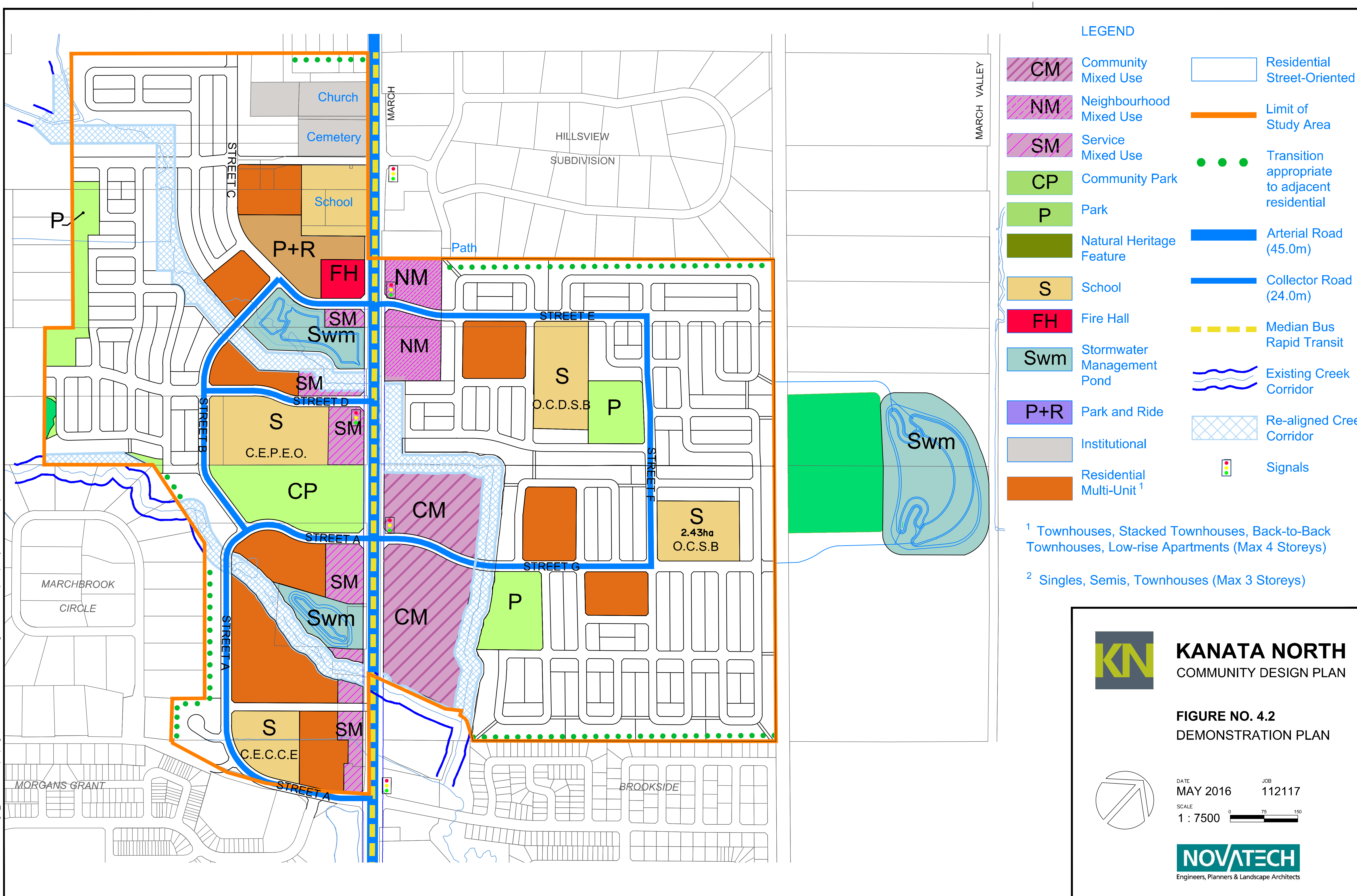


M:\2012\112117\CAD\Design_EMP\MEMO (CS)\Figure 9.1 Demonstration Plan.dwg, DEMO PLAN (MSS), May 26, 2016 - 3:56pm, tbrooks

5.0 STORM DRAINAGE & SERVICING

The Environmental Management Plan (EMP), prepared by Novatech, evaluates the stormwater management servicing options for the KNUEA. The EMP recommends servicing the proposed development with three stormwater management (SWM) ponds to provide water quality, erosion and peak flow control for the proposed development. The conceptual SWM facility design and analysis are provided in the EMP. The location of the SWM ponds and their associated contributing drainage areas are shown on **Figure 5.1**.

5.1 Stormwater Management Criteria

Stormwater management criteria have been established and are outlined in the EMP. The SWM criteria have been developed on the basis of aquatic habitat protection and the sensitivity of the downstream erosion regime. Quality control objectives have been developed based on the recommendations of the Shirley's Brook and Watt's Creek Subwatershed Study. Quantity control objectives have been developed to ensure there is no adverse impact on the downstream watercourses resulting from the proposed development. A summary of the stormwater management criteria presented in the EMP is provided below.

Quantity Control

- West of March Road, quantity control storage is to be designed to ensure no increase in peak flow in the receiving watercourses (Tributaries 2 & 3) downstream of the KNUEA;
- East of March Road, post-development peak flows from the development area are to be controlled to pre-development rates for all storms up to and including the 100-year event.
- Ensure no adverse impacts on erosion in the watercourses resulting from future development within the KNUEA.

Quality Control

- An *Enhanced* level of water quality treatment (80% long-term TSS removal) is required for all development within the Shirley's Brook subwatershed.

Storm Drainage

- Storm drainage within the urban area will be provided using storm sewers sized to convey the uncontrolled 5-year post-development peak flow (10-year for March Road right-of-way).
- Major system flows are to be conveyed within the rights-of-way and/or along defined overland flow routes with no encroachment onto private property.
- Major system flows must not flow overland across arterial roads (March Road).

Watercourse Crossings (Culverts)

- Watercourse crossings are to be sized to convey the 100-year peak flow without overtopping the roadways.
- Watercourse crossings should be designed in accordance with geomorphology principles.
- Watercourse crossings should be designed to ensure they meet any additional requirements for terrestrial and aquatic habitat.

SWM Facilities

- All proposed SWM facilities are to be designed in accordance with the following guidelines and manuals:
  - City of Ottawa Stormwater Management Facility Design Guidelines.
  - MOE SWM Planning and Design Manual.
- The normal water level (permanent pool) in wet ponds should ideally be above the 2-year water level in the receiving watercourse.
- Where possible, sanitary overflows are to be directed to SWM facilities. City design standards for overflows are currently in development. The following sanitary overflow criteria have been applied to the KNUEA:
  - Sanitary overflows are to operate by gravity and be directed to a SWM facility.
  - The sanitary overflow must be above the 100-year elevation in the SWM facility.
- SWM facilities should be integrated into the community through the use of pathways or other linkages.

Geotechnical / Rock Elevation

The proposed stormwater strategies are to be designed to minimize the extent of bedrock excavation as much as possible. The depth to bedrock is relatively shallow in some areas, and some bedrock excavation will be required.

Low Impact Development / Green Stormwater Infrastructure

Low impact development (LID) represents a design philosophy which attempts to minimize the impacts on the hydrologic cycle resulting from development. Green stormwater infrastructure represents the stormwater management technologies used to achieve this objective. The City of Ottawa has recently implemented several LID pilot projects to evaluate the performance and maintenance requirements of LID designs, with the expectation that LID designs will become more prevalent in the near future. The EMP provides general guidance for areas and opportunities where LID techniques could be considered at the plan of subdivision / site plan stage.

5.2 Storm Drainage Design

The MSS has built upon the recommendations of the EMP to develop a preliminary storm servicing design. The conceptual design of the SWM ponds included establishing contributing drainage areas for each SWM pond. These drainage areas were used to establish a conceptual layout of trunk sewers based on the road network shown on the Demonstration Plan (**Figure 4.2**). Factors such as optimizing routing to the outlet location (SWM ponds), minimizing creek crossings, and collection of runoff from upstream drainage areas have been considered as part of the conceptual storm drainage design.

In accordance with City of Ottawa Sewer Design Guidelines (October 2012) a dual drainage approach was applied to the design of the KNUEA storm drainage system, which includes:

- Storm sewers (minor system) will be used for conveyance of runoff up to the 5-year return period (10-year for March Road);
- An overland flow network (major system) consisting of the road network and other defined overland flow routes will be designed to provide safe conveyance of runoff from larger storm events when peak flows exceed the inlet capacity to the minor system.

5.3 Storm Drainage Design – Minor System

5.3.1 Minor System Criteria

The storm sewers servicing the KNUEA are to be designed based on the criteria outlined in the *City of Ottawa Sewer Design Guidelines*, as summarized below:

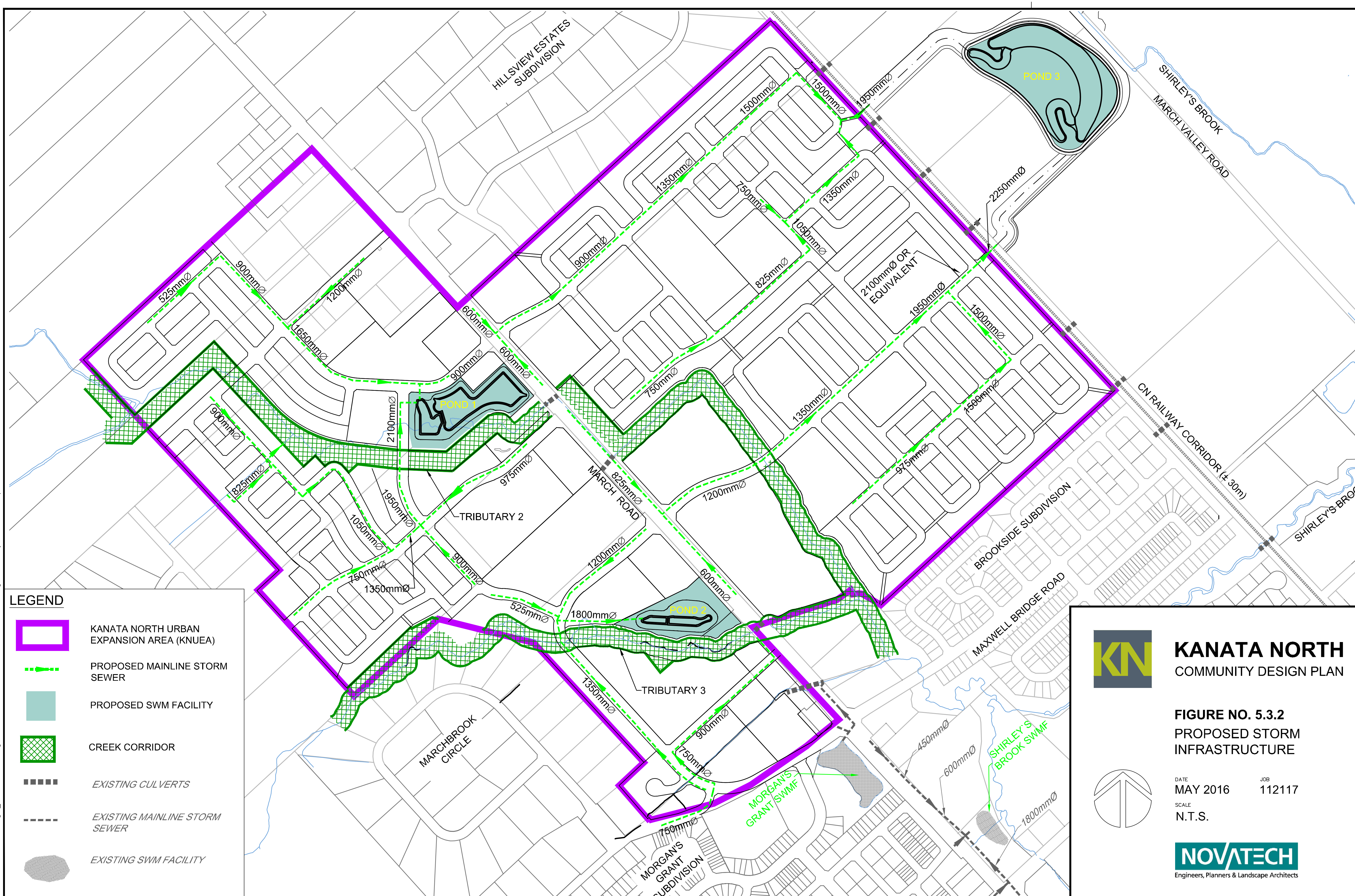
<u>Return Period</u>

- 5 year - Local and Collector Roads
- 10 year - Arterial Roads and Transitways

<u>Design Flows</u>

- Storm Sewer Design Sheets created using Rational Method
- IDF Rainfall Data as per *City of Ottawa Sewer Design Guidelines*
- Initial Time of Concentration T_c = 15 minutes (trunk sewers only)
- Runoff Coefficients
    - Mixed Use / Commercial C = 0.85
    - Arterial Roads / Transitway C = 0.65
    - Parks C = 0.40
    - Open Space C = 0.20
    - Schools / Church C = 0.65
    - Street Oriented Residential C = 0.65
    - Multi / Unit Residential C = 0.70
    - Park and Ride C = 0.85

M:\2012\112117\CAD\Design_MSS\FIGURES\Figure 5.3.2-PROP STORM INFRASTRUCTURE.dwg, FIG 5, May 18, 2016 - 3:15pm, mhrehoriak



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analysis for the trunk sewers will need to be confirmed on a sewershed basis using a hydrodynamic model or some similar approach acceptable to the City.

Methodology

The HGL analysis uses steady-state flows to calculate the 100-year hydraulic grade line. The 100-year flow was estimated by modifying the storm sewer design sheets to use a fixed time of concentration of 15 minutes for the 5-year design storm. The resulting flows approximate the controlled 100-year peak flow, assuming the inlets are restricted to the 5-year peak flow using ICDs. During large storm events, ICDs will restrict inflows to a relatively constant and sustained flow, and the peak flows from each minor system inlet will converge in the minor system at roughly the same time. This approach is not dependant on the major system design, but has been demonstrated to produce results comparable to a dynamic dual-drainage model. The major system was evaluated using a different methodology ï refer to **Section 5.4.**

- The model uses hydrodynamic routing to calculate the HGL in the storm sewers.
- Peak flows have been calculated using City of Ottawa IDF data using a fixed 15-minute time of concentration - refer to design sheet in **Appendix B**.
- The steady-state peak flows are added at each node, corresponding to the upstream maintenance holes in the storm sewer design sheets.
- Downstream boundary conditions are based on the 2-year water levels in the SWM facilities. As this is a steady-state analysis, using the 100-year water level as the boundary condition was deemed to be too conservative. The 2-year elevation represents the approximate storage depth that will coincide with the 100-year peak inflow.
- The model was run until the HGL reaches an equilibrium based on the steady-state peak flows and downstream boundary conditions.
- Entrance and exit losses are applied at the inlet and outlet of each pipe section. The losses are documented in the model output provided in **Appendix B**.

Based on the HGL assessment, some pipes were upsized to ensure the 100-year HGL is no higher than 0.6m above the pipe obverts. This cap was applied to ensure that pipes maintain a sustainable HGL elevation. When HGL elevations are high, relatively small increases in flow result in much larger increases in HGL elevation throughout a storm sewer system under surcharge conditions. The greater the surcharge condition, the greater the potential variance as the pipe system struggles to pass the additional flow. A maximum HGL of 0.6m above the pipe obvert also helps to ensure a reasonable design of storm sewer networks which discharge to the trunk sewers.

This HGL analysis is conceptual and HGL elevations will need to be re-evaluated during detail design. The SSA modelling output is included in **Appendix B**.

5.4 Storm Drainage Design - Major System

A conceptual analysis of the major system was completed to evaluate the conveyance of overland flows exceeding the capacity of the minor system during the 100-year storm event.

5.4.1 Major System Criteria

Design of the major system will adhere to the design standards outlined in Section 5.5 of the *City of Ottawa Sewer Design Guidelines*. Criteria used in the major system design are summarized below:

Major System Flow Outlets
Major system flow must be directed to either:

- One of the proposed SWM facilities; or
- An outlet watercourse.

Maximum Flow/Velocity on Streets
For overland flow the product of the Velocity (m/s) x Depth (m) should not be greater than 0.6.

Cross-Street Flow
No cross-street flow is permitted for the minor (5-year) storm event, and there is to be only minimal ponding within the roadways. Major system flow from local streets can be conveyed to other local or collector roads, or to a SWM facility or watercourse.

Major System Flow Depths
For events exceeding the minor system design storm and up to the 100 year design storm, flow depth is permitted in the right of way up to the following maximum water depths:

- Local: 300mm at edge of pavement
- Collector: 250mm at edge of pavement
- Arterial: No barrier curbs overtopping. Flow spread must leave at least one lane free of water in each direction

It should also be noted that during detailed design, where possible, it is desirable to promote overland sheet drainage directly to the tributaries from primarily vegetated open spaces (i.e. School yards, parks, and low density residential rear yards). These mainly pervious areas will generally have ćleanôrunoff, and as such do not require quality or quantity treatment. Allowing these vegetated areas to sheet drain will help distribute major system flows along the tributaries, which will reduce the flows directed along the proposed rights-of-way, and to the SWM ponds.

Where on-site storage is provided up to the 100-year event and if locations permit, major system flows in excess of the 100-year storm event may be allowed to flow overland directly to the tributaries.

Culverts

There are various culverts proposed to service the KNUEA. These culverts include:

- Existing culverts crossing March Road. These existing culverts have been evaluated in terms of condition and capacity in the EMP.
- Existing culverts crossing the abandoned rail corridor. These existing culverts have been evaluated in the MSS to confirm there is capacity to convey major flows from the proposed development.
- Proposed culverts for the road crossings proposed along Tributary 2 and 3. Supporting calculations for these proposed culverts are included in the EMP.

It should be noted that there will be services located at the tributary crossings including storm sewer, sanitary sewer and watermain. The proposed trenches for these crossings will be in rock and will require a clay cap to prevent surface water in the tributaries from migrating into the underlying trenches. Prior to Draft Plan Approval the details of the crossings will need to be confirmed to ensure City requirements have been met.

5.4.2 Major System Drainage Areas

A preliminary grading plan was developed using the Demonstration Plan. This Preliminary Grading Plan provides preliminary grades at key points such as intersections and defines the major system overland flow routes within the KNUEA. A major system drainage area plan was developed based on this preliminary macro-grading plan that subdivides the site into overland flow catchment areas. The macro-grading is shown on the Preliminary Grading Plan (112117-PGR) in **Appendix E**. Prior to Draft Plan Approval the routing of sub-drainage areas in the northwest quadrant tributary to Pond 1 and specifically the Park and Ride block will need to be confirmed once more information on the proposed development is available. Consideration will need to be given to elements including grade raise restrictions, shallow rock, overland flow routes and any existing storm drainage plans. The overall drainage area (sewershed) to Pond 1 will remain unchanged.

The northwest quadrant of the KNUEA, including portions of March Road will be graded to direct the major system drainage to Pond 1. The southwest quadrant will be graded, where possible, to direct the major system drainage to Pond 2. Some areas of the southwest quadrant are at a lower elevation and the major system flow will be directed either along March Road directly to Tributary 3, or to cross under March Road to Pond 3.

East of March Road, the major system drainage will be directed along collector roads, and cross through existing and proposed culverts (if required) along the abandoned rail corridor and outlet into the proposed drainage swales leading to Pond 3. The existing culverts have been evaluated and have capacity to convey the proposed flows. However, there may be more preferable locations for culverts to cross the abandoned rail corridor therefore, new culverts may be proposed during the detail design. It is also anticipated that the existing abandoned rail corridor drainage ditch will be used to provide rear yard drainage for lots adjacent to the rail corridor, as well as provide conveyance for the major system from the proposed subdivision to the various culverts crossing the abandoned rail corridor. The existing ditch has also been evaluated and has capacity to convey the major flows from the proposed development. A figure showing the ditch sections and culvert locations, and capacity calculations are included in **Appendix B.**

Commercial / Institutional / Multi-Unit Residential Areas

The major system analysis also assumes that on-site storage will be provided for commercial, institutional, and multi-unit residential areas for storms greater than the 5-year and up to the 100-year event, and that no major system flows will be generated for these areas. The overall site grading does provide major drainage outlets from these areas in the event that the available on-site storage is exceeded.

Table 5.4.3: Estimated Major System Peak Flows and Runoff Volumes

Land Use	'C'	% Imperv	Minor System Inlet Rate (L/s/ha)	Major System Discharge Rate (L/s/ha)
Arterial Roads / Transitway	0.65	64%	185	101
Collector Roads	0.70	71%	145	125
Mixed Use / Commercial	0.85	93%	150	0
Schools/Church	0.65	64%	115	130
Parks	0.40	29%	70	12
Open Space	0.20	0%	50	26
Street Oriented Residential	0.65	64%	100	Varies, see Figure 5.4.3
Multi Unit Residential	0.70	71%	115	Varies, see Figure 5.4.3
Park and Ride	0.85	93%	185	0

5.6 Additional Storm System Capacity

The proposed storm sewer system, both major and minor, was designed to provide additional capacity in the event of minor changes to the proposed plan. The following measures were taken to create the additional capacity:

- The minor system storm sewer design limited pipe sizes to no more than 80% capacity during the minor system design storm;
- Runoff coefficient were determined based on a more conservative assumption for housing density;
- Major system overland flow routes were limited to no more than 80% capacity during the major system design storm; and
- SWM ponds were conceptually graded using the minimum permanent pool depth and 5:1 slopes, both of which increase the proposed footprint of the facility and could be modified to obtain greater pond storage volume.

5.7 Off-Site Drainage Areas

There are two off-site, upstream drainage areas that drain onto the KNUEA. Storm drainage from these areas are re-routed and accounted for in the storm servicing design for the KNUEA. The areas and the drainage solution are as follows:

- Nadia Lane drainage ï A primarily rural residential area, approximately 26 hectares in size, northwest of the KNUEA. This area currently drains to an existing ditch in the northwest quadrant which outlets to Tributary 2 as shown on **Figure 5.7.1**. It is proposed to collect this drainage once it flows onto the KNUEA in a ditch inlet catchbasin within a proposed park area and provide a storm sewer to convey the drainage directly to Tributary 2 as per existing conditions.

- Marchbrook Circle drainage ï A primarily rural residential area, approximately 19 hectares in size, southwest of the KNUEA. This area currently drains to an existing ditch which outlets to Tributary 4 as shown on **Figure 5.7.2**. It is proposed to collect a portion this drainage area (15ha) in a storm sewer along Old Carp Road. The storm sewer will convey the major and minor system drainage though the southwest quadrant and outlet directly to Tributary 3. The remainder of the area (3.5ha) will have the minor system drain to Pond 2 through the Street A storm sewer and the major system directed overland through the proposed rear yards directly to Tributary 3. Prior to Draft Plan Approval this off-site drainage proposal will require confirmation including adequate maintenance access.

These drainage areas, the existing drainage patterns and proposed drainage solutions are shown on **Figures 5.7.1** and **5.7.2**. Supporting calculations for the sizing of the proposed storm sewers are provided in **Appendix B**.

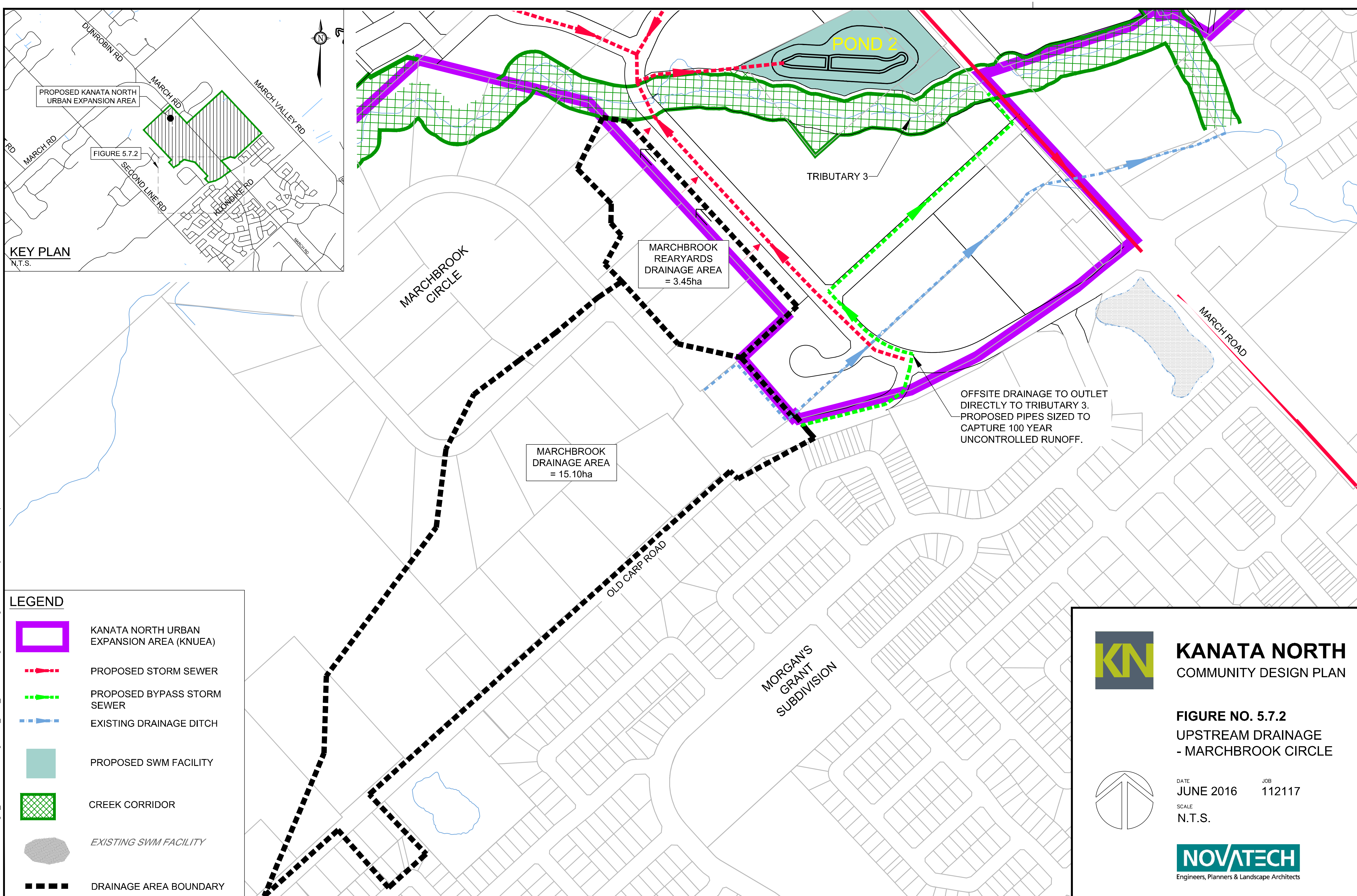


FIGURE NO. 5.7.2
UPSTREAM DRAINAGE - MARCHBROOK CIRCLE

KANATA NORTH URBAN EXPANSION AREA
COMMUNITY DESIGN PLAN

STORM SEWER DESIGN SHEET

TABLE B-1b:
CONCEPUTAL DESIGN FOR SOUTHWEST SWMF
FLOW RATES BASED ON RATIONAL METHOD

Engineers, Planners & Landscape Architects

LOCATION			AREA (ha)			FLOW					SEWER DATA								
Catchment ID	From Node	To Node	Area (ha)	C	AC (ha)	Indiv 2.78 AC	Accum 2.78 AC	Time of Conc.	Intensity (mm/hr)	Peak Flow (L/s)	Dia. (m) Actual	Dia. (mm)	Type	Slope (%)	Length (m)	Capacity (L/s)	Velocity (m/s)	Flow Time (min)	Ratio Q/Q full
SW-1	SW-1	SW-3	1.48	0.70	1.04	2.880	2.880	15.00	83.56	241	0.533	525	Conc	1.00	179.0	448.4	2.01	1.49	54%
SW-2	SW-2	SW-3	7.69	0.65	5.00	13.896	13.896	15.00	83.56	1,161	1.219	1200	Conc	0.10	230.0	1,285.7	1.10	3.48	90%
SW-3	SW-3	INLET	0.56	0.70	0.39	1.090	17.866	18.48	73.77	1,318	1.524	1500	Conc	0.10	33.0	2,331.3	1.28	0.43	57%
SW-4	SW-4	INLET	8.90	0.57	5.04	14.006	14.006	15.00	83.56	1,170	1.372	1350	Conc	0.20	464.0	2,489.3	1.68	4.59	47%
	INLET	SW-SWMF			0.00	0.000	31.872	19.59	71.16	2,268	1.803	1800	Conc	0.10	176.0	3,652.3	1.43	2.05	62%
401 (OFFSITE)	401	OFF-1	15.10	0.35	5.29	14.692	14.692	95.00 [1]	23.31	342	0.762	750	Conc	0.20	298.0	519.1	1.14	4.36	66%
OFF-1	OFF-1	March Road	6.49	0.70	4.54	12.630	27.322	99.36	22.52	615	0.914	900	Conc	0.50	363.0	1,334.8	2.03	2.98	46%

Q = 2.78 AIC, where
Q= Peak Flow in Litres per Second (L/s)
A= Area in hectares (ha)
I= Rainfall Intensity (mm/hr), 5 year storm
C= Runoff Coefficient

Consultant:	**Novatech Engineering Consultants Ltd.**	
Date:	May, 2016	
Design By:	Alex McAuley	
Client:	**Dwg. Reference:**	**Checked By:**
Kanata North Land Owners	112117-STM1, 112117-STM2	CJR

Note: 1. TC based on flow provided by SWMHYMO model

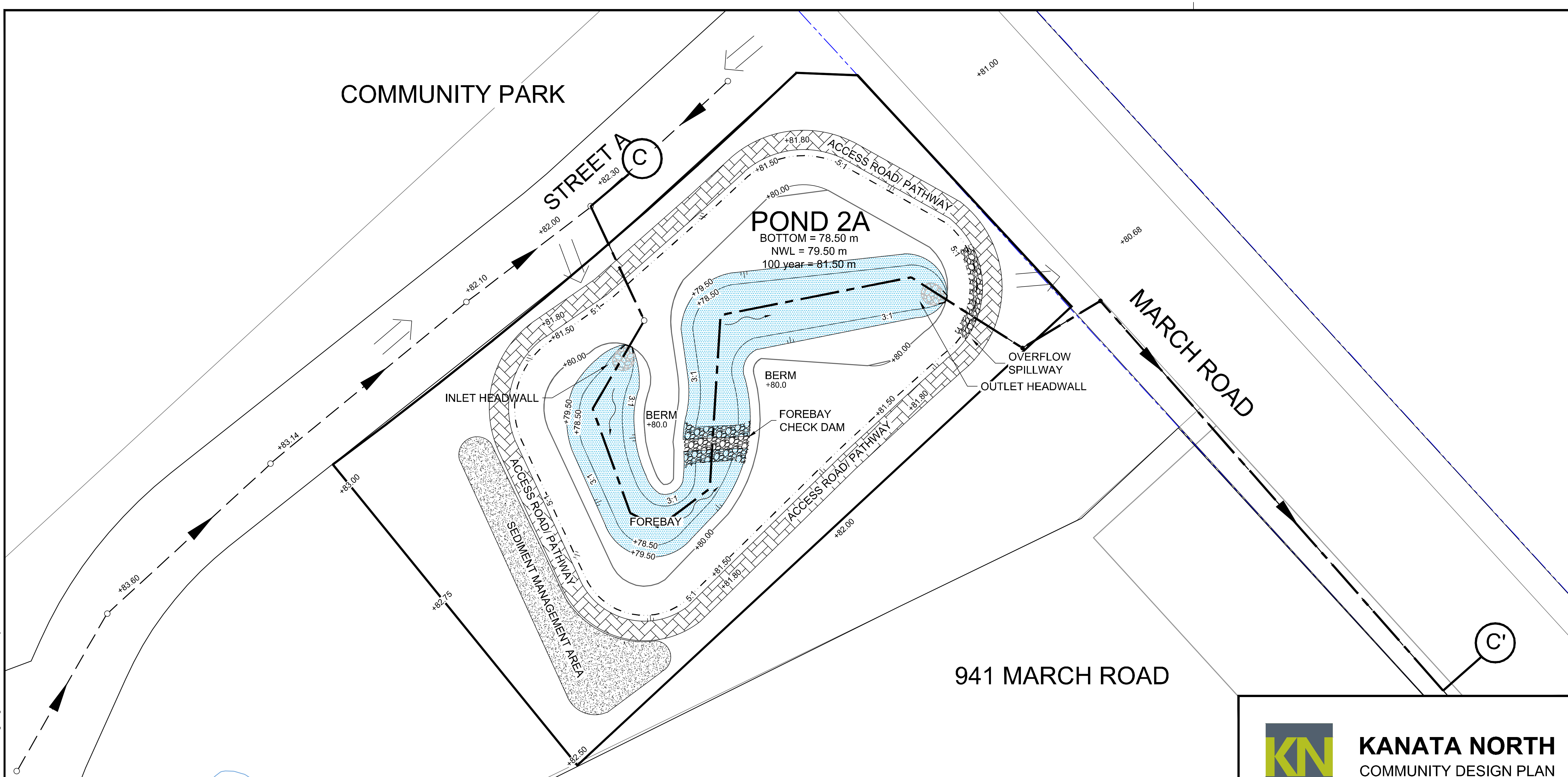
KANATA NORTH URBAN EXPANSION AREA
COMMUNITY DESIGN PLAN

PROJECT :	112117
DESIGNED BY:	ARM
CHECKED BY:	CJR
DATE:	May-16

NOVATECH
Engineers, Planners & Landscape Architects

Table B-2 - Major Overland Flow Summary

Area ID	Indiv. Area (ha)	Indiv C	Tot. Area (ha)	Tot C	Contribution (L/s/ha)	Flow (m^3/s)	Cross-section	Manning's n	Slope	Depth (m)	Velocity (m/s)	Notes	V*D check
Pond 1													
M1.1	7.04	0.65	7.04	0.65	110	0.77	18m ROW	0.015	0.72%	0.11	2.01		0.2
M1.3	4.35	0.67	11.39	0.66	90	1.03	18m ROW	0.015	0.95%	0.11	2.39		0.3
M1.4	4.24	0.78	15.63	0.69	75	1.17	18m ROW	0.015	3.00%	0.10	3.81		0.4
M1.6	5.21	0.60	5.21	0.60	120	0.63	18m ROW	0.015	0.58%	0.10	1.76	Significant high density	0.2
M1.7	6.67	0.58	11.88	0.59	80	0.95	18m ROW	0.015	0.43%	0.13	1.74		0.2
M1.8	8.76	0.62	8.76	0.62	125	1.10	18m ROW	0.015	1.20%	0.11	2.65		0.3
M1.9	5.95	0.65	5.95	0.65	130	0.77	18m ROW	0.015	0.81%	0.11	2.10		0.2
M1.10	1.39	0.72	1.39	0.72	130	0.18	18m ROW	0.015	0.81%	0.06	1.46		0.1
M1.11	1.21	0.69	21.85	0.61	60	1.31	18m ROW	0.015	0.16%	0.17	1.30		0.2
M1.2	10.00	0.65	10.00	0.65	90	0.90	24m ROW	0.015	0.68%	0.11	2.04		0.2
M1.5	2.13	0.81	12.13	0.68	85	1.03	24m ROW	0.015	0.24%	0.15	1.43		0.2
Pond 2													
M2.1	1.96	0.70	8.77	0.56	110	0.96	18m ROW	0.015	1.53%	0.10	2.82	Significant high density	0.3
M2.4	1.59	0.70	1.59	0.70	130	0.21	18m ROW	0.015	1.15%	0.06	1.72	Significant high density	0.1
M2.5	3.36	0.65	6.81	0.52	100	0.68	18m ROW	0.015	0.20%	0.13	1.20	Significant high density	0.2
M2.6	3.45	0.40	3.45	0.40	76	0.26	18m ROW	0.015	0.31%	0.08	1.12	Significant high density	0.1
M2.2	4.55	0.40	4.55	0.40	76	0.35	24m ROW	0.015	0.75%	0.08	1.67	Significant high density	0.1
M2.3	1.67	0.65	6.22	0.47	76	0.47	24m ROW	0.015	0.75%	0.09	1.80	Significant high density	0.2
Pond 3 (North)													
M1.12	0.76	0.65	0.76	0.65	130	0.10	18m ROW	0.015	1.82%	0.04	1.70		0.1
M3.1	9.11	0.73	9.11	0.73	90	0.82	18m ROW	0.015	1.14%	0.10	2.42	Significant high density	0.2
M3.2	9.21	0.65	18.32	0.69	65	1.19	18m ROW	0.015	0.33%	0.15	1.67		0.2
M3.3	6.76	0.65	25.08	0.68	55	1.38	18m ROW	0.015	2.55%	0.11	3.73		0.4
M3.4	4.60	0.65	4.60	0.65	130	0.60	18m ROW	0.015	0.33%	0.11	1.41		0.2
M3.5	4.34	0.55	8.94	0.60	110	0.98	18m ROW	0.015	2.23%	0.10	3.26	Park Area	0.3
M3.6	3.48	0.65	12.42	0.62	85	1.06	18m ROW	0.015	1.50%	0.11	2.86		0.3
Pond 3 (South)													
M4.1	0.92	0.65	0.92	0.65	130	0.12	18m ROW	0.015	3.86%	0.04	2.37		0.1
M4.5	11.30	0.63	12.22	0.63	85	1.04	18m ROW	0.015	3.86%	0.09	4.06		0.4
M4.6	8.94	0.63	8.94	0.63	90	0.80	18m ROW	0.015	0.16%	0.14	1.15		0.2
M4.7	6.55	0.65	15.49	0.64	80	1.24	18m ROW	0.015	0.16%	0.17	1.29		0.2
M4.8	9.96	0.65	37.67	0.64	50	1.88	18m ROW	0.015	0.16%	0.20	1.43		0.3



LEGEND

- RIGHT OF WAYS
- POND BLOCK
- EXISTING CREEK CORRIDOR
- PERMANENT POOL
- ACCESS ROAD/PATHWAY
- ROCK WALL CHECK DAM
- MAJOR OVERLAND FLOW DIRECTION
- STORM SEWER

LEGEND

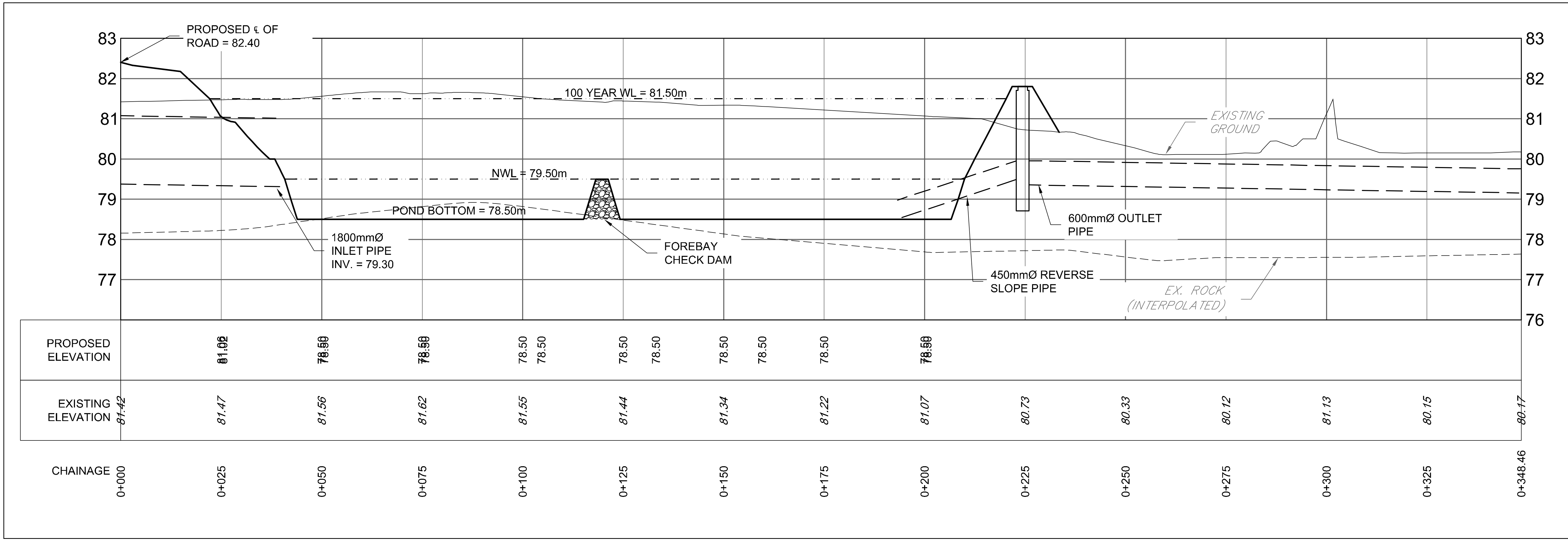
- DIRECTION OF POND FLOW
- HEADWALL C/W RIPRAP
- +81.50 PROPOSED GRADE
- 3:1 TERRACING (MAX. SLOPE)
- 100YR WATER LEVEL

KANATA NORTH
COMMUNITY DESIGN PLAN

FIGURE NO. 9.3
POND 2A
CONCEPTUAL LAYOUT

DATE MAY 2016
JOB 112117
SCALE 1:1000
0 5m 10m 20m

NOVATECH
Engineers, Planners & Landscape Architects



KANATA NORTH

COMMUNITY DESIGN PLAN

FIGURE NO. 9.3A

POND 2A

CROSS SECTION C-C'

DATE
MAY 2016

JOB
112117

SCALE
1:1000

0 5m 10m 20m

NOVATECH

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M:\2012\112117\CAD\Design_EMP\MEMO (KJA)\Figure 9.3 Pond 2A Functional.dwg, Figure 9.3A Pond 2A, May 17, 2016 - 11:49am, tbrooks

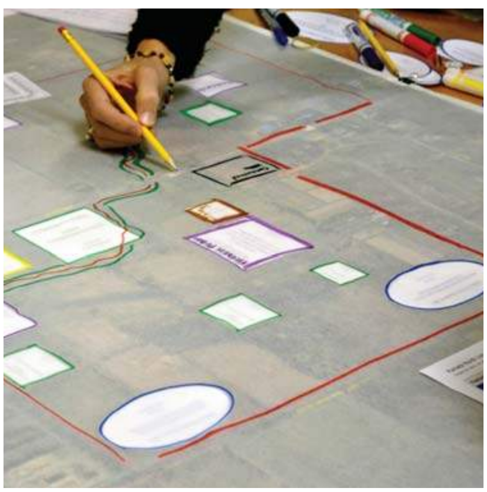
Appendix D GEOTECHNICAL INVESTIGATION EXCERPTS

KANATA NORTH
COMMUNITY DESIGN PLAN

ENVIRONMENTAL MANAGEMENT PLAN

REPORT






FINAL
JUNE 28, 2016

Engineers, Planners & Landscape Architects

Section 3.0 Existing Conditions Assessment

The existing conditions reports provide the basis for identifying and mapping significant natural features within the limits of the KNUEA study area in accordance with provincial and municipal policies.

Study area extents for each of the various studies listed below vary, and are outlined in the respective reports. Generally, the study area follows the northern, southern, and western boundaries of the KNUEA and extends just east of Shirley's Brook Main Branch at the boundary of the DND lands.

The environmental inventory represents the integrated summary and assessment of the natural features identified in the existing conditions reports (available under separate cover in Volume 3):

- Kanata North Urban Expansion Area Community Design Plan Environmental Management Plan Existing Conditions Report: Storm Drainage, Hydrology & Floodplain Mapping (Novatech – February 2016)
- Existing Conditions Natural Environment Features Kanata North Urban Expansion Area (Muncaster Environmental Planning Inc. – January 2016)
- Consolidated Preliminary Geotechnical Investigation Kanata North Urban Expansion Area Community Design Plan (Patterson Group – October 7, 2013)
- Hydrogeological Existing Conditions Report Kanata North Urban Expansion Area (Patterson Group – May 18, 2016)
- Kanata North Urban Expansion Area Fluvial Geomorphic Assessment (Parish Aquatic Services – March 2016)
- Kanata North Urban Expansion Area Headwater Drainage Features Geomorphic Assessment (Parish Aquatic Services – March 2016)
- Kanata North Headwaters Report (Bowfin Environmental Consulting & Muncaster Environmental Planning Inc. – September 2015)
- Sensitive Groundwater Assessment: Discharge and Recharge Area Evaluation Woodlot S20 (Patterson Group – October 24, 2014)
- South March Highlands Blanding's Turtle Conservation Needs Assessment (Dillon Consulting Limited – January 31, 2013)
- Kanata North Community Design Plan Blanding's Turtle Compensation Plan (DST Consulting Engineers – June 2015)
- Kanata North Community Design Plan Blanding's Turtle Compensation Plan – Offsite Compensation Concept (Memo) (DST Consulting Engineers – November 12, 2015)

3.6.3 Southwest Wooded Area

The Southwest Wooded Area is located in the southwest quadrant of the KNUEA adjacent to the Marchbrook Circle Subdivision. This area is included on Schedule L3 of the City of Ottawa Natural Heritage System Overlay.

This area has been historically disturbed by agriculture and had no contiguous tree cover on 1976 aerial photography. The southwest wooded area does extend in a continuous, although tenuous, manner west and southwest to the core Woodland S12 area. As a watercourse is present and the contiguous forest to the southwest of the site does have small areas of forest that are greater than 100 metres from a forest edge, the entire contiguous forest is considered a Significant Woodland.

A portion of the wooded area (approximately 0.3 ha), located along the western border of the KNUEA is to be retained as a part of the Natural Heritage System (NHS). This area consists of a white cedar coniferous forest, where the trees are generally young, but in good health. This portion of the southwest wooded area is contiguous with and forms a part of the larger wooded area to the west and southwest, including Woodlot S12. As this area is considered a part of the NHS, it is important that it be retained as a part of the proposed development and conveyed to the City for conservation. The other portions of the southwest wooded area within the KNUEA lack the same degree of connectivity to the larger wooded area to the west and southwest, have fewer regenerating stems and opportunities for wildlife habitat, and a lower condition of ecological integrity.

3.7 Geotechnical

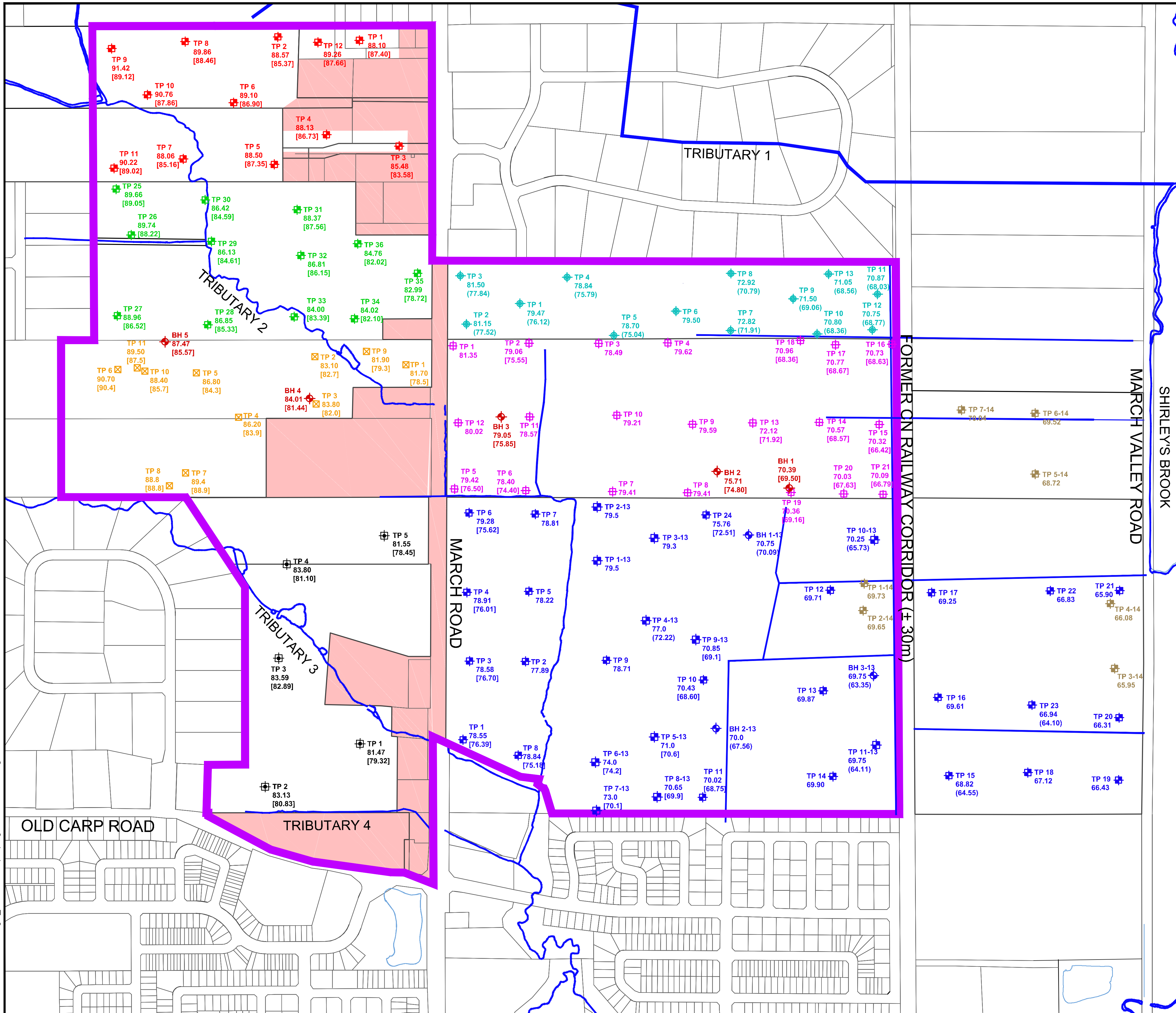
A geotechnical investigation of the soils within the KNUEA was completed to assess soils conditions and provide preliminary guidelines with respect to slope stability, grade raise restrictions and foundation design requirements. The following report (which can be found in **Volume 3**, **Appendix L**) consolidates the geotechnical studies completed for the individual properties within the KNUEA:

- *Consolidated Preliminary Geotechnical Investigation Kanata North Urban Expansion Area Community Design Plan* (Patterson – October 7, 2013)

3.7.1 Methodology

The geotechnical investigation included a field program consisting of test pits excavated by a hydraulic shovel or backhoe. The test holes were distributed in a manner to provide general coverall of the subject sites comprising the KNUEA. Refer to **Figure 3.4** for the location of all test pits and boreholes within the KNUEA.

- Soils samples from the test pits were recovered from the side walls for further examination and classification.
- Subsurface conditions observed in the boreholes were recorded in detail in the field and logged on the test pit data sheets.
- Groundwater infiltration levels were observed at the time of excavation at each test pit location.



LEGEND

	KNUEA
	DRAINAGE CHANNEL
	LANDS NOT INCLUDED IN GEOTECHNICAL REPORTS
78.55	GROUND ELEVATION (m)
[76.39]	BEDROCK ELEVATION (m)
(64.10)	PRACTICAL REFUSAL TO EXCAVATION ELEV. (m)

TEST PIT/BOREHOLE LOCATIONS AS PER VARIOUS GEOTECHNICAL INVESTIGATIONS:

TP 5	TEST PIT LOCATION, PATERSON GROUP LETTER PG1626-LET.01 DATED MARCH 3, 2008
TP 5	TEST PIT LOCATION, PATERSON GROUP LETTER PG1716-LET.01 DATED AUGUST 28, 2008
TP 5	TEST PIT LOCATION, PATERSON GROUP LETTER PG1823-LET.01 DATED MARCH 3, 2009
TP 6	TEST PIT LOCATION, PATERSON GROUP LETTER PG2256-LET.01 DATED FEBRUARY 7, 2011
TP 24 BH 1-13	TEST PIT/BOREHOLE LOCATION, PATERSON GROUP REPORT PG2878-4 DATED JUNE 13, 2013
TP 31	TEST PIT LOCATION, PATERSON GROUP REPORT PG2878-3 DATED APRIL 19, 2013
TP 1-14	TEST PIT LOCATION, PATERSON GROUP MEMO PG2878-MEMO.01 DATED SEPTEMBER 24, 2014
BH 2	BOREHOLE LOCATION, PATERSON GROUP REPORT PH2223-4, DATED AUGUST 7, 2015
TP 9	TEST PIT LOCATION BY OTHERS

KANATA NORTH
COMMUNITY DESIGN PLAN

FIGURE NO. 3.4

TEST PIT & BOREHOLE LOCATIONS

DATE: MAY 2016
JOB: 112117
SCALE: 1:7500 (0, 37.5m, 75m, 150m)

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M:\2012\112117\CAD\Design_EMP\MEMO (CS)\Figure 3.4 TP&BH.dwg, FIG-3.4, Mar 24, 2016 - 11:56am, kbanks

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3.7.2 Surficial Geology

The surficial geology of the KNUEA is shown on **Figure 3.5**. The surficial soils in the subject area generally consist of silty clay and glacial till, which is generally consistent with marine deposits associated with the Champlain Sea. Silty sand with trace clay was found in several test pits, but is only present in isolated pockets throughout the site. Based on the borehole and test pit program carried out by Paterson Group, the overburden thickness across the site generally ranges from 0m thick to greater than 10m thick. Bedrock is present just beneath the topsoil and glaciofluvial soil veneer in the southwest quadrant of the KNUEA and trends downward moving towards the northern portion of the site. There are weathered outcroppings of bedrock in both the southeast and southwest quadrants, and both Tributary 2 and Tributary 3 contain long expanses of exposed, competent bedrock.

3.7.3 Bedrock Geology

The bedrock which underlies the KNUEA consists of generally flat-lying bedrock of sedimentary origin. Bedrock is present at variable depths across the subject lands, and the depth to bedrock varies significantly from the south to the north, as well as from the east to the west. The site primarily consists of interbedded sandstone and limestone of the March Formation. Approximately one third of the study area (in the northeast and northwest quadrants) is underlain by limestone of the Oxford Formation.

The March Formation is the older of the two formations, and transitions to the Oxford Formation by way of a vertical fault. Sections of the bedrock mapping for the KNUEA and surrounding area are provided in the Consolidated Preliminary Geotechnical Investigation Report.

A review of the Ontario Geologic Survey (OGS) bedrock mapping reveals that the March and Oxford Formations present beneath the KNUEA are not considered to contain potential or inferred karst features. The term karst is used to describe a geologic formation which is shaped by the dissolution of a layer, or layers, of soluble bedrock. Typically this is found in carbonate rock such as limestone or dolostone. Although the bedrock that underlays the site is comprised of carbonate bedrock, they represent older bedrock in the study area and have a denser crystalline structure versus the younger Ottawa Formation bedrock.

3.7.4 Slope Stability

A significant soil ridge (approximately 9.0 m high with a slope of 8H:1V) runs in a north-south direction through the east portion of the KNUEA.. Test pits and boreholes conducted in the area of the existing slope were analyzed to determine the subsurface soil conditions.

Paterson Group conducted modeling of two cross-sections along the slope, and found that both sections are stable with slope stability factors of safety greater than 1.5. Refer to **Volume 3**, **Appendix M** for slope stability tables & data.

3.8 Hydrogeology

A hydrogeologic investigation was completed to characterize the existing conditions within the KNUEA with respect to bedrock and surficial geology, aquifers, aquitards, horizontal and vertical flow patterns, existing groundwater use, and aquifer vulnerability. The hydrogeologic characterization is based on a combination of existing information and site specific information provided by the fieldwork and other analyses. Please refer to the following report (located in **Volume 3**, **Appendix N**) for additional information:

- *Hydrogeological Existing Conditions Report - Kanata North Urban Expansion Area* (Paterson, May 18, 2016)

3.8.1 Groundwater Recharge and Discharge

In general, groundwater will follow the path of least resistance from areas of higher hydraulic head to areas of lower hydraulic head. While upward and downward hydraulic gradients may be indicative of areas of discharge and recharge respectively, other factors must be considered.

Previous Studies

The *Shirley's Brook and Watt's Creek Subwatershed Study* (Dillon 1999) and the *Kanata North Environmental Stormwater Management Plan* (CH2MHill 2001) reports were reviewed by Paterson staff as part of the existing conditions geotechnical investigation. While the majority of overburden soils within the KNUEA were reportedly silty clay or glacial till deposits, the Dillon report identified alluvial soils in the eastern portions of the study area. Alluvial soils are comprised of loose, unconsolidated material which has previously been eroded and re-shaped by water, and can potentially transmit overburden groundwater significant lateral distances via gravity flow and provide groundwater recharge and discharge to Shirley's Brook.

Dillon (1999) estimated the alluvial soils to be up to 2 m thick, where present, and indicated that these soils could provide an opportunity for infiltration-based stormwater management measures. The Dillon report also identified exposed bedrock ridges near the western boundary of the study area as representing a potential bedrock groundwater recharge area.

The *Greater Shirley's Brook Constance Creek Environmental Management Study* (Aquafor Beech, October 2006) also indicates the presence of a large alluvial sand deposit between March Road and March Valley Road extending for a distance of approximately 7 km through the low area below the ridge. Refer to **Volume 2**, **Appendix G**, **Figure 1** for the location of the alluvial soils deposit, identified as "High Recharge" in the legend.

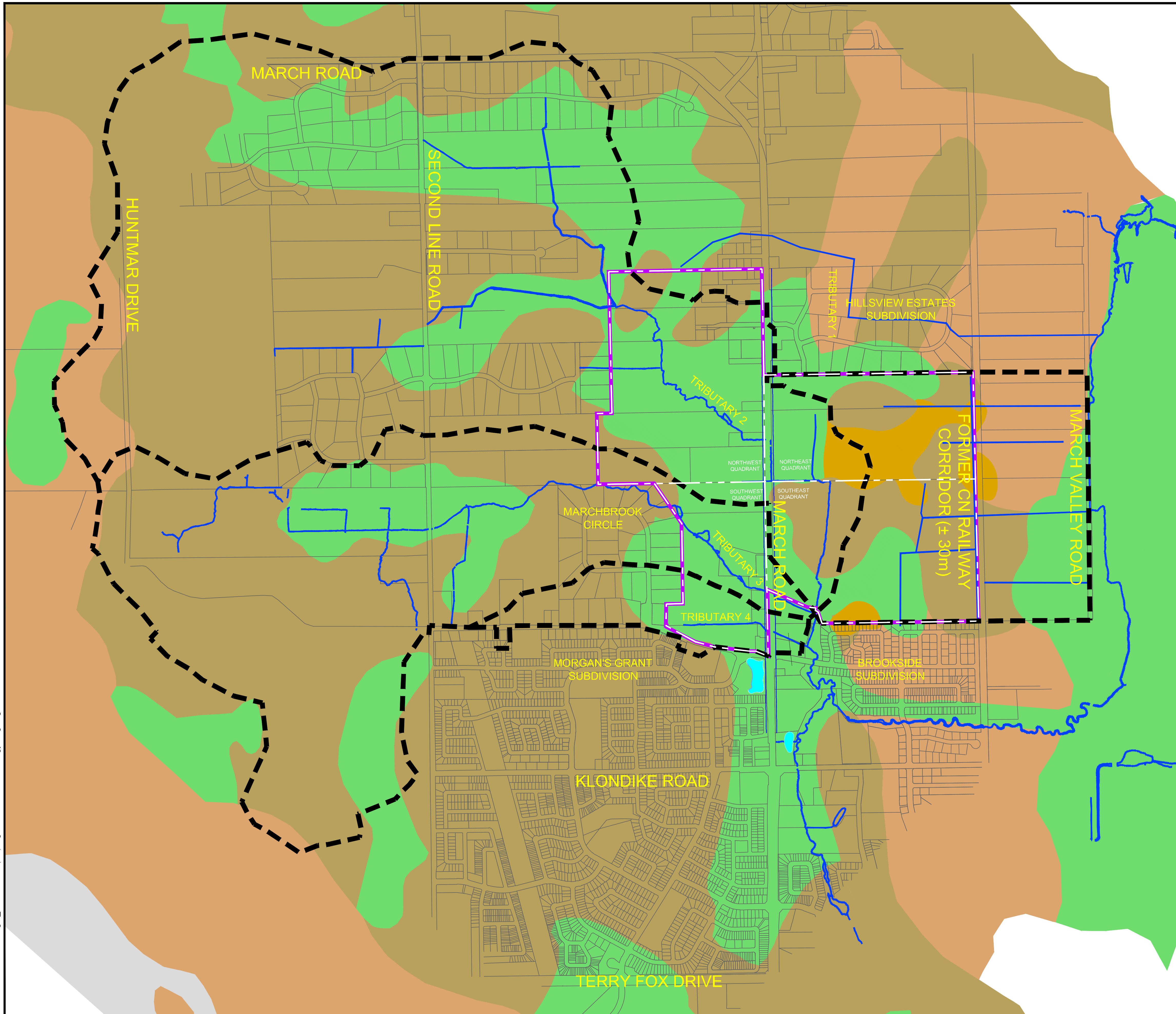
Within the limits of the KNUEA, the alluvial sand deposits are generally underlain by stiff silty clay, which significantly limits the groundwater recharge potential in this area. The alluvial soils correspond to the sand / sandy loam areas shown on **Figure 3.5**.

Results of Field Testing

Based on hydraulic conductivity testing undertaken in the bedrock unit, and hydraulic conductivity estimates based on grain size analysis of overburden soils, the bedrock unit is considered to have a higher hydraulic conductivity than the silty clay and glacial till overburden soils, which are generally considered to act as a confining layer. As such, groundwater will generally flow laterally through the fractured bedrock aquifer units or through localized shallow silty sand deposits, as opposed to vertically upwards or downwards through the overburden soils of lower hydraulic conductivity. The borehole and piezometer locations used in the groundwater recharge/discharge assessment are shown on **Figure 3.4**.

- In areas where downward hydraulic gradients were observed (BH1/BH1A, BH4/ BH4A), the presence of overburden soils of lower hydraulic conductivity overlying the bedrock aquifer units are considered to limit the potential for significant groundwater recharge in these areas.
- In areas where upward hydraulic gradients were observed (BH2/BH2A, BH3/BH3A, BH5/BH4A), the presence of overburden soils of lower hydraulic conductivity overlying the bedrock aquifer units are considered to limit the potential for significant groundwater discharge in these areas.

Furthermore, the presence of groundwater levels in the vicinity of BH1/BH1A and BH5/BH5A at elevations above ground surface supports the conclusion that overburden soils are acting as a confining layer above the bedrock aquifer units in these specific locations.



LEGEND

- KNUEA
- DRAINAGE CHANNEL
- PRE-DEVELOPMENT DRAINAGE BOUNDARIES

SURFICIAL SOIL TYPE (HSG)

- MEDIUM/COARSE SAND (HSG 'AB')
- SANDY LOAM OR LOAMY SAND (HSG 'B')
- FINE SANDY LOAM OR LOAMY FINE SAND (HSG 'C')
- SILT LOAM, SILTY CLAY, SILTY CLAY LOAM, CLAY LOAMS OR CLAY (HSG 'D')

SOURCE OF INFORMATION

1. KNUEA
(BASED ON GEOTECHNICAL REPORTS - REFER TO FIGURE 3.4)
2. EXTERNAL AREAS
(BASED ON SOILS OF THE REGIONAL MUNICIPALITY OF OTTAWA-CARELTON (ONTARIO). 1987. SOIL SURVEY REPORT NO. 58 (SHEET 3)

KANATA NORTH
COMMUNITY DESIGN PLAN

FIGURE NO. 3.5
SURFICIAL SOILS
HYDROLOGIC SOIL GROUP (HSG)

DATE
MAY 2016

JOB
112117

SCALE
NTS

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M:\2012\112117\CAD\Design_EMP\MEMO (CS)\Figure 3.5 Surficial Geology.dwg, Figure 3.5, Mar 24, 2016 - 11:57am, kbanks

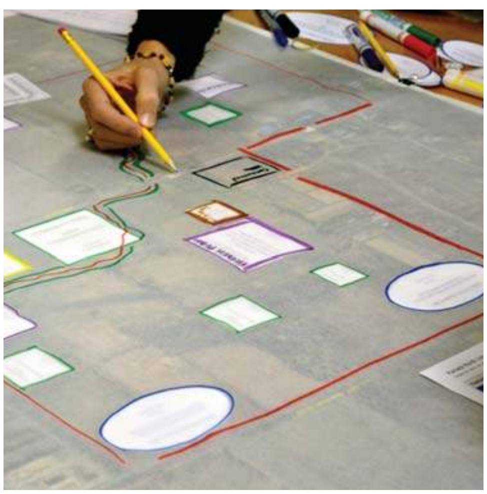
SHT11x17.DWG - 279mmx432mm

KANATA NORTH
COMMUNITY DESIGN PLAN

ENVIRONMENTAL MANAGEMENT PLAN

SUPPORTING REPORTS






FINAL
JUNE 28, 2016

Ottawa

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Appendix L

Consolidated Preliminary Geotechnical Investigation
Kanata North Urban Expansion Area Community Design Plan

(Patterson Group – October 7, 2013)

Geotechnical Engineering

Environmental Engineering

Archaeological Studies

Hydrogeology

Geological Engineering

Materials Testing

Archaeological Studies

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Consolidated Preliminary Geotechnical Investigation

Kanata North Urban Expansion Area
Community Development Plan
March Road
Ottawa, Ontario

Prepared For

Novatech Engineering Consultants

October 7, 2013

Report PG2878-1R

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APPENDICES

Appendix 1	Soil Profile and Test Data Sheets Symbols and Terms Analytical Testing Results
Appendix 2	Figure 1 - Key Plan Drawing PG2878-1 - Test Hole Location Plan Drawing PG2878-2 - Permissible Grade Raise Areas - Housing

1.0 INTRODUCTION

Paterson Group (Paterson) was commissioned by Novatech Engineering Consultants to prepare a preliminary geotechnical report outlining the geotechnical constraints for the Kanata North Urban Expansion Area Community Design Plan (CDP) along March Road in the City of Ottawa, Ontario (refer to Figure 1 - Key Plan in Appendix 2 of this report).

The current report consolidates the existing geotechnical studies completed for the individual properties. The relevant geotechnical studies are listed below:

- ❑ Paterson Report PG2878-2 dated April 8, 2013 entitled "Preliminary Geotechnical Investigation, 936 March Road, Ottawa, Ontario".
- ❑ Paterson Report PG2878-3 dated April 8, 2013 entitled "Preliminary Geotechnical Investigation, 1075 March Road, Ottawa, Ontario".
- ❑ Paterson Letter Report PG2256-LET.01 dated February 7, 2011 entitled "Geotechnical Investigation Proposed Residential Development, Dekok Lands, March Road, Ottawa."
- ❑ Paterson Letter Report PG1823-LET.01 dated March 18, 2009 entitled "Preliminary Geotechnical Investigation, Proposed Residential Development, Burke and Maxwell Properties, March Road, Ottawa."
- ❑ Paterson Letter Report PG1716-LET.01 dated August 25, 2009 entitled "Preliminary Geotechnical Investigation Proposed Residential Development, Foley Lands, March Road, Ottawa."
- ❑ Paterson Letter Report PG1626-LET.01 dated March 12, 2008 entitled "Preliminary Geotechnical Investigation, Vacant Property, 927 March Road, Ottawa (Kanata), Ontario."
- ❑ Morey Associates Ltd. Report 012417 dated February 2013 entitled "Report on Geotechnical Investigation, Proposed Residential Development, 1020 March Road, Ottawa, Ontario."

The following report has been prepared specifically and solely for the aforementioned project which is described herein. It contains our findings and includes preliminary geotechnical recommendations pertaining to the design and construction of the proposed development as they are understood at the time of writing this report.

2.0 PROPOSED DEVELOPMENT

Details of the development were not available at the time of issuance of this report. It is understood that the following properties are part of the Kanata North Urban Expansion Area Community Design Plan:

- 927 March Road - Owner: 6095186 Canada Inc.
- 936 March Road - Owner: Metcalfe Realty Company Limited
- 1020 March Road - Owner: Kanata Research Park
- 1015 March Road - Owner: Multivesco
- 1035 March Road - Owner: Multivesco
- 1070 March Road - Owner: Valecraft
- 1075 March Road - Owner: Multivesco
- 1145 March Road - Owner: 7089121 Canada Inc.

3.0 METHOD OF INVESTIGATION

3.1 Field Investigation

Field Program

Test pits excavated by a hydraulic shovel or rubber tired backhoe were completed throughout the subject properties. The test holes were distributed in a manner to provide general coverage of the subject sites. Approximate locations of the test holes are shown in Drawing PG2878-1 - Test Hole Location Plan included in Appendix 2.

Sampling and In Situ Testing

Soil samples from the test pits were recovered from the side walls of the open excavation and all soil samples were initially classified on site. All samples were transported to our laboratory for further examination and classification. The depths at which the grab samples were recovered from the test holes are shown as G on the Soil Profile and Test Data sheets in Appendix 1.

Undrained shear strength testing, using a hand held vane apparatus, was carried out at regular intervals of depth in cohesive soils.

The subsurface conditions observed in the test holes were recorded in detail in the field. The soil profiles are logged on the Soil Profile and Test Data sheets in Appendix 1 of this report.

Groundwater

Open hole groundwater infiltration levels were observed at the time of excavation at each test pit location. Our observations are presented in the Soil Profile and Test Data sheets in Appendix 1.

Sample Storage

All samples will be stored in the laboratory for a period of one month after issuance of this report. They will then be discarded unless we are otherwise directed.

3.2 Field Survey

The ground surface elevations at the test pit locations are presented on Drawing PG2878-1 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

The soil samples recovered from the subject site were examined in our laboratory to review the results of the field logging.

3.4 Analytical Testing

Four (4) soil samples were submitted for analytical testing to assess the corrosion potential for exposed ferrous metals and the potential of sulphate attacks against subsurface concrete structures. The samples were submitted to determine the concentration of sulphate and chloride, the resistivity and the pH of the soil. The analytical test results are presented in Appendix 1 and discussed in Subsection 6.6 of this report.

4.0 OBSERVATIONS

4.1 Surface and Subsurface Observations

The subject site currently covers an area of approximately 194 hectares. The majority of the site is undeveloped (tilled agricultural or treed) areas. Observations at the subject properties are presented below.

927 March Road

The vacant property located at 927 March Road is relatively flat, grass covered agricultural farm land. Several mature trees follow the 1.5 to 2.5 m deep creek that meanders diagonally through the subject site. It was observed during out field investigation that the shallow creek is flowing on the bedrock surface in several locations across the site.

The subsoil conditions at the test hole locations consist of a surficial topsoil layer underlain by a very stiff silty clay deposit followed by a glacial till layer and sound bedrock encountered at all test holes on the two parcels of land located on 927 March Road.

936 March Road

The vacant property located at 936 March Road consists of mostly undeveloped land. Dense bush was noted in the northwestern portion of the site. The site is bisected by an existing rail track. The remainder of the site consists of agricultural land or an existing fam house. A significant slope was noted to exist north of the residential house, but south of the existing rail tracks.

The subsoil conditions at the test hole locations consist of topsoil, agricultural soil or fill underlain by a stiff to very stiff silty clay deposit. Glacial till was noted below the silty clay in the southern portion of the property. Practical refusal to excavation was also noted in the southern portion of the site.

1015 and 1035 March Road

1015 and 1035 March Road is currently grass covered with several large trees bordering the property. The site slopes gradually downward to the east toward to the meandering creek located within the east portion of the subject site.

1145 March Road

1145 March Road is undeveloped and grass covered. The site slopes gradually downward to the east.

The subsoil conditions at the test hole locations consist of topsoil underlain by very stiff brown silty clay, silty sand/sandy silt, glacial till and/or bedrock. Practical refusal to excavation was encountered between 0.7 to 3.2 m below surface at all test hole locations.

Based on available geological mapping, the bedrock below the majority of the subject site consists of interbedded sandstone and dolomite of the March formation. Below the east portion of the site, bedrock consists of either dolomite of the Oxford formation or sandstone of the Nepean formation. The overburden thickness varies from 0 to 10 m depth throughout the proposed development area, with shallow bedrock encountered within the west portion of the site.

4.2 Groundwater

Groundwater levels (GWL) were measured in the test pits upon completion of the field program. The results are summarized in Table 1. It should be noted that groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater levels could vary at the time of construction.

Table 1 - Summary of Groundwater Level Readings

Test Pit Number	Ground Surface Elevation (m)	Groundwater Level (m)	Groundwater Depth (m)	Recording Date
PG1626 - 927 March Road				
TP 1	--	1.60	--	February 25, 2008
TP 2	--	0.70	--	February 25, 2008
TP 3	--	dry	--	February 25, 2008
TP 4	--	1.00	--	February 25, 2008
TP 5	--	1.60	--	February 25, 2008
PG1716 - 1015 and 1035 March Road				
TP 1	81.70	1.75	79.95	July 9, 2008
TP 2	83.10	dry	--	July 9, 2008
TP 3	83.80	1.75	82.05	July 9, 2008
TP 4	86.20	1.20	85.00	July 9, 2008
TP 5	86.80	1.10	85.70	July 9, 2008

5.0 DISCUSSION

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is adequate for the anticipated development. It is expected that low rise wood framed buildings or mid to high rise buildings could be founded on conventional shallow footings placed on an undisturbed, stiff silty clay, compact silty sand, compact glacial till or surface-sounded bedrock bearing surface.

A permissible grade raise restriction is required for the proposed residential development where the silty clay layer is present below the proposed buildings. Areas effected by a permissible grade raise restriction due to the presence of a silty clay deposit are indicated in Drawing PG2878-2 - Permissible Grade Raise Areas - Housing in Appendix 2.

The above and other considerations are discussed in the following paragraphs.

5.2 Site Grading and Preparation

Stripping Depth

Topsoil, and any deleterious fill, such as those containing organic materials, should be stripped from under any buildings and other settlement sensitive structures. Other settlement sensitive structures include, but are not limited to, underground services and paved areas.

Existing foundation walls and other construction debris should be entirely removed from within the building perimeter. Under paved areas, existing construction remnants such as foundation walls should be excavated to a minimum of 1 m below final grade.

Bedrock Removal

It is expected that line-drilling in conjunction with hoe-ramming or controlled blasting may required to remove the bedrock. In areas of weathered bedrock and where only a small quantity of bedrock is to be removed, bedrock removal may be possible by hoe-ramming.

Prior to considering blasting operations, the blasting effects on the existing services, buildings and other structures should be addressed. A pre-blast or pre-construction survey of the existing structures located in proximity of the blasting operations should be carried out prior to commencing site activities. The extent of the survey should be determined by the blasting consultant and should be sufficient to respond to any inquiries/claims related to the blasting operations.

As a general guideline, peak particle velocities (measured at the structures) should not exceed 25 mm per second during the blasting program to reduce the risks of damage to the existing structures.

The blasting operations should be planned and conducted under the supervision of a licensed professional engineer who is also an experienced blasting consultant.

Excavation side slopes in sound bedrock can be carried out using almost vertical side walls. A minimum 1 m horizontal ledge, should be left between the bottom of the overburden excavation and the top of the bedrock surface to provide an area to allow for potential sloughing or to provide a stable base for the overburden shoring system. However, should the entire area be required to accommodate the parking garage, drilled piles into the weathered portion of the bedrock can be used to support the upper levels of the excavation and can be placed at the property boundary.

Vibration Considerations

Construction operations are also the cause of vibrations, and possibly, sources of nuisance to the community. Therefore, means to reduce the vibration levels as much as possible should be incorporated in the construction operations to maintain, as much as possible, a cooperative environment with the residents.

The following construction equipments could be a source of vibrations: piling rig, hoe ram, compactor, dozer, crane, truck traffic, etc. The construction of the shoring system using soldier piles or sheet piling will require the use of this equipment. Vibrations, whether it is caused by blasting operations or by construction operations, could be the cause of the source of detrimental vibrations on the adjoining buildings and structures. Therefore, it is recommended that all vibrations be limited.

Two parameters are used to determine the permissible vibrations, namely, the maximum peak particle velocity and the frequency. For low frequency vibrations, the maximum allowable peak particle velocity is less than that for high frequency vibrations. As a guideline, the peak particle velocity should be less than 15 mm/s between frequencies of 4 to 12 Hz, and 50 mm/s above a frequency of 40 Hz (interpolate between 12 and 40 Hz). It should be noted that these guidelines are for today's construction standards. Considering that these guidelines are above perceptible human level and, in some cases, could be very disturbing to some people, it is recommended that a pre-construction survey be completed to minimize the risks of claims during or following the construction of the proposed building.

Fill Placement

Fill used for grading beneath the building areas should consist, unless otherwise specified, of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II material. The fill should be placed in lifts no greater than 300 mm thick and compacted using suitable compaction equipment for the lift thickness. Fill placed beneath the buildings should be compacted to at least 98% of its standard Proctor maximum dry density (SPMDD).

Non-specified existing fill along with site-excavated soil can be used as general landscaping fill where settlement of the ground surface is of minor concern. These materials should be spread in thin lifts and at least compacted by the tracks of the spreading equipment to minimize voids. If excavated stiff brown silty clay, free of organics and deleterious materials, is to be used to build up the subgrade level for areas to be paved, the silty clay, under dry conditions, should be compacted in thin lifts to a minimum density of 95% of their respective SPMDD. Non-specified existing fill and site-excavated soils are not suitable for use as backfill against foundation walls unless a composite drainage blanket connected to a perimeter drainage system is provided.

5.3 Foundation Design

Shallow Foundation

Strip footings, up to 2 m wide, and pad footings, up to 4 m wide, placed on an undisturbed, stiff silty clay bearing surface can be designed using a bearing resistance value at serviceability limit state (SLS) of **150 kPa** and a factored bearing resistance value at ultimate limit state (ULS) of **225 kPa**. Footings placed on an undisturbed, compact silty sand or compact glacial till bearing surface can be designed using a bearing resistance value at SLS of **150 kPa** and a factored bearing resistance value at ULS of **225 kPa**. Footings placed on a clean, weathered bedrock can be designed using a bearing resistance value at SLS of **500 kPa** and a factored bearing resistance value at ULS of **750 kPa**.

An undisturbed soil bearing surface consists of a surface from which all topsoil and deleterious materials, such as loose, frozen or disturbed soil, whether in situ or not, have been removed, in the dry, prior to the placement of concrete for footings.

A clean, weathered bedrock surface consists of one from which all topsoil, soils, deleterious materials and loose rock have been removed prior to concrete placement.

Footings designed using the bearing resistance value at SLS given above will be subjected to potential post construction total and differential settlements of 25 and 20 mm, respectively. A geotechnical resistance factor of 0.5 was applied to the above noted bearing resistance value at ULS.

A **permissible grade raise restriction of 2 m** is recommended for areas where building foundations are founded over a silty clay deposit. Areas effected by a permissible grade raise restriction due to the presence of a silty clay deposit are indicated in Drawing PG2878-2 - Permissible Grade Raise Areas - Housing in Appendix 2. Footings bearing on a dense glacial till are not subjected to permissible grade raise restrictions.

Lateral Support

The bearing medium under footing-supported structures is required to be provided with adequate lateral support. Adequate lateral support is provided to a stiff silty clay or compact glacial till bearing medium when a plane extending down and out from the bottom edge of the footing, at a minimum of 1.5H:1V.

patersongroup Consulting Engineers

154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
927 March Road at Old Carp Rd.
Ottawa (Kanata), Ontario

DATUM Ground surface elevations provided by Novatech Engineering Consultants Ltd.

REMARKS

BORINGS BY Hydraulic Shovel

DATE Feb 25, 08

FILE NO. PG1626

HOLE NO. TP 1

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	81.47		
TOPSOIL 0.30									
Very stiff, brown **SILTY CLAY** 2.15		G	1			1	80.47	▲ 128	
								▲ 128	▽
								▲ 128	
						2	79.47		
End of Test Pit TP terminated on bedrock surface @ 2.15m depth (Groundwater infiltration @ 1.6m depth)									

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
927 March Road at Old Carp Rd.
Ottawa (Kanata), Ontario

DATUM Ground surface elevations provided by Novatech Engineering Consultants Ltd.

FILE NO. PG1626

REMARKS

HOLE NO. TP 2

BORINGS BY Hydraulic Shovel **DATE** Feb 25, 08

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	83.13		
TOPSOIL 0.25									
Very stiff, brown **SILTY CLAY** 1.80		G	1			1	82.13	128, 128	∇
GLACIAL TILL: Brown silty sand with gravel, cobbles, boulders, trace clay 2.30		G	2			2	81.13		
End of Test Pit TP terminated on bedrock surface @ 2.30m depth (Groundwater infiltration @ 0.70m depth)									

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
927 March Road at Old Carp Rd.
Ottawa (Kanata), Ontario

DATUM Ground surface elevations provided by Novatech Engineering Consultants Ltd.

FILE NO. **PG1626**

REMARKS

HOLE NO. **TP 3**

BORINGS BY Hydraulic Shovel **DATE** Feb 25, 08

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	83.59		
TOPSOIL 0.30									
Very stiff, brown **SILTY CLAY** 0.70									
BEDROCK 1.20						1	82.59		
End of Test Pit (TP dry upon completion)									

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
927 March Road at Old Carp Rd.
Ottawa (Kanata), Ontario

DATUM Ground surface elevations provided by Novatech Engineering Consultants Ltd.

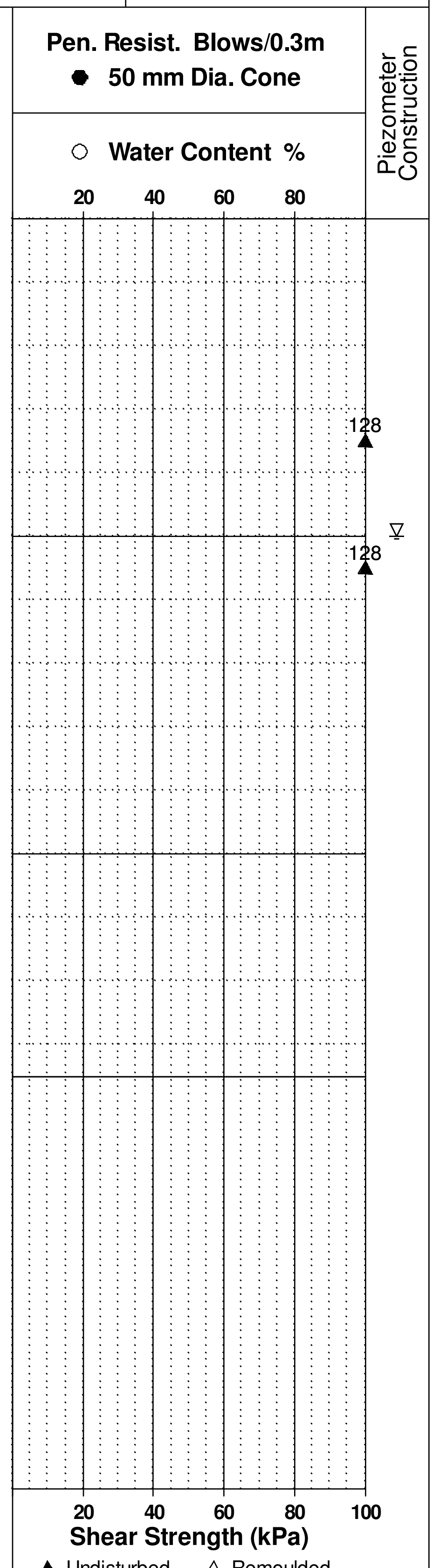
REMARKS

BORINGS BY Hydraulic Shovel **DATE** Feb 25, 08

FILE NO. PG1626

HOLE NO. TP 4

SOIL DESCRIPTION	STRATA PLOT (bottom depth, m)	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	83.80
TOPSOIL	0.30						
Very stiff, brown **SILTY CLAY**	1.65	G	1			1	82.80
GLACIAL TILL: Brown silty sand with gravel, cobbles and boulders	2.70	G	2			2	81.80
		G	3				
End of Test Pit TP terminated on bedrock surface @ 2.70m depth (Groundwater infiltration @ 1.0m depth)							



NO.	REVISIONS	DATE	INITIAL

patersongroup
consulting engineers
154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SCALE: 1:3000
DESIGN: SB
DRAWN: MPG
CHECKED: DG
DATE: 04/2013

CONSOLIDATED PRELIMINARY GEOTECHNICAL INVESTIGATION
KANATA NORTH URBAN EXPANSION AREA
COMMUNITY DEVELOPMENT PLAN - MARCH ROAD
OTTAWA, ONTARIO

DWG. NO. PG2878-1

NOVATECH ENGINEERING CONSULTANTS LTD.

TEST HOLE LOCATION PLAN

NO.	REVISIONS	DATE	INITIAL

patersongroup
consulting engineers
154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SCALE: 1:3000
DESIGN: SB
DRAWN: MPG
CHECKED: DG
DATE: 04/2013

CONSOLIDATED PRELIMINARY GEOTECHNICAL INVESTIGATION
KANATA NORTH URBAN EXPANSION AREA
COMMUNITY DEVELOPMENT PLAN - MARCH ROAD
OTTAWA, ONTARIO

DWG. NO. PG2878-2

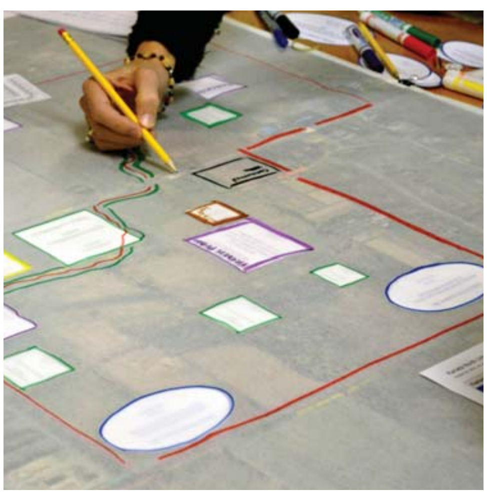
NOVATECH ENGINEERING CONSULTANTS LTD.

PERMISSIBLE GRADE RAISE PLAN - HOUSING

KANATA NORTH
COMMUNITY DESIGN PLAN

MASTER SERVICING STUDY **REPORT**






FINAL
JUNE 28, 2016

Ottawa

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3.0 EXISTING CONDITIONS

Existing conditions and existing infrastructure were reviewed in order to prepare and assess proposed servicing options for the Kanata North Urban Expansion Area. A summary of the existing conditions is as follows:

Ownership - Figure 3.1 shows the various land owners within KNUEA. The major land owners are outlined in red and the minor land owners are outlined in yellow. The major land owners formed the Kanata North Land Owners Group (KNLOG). This group is comprised of the following landowners: Metcalfe Realty Company Limited, J.G. Rivard Ltd. and 8409706 Canada Inc. (Valecraft Homes), 3223701 Canada Inc. (Brigil) and 7089121 Canada Inc. (Junic/Multivesco).

Topography - Figure 3.2 is a colour coded contour map of the study area. Lower elevations to the east are shown in light brown (70m) and higher ground to the west is shown in purple and red (90+m). There is a 24m grade elevation change from the northwest to southeast corner of the property. There is also a ridge (approx. 9m in height) located on the east side of the property that runs in a north south direction.

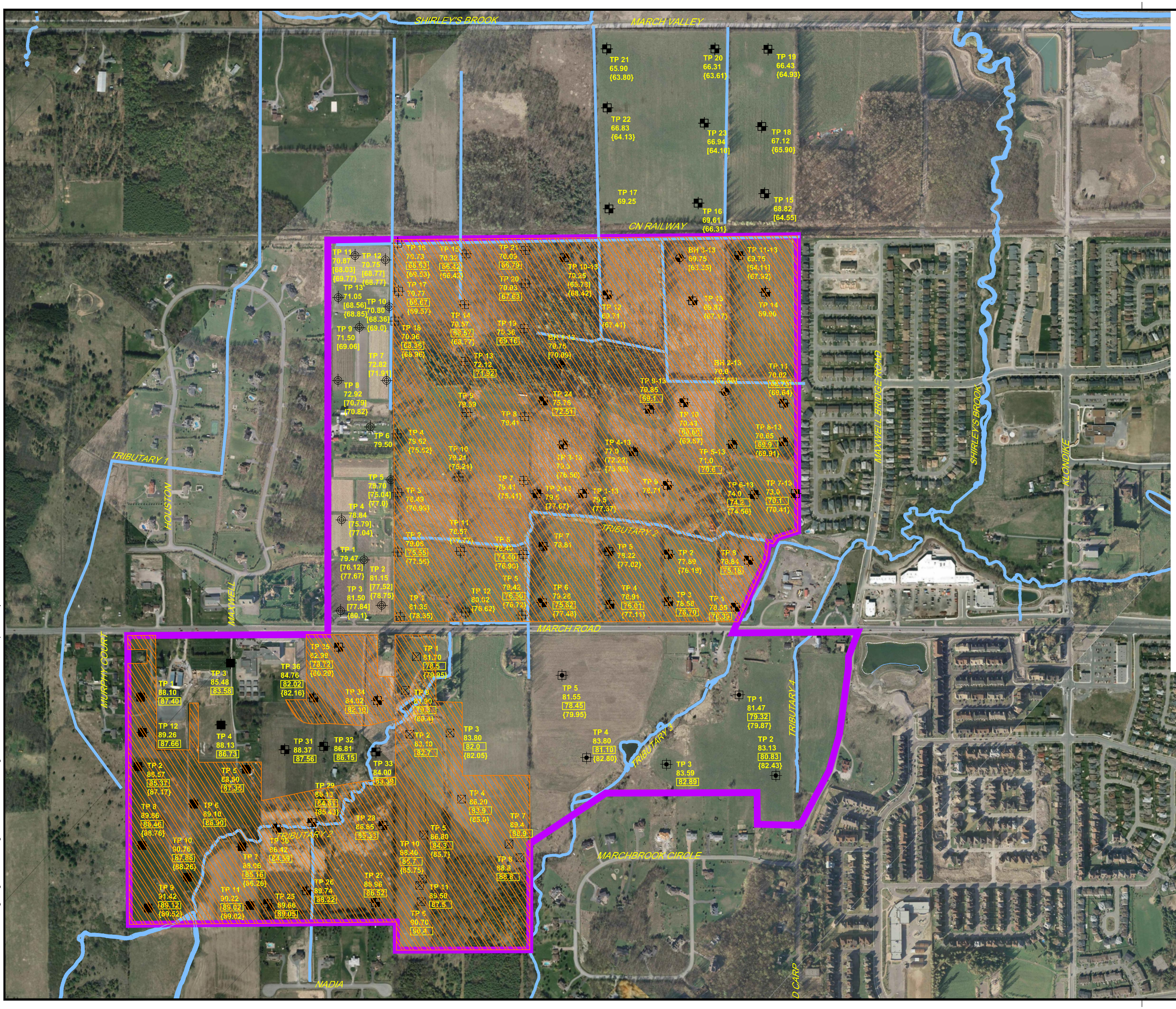
Geotechnical - Figure 3.3 shows test pits locations from the various geotechnical investigations completed to date. Ground elevations and rock elevations are also noted where possible. The majority of the property has soils profile of topsoil, stiff silty clay underlain by glacial till and/or bedrock. The depth to bedrock ranges from 0 to 10m over the site with the shallowest bedrock located in the western portion of the site. The depth to groundwater also ranges over the site from 0.7m to 3.9m below surface. Numerous test pits were dry upon excavation. There is also a maximum permissible grade raise over most of the site that ranges from 1.5 to 3.0m as shown on Figure 3.3.

Existing Surface Drainage - Figure 3.4 shows existing drainage channels within the KNUEA and surrounding area and their drainage boundaries. The property is within the Shirley's Brook subwatershed and there are three tributaries to Shirley's Brook that run through the property.

Existing Environmental Inventory – Figure 3.5 shows the environmental features within the KNUEA. These include existing drainage channels and creek corridors/setbacks, existing rail corridor, existing floodplain limits, and existing natural areas to be retained.

Stormwater Infrastructure – Figure 3.6 shows existing storm infrastructure. There are no existing storm sewer systems within the KNUEA. Storm drainage consists of surface drainage through existing ditches with culverts for March Road crossings. Refer to the Environmental Master Plan for additional information on existing storm drainage and infrastructure.

Wastewater Infrastructure – Figure 3.7 shows the wastewater infrastructure in the surrounding area. The City of Ottawa West Urban Community (former City of Kanata) sanitary collection network consists of separated gravity sewers and local pumping stations. These facilities discharge into a regional trunk system that carries sewage flow to the Robert O. Pickard Environmental Centre in eastern Ottawa for treatment of wastewater.



LEGEND

- KANATA NORTH URBAN EXPANSION AREA (KNUEA)
- EXISTING DRAINAGE CHANNEL
- IDENTIFIED MAXIMUM PERMISSIBLE GRADE RAISE LESS THAN 1.5m TO 3.0m
- TEST PIT LOCATION, CURRENT INVESTIGATION PATTERSON GROUP REPORT PG2878
- TEST PIT LOCATION, PREVIOUS INVESTIGATION PATERSON GROUP REPORT PG2256, 2011
- TEST PIT LOCATION, PREVIOUS INVESTIGATION PATERSON GROUP REPORT PG1823, 2009
- TEST PIT LOCATION, PREVIOUS INVESTIGATION PATERSON GROUP REPORT PG1716, 2008
- TEST PIT LOCATION, PREVIOUS INVESTIGATION PATERSON GROUP REPORT PG1626, 2008
- TEST PIT LOCATION BY OTHERS

78.55 GROUND ELEVATION (m)

[76.39] BEDROCK ELEVATION (m)

[64.10] PRACTICAL REFUSAL TO EXCAVATION ELEV. (m)

{76.19} GROUNDWATER ELEVATION (m)

KANATA NORTH

COMMUNITY DESIGN PLAN

FIGURE NO. 3.3

GEOTECHNICAL INFORMATION

DATE FEB 2016

JOB 112117

SCALE N.T.S.

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M:\2012\112117\CAD\Design\Figures\MSS\Fig 3.3-Geotechnical.dwg, FIGURE 3.3, Mar 30, 2016 - 2:29pm, lseely

SHT11x17.DWG - 279mmx432mm

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

No.	REVISION	DATE	BY
3.	ISSUED WITH DRAFT MASTER SERVICING STUDY	MAY 20/16	JLS
2.	ISSUED WITH DRAFT MASTER SERVICING STUDY	APR 4/16	JLS
1.	ISSUED WITH DRAFT MASTER SERVICING STUDY	FEB 26/16	JLS

SCALE 1:3000

DESIGN ARM / TB
CHECKED ARM
DRAWN TB
CHECKED CJR
APPROVED JLS

FOR REVIEW ONLY

NOVATECH
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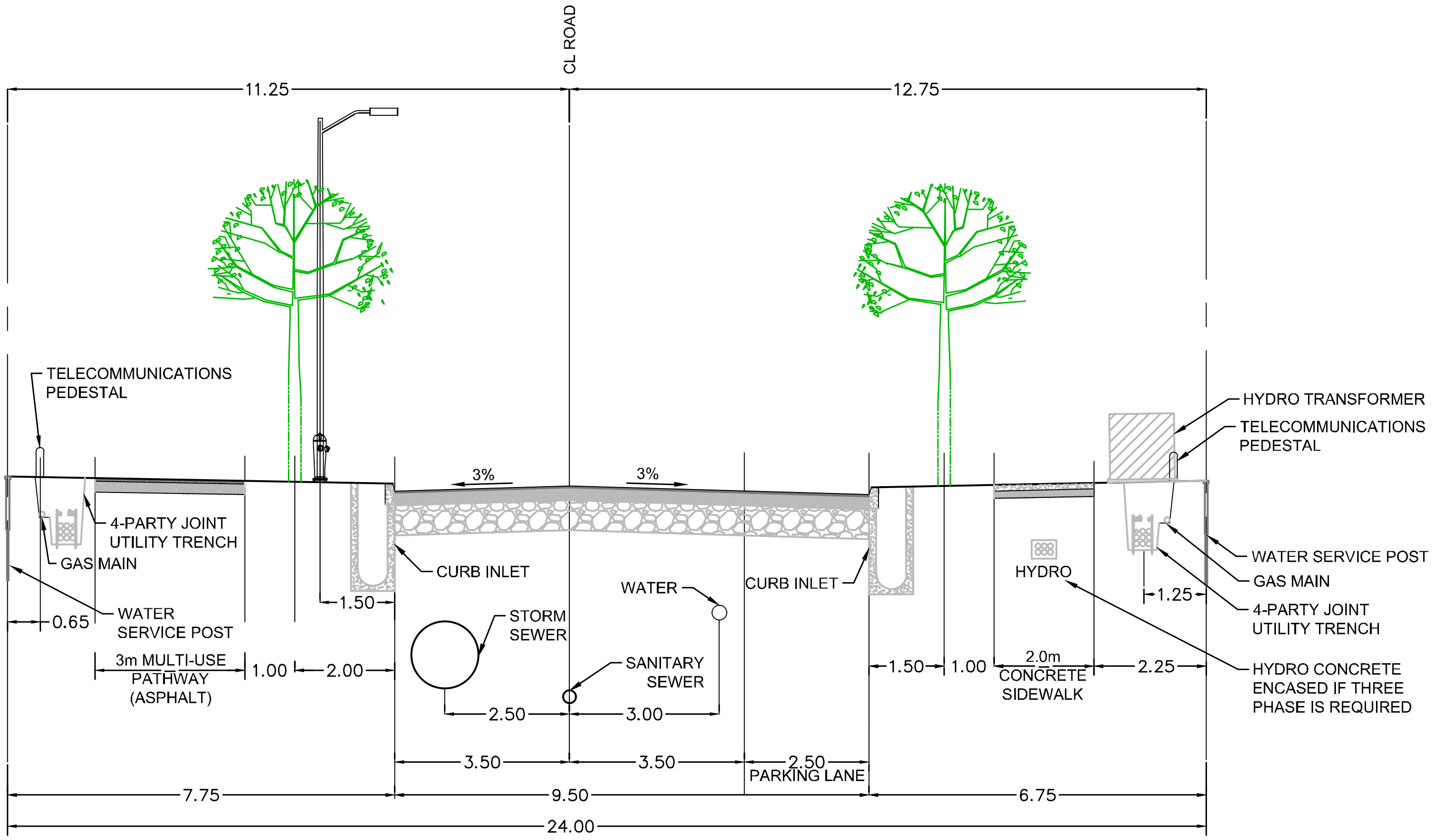
Facsimile (613) 254-5867
Website www.novatech-eng.com

LOCATION
KANATA NORTH URBAN EXPANSION AREA
COMMUNITY DESIGN PLAN

DRAWING NAME
PRELIMINARY GRADING PLAN

PROJECT No. 112117-00
REV REV # 3
DRAWING No. 112117-PGR

PLANB1.DWG - 1000mmx707mm



M:\2012\112117\CAD\Design\Figures\Traffic\TMP\FINAL\112117 - FIG-24mROW-MUP (1-150).dwg, TYPICAL 1 (TMP), Feb 23, 2016 - 1:14pm, tbrooks

KN

KANATA NORTH
COMMUNITY DESIGN PLAN

DATE
FEB 2016

JOB
112117

SCALE
1:150

0 1m 2m 4m

FIGURE NO. 25

COLLECTOR ROAD -
TYPICAL CROSS SECTION 1

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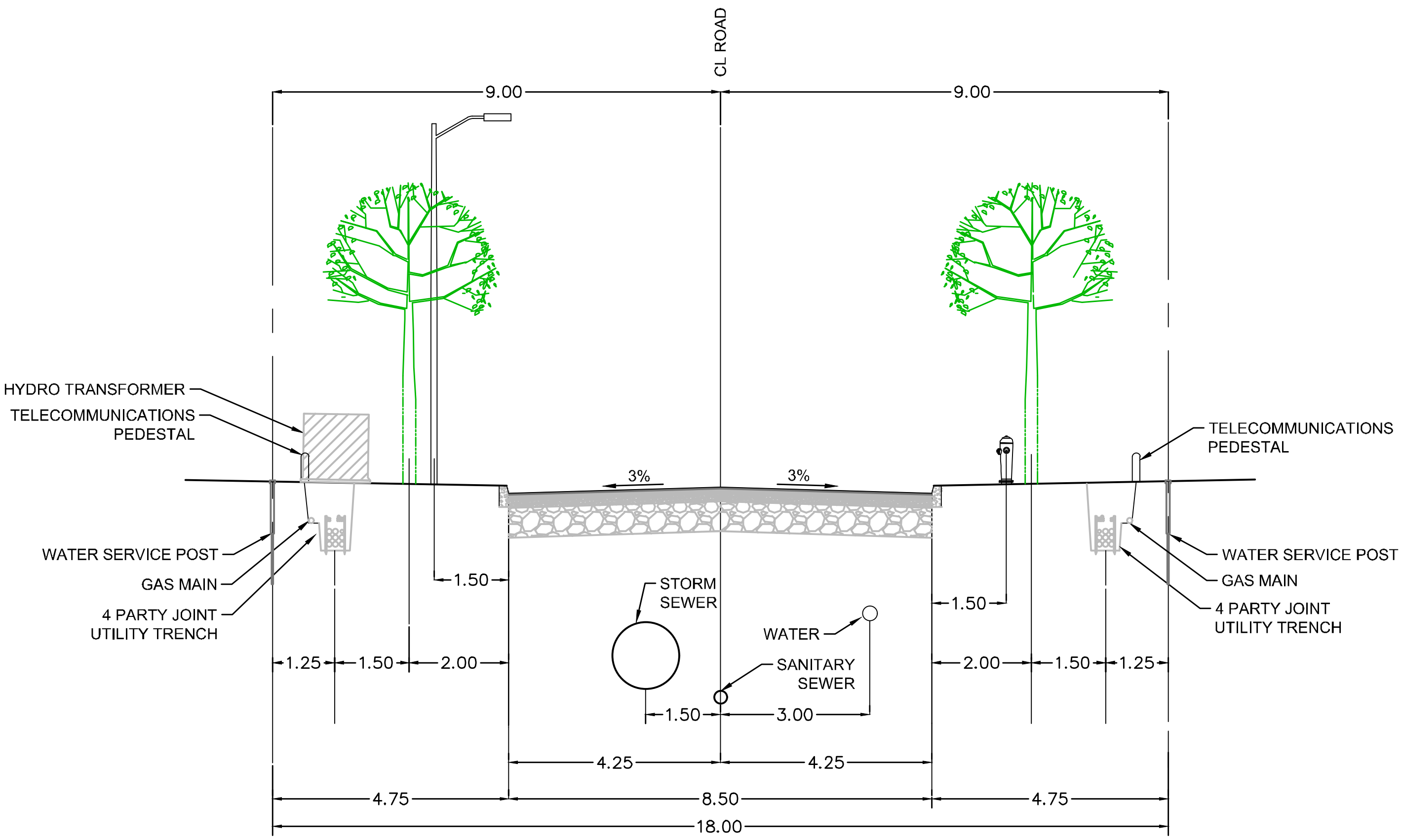
SHT8x11.DWG - 216mmx279mm



KANATA NORTH

COMMUNITY DESIGN PLAN

FIGURE NO. 30

LOCAL ROAD
- TYPICAL 18m ROW
CROSS SECTION

DATE
FEB 2016

JOB
112117

SCALE
1:150

0 1m 2m 4m

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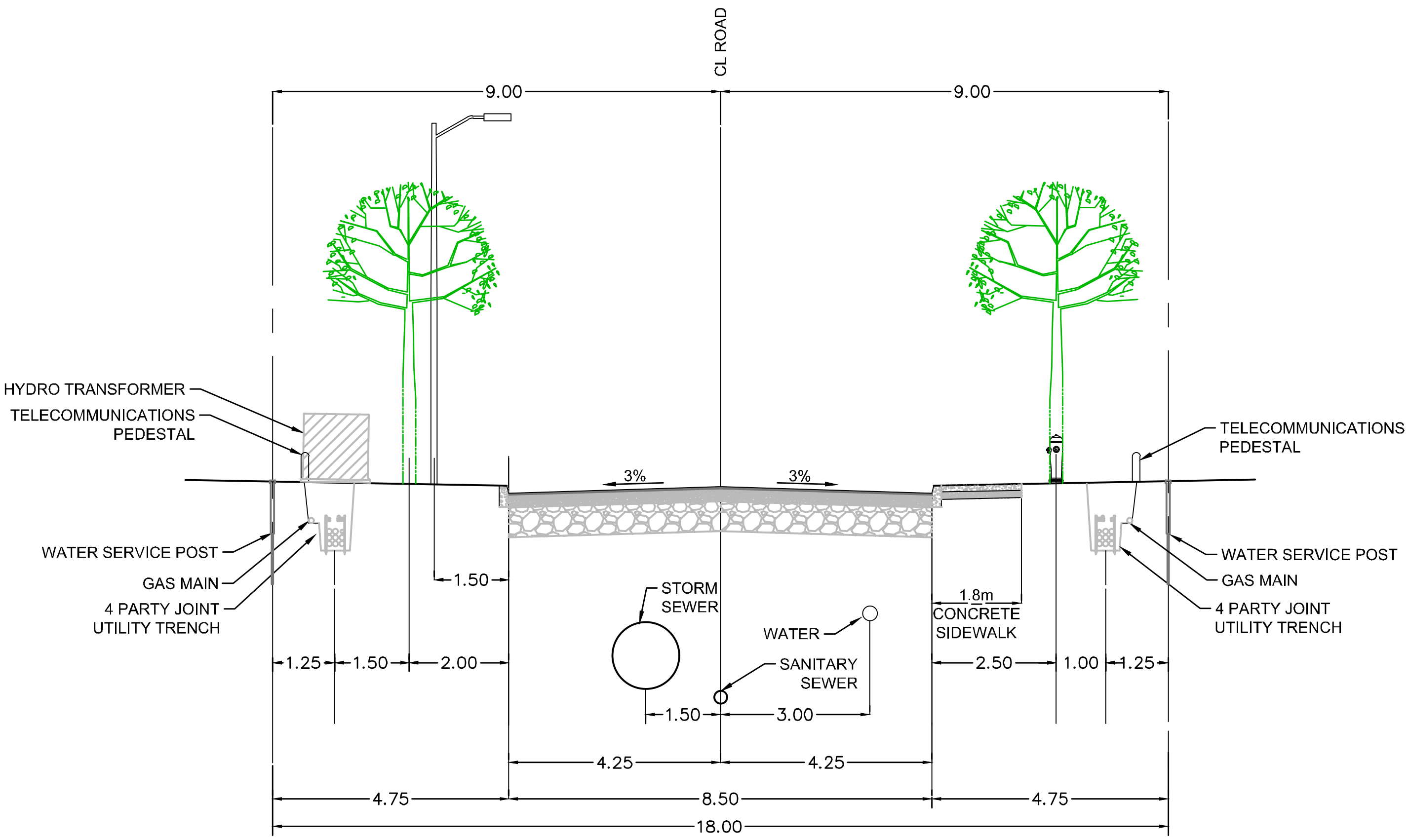
M:\2012\112117\CAD\Design\Figures\Traffic\TMP\FINAL\112117 - FIG-18m-LOCAL (1-150).dwg, LOCAL (TMP), Mar 02, 2016 - 10:45am, tbrooks

SHT8x11.DWG - 216mmx279mm



M:\2012\112117\CAD\Design\Figures\Traffic\TMP\FINAL\112117 - FIG-18m-LOCAL (1-150).dwg, LOCAL SW (TMP), Mar 02, 2016 - 10:45am, tbrooks

KANATA NORTH
COMMUNITY DESIGN PLAN

DATE
FEB 2016

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112117

SCALE
1:150

0 1m 2m 4m

FIGURE NO. 31

LOCAL ROAD
- TYPICAL 18m ROW CROSS SECTION WITH SIDEWALK

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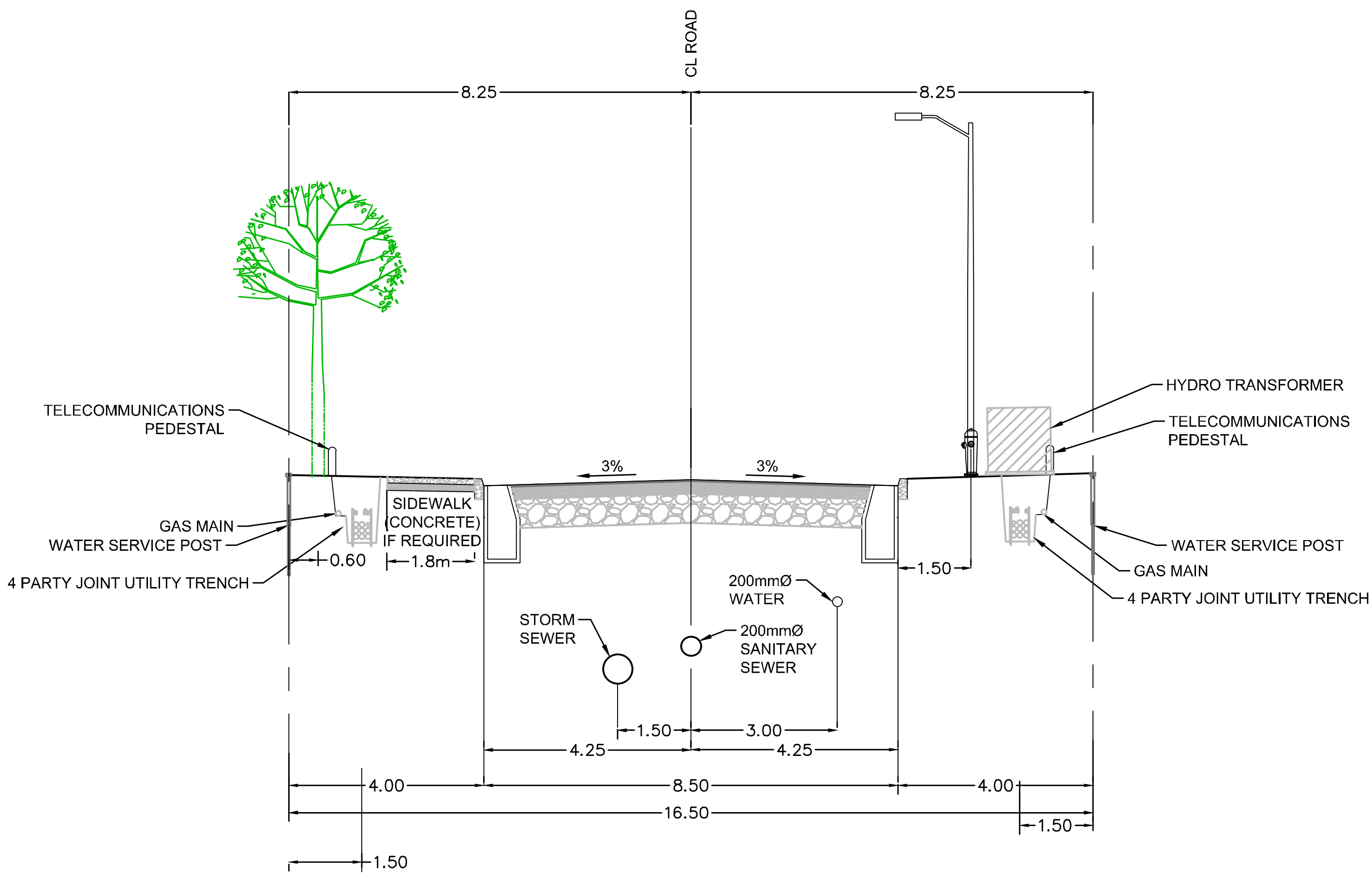
SHT8x11.DWG - 216mmx279mm



NOTES:

FOR SINGLE LOADED ROAD, BOULEVARD WITH NO HOUSING MAY BE REDUCED TO A MINIMUM OF 1.5m. HOUSING AND TREES TO BE LOCATED ON OPPOSITE SIDES OF THE STREET.

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KANATA NORTH

COMMUNITY DESIGN PLAN

DATE
FEB 2016

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SCALE
1:150

0 1m 2m 4m

FIGURE NO. 32

LOCAL ROAD
- TYPICAL 16.5m ROW
CROSS SECTION

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Appendix E DRAWINGS