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1055 Klondike – Maple Leaf Homes

Site Serviceability and Stormwater Management Report

MAPLE LEAF HOMES

1055 KLONDIKE ROAD

SITE SERVICEABILITY AND STORMWATER MANAGEMENT REPORT

Prepared for:

Maple Leaf Homes

Prepared By:

NOVATECH
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario
K2M 1P6

Issued: July 26, 2019

Novatech File: 117034
Report Ref: R-2019-142

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Engineers, Planners & Landscape Architects

July 26, 2019

City of Ottawa
Planning, Infrastructure and Economic Development Department
Planning Services Branch
110 Laurier Ave. West, 4th Floor
Ottawa, Ontario
K1P 1J1

Attention: **Gabrielle Schaeffer**

Reference: **1055 Klondike Road**
Site Serviceability and Stormwater Management Report
Novatech File No.: 117034

Novatech has prepared this Site Serviceability and Stormwater Management Report on behalf of Maple Leaf Homes to support a Draft Plan of Subdivision application for 1055 Klondike Road.

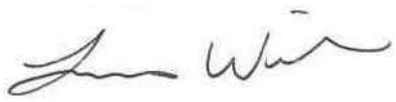
Maple Leaf Homes intends to develop a residential subdivision consisting of semi-detached, townhouses and a medium density block.

The report addresses how the subject development will be serviced by sanitary sewer, watermain, storm sewers, and stormwater management.

Should you have any questions or comments, please do not hesitate to contact us.

Sincerely,

NOVATECH



Lucas Wilson, P.Eng.
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117034-GR Grading Plan

ENCLOSED CD

- Report (pdf)
- Drawings (pdf)
- PCSWMM Packaged Model Files
    - 100-year 3-hour Chicago Storm
    - 100-year 24-hour SCS Storm (JFSA)

1.0 INTRODUCTION

Novatech has been retained by Maple Leaf Homes to prepare a Site Serviceability and Stormwater Management Report for 1055 Klondike Road in North Kanata, Ottawa.

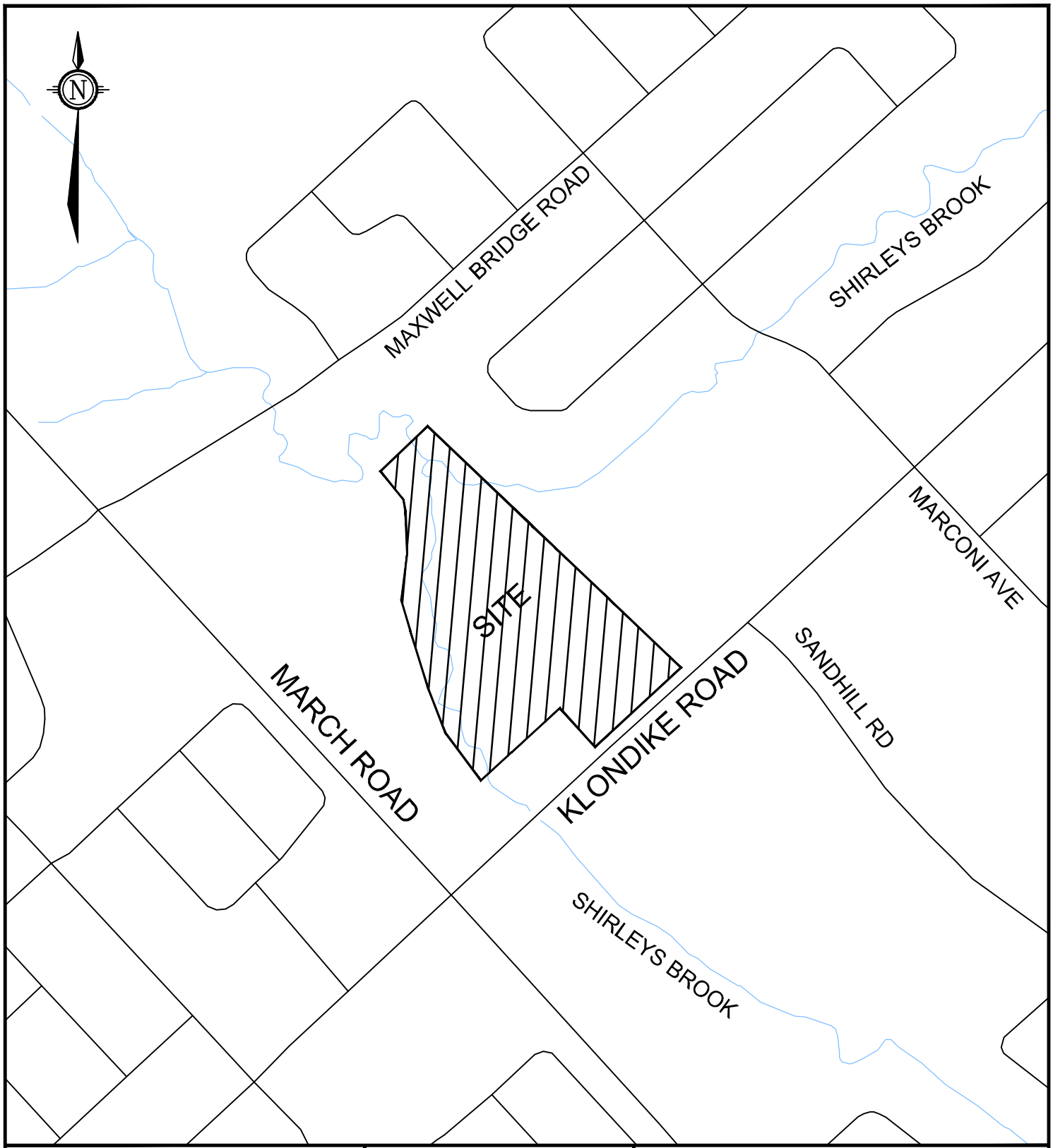
This report outlines the servicing and proposed storm drainage and stormwater management strategy for the site.

1.1 Background

The proposed development is located within the Kanata North Community west of the intersection of Klondike Road and Sandhill Road. The development is approximately 2.43ha and is bounded by Klondike Road to the south, Shirley's Brook to the west and north, and park lands to the east. Refer to **Figure 1** – Site Location and **Figure 2** – Key Plan.

Figure 1 – Site Location: 1055 Klondike Rd

The proposed development will consist of 46 townhome units, 12 semi-detached units and a Medium Density Block (56 units). The proposed development is shown in **Figure 3** – Concept Plan.



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CITY OF OTTAWA
1055 KLONDIKE ROAD

KEY PLAN

SCALE 1 : 5000 (0, 50, 100, 150, 200)

DATE	JOB	FIGURE
JULY 2019	117034	FIG 2

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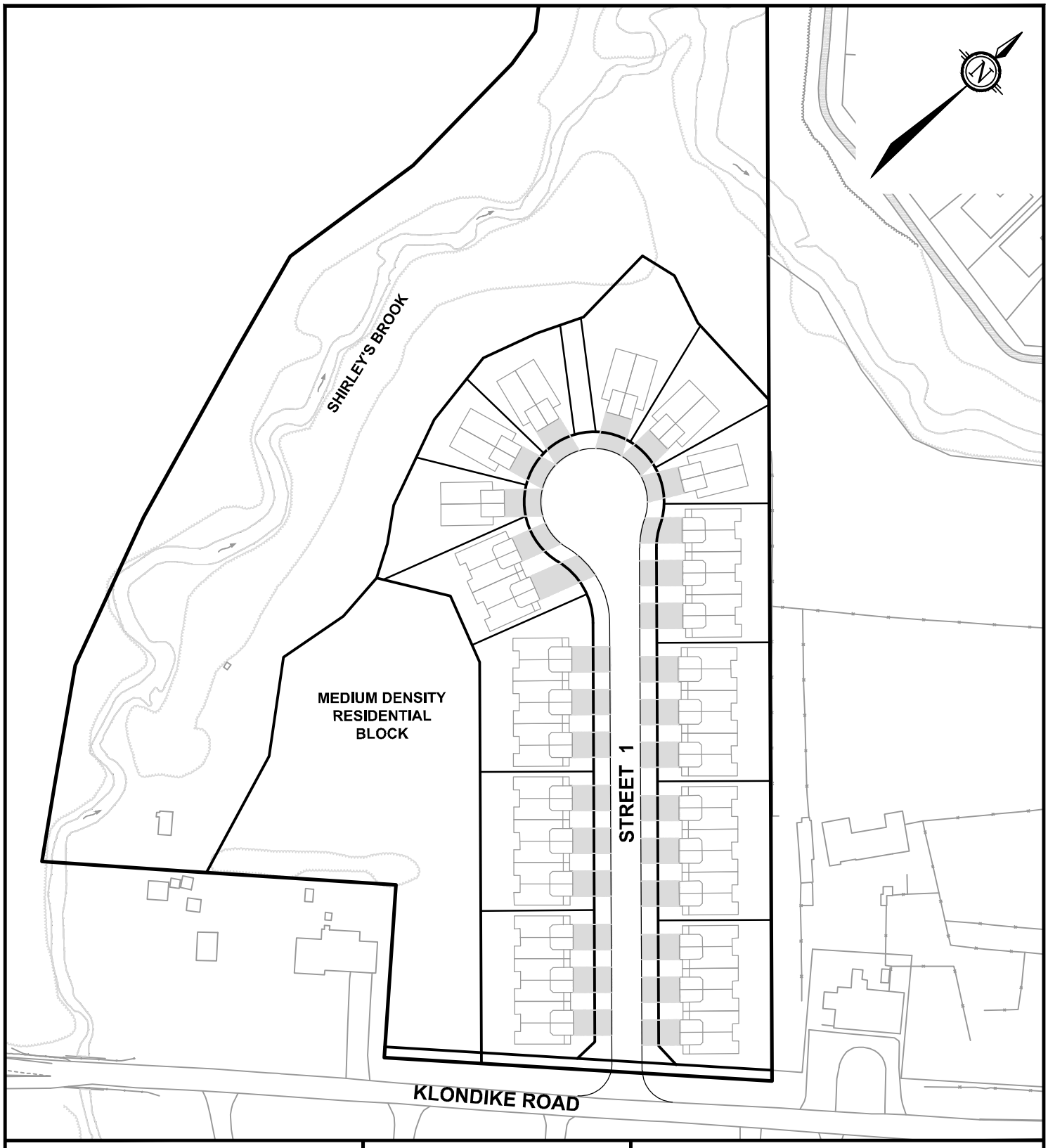

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LEGEND

SITE BOUNDARY

CITY OF OTTAWA
1055 KLONDIKE ROAD

CONCEPT PLAN

SCALE 1 : 1500 (0, 15, 30, 45, 60)

DATE JULY 2019 | JOB 117034 | FIGURE FIG 3

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1.2 Existing / Planned Adjacent Land Uses

The following describes the existing and planned land uses adjacent to the subject site:

North: To the North of 1055 Klondike, Shirley's Brook Separates the Subject Site from Brookside subdivision. The existing Brookside Subdivision consists of Single-Family Homes and Town House units.

East: The lands east of the proposed subdivision are currently vacant with plans for further residential development.

South: Klondike Road, a two-lane urban collector road, bounds the Subject Site to the south. The Subject Site is located between March Road and Sandhill Road on the North Side of Klondike Road.

Southeast: To the Southeast of the Subject Site, across Klondike Road, are Brookside Baptist Church and The Greenwoods Academy.

West: The RioCentre Kanata (832-858 March Road) is located to the west of the Subject Site, separated by Shirly's Brook.

The proposed development is shown on **Figure 3** – Concept Plan. The proposed site will consist of 46 townhouse units, 12 semi-detached units and 56 apartment units within a medium density block.

1.3 Additional Reports

This report provides information on the considerations and approach by which Novatech has designed and evaluated the proposed servicing for the Maple Leaf Homes Lands. This report should be read in conjunction with the following:

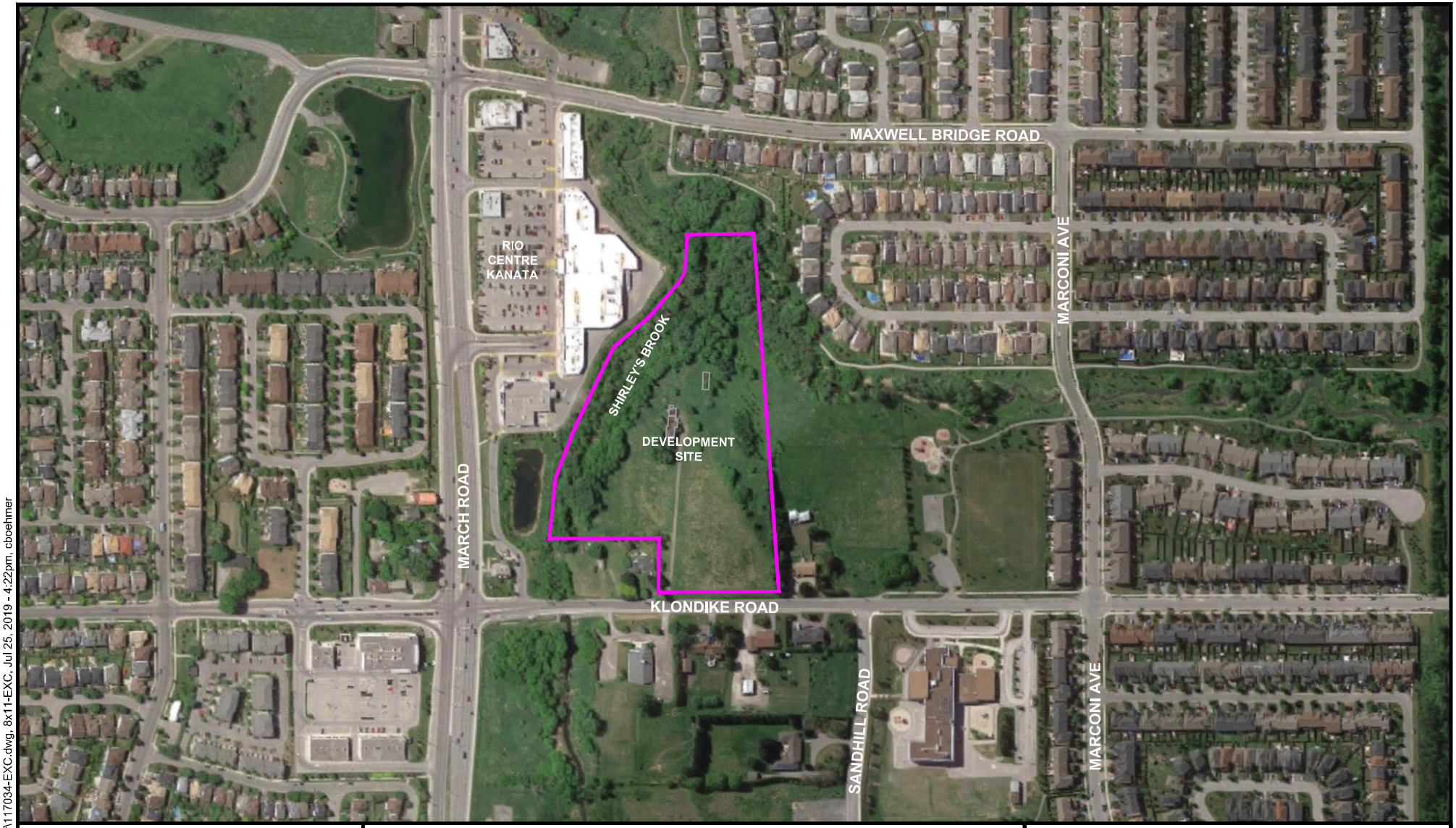
- *Maple Leaf Homes Development, 1055 Klondike Road, Noise Impact Feasibility Report, completed by Novatech, Ref. No.: R-2019-139, dated July 26, 2019;*
- *Brookside Subdivision Infrastructure Servicing Study, completed by Novatech, Ref. No.: R-2006-071 dated November 2006;*
- *Shirley's Brook SWM Facility 'C', Detailed Design Report, completed by Novatech, Ref. No.: R-2006-105 dated November 2006;*

2.0 EXISTING CONDITIONS

2.1 Topography & Drainage

The proposed site is currently undeveloped and consists of grassed table land and a tree-lined municipal watercourse. Access to the site is currently provided off Klondike Road via a private gravel entrance. Refer to **Figure 4** – Existing Conditions Plan.

The site gently slopes from the east, westerly towards a ridge running north south down the centre of the site. The ridge drops 4.0m at approximately 17% and then slopes gently towards Shirley's Brook.



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LEGEND

EXISTING PROPERTY BOUNDARY

CITY OF OTTAWA
1055 KLONDIKE ROAD

EXISTING CONDITIONS PLAN

SCALE 1 : 5000 (0, 50, 100, 150, 200)

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2.2 Subsurface Conditions

Gemtec completed three (3) geotechnical investigations in support of the proposed development. The first geotechnical investigation was conducted to provide a preliminary geotechnical investigation and slope stability assessment of the site:

- *Preliminary Geotechnical Investigation, Proposed Residential Subdivision, 1055 Klondike Road, Ottawa, Ontario, dated April 13, 2017 (Project: 60616.46).*

A second geotechnical investigation was conducted to obtain additional borehole information to provide engineering guidelines and recommendations on the geotechnical design aspects of this project and should be read in conjunction with the preliminary report:

- *Geotechnical Investigation, Proposed Residential Subdivision, 1055 Klondike Road, Ottawa Ontario, dated April 4, 2018 (Project: 64153.85).*

A third geotechnical investigation was conducted to supplement the existing subsurface information providing additional boreholes to obtain more precise grade raise restrictions within the site:

- *Supplemental Geotechnical Investigation, Proposed Residential Development, 1055 Klondike – Ottawa, dated April 10, 2019 (File: 64153.85).*

The principal findings of the geotechnical investigations are as follows:

- The work consisted of advancing eleven (11) boreholes to depths ranging from 4.0m to 10.2 m below ground surface.
- The existing soil profile consists of having a layer of topsoil ranging from 0.10m to 0.31m thick. Deposits of grey brown silty sand were encountered at all boreholes ranging from 0.8 to 2.0m thick. Native deposits of weathered, grey brown silt and clay with trace amounts of sand were encountered underlying the sand and silty sand at all locations ranging from 3.0m to 4.6m thick.
- Bedrock is expected to range from 4m-10m below grade.
- Groundwater is expected to range from 2.2m to 6.7m based on observations.
- Within the low-lying area at the bottom of the ridge (existing surface elevation less than 72.0m) there is an estimated grade raise fill restriction of 6.0m. In areas along the midsection of the ridge (existing surface elevation between 72m and 75m) there is an estimated grade raise fill restriction of 4.0m. In areas near the top of the ridge (existing ground elevation between 75m and 78m) a grade fill restriction of 2.0m would apply.

The report provides engineering guidelines based on Gemtec's interpretation of the borehole information and project requirements. Refer to the above-noted report for complete details.

3.0 SANITARY SERVICING

3.1 Previous Studies

The Subject Site is located within the Briar Ridge Pump Station catchment area. The Brookside Subdivision Infrastructure Servicing Study, prepared by Novatech, dated November 2006, accounted for sanitary flows from the subject site to outlet to the Klondike Road sanitary sewer and ultimately outletting to the Briar Ridge Pump Station. A sanitary flow of 4.1 L/s was calculated for the area comprising the subject site.

3.2 Existing Sanitary Sewer System for the Subject Lands

Currently, there is an existing 200mm sanitary sewer along Klondike Road with an existing manhole at Sandhill Road located approximately 117m from the site entrance. Flows from the site will be routed through the Klondike Road sewers to the 450mm trunk sanitary sewer within the pump station access road outletting to the Briar Ridge Pump Station.

3.3 Proposed Sanitary Sewer Outlet

It is proposed that a 200mm sanitary sewer will be installed along Klondike Road connecting the subject site to the existing manhole located at Klondike Road and Sandhill Road. The proposed outlet is consistent with the approved Brookside Infrastructure Servicing Study (Novatech).

The proposed development can be serviced with a 200mm sanitary sewer system. The proposed sanitary layout can be seen on **Figure 5** – Sanitary Sewer Layout.

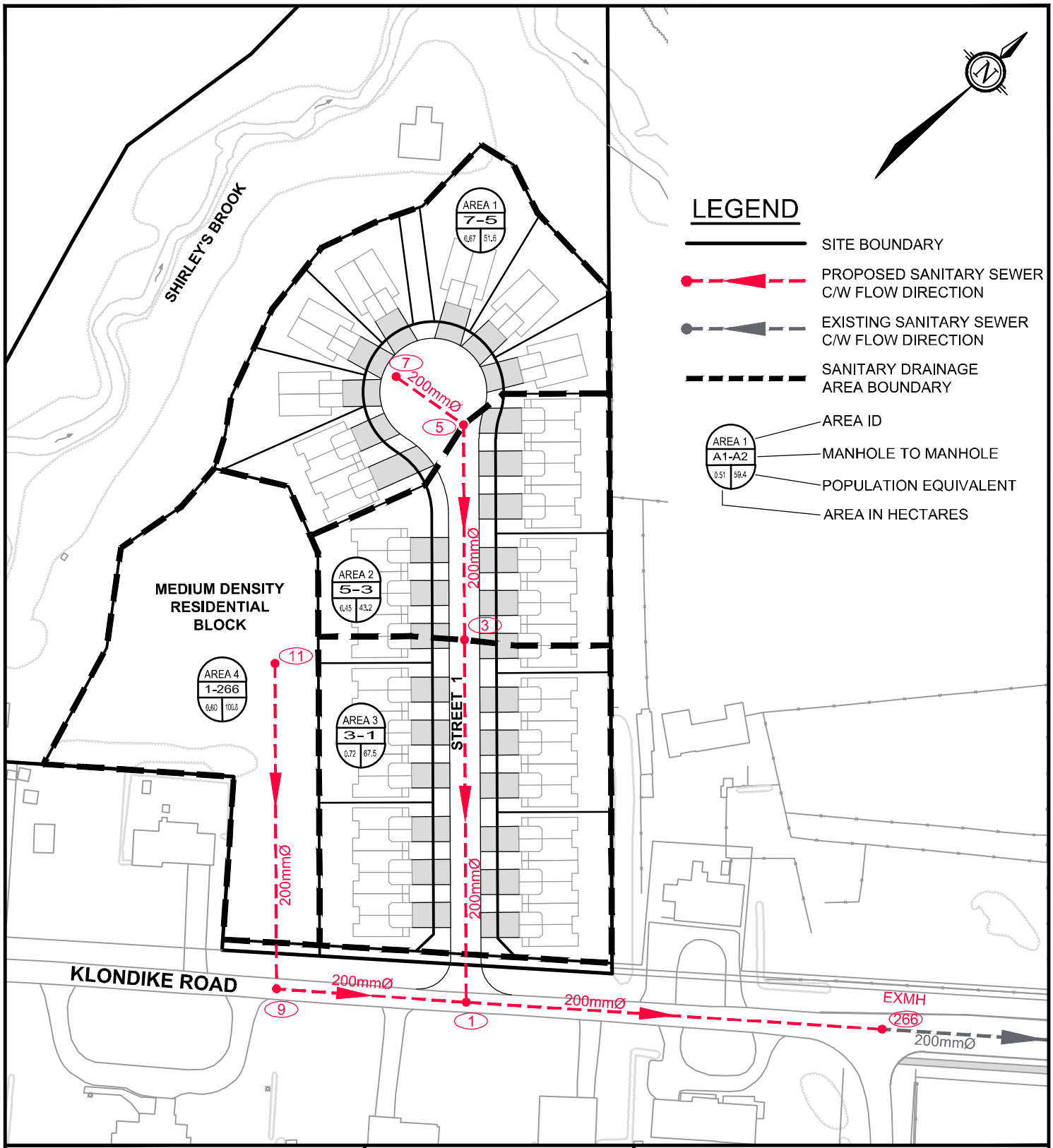
3.4 Design Criteria

Sanitary sewers, for the proposed development, are designed based on criteria established by the City of Ottawa in the following documents:

- Section 4.0 of the City of Ottawa Sewer Design Guidelines (October 2012).
- Technical Bulletin ISTB-2018-01 from the City of Ottawa regarding new sanitary design parameters. Design parameters from this technical bulletin will supersede values within the Sewer Design Guidelines (2012).

The resulting design parameters are summarized as follows:

Population Flow = 280 L/capita/day
Infiltration = 0.33 L/s/ha
Semi-Detached Home = 3.4 persons per unit
Townhouse = 2.7 persons per unit
Apartment = 1.8 persons per unit
Maximum Residential Peak Factor = 4.0
Harmon Correction Factor = 0.8
Minimum velocity = 0.6m/s
Manning's n = 0.013



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CITY OF OTTAWA
1055 KLONDIKE ROAD

SANITARY LAYOUT

SCALE 1 : 1500 (0, 15, 30, 45, 60)

DATE JULY 2019 | JOB 117034 | FIGURE FIG 5

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3.5 Proposed Sanitary Sewer System

The calculated peak sanitary design flow for the development is 3.8 L/s. For detailed calculations refer to the Sanitary Sewer Design Sheet located in **Appendix B** and **Figure 5** – Sanitary Sewer Layout for sanitary drainage areas.

As previously noted, sanitary flows from the site will be directed to an existing 200mm diameter sanitary sewer on Klondike Road at Sandhill Road.

As shown above, the calculated peak design flow of 3.8 L/s from the site is less than Novatech's Brookside Subdivision Infrastructure Servicing Study value of 4.1 L/s. This indicates there will be adequate capacity in the Klondike Road sewers to accommodate the proposed development.

For design sheet, drainage plans and design parameters from the Brookside Infrastructure Servicing Study, refer to excerpts in **Appendix B**.

An HGL analysis of the sanitary system is required to confirm that the underside of footing elevations are acceptable as per the Ottawa Sewer Design Guidelines. An analysis of the sanitary HGL will be completed at the detailed design stage.

4.0 WATERMAIN

4.1 Proposed Watermain System

A preliminary hydraulic analysis was performed for the Subject Lands. It is proposed to service the site with a combination of 50mm, 200mm and 400mm pipe with a connection to the existing 400mm diameter watermain at Klondike Road and Sandhill Road. **Figure 6** – Watermain Layout highlights the proposed works and connection point. All existing watermain boundary conditions were provided by the City of Ottawa and are included in **Appendix C**.

4.2 Design Criteria

Fire flow demands have been calculated as per the Fire Underwriter's Survey (FUS) and are included in **Appendix C**. However as per the City of Ottawa's technical bulletin ISTB-2014-02 (Revisions to Ottawa Design Guidelines – Water), the semi-detached and townhouse fireflows have been capped at 10,000 L/min (167 L/s). Watermain analysis was completed based on the following criteria:

Demands:

- Semi-Detached Unit Density 3.4 persons/unit
- Townhouse Density 2.7 persons/unit
- Condo/Apartment Density 1.8 persons/unit
- Average Daily Demand 280 L/capita/day
- Max. Daily Demand 2.5 x Average Daily Demand
- Peak Hour Demand 2.2 x Maximum Daily Demand
- Fire Flow Demand Fire Underwriters Survey

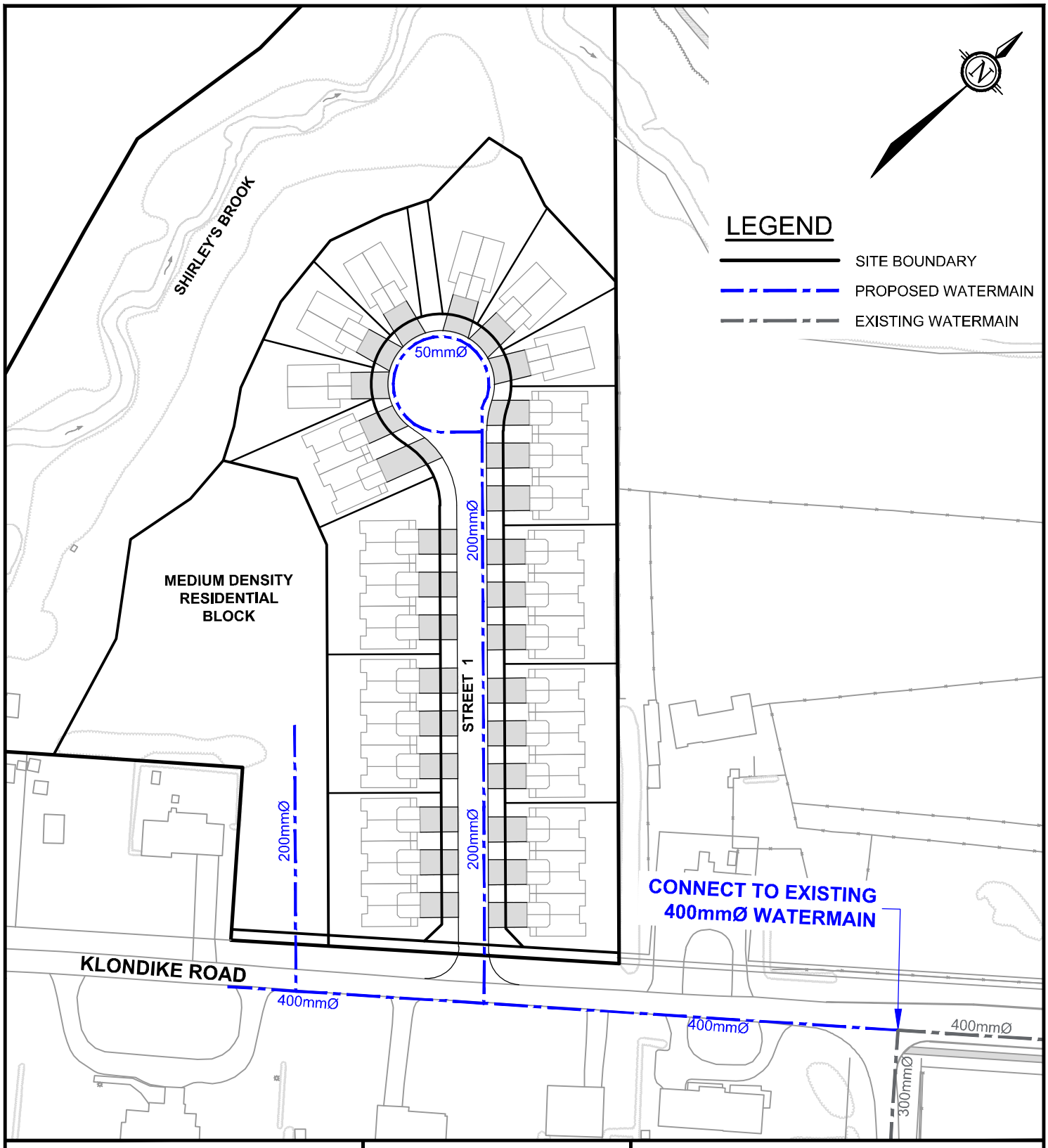
System Requirements:

- Max. Pressure (Unoccupied Areas) 690 kPa (100 psi)
- Max. Pressure (Occupied Areas) 552 kPa (80 psi)
- Min. Pressure 276 kPa (40 psi) excluding fire flows
- Min. Pressure (Fire) 138 kPa (20 psi) including fire flows
- Max. Age (Quality) 192 hours (onsite)

Friction Factors:

- Watermain Size C-Factor
- 50mm 100
- 200 110

Hydraulic modeling of the Subject Site was completed using EPANET 2.0. EPANET is public domain software capable of modeling municipal water distribution systems by performing simulations of the water movement within a pressurized system. EPANET uses the Hazen-Williams equation to analyze the performance of the proposed watermain and considered the following input parameters: water demand, pipe length, pipe diameter, pipe roughness, and pipe elevation.



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CITY OF OTTAWA
1055 KLONDIKE ROAD

WATERMAIN LAYOUT

SCALE 1 : 1500 (0, 15, 30, 45, 60)

DATE	JOB	FIGURE
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4.3 Hydraulic Analysis

Table 4.1 summarizes the watermain operating conditions during the high pressure, maximum daily demand and fire flow, and peak hour demands. Results of the hydraulic analysis are included in **Appendix C**. Refer to **Figure WM** – Proposed Watermain Node Network, provided in **Appendix C**, for details about the node and pipe network.

Table 4.1: Water Demand Summary

Condition	Demand (L/s)	Fire Flow (L/s)	Allowable Max/Min Pressure (kPa/psi)	Max/Min Pressure (kPa/psi)	Time (hours)
High Pressure	0.86	N/A	690/80 (Max)	524.8/76.1	13.09
Maximum Daily Demand + Fire Flow	2.15	167	138/20 (Min)	240.8/34.9	N/A
Maximum Daily Demand + Fire Flow	2.15	250	138/20 (Min)	142.9/20.7	N/A
Peak Hour	4.74	N/A	276/40 (Min)	450.0/65.3	N/A

The analysis of the maximum daily demand plus fire flow condition was completed in accordance with City of Ottawa's technical bulletin ISTB-2018-02 (Revisions to Ottawa Design Guidelines – Water).

The analysis confirms the proposed watermain can service the Subject Site under all operating conditions.

A copy of the boundary conditions provided by the City of Ottawa, fire flow calculations, detailed hydraulic analysis results, and watermain layout figure are included in **Appendix C**.

There are no deviations from the City of Ottawa Design Guidelines – Water Distribution (2010).

5.0 STORM SEWER SYSTEM AND STORMWATER MANAGEMENT

The proposed development will consist of townhouse blocks, semi-detached homes and a proposed medium density Site Plan Block. The townhouse blocks / semi-detached homes will front the proposed Street 1 with a connection to Klondike Road. The Site Plan Block will have a separate entrance to Klondike Road.

The storm drainage and stormwater management systems have been designed in accordance with the Ottawa Sewer Design Guidelines and will adhere to previously established release rates for this area.

The stormwater management strategy is based on the development of both the subdivision and the Site Plan Block, as they are part of the same property. Interim measures may be required to meet the SWM criteria should development of the subdivision proceed before the Site Plan Block. Interim measures will be explored during detailed design.

5.1 Previous Studies

The proposed development is tributary to the existing storm sewer on Klondike Road, which outlets to Shirley's Brook Stormwater Management (SWM) Facility 'C'. Both the storm sewer and SWM Facility were designed by Novatech (2006), as part of the Brookside Subdivision (formerly Klondike Road Lands). The outlet for SWM Facility 'C' is Shirley's Brook; refer to *Shirley's Brook SWM Facility 'C' Detailed Design Report, prepared by Novatech (November 2006)* provided in **Appendix F**.

The Subject Site (1055 Klondike Road) was included in the overall storm drainage design for SWM Facility 'C', and is part of subcatchments C-201 & C-202. Refer to *Drawing 103106-STM1 – SWM Facilities Storm Drainage Area Plan, Brookside Subdivision (Rev. 12), prepared by Novatech (*January 16, 2014), provided in **Appendix D**.

5.2 Allowable Release Rate

Storm runoff from the Subject Site was allocated to MH159 on Klondike Road based on the following parameters:

Storm Drainage Parameters: 1055 Klondike Road

- Area IDs = part of C-201 & C-202
- Drainage Area = 2.44 ha (Subject Site)
  = 5.09 ha (C-201 & C-202)
- Runoff Coefficient = 0.50

The stormwater management model for the Klondike Road Lands assigned the following stormwater management criteria to subcatchments C-201 & C-202:

- Minor system inlet rate = 85 L/s/ha
- Major system storage = 50 m^3/ha
- After the two above criteria are met, major system overland flow to Shirley's Brook is permitted.

The 85 L/s/ha release rate for the 2.44 ha area (Subject Site) corresponds to an allowable minor system peak flow of 207.4 L/s.

At the detailed design stage, Novatech may re-evaluate the allowable release rates to ensure that the SWM design is consistent with the current City of Ottawa Sewer Design Guidelines.

5.3 Existing Drainage Conditions

Under existing conditions, storm runoff from the site generally flows overland to the main branch of Shirley's Brook along the north side of the site. A small amount of drainage is directed to Klondike Road.

5.4 Existing and Proposed Storm Infrastructure

Refer to **Figure 7** – Storm Sewer Layout.

The proposed subdivision will be serviced by approximately 181m of storm sewer ranging from 375mm to 600mm in diameter; the Site Plan Block will be serviced by approximately 90m of 450mm dia. storm sewer.

The minor system outlet is the 825mm storm sewer on Klondike Road. The existing sewer stops at the intersection of Klondike Road and Sandhill Road (MH 159). As part of the proposed works, the Klondike Road storm sewer will be extended from MH 159 approximately 170 m to Street 1 and the entrance of the Site Plan Block. A future storm sewer to service the Subject Site and adjacent lands was identified in the Novatech (2006) design.

Runoff from the pathway block will flow overland directly into Shirley's Brook. The pathway block is the major system outlet for the Subject Site.

5.4.1 Minor System (Storm Sewers)

Storm servicing will be provided using a dual-drainage system. Runoff from frequent events will be conveyed by the proposed storm sewers (minor system), while flows from large storm events that exceed the capacity of the minor system will be stored on the surface in road sags, and/or conveyed overland along defined overland flow routes (major system).

Storm Sewer Design Criteria

The following is the storm sewer design criteria [Ottawa Sewer Design Guidelines (Oct. 2012)]:

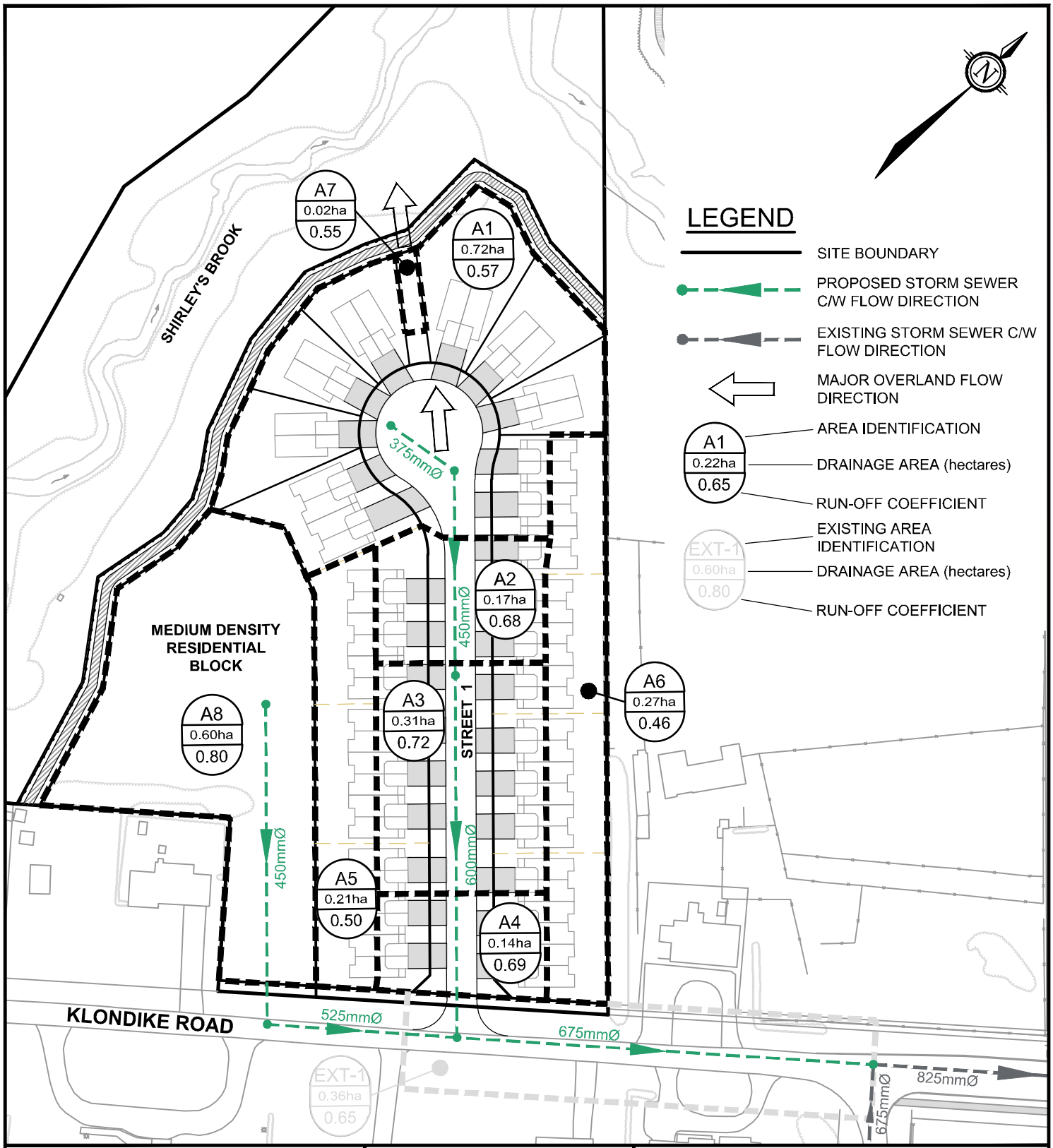
- Rational Method (Q) = 2.78CIA, where
    - Q = peak flow (L/s)
    - C = runoff coefficient
        - C = (0.70 * %Imp.) + 0.20
    - I = rainfall intensity for a 2-year return period (mm/hr)
        - $I_{2yr} = 732.951 / [(Tc(min) + 6.199)]^{0.810}$
    - A = site area (ha)
- Minimum Pipe Size = 250 mm; Minimum / Maximum Full Flow Velocity = 0.8 m/s / 3.0 m/s

The on-site storm sewers will be sized to convey the peak flows corresponding to a 2-year return period storm event. The proposed storm sewers on Klondike Road will be sized for the 5-year return period storm event. Refer to the storm sewer design sheets provided in **Appendix D**.

Inlet Control Devices

Inlet control devices (ICDs) will restrict inflows to the minor system. Rear yard catch basins will be connected in series with an ICD installed at the outlet of the most downstream structure. ICDs will be sized to control minor system peak flows to the Klondike Road storm sewer to the allowable release rate of 207.4 L/s.

The pathway block will drain uncontrolled directly to Shirley's Brook. The uncontrolled flows from this area have been accounted for as part of the major system design. Additional uncontrolled



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CITY OF OTTAWA
1055 KLONDIKE ROAD

STORM LAYOUT

SCALE 1 : 1500 (0, 15, 30, 45, 60)

DATE JULY 2019 | JOB 117034 | FIGURE FIG 7

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areas (i.e. rear yards) may be directed towards Shirley's Brook. This will be determined at detailed design.

Hydraulic Grade Line

The storm sewers will be designed to ensure the hydraulic grade line (HGL) for a 100-year storm event will provide a minimum 0.30 m clearance from the underside of footing (USF) elevation.

5.4.2 Major System (Overland Flow)

Under post-development conditions, the site will be graded to provide an overland flow path towards Street 1. Street 1 has been graded to direct overland flow towards a pathway block, which will outlet to Shirley's Brook. Refer to the Grading Plan (Drawing 117034-GR).

Major System (Overland Flow) Criteria

Runoff from storms that exceed the minor system capacity are to be stored or conveyed overland within the right-of-way and/or defined drainage easements. The following overland flow criteria will be applied to the design:

- Provide a minimum of 50 m^3/ha of major system storage.
- Ensure that major system flows have a maximum dynamic depth of 0.35 m during the 100-year event.
- Ensure the product of velocity x depth does not exceed 0.60 during the 100-year event.
- Ensure that water levels will not touch the building envelope / lowest opening during the Stress Test event (100-year +20%).

During detailed design, the major system will be evaluated using a hydraulic model to ensure that the major system criteria are satisfied.

5.5 Proposed Stormwater Management Strategy

Stormwater Quality Control

At the time it was designed, Shirley's Brook SWM Facility 'C' upstream Shirley's Brook was required to provide a *Normal* level of water quality control (70% long-term TSS removal) for the contributing drainage area (26.2 ha, 52% imperviousness), including the Subject Site. The required permanent pool volume was 1,834 m^3.

SWM Facility 'C' provides a permanent pool volume of 4,370 m^3 (report provided in **Appendix F)**, which exceeds the required volume for an *Enhanced* level of water quality treatment for a contributing drainage area with 55% imperviousness. The required extended detention storage (40 m^3/ha) is the same for both *Normal* and *Enhanced* water quality treatment.

The increased imperviousness of the Subject Site will increase the overall imperviousness of the SWMF 'C' catchment area to 54%.

Therefore, SWM Facility 'C' will meet the design requirements for an *Enhanced* level of water quality treatment for the contributing drainage area, including the subject site.

Stormwater Quantity Control

Surface storage will be provided within the road sags, based on the major system storage requirement of 50 m^3/ha.

The Klondike Road storm sewer and Shirley's Brook SWM Facility 'C' have been designed to accommodate post-development runoff from the site, and no modifications to SWM Facility 'C' are proposed. Any increases in runoff will be stored within the Site Plan Block (refer to **Section 5.6.4**). This will be further reviewed during detailed design.

Best Management Practices and Low Impact Development

The proposed development will explore the use of best management practices (BMPs) and low impact development (LID) techniques to reduce the impacts of development on the hydrologic cycle; and mitigate the reduction in groundwater infiltration / recharge resulting from the proposed increase in impervious areas.

The use and implementation of BMPs and LIDs will be reviewed during the detailed design process. Measures may include the use of bioretention / infiltration systems within the rights-of-way.

5.6 Stormwater Management Modeling

A conceptual stormwater management model (PCSWMM) for the Subject Site and Site Plan Block was prepared. The model provides estimated minor and major system peak flows, overland flow depths, preliminary HGL elevations, and on-site storage requirements. The model is based on the previously established SWM criteria.

5.6.1 PCSWMM Model Parameters

Design Storms

The model includes the following design storms based on the City of Ottawa IDF data presented in the City of Ottawa Sewer Design Guidelines (October 2012):

- 3-hour Chicago Storm Distribution (10-minute time step)
- 12-hour SCS Storm Distribution (30-minute time step)

Each storm distribution includes the 2-year, 5-year, 100-year, and 100-year (+20%) return periods.

The 3-hour Chicago storm distribution was determined to be the critical design storm for the proposed development. This is also consistent in the analysis by Novatech (2006), who designed SWM Facility 'C' using the SWMHYMO hydrologic model.

PCSWMM Model Schematics, Output Data and Modeling Files

PCSWMM model schematics and output data for the 100-year 3-hour Chicago storm distribution is provided in **Appendix D**. The PCSWMM modeling files are provided on the enclosed CD.

Subcatchment Areas / Runoff Coefficients

- The conceptual PCSWMM model uses a semi-lumped approach, with catchment areas representing the total area to each storm sewer run (i.e. front and rear yard areas are combined in some areas) based on the preliminary grading plan (Drawing 117034-GR). In some instances, the rear yards have been split from the front yard drainage to represent

areas draining to catchbasins on a continuous grade. Refer to **Figure 7** – Storm Sewer Layout for drainage areas.

- Weighted runoff coefficients were assigned based on estimated percent impervious values used in the PCSWMM model. As per the City of Ottawa Sewer Design Guidelines (October 2012), the runoff coefficient is based on the following equation:

  C = (% Imp. * 0.7) – 0.2

  The Site Plan Block was assumed to have a runoff coefficient of 0.80 (86% impervious).

  Refer to **Appendix D** for runoff coefficients and subcatchment parameters.

Depression Storage

- The default values for depression storage (1.57mm impervious / 4.67 mm pervious) have been applied to all catchments.
- The 'zero impervious' parameter (areas with no depression storage) for all front yard catchments draining to proposed Street 1 and the Site Plan Block is set to 50%. This represents the percent of roof top areas to total impervious area.
- The 'zero impervious' parameter for rear yard areas is set to 90%. This represents the imperviousness of rear yard areas being 90% rooftop areas and 10% other impervious areas (i.e. patios).

Subarea Routing

- Subarea routing for front yard subcatchments draining to proposed Street 1 and the Site Plan Block is 'direct to outlet'.
- Subarea routing for rear yard areas is set to 'impervious to pervious'.

Equivalent Width

- The equivalent width parameter for all subcatchments is based on the measured flow length. The front yard areas draining to proposed Street 1 has a 'double loaded' equivalent width parameter.

Inlets / Orifices / Outlet Rating Curves

Each inlet to the minor system has been sized to provide the equivalent 85 L/s/ha flow rate (based on the subcatchment area):

- Inlets for catchbasins at low points are represented as orifices assuming a head of 1.4m plus the static ponding depth.
- Inlets for catchbasins on-grade are represented as outlets, with rating curves based on capture / bypass characteristics of standard CB grates and capped at 85 L/s/ha.

Minor System Conduits (Bend / Exit Losses)

- The minor system network was created in Civil3D and imported into PCSWMM.
- The following exit losses have been inputted into the model. They represent the loss coefficient based on the bend angle, as per the Appendix 6-B in the City of Ottawa Sewer Design Guidelines (October 2012).

Bend Angle	Loss Coefficient
0	0.00
15	0.09
30	0.21
45	0.39
60	0.64
75	0.96
90	1.32

Major System Conduits

- Major system conduits (road network) have been defined using an irregular transect representing an 18 m right-of-way with a 3% crossfall from the centerline of the road to the bottom of curb.
- Junctions at high points have an invert elevation that represents either the bottom of curb or the road centerline, depending on the path of the overland flow route.

Downstream Boundary Condition (Minor System)

- The storm sewer outlet for the proposed development is the existing maintenance hole (MH 159) on Klondike Road. The model was run using a 'Normal' outfall for the minor system. During detailed design the analysis will be extended to MH 159.

5.6.2 Hydraulic Grade Line (PCSWMM)

The Hydraulic Grade Line (HGL) within the storm sewer system will be evaluated during detailed design. Novatech (2006) estimated a 100-year HGL of 69.73 m at MH 159 on Klondike Road; refer to excerpt provided in **Appendix D**. This HGL elevation is equivalent to obvert elevation of the outgoing 825mm storm sewer (69.73 m); therefore, it is assumed that this storm sewer does not surcharge during the 100-year storm event. In addition, this HGL elevation is lower than the invert elevation of the outgoing pipe from MH 02 at the end of proposed Street 1 (70.25 m).

During both the 100-year and 100-year (+20%) storm events the on-site storm sewer will not surcharge. The minimum USF elevations will be set 0.30 m higher than the pipe obvert, which is higher than the 100-year HGL elevations.

5.6.3 Summary of Peak Flows

Table 5.1 provides a summary of the minor system flows from the proposed development to Klondike Road and major system flows / direct flows to Shirley's Brook.

Table 5.1: Summary of Peak Flows

Proposed Development	Drainage Area (ha)	Allowable Release Rate[1] (L/s)	100-year Peak Flow[2] (L/s)		
			Minor System	Major System	TOTAL
Subdivision	1.84	156.4	155.9	227.0	**382.9**
Site Plan Block	0.60	51.0	50.7	268.6	**319.3**
TOTAL	**2.44**	**207.4**	**206.6**	**495.6**	**702.2**

(1) Allowable release rate is based on drainage area x 85 L/s/ha.
(2) PCSWMM model results for the 3-hour Chicago storm distribution.

The 100-year minor system peak flow to Klondike Road is controlled to just under the allowable release rate of 207.4 L/s for the 3-hour Chicago storm distribution. The total 100-year major system peak flows are 495.6 L/s. The total minor and major system peak flow is 702.2 L/s.

The conceptual PCSWMM model is based on the conceptual grading design and required 50 m^3/ha of major system storage. The grading design and available storage will be confirmed during detailed design.

5.6.4 On-Site Storage Requirements (Site Plan Block)

The subject site (2.44 ha) is required to provide 50 m^3/ha. On an area-weighted basis, this corresponds to:

Subdivision	(1.84 ha)	92 m^3
Site Plan	(0.60 ha)	30 m^3
Total	(2.44 ha)	122 m^3

Subdivision

Due to the grading of Street 1, the available surface storage within the subdivision is 51.6 m^3. The additional storage required to meet the 50 m^3/ha target will be provided within the Site Plan Block.

Site Plan Block

Storage in the Site Plan Block can be provided underground, on the surface, or a combination of both. The total storage to be provided is as follows:

Drainage Area	= 0.60 ha
Major System Storage (50 m^3/ha)	= 30.0 m^3
Major System Storage for Subdivision	= 40.4 m^3
Total Major System Storage for Site Plan Block	= 70.4 m^3

Interim Conditions

If the subdivision is developed before the site plan block, then temporary measures may be required to adhere to the major system criteria. Temporary measures may include a dry pond and outlet swale within Site Plan Block that would receive drainage from the adjacent rear yards in the subdivision (Area A05). Under interim conditions, major system flows from the rear yards exceeding the minor system capture rate (85 L/s/ha) would be directed into the dry pond. The dry pond and outlet swale to Shirley's Brook would be filled in when the Site Plan Block is developed.

6.0 TRAFFIC IMPACT BRIEF

A traffic screening form was completed and provided to the City of Ottawa to determine the requirement for a Traffic Impact Brief. Through consultation with the City it was determined that a TIA is not required. See **Appendix A** for correspondence and screening form.

7.0 ROADWAYS

7.1 Proposed Road Infrastructure

The proposed development will consist of a local roadway with an 18.0m right of way (ROW) to provide access to the townhome and semi-detached units. The access to the medium density

block will consist of a private roadway. The proposed cross sections will conform to City of Ottawa Standards.

8.0 NOISE CONTROL

The analysis of the roadway traffic along Klondike Road and Sandhill Road indicates that the City of Ottawa's criteria for residential noise will be exceeded, primarily for units in close proximity to the noise sources. Attenuation measures are required and they may include the installation of a noise barrier, central air conditioning, forced air ventilation and/or a notice may be placed on title with regards to the noise levels to be expected. The detailed results are included in the Noise Impact Feasibility Study and is submitted under a separate cover. Refer to *1055 Klondike Road, Noise Impact Feasibility Study, dated July 26, 2019 by Novatech, Report No.: R-2019-139* for more details.

9.0 UTILITIES

The development will be serviced by hydro, phone, gas and cable, which will be constructed in a four-party trench, as per the City and utility standard right-of-way cross-sections. All local roads will follow the City of Ottawa standard cross-section. During detailed design, the works will be coordinated with local utility companies. Canada Post will service the site with community mailboxes. Site lighting will be provided along roadways, sidewalks and walkways as per City standards.

10.0 EROSION AND SEDIMENT CONTROL

Erosion and sediment control measures will be implemented during construction in accordance with the "Guidelines on Erosion and Sediment Control for Urban Construction Sites" (Government of Ontario, May 1987). An Erosion and Sediment Control Plan will be prepared as part of the detailed design.

Typical erosion and sediment control measures recommended include, but are not limited to, the use of silt fences around perimeter of site (OPSD 219.110), catch basin inserts under catch basin/maintenance hole lids, heavy duty silt fence barrier (OPSD 219.130), straw bale check dams (OPSD 219.180), rock check dams (219.210 or OPSD 219.211), riprap (OPSS 511), mud mats, silt bags for dewatering operations, topsoil and sod to disturbed areas and natural grassed waterways. Dewatering and sediment control techniques will be developed for the individual situations based on the above guidelines and utilizing typical measures to ensure erosion and sediment control is controlled in an acceptable manner and there is no negative impact to adjacent Lands, water bodies or water treatment/conveyance facilities.

It will be the responsibility of the Contractor to submit a detailed construction schedule and appropriate staging, dewatering and erosion and sediment control plans to the Contract Administrator for review and approval prior to the commencement of work. A copy of the City of Ottawa Special Provision F-1005 is included in **Appendix E** which will become part of any contract and which outlines the contractual requirements which includes preparation of a detailed erosion and sediment control plan.

General Erosion and Sediment Control Measures

- All erosion and sediment control measures are to be installed to the satisfaction of the engineer, the municipality and the conservation authority prior to undertaking any site alterations (filling, grading, removal of vegetation, etc.) and remain present during all phases of site preparation and construction.

- A qualified inspector, provided by the owner, should conduct daily visits during construction to ensure that the contractor is working in accordance with the design drawings and that mitigation measures are being implemented as specified.
    - A light duty silt fence barrier is to be installed in the locations shown on the Erosion and Sediment Control Plan.
    - Rock check dams and/or straw bales are to be installed in drainage ditches.
    - Catch basin inserts are to be placed under the grates of all proposed and existing catchbasins and structures.
    - After complete build-out, all sewers are to be inspected and cleaned and all sediment and construction fencing is to be removed.
- The contractor shall ensure that proper dust control is provided with the application of water (and if required, calcium chloride) during dry periods.
- The contractor shall immediately report to the engineer or inspector any accidental discharges of sediment material into any ditch or sewer system. Appropriate response measures shall be carried out by the contractor without delay.

The contractor acknowledges that failure to implement erosion and sediment control measures may result in penalties imposed by any applicable regulatory agency.

11.0 CONCLUSIONS AND RECOMMENDATIONS

Sanitary Servicing

The analysis of the proposed sanitary servicing confirms the following:

- It is proposed that the development will outlet directly to the 200mm sanitary sewer along Klondike Road at Sandhill Road. The proposed outlet is consistent with the approved Brookside Subdivision Infrastructure Servicing Study (Novatech).
- The proposed development can be serviced with a 200mm sanitary sewer system.
- The total proposed sanitary flow from the subject lands is 3.8 L/s, which represents a slight decrease in sanitary flows compared to the calculated flows in the Brookside Subdivision Servicing Study (4.1 L/s).
- The proposed sanitary sewers have adequate capacity to accommodate the peak sanitary flow.

Watermain

The analysis of the proposed watermain network confirms the following:

- It is proposed to service the site with 50mm and 200mm pipe with a connection to the existing 400mm diameter watermain at Klondike and Sandhill Road.
- The analysis confirms the proposed watermain provides adequate fire protection and domestic service under all operating conditions.

Stormwater Management

The following provides a summary of the storm sewer and stormwater management system:

- Proposed storm sewer system will convey stormwater to existing MH 159 on Klondike Road.
    - Storm sewers (minor system) have been designed to convey the uncontrolled 2-year peak flow using the Rational Method.
    - Inflows to the minor system will be controlled using inlet control devices (ICDs) to an overall allowable release rate of 207.4 L/s (85 L/s/ha).
    - A minimum clearance of 0.30m will be provided between the 100-year hydraulic grade line (HGL) or storm sewer obvert and the designed underside of footing elevations.
- Roads graded in a saw-toothed pattern to provide surface stormwater storage during storm events that exceed the allowable minor system inlet rate.
    - The major overland flow outlet for the site is the pathway block to Shirley's Brook.
    - Ponding depths will not exceed 0.35m for all storms up to and including the 100-year event.
    - The minimum major system storage requirement of 50 m^3/ha is provided within the subdivision and Site Plan Block in unison. Based on the conceptual grading design of the subdivision, additional major system storage will be required in the Site Plan Block.

Erosion and Sediment control

- Erosion and sediment control measures (i.e. filter fabric, silt fences, etc.) will be implemented prior to construction and are to remain in place until vegetation is established.
- An Erosion and Sediment Control Plan will be prepared during detailed design to ensure erosion and sediment control is controlled in an acceptable manner and there is no negative impact to adjacent lands, water bodies or water treatment/conveyance facilities.

12.0 CLOSURE

The preceding report is respectfully submitted for review and approval. Please contact the undersigned should you have questions or require additional information.

NOVATECH

Prepared by:

Lucas Wilson, P.Eng.
Project Coordinator, Engineering

Conrad Stang, M.A.Sc., P.Eng.
Project Manager, Water Resources

FOR REVIEW

Appendix A

Correspondence

City of Ottawa 2017 TIA Guidelines Screening Form

1. Description of Proposed Development

Municipal Address	**1055 Klondike Road**
Description of Location	**Undeveloped 1.8-hectare parcel north of Klondike Road, approximately 240m east of March Road and 130m west of Sandhill Road**
Land Use Classification	**Residential**
Development Size (units)	**58 dwellings (12 semi-detached, 46 townhomes)**
Development Size (m^2)	**-**
Number of Accesses and Locations	**One access on Klondike Road**
Phase of Development	**1**
Buildout Year	**2022**

If available, please attach a sketch of the development or site plan to this form.

2. Trip Generation Trigger

Considering the Development's Land Use type and Size (as filled out in the previous section), please refer to the Trip Generation Trigger checks below.

Land Use Type	Minimum Development Size
Single-family homes	40 units
Townhomes or apartments	90 units
Office	3,500 m^2
Industrial	5,000 m^2
Fast-food restaurant or coffee shop	100 m^2
Destination retail	1,000 m^2
Gas station or convenience market	75 m^2

** If the development has a land use type other than what is presented in the table above, estimates of person-trip generation may be made based on average trip generation characteristics represented in the current edition of the Institute of Transportation Engineers (ITE) Trip Generation Manual.*

If the proposed development size is greater than the sizes identified above, the Trip Generation Trigger is satisfied.

3. Location Triggers

	Yes	No
Does the development propose a new driveway to a boundary street that is designated as part of the City's Transit Priority, Rapid Transit or Spine Bicycle Networks?		✓
Is the development in a Design Priority Area (DPA) or Transit-oriented Development (TOD) zone?*		✓

**DPA and TOD are identified in the City of Ottawa Official Plan (DPA in Section 2.5.1 and Schedules A and B; TOD in Annex 6). See Chapter 4 for a list of City of Ottawa Planning and Engineering documents that support the completion of TIA).*

If any of the above questions were answered with 'Yes,' the Location Trigger is satisfied.

4. Safety Triggers

	Yes	No
Are posted speed limits on a boundary street are 80 km/hr or greater?		✓
Are there any horizontal/vertical curvatures on a boundary street limits sight lines at a proposed driveway?		✓
Is the proposed driveway within the area of influence of an adjacent traffic signal or roundabout (i.e. within 300 m of intersection in rural conditions, or within 150 m of intersection in urban/suburban conditions)?		✓
Is the proposed driveway within auxiliary lanes of an intersection?		✓
Does the proposed driveway make use of an existing median break that serves an existing site?		✓
Is there is a documented history of traffic operations or safety concerns on the boundary streets within 500 m of the development?		✓
Does the development include a drive-thru facility?		✓

If any of the above questions were answered with 'Yes,' the Safety Trigger is satisfied.

5. Summary

	Yes	No
Does the development satisfy the Trip Generation Trigger?		✓
Does the development satisfy the Location Trigger?		✓
Does the development satisfy the Safety Trigger?		✓

If none of the triggers are satisfied, the TIA Study is complete. If one or more of the triggers is satisfied, the TIA Study must continue into the next stage (Screening and Scoping).

Lucas Wilson

From: Baggs, Rosanna <Rosanna.Baggs@ottawa.ca>
Sent: Tuesday, January 22, 2019 2:56 PM
To: Brad Byvelds
Cc: Joshua Audia; Mark Bissett; McCreight, Laurel; Sweet, Louise
Subject: RE: 1055 Klondike Road - TIA Screening
Attachments: 117034-CP7.pdf; 117034 - Screening Form.pdf

Hi Brad,

No TIA is required. If anything changes with the proposal, please resubmit an update screening form to ensure that the new proposal does not trigger anything.

Regards,

Rosanna Baggs, C.E.T.
Project Manager, Infrastructure Approvals | GPRJ Approbation demandes infrastructure
Development Review West Branch | Dir Services d'exam des dem d'amgt
Tel |Tél. : 613-580- 2424 ext. | poste 26388

From: Brad Byvelds <B.Byvelds@novatech-eng.com>
Sent: Tuesday, January 22, 2019 1:24 PM
To: Baggs, Rosanna <Rosanna.Baggs@ottawa.ca>
Cc: Joshua Audia <j.audia@novatech-eng.com>; Mark Bissett <m.bissett@novatech-eng.com>
Subject: 1055 Klondike Road - TIA Screening

Hi Rosanna,

Please find attached a concept plan and completed screening form for the proposed development at 1055 Klondike Road. The proposed development consists of 46 townhouses, 12 semi-detached units and a future residential block. As the number of units within the future residential block is currently unknown, this TIA will review the impacts of the townhouse/semi-detached units exclusively. The future residential block will be subject to a future Site Plan Control application, where, if required, a separate TIA can be prepared. Please see below for discussion on the proposed 58 residential units.

Based on TRANS trip generation rates for semi-detached units/townhouses in the suburban area, the proposed development is anticipated to generate 57 person trips during the AM peak hour and 67 person trips during the PM peak hour. Based on ITE, 10th Edition, Land Use 220 – Multifamily Housing (Low-Rise) rates, which include data from apartments, townhouses, and condominiums located in the same building with at least three other dwelling units and have one or two levels, the proposed development is anticipated to generate 36 person trips during the AM peak hour and 46 person trips during the PM peak hour. Based on the foregoing, the TRANS rates are approximately 50% higher than the ITE rates.

It is noted that the Trip Generation Trigger table of the screening form identifies 90 units as the threshold for townhouses/apartments based on the ITE rate. The ITE land use is reflective of the proposed development, and does not meet the 60 person trip generation trigger.

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Similarly, the location trigger is not met, as Klondike Road is not located in a Design Priority Area of Transit-Oriented Development, nor is it a Spine Cycling Route or a Rapid Transit/Transit Priority street.

A site visit was conducted to review sightlines at the proposed access due to vertical curvatures on Klondike Road. The sight distance requirements outlined in TAC, along with the corresponding sight distance field measurements, are as follows:

- Stopping Sight Distance (vehicle on Klondike travelling eastbound): 80m required, 85m provided
- Stopping Sight Distance (vehicle on Klondike travelling westbound): 85m required, > 200m provided
- Turning Sight Distance (vehicle exiting onto Klondike, looking east): 110m required, > 200m provided
- Turning Sight Distance (vehicle exiting onto Klondike, looking west): 130m required, 140m provided

Based on the above, there are no sightline concerns regarding the proposed access on Klondike Road. None of the other safety criteria are met, and therefore no safety triggers have been met. As no trip generation, location, or safety triggers have been met, it is requested that the TIA Study be screened out for this application. Please review and confirm if you are in agreement.

Thanks,

Brad Byvelds, P.Eng., Project Coordinator | Transportation/Traffic
NOVATECH Engineers, Planners & Landscape Architects
240 Michael Cowpland Drive, Suite 200, Ottawa, ON, K2M 1P6 | Tel: 613.254.9643 x 286 | Fax: 613.254.5867
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Appendix B

Sanitary Design Sheets &
Excerpts from Relevant Reports

1055 Klondike Road - Sanitary Sewer Design Sheet

AREA			RESIDENTIAL										INFILTRATION				PIPE					
			SEMIS		TOWNS		Medium-Density		TOTAL													
ID	From	To	Units	Pop.	Units	Pop.	Units	Pop.	Pop.	Accum. Pop.	Peak Factor	Peak Flow (l/s)	Total Area (ha)	Accum. Area (ha)	Infilt. Flow (l/s)	**Total Flow (l/s)**	Size (mm)	Slope (%)	Length (m)	Capacity (l/s)	Full Flow Vel. (m/s)	Q/Q_{full} (%)
Site																						
1	7	5	12	40.8	4	10.8			51.6	51.6	3.6	0.6	0.67	0.67	0.2	0.8	200	1.00	23.3	34.2	1.06	2.4%
2	5	3			16	43.2			43.2	94.8	3.6	1.1	0.45	1.12	0.4	1.5	200	0.35	60.4	20.2	0.62	7.3%
3	3	1			26	70.2			70.2	165.0	3.5	1.9	0.72	1.84	0.6	2.5	200	0.35	101.8	20.2	0.62	12.4%
4	11	9					56.0	100.8	100.8	100.8	3.6	1.2	0.60	0.60	0.2	1.4	200	0.35	91.5	20.2	0.62	6.8%
	9	1							0.0	100.8	3.6	1.2	0.00	0.60	0.2	1.4	200	1.00	53.4	34.2	1.06	4.0%
	1	266							0.0	265.8	3.5	3.0	0.00	2.44	0.8	3.8	200	1.00	117.0	34.2	1.06	11.1%

Design Parameters:

ISTB-2018-01 Avg Flow/Person (Site) =	280	l/day	**Population Density:**	ppl/unit	units/net ha	**Project: 1055 Klondike Road (117034)**
Avg Flow/Person =	350	l/day	Medium Density	1.80	90	Designed: LRW
Comm./Inst. Flow =	28000	l/ha/day				Checked: MAB
ISTB-2018-01 Infiltration (Site) =	0.33	l/s/ha	Singles	3.40		Date: July 26, 2019
Infiltration =	0.28	l/s/ha	Towns/Semis	2.70	60	
Pipe Friction n =	0.013					

Residential Peaking Factor = Harmon Equation (max 4, min 2)

Peaking Factor Comm./Inst. 1.5

NOVATECH
Engineers, Planners & Landscape Architects

BROOKSIDE SUBDIVISION
SANITARY SEWER DESIGN SHEET

LOCATION			RESIDENTIAL AREA AND POPULATION								IND			INST		ICI	INFILTRATION			FLOW	PIPE						
Street	From	To	Area	Dwellings		Pop.	Cumulative		Peak	Peak	Area	Accu.	Peak	Area	Accu.	Peak	Total	Accu.	Infiltration	Total	Length	Dia	Dia	Slope	Velocity	Capacity	Ratio
	Node	Node		SFH	TH		Area	Pop.	Factor	Flow		Area	Factor		Area	Flow	Area	Area	Flow	Flow		Act	Nom		(Full)	(Full)	Q/Qfull
			(ha)				(ha)			(l/s)	(ha)	(ha)		(ha)	(ha)	(l/s)	(ha)	(ha)	(l/s)	(l/s)	(m)	(mm)	(mm)	(%)	(m/s)	(l/s)	(%)
Area 1 - March Road																											
	Offsite	MH 261	6.10			610	6.10	610.0	3.93	9.7							6.1	6.1	1.7	11.4							
	MH 261	MH 260	0.19				6.29	610.0	3.93	9.7							0.2	6.3	1.8	11.5	92.0	203	200	0.33	0.61	19.6	58%
	MH 260	MH 259	0.17				6.46	610.0	3.93	9.7							0.2	6.5	1.8	11.5	71.0	203	200	1.13	1.12	36.3	32%
	MH 259	MH 258	0.13				6.59	610.0	3.93	9.7							0.1	6.6	1.8	11.6	54.4	203	200	0.37	0.64	20.8	56%
Area 3 - Brookside Subdivision																											
Maxwell Bridge Rd	MH 258	MH 256	0.24	3		10.2	6.83	620.2	3.92	9.9							0.2	6.8	1.9	11.8	42.6	203	200	2.35	1.62	52.4	22%
Windance Cres	MH 249	MH 257	0.47	7		23.8	0.47	23.8	4.00	0.4							0.5	0.5	0.1	0.5	54.7	203	200	2.00	1.49	48.3	1%
	MH 257	MH 256	0.37	5		17.0	0.84	40.8	4.00	0.7							0.4	0.8	0.2	0.9	51.5	203	200	0.82	0.95	31.0	3%
Maxwell Bridge Rd	MH 256	MH 255	0.60	9		30.6	8.27	691.6	3.90	10.9							0.6	8.3	2.3	13.2	80.5	203	200	1.11	1.11	36.0	37%
	MH 255	MH 250	0.38	6		20.4	8.65	712	3.89	11.2							0.4	8.7	2.4	13.6	56.4	203	200	1.35	1.22	39.7	34%
Pendra Way	MH 246	MH 254	0.44	7		23.8	0.44	23.8	4.00	0.4							0.4	0.4	0.1	0.5	52.0	203	200	0.90	1.00	32.4	2%
	MH 254	MH 253	0.22	2		6.8	0.66	30.6	4.00	0.5							0.2	0.7	0.2	0.7	11.5	203	200	0.61	0.82	26.7	3%
	MH 253	MH 252	0.00			0.0	0.66	30.6	4.00	0.5							0.0	0.7	0.2	0.7	35.2	203	200	0.57	0.80	25.8	3%
	MH 252	MH 251	0.11	1		3.4	0.77	34.0	4.00	0.6							0.1	0.8	0.2	0.8	10.6	203	200	0.66	0.86	27.8	3%
	MH 251	MH 250	0.54	9		30.6	1.20	61.2	4.00	1.0							0.5	1.2	0.3	1.3	67.8	203	200	0.60	0.82	26.5	5%
Maxwell Bridge Rd	MH 250	MH 242	0.42	6		20.4	10.27	793.6	3.86	12.4							0.4	10.3	2.9	15.3	82.0	203	200	0.80	0.94	30.6	50%
Windance Cres	MH 249	MH 248	0.15	2		6.8	0.15	6.8	4.00	0.1							0.2	0.2	0.0	0.2	20.2	203	200	1.00	1.05	34.2	0%
	MH 248	MH 247	0.23	2		6.8	0.38	13.6	4.00	0.2							0.2	0.4	0.1	0.3	13.1	203	200	2.30	1.60	51.8	1%
	MH 247	MH 246	0.49	6		20.4	0.87	34.0	4.00	0.6							0.5	0.9	0.2	0.8	81.5	203	200	2.90	1.80	58.2	1%
	MH 246	MH 245	0.94	14		47.6	1.81	81.6	4.00	1.3							0.9	1.8	0.5	1.8	123.0	203	200	1.20	1.15	37.4	5%
	MH 245	MH 244	0.20		3	8.1	2.01	89.7	4.00	1.5							0.2	2.0	0.6	2.0	11.2	203	200	0.36	0.63	20.5	10%
	MH 244	MH 243	0.18		5	13.5	2.19	103.2	4.00	1.7							0.2	2.2	0.6	2.3	29.8	203	200	0.34	0.61	19.9	11%
	MH 243	MH 242	0.79	7	12	56.2	2.80	145.9	4.00	2.4							0.8	2.8	0.8	3.1	108.0	203	200	0.32	0.60	19.3	16%
Maxwell Bridge Rd	MH 242	MH 240	0.39	5		17.0	13.46	956.5	3.81	14.8							0.4	13.5	3.8	18.5	82.0	254	250	0.38	0.75	38.2	49%
Celtic Ridge Cres	MH 233	MH 241	0.63		20	54.0	0.63	54.0	4.00	0.9							0.6	0.6	0.2	1.1	73.3	203	200	0.33	0.61	19.6	5%
	MH 241	MH 240	0.45		13	35.1	1.08	89.1	4.00	1.4							0.5	1.1	0.3	1.7	63.7	203	200	1.21	1.16	37.6	5%
Maxwell Bridge Rd	MH 240	MH 238	0.40		9	24.3	14.94	1069.9	3.78	16.4							0.4	14.9	4.2	20.6	82.0	254	250	0.24	0.60	30.4	68%
Celtic Ridge Cres	MH 233	MH 232	0.19		3	8.1	0.19	8.1	4.00	0.1							0.2	0.2	0.1	0.2	12.4	203	200	0.65	0.85	27.6	1%
	MH 232	MH 231	0.46		12	32.4	0.65	40.5	4.00	0.7							0.5	0.7	0.2	0.8	73.3	203	200	0.40	0.67	21.6	4%
Celtic Ridge Cres	MH 230	MH 231	0.41		11	29.7	0.41	29.7	4.00	0.5							0.4	0.4	0.1	0.6	82.1	203	200	0.33	0.61	19.6	3%
Braecreek Ave	MH 231	MH 239	0.92		28	75.6	1.98	145.8	4.00	2.4							0.9	2.0	0.6	2.9	120.0	203	200	0.33	0.61	19.6	15%
	MH 239	MH 238	0.17		4	10.8	2.15	156.6	4.00	2.5							0.2	2.2	0.6	3.1	27.4	203	200	1.82	1.42	46.1	7%
Maxwell Bridge Rd	MH 238	MH 236	0.42		13	35.1	17.51	1261.6	3.73	19.1							0.4	17.5	4.9	24.0	82.0	254	250	0.24	0.60	30.4	79%
Fordell Ave	MH 230	MH 237	0.86		30	81.0	0.86	81.0	4.00	1.3							0.9	0.9	0.2	1.6	110.0	203	200	0.32	0.60	19.3	8%
	MH 237	MH 236	0.23		6	16.2	1.09	97.2	4.00	1.6							0.2	1.1	0.3	1.9	39.1	203	200	2.30	1.60	51.8	4%

BROOKSIDE SUBDIVISION
SANITARY SEWER DESIGN SHEET

LOCATION			RESIDENTIAL AREA AND POPULATION								IND			INST		ICI	INFILTRATION			FLOW	PIPE						
Street	From	To	Area	Dwellings		Pop.	Cumulative		Peak	Peak	Area	Accu.	Peak	Area	Accu.	Peak	Total	Accu.	Infiltration	Total	Length	Dia	Dia	Slope	Velocity	Capacity	Ratio
	Node	Node		SFH	TH		Area	Pop.	Factor	Flow		Area	Factor		Area	Flow	Area	Area	Flow	Flow		Act	Nom		(Full)	(Full)	Q/Qfull
			(ha)				(ha)			(l/s)	(ha)	(ha)		(ha)	(ha)	(l/s)	(ha)	(ha)	(l/s)	(l/s)	(m)	(mm)	(mm)	(%)	(m/s)	(l/s)	(%)
Maxwell Bridge Rd	MH 236	MH 234	0.39		12	32.4	18.99	1391.2	3.70	20.9							0.4	19.0	5.3	26.2	82.0	305	300	0.24	0.68	49.4	53%
Arncliffe Ave	MH 229	MH 235	0.87		30	81.0	0.87	81.0	4.00	1.3							0.9	0.9	0.2	1.6	120.0	203	200	0.33	0.61	19.6	8%
	MH 235	MH 234	0.22		6	16.2	1.09	97.2	4.00	1.6							0.2	1.1	0.3	1.9	29.3	203	200	2.90	1.80	58.2	3%
Maxwell Bridge Rd	MH 234	MH 225	0.26		6	16.2	20.34	1504.6	3.68	22.4							0.3	20.3	5.7	28.1	79.8	305	300	0.25	0.69	50.4	56%
Celtic Ridge Cres	MH 230	MH 229	0.43		12	32.4	0.43	32.4	4.00	0.5							0.4	0.4	0.1	0.6	81.9	203	200	0.32	0.60	19.3	3%
	MH 229	MH 228	0.38		11	29.7	0.81	62.1	4.00	1.0							0.4	0.8	0.2	1.2	70.3	203	200	0.33	0.61	19.6	6%
	MH 228	MH 227	0.10		0	0.0	0.91	62.1	4.00	1.0							0.1	0.9	0.3	1.3	12.3	203	200	0.33	0.61	19.6	6%
	MH 227	MH 226	0.46		13	35.1	1.37	97.2	4.00	1.6							0.5	1.4	0.4	2.0	97.0	203	200	0.32	0.60	19.3	10%
	MH 226	MH 225	0.21		5	13.5	1.58	110.7	4.00	1.8							0.2	1.6	0.4	2.2	43.7	203	200	0.94	1.02	33.1	7%
Celtic Ridge Cres	MH 225	MH 224	0.58		12	32.4	22.50	1647.7	3.65	24.4							0.6	22.5	6.3	30.7	97.5	381	375	0.20	0.72	81.7	38%
	MH 224	MH 209	0.22		4	10.8	22.72	1658.5	3.65	24.5							0.2	22.7	6.4	30.9	66.5	381	375	0.20	0.72	81.7	38%
Streamside Cres	MH 217	MH 218	0.26	2		6.8	0.26	6.8	4.00	0.1							0.3	0.3	0.1	0.2	12.4	203	200	1.00	1.05	34.2	1%
	MH 218	MH 219	0.96	20		68.0	1.22	74.8	4.00	1.2							1.0	1.2	0.3	1.6	120.0	203	200	0.80	0.94	30.6	5%
	MH 219	MH 220	0.62	11		37.4	1.84	112.2	4.00	1.8							0.6	1.8	0.5	2.3	77.8	203	200	0.32	0.60	19.3	12%
Glenbrae Ave	MH 220	MH 221	0.96		28	75.6	2.80	187.8	4.00	3.0							1.0	2.8	0.8	3.8	118.9	203	200	0.32	0.60	19.3	20%
	MH 221	MH 222	1.04		33	89.1	3.84	276.9	4.00	4.5							1.0	3.8	1.1	5.6	119.0	203	200	0.32	0.60	19.3	29%
	MH 222	MH 223	0.20		3	8.1	4.04	285.0	4.00	4.6							0.2	4.0	1.1	5.7	12.9	203	200	0.39	0.66	21.3	27%
	MH 223	MH 210	0.22		4	10.8	4.26	295.8	4.00	4.8							0.2	4.3	1.2	6.0	72.9	203	200	0.33	0.61	19.6	30%
Streamside Cres	MH 217	MH 216	0.37	5		17.0	0.37	17.0	4.00	0.3							0.4	0.4	0.1	0.4	40.1	203	200	0.65	0.85	27.6	1%
	MH 216	MH 215	0.17	2		6.8	0.54	23.8	4.00	0.4							0.2	0.5	0.2	0.5	13.6	203	200	0.65	0.85	27.6	2%
	MH 215	MH 214	0.17	2		6.8	0.71	30.6	4.00	0.5							0.2	0.7	0.2	0.7	31.6	203	200	0.50	0.75	24.2	3%
	MH 214	MH 213	1.02	18		61.2	1.73	91.8	4.00	1.5							1.0	1.7	0.5	2.0	119.0	203	200	0.90	1.00	32.4	6%
	MH 213	MH 212	0.50	7		23.8	2.23	115.6	4.00	1.9							0.5	2.2	0.6	2.5	56.5	203	200	0.32	0.60	19.3	13%
Celtic Ridge Cres	MH 212	MH 211	1.04	16		54.4	3.27	170.0	4.00	2.8							1.0	3.3	0.9	3.7	124.9	203	200	0.32	0.60	19.3	19%
	MH 211	MH 210	0.94	16		54.4	4.21	224.4	4.00	3.6							0.9	4.2	1.2	4.8	122.0	203	200	0.33	0.61	19.6	25%
Celtic Ridge Cres	MH 210	MH 209	0.58	11		37.4	9.05	557.6	3.95	8.9							0.6	9.1	2.5	11.5	80.9	203	200	0.75	0.91	29.6	39%
Easement	MH 209	MH 208	0.06			0.0	31.83	2216.1	3.55	31.9							0.1	31.8	8.9	40.8	50.3	381	375	0.20	0.72	81.7	50%
	MH 208	MH 207	0.24			0.0	32.07	2216.1	3.55	31.9							0.2	32.1	9.0	40.9	111.6	381	375	0.20	0.72	81.7	50%
Area 4a - Phase 2 Lands																											
	MH 273	MH 272	0.57		9	24.3	0.57	24.3	4.00	0.4							0.6	0.6	0.2	0.6	66.0	203	200	0.65	0.85	27.6	2%
	MH 272	MH 271	0.92		16	43.2	1.49	67.5	4.00	1.1							0.9	1.5	0.4	1.5	90.2	203	200	0.40	0.67	21.6	7%
	MH 271	MH 270	1.06		19	51.3	2.55	118.8	4.00	1.9							1.1	2.6	0.7	2.6	113.0	203	200	0.40	0.67	21.6	12%
	MH 270	MH 207	0.00		0	0.0	2.55	118.8	4.00	1.9							0.0	2.6	0.7	2.6	16.0	254	250	0.32	0.69	35.1	8%
Easement	MH 207	MH 206	0.22			0.0	34.84	2240.4	3.55	32.2							0.2	34.8	9.8	41.9	100.0	457	450	0.20	0.81	132.9	32%
Area 2																											
	Area 2	MH 266	3.10			202	3.10	202.0	4.00	3.3							3.1	3.1	0.9	4.1	-	203	200	0.32	0.60	19.3	21%
Klondike Road & Area 4b																											
	MH 266	MH 265	0.24				3.34	202.0	4.00	3.3							0.2	3.3	0.9	4.2	93.7	203	200	0.32	0.60	19.3	22%
	Park	MH 265	1.89				1.89	0.0	4.00	0.0							1.9	1.9	0.5	0.5	13.0	203	200	0.32	0.60	19.3	3%
	MH 265	MH 264	0.31				5.54	202.0	4.00	3.3							0.3	5.5	1.6	4.8	120.0	203	200	0.32	0.60	19.3	25%

BROOKSIDE SUBDIVISION
SANITARY SEWER DESIGN SHEET

LOCATION			RESIDENTIAL AREA AND POPULATION								IND			INST		ICI	INFILTRATION			FLOW	PIPE						
Street	From	To	Area	Dwellings		Pop.	Cumulative		Peak	Peak	Area	Accu.	Peak	Area	Accu.	Peak	Total	Accu.	Infiltration	Total	Length	Dia	Dia	Slope	Velocity	Capacity	Ratio
	Node	Node		SFH	TH		Area	Pop.	Factor	Flow		Area	Factor		Area	Flow	Area	Area	Flow	Flow		Act	Nom		(Full)	(Full)	Q/Qfull
			(ha)				(ha)			(l/s)	(ha)	(ha)		(ha)	(ha)	(l/s)	(ha)	(ha)	(l/s)	(l/s)	(m)	(mm)	(mm)	(%)	(m/s)	(l/s)	(%)
Marconi Ave	MH 269	MH 268	0.14		3	8.1	0.14	8.1	4.00	0.1							0.1	0.1	0.0	0.2	21.3	203	200	1.00	1.05	34.2	0%
	MH 268	MH 267	0.11		2	5.4	0.25	13.5	4.00	0.2							0.1	0.3	0.1	0.3	26.6	203	200	0.56	0.79	25.6	1%
	MH 267	MH 264	0.95		26	70.2	1.20	83.7	4.00	1.4							1.0	1.2	0.3	1.7	120.0	203	200	0.67	0.86	28.0	6%
	MH 264	MH 263	0.78		20	54.0	7.52	339.7	4.00	5.5							0.8	7.5	2.1	7.6	100.0	254	250	0.24	0.60	30.4	25%
	MH 263	MH 262	0.91		27	72.9	8.43	412.6	4.00	6.7							0.9	8.4	2.4	9.0	88.3	254	250	0.24	0.60	30.4	30%
	MH 262	MH 206	0.95		29	78.3	9.38	490.9	3.98	7.9							1.0	9.4	2.6	10.5	118.0	254	250	0.24	0.60	30.4	35%
	MH 206	MH 205	0.10			0.0	44.32	2731.3	3.48	38.5							0.1	44.3	12.4	50.9	52.5	457	450	0.20	0.81	132.9	38%
Area 5a & 5b (KRP) - Klondike Road																											
	Area 5	MH 205									5.4	5.4	4.7			10.3	5.4	5.4	1.5	11.8	-	254	250	0.25	0.61	31.0	38%
Briar Ridge Pump Station Access Road + Area 6 (KRP)																											
	MH 205	MH 204					44.32	2731.3	3.48	38.5		5.4	4.7			10.3	0.0	49.7	13.9	62.7	79.7	457	450	0.20	0.81	132.9	47%
	MH 204	MH 203					44.32	2731.3	3.48	38.5		5.4	4.7			10.3	0.0	49.7	13.9	62.7	79.7	457	450	0.20	0.81	132.9	47%
	Area 6	MH 203									7.9	7.9	4.4			14.1	7.9	7.9	2.2	16.3	-	254	250	0.25	0.61	31.0	53%
	MH 203	MH 202					44.32	2731.3	3.48	38.5		13.3	3.9			21.0	0.0	57.6	16.1	75.6	90.0	457	450	0.26	0.92	151.6	50%
	MH 202	MH 201B					44.32	2731.3	3.48	38.5		13.3	3.9			21.0	0.0	57.6	16.1	75.6	95.0	457	450	0.26	0.92	151.6	50%
	MH 201B	MH 201A					44.32	2731.3	3.48	38.5		13.3	3.9			21.0	0.0	57.6	16.1	75.6	85.0	457	450	0.25	0.91	148.6	51%
	MH 201A	MH 201					44.32	2731.3	3.48	38.5		13.3	3.9			21.0	0.0	57.6	16.1	75.6	90.0	457	450	0.25	0.91	148.6	51%
	MH 201	PS					44.32	2731.3	3.48	38.5		13.3	3.9			21.0	0.0	57.6	16.1	75.6	21.6	457	450	0.15	0.70	115.1	66%
Area 7 (KRP - Ex. Golf Course)																											
	Ex. MH	PS									15.2	15.2	3.9			24.0	15.2	15.2	4.3	28.3							
Area 8 (Claridge Lands)																											
	Ex. MH	PS	45.57			3100	45.57	3100.0	3.43	43.1							45.6	45.6	12.8	55.8							
Pump Station (Areas 1-8)							89.89	5831.3	3.18	75.2		28.5	3.4			39.3	0.0	118.4	33.1	147.6							

DESIGN PARAMETERS

Average Daily Flow=	350	L/cap/day	Industrial Peak Factor=	per MOE graph	
Comm/Inst Flow=	50000	L/ha/day	Extraneous Flow=	0.28 L/s/ha	0.28 L/s/ha
Industrial Flow=	35000	L/ha/day	Minimum Velocity=	0.60 m/s	0.60 m/s
Max Res Peak Factor=	4.00		Manning's n=	0.013	0.01
Comm/Inst Peak Factor=	1.50				

Designed: MAB

Checked: JGR

Dwg. Reference: 103106-SAN1
103106-SAN2

PROJECT:
Brookside Subdivision

CLIENT:
Klondike Developments Inc

Date: August 29, 2007

LEGEND

3 — AREA I.D.

10.5 RES 500 — AREA IN HECTARES; LANDUSE TYPE: RES = RESIDENTIAL, IND = LIGHT INDUSTRIAL; POPULATION ESTIMATE

SANITARY DRAINAGE AREA BOUNDARY

NOTES:

1. SANITARY DRAINAGE AREAS AND POPULATION VALUES DEPICTED ON THIS DRAWING WERE TAKEN FROM THE "BRIAR RIDGE SANITARY PUMP STATION PRE-DESIGN REPORT" BY CCL (REPORT No. xxxxxxx). THE BOUNDARY LINES ON THIS PLAN HAVE BEEN APPROXIMATED FROM THAT REPORT. PRECISE BOUNDARY LOCATIONS SHOULD BE TAKEN FROM THE APPROVED PUMPING STATION REPORT.
2. AREA No.1 AS BOUNDED HAS A LAND AREA OF 9.0ha. A SIZEABLE PORTION IS ATTRIBUTED TO FUTURE STORMWATER MANAGEMENT FACILITY 'A' WHICH HAS YET TO BE DESIGNED. THE BALANCE OF THE LAND AREA IS ATTRIBUTED TO RESIDENTIAL AND ROADWAY USES. THE DEVELOPMENT AREA=6.10ha WITH POPULATION 610 IS TAKEN DIRECTLY FROM THE "BRIAR RIDGE SANITARY PUMP STATION PRE-DESIGN REPORT".
3. AREA No.2 CURRENTLY EXCLUDES A SMALL PARCEL OF LAND (±1.1ha) ON THE NORTH SIDE OF KLONDIKE ROAD BETWEEN SANDHILL ROAD AND SHIRLEY'S BROOK. THE CITY OF OTTAWA MAY CHOOSE TO EXPLORE SERVICING THIS PARCEL WITH A CONNECTION TO A FUTURE SANITARY SEWER WITHIN KLONDIKE ROAD. RESIDUAL FREE FLOW CAPACITY APPEARS TO EXIST IN THE SANITARY SEWER LINES TO THE PUMP STATION.
4. FOR AREAS No. 3, No. 5 AND No.6 THE POPULATION AND AREA VALUES HAVE BEEN UPDATED FROM THE NOVEMBER 2000 CCL REPORT "BRIAR RIDGE SANITARY PUMP STATION PRE-DESIGN REPORT" TO REFLECT THE LATEST LANDUSE PLANS.
5. ALL PIPE DISTANCES AND SLOPE VALUES IDENTIFIED ON THIS PLAN ARE NOMINAL.

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
9.	AS-BUILT	JAN 16/14	MAB
8.	ISSUED FOR MOE APPROVAL	NOV 09/06	MAB
7.	ISSUED TO CLIENT	OCT 10/06	MAB
6.	ISSUED FOR CONSTRUCTION	AUG 17/06	MAB
5.	ISSUED WITH MOE APPLICATION	AUG 08/06	MAB
4.	ISSUED FOR TENDER	MAY 26/06	MAB
3.	ISSUED FOR MOE APPROVAL	MAY 01/06	MAB
2.	REVISED PER CITY COMMENTS	APR 24/06	MAB
1.	ISSUED TO CITY FOR REVIEW	MAR 20/06	MAB

LICENSED PROFESSIONAL ENGINEER M.A. BISSETT PROVINCE OF ONTARIO

REGISTERED PROFESSIONAL ENGINEER J.G. RIDDELL PROVINCE OF ONTARIO

NOVATECH ENGINEERING CONSULTANTS LTD.
ENGINEERS & PLANNERS
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Email: novainfo@novatech-eng.com

DESIGN	MAB
CHECKED	SAY
DRAWN	SM
CHECKED	MAB
APPROVED	JGR
SCALE	1:2000

CITY OF OTTAWA

BROOKSIDE SUBDIVISION

BRIAR RIDGE PUMP STATION SANITARY DRAINAGE PLAN

PROJECT No. 103106-0

DATE AUGUST 2006

DRAWING No. 103106-SANI

PLAN8.DWG - 1000mmX707mm

Drawing:M:\2003\03106\CAD\design\03106san.dwg, Layout:SAN Updated NOV 09, 2006 at 3:32pm by smatthews

Appendix C

Watermain Boundary Conditions,
FUS Calculations, &
Modelling Results

Lucas Wilson

From: Schaeffer, Gabrielle <gabrielle.schaeffer@Ottawa.ca>
Sent: Friday, February 2, 2018 10:00 AM
To: Lucas Wilson
Cc: Mark Bissett
Subject: RE: 1055 Klondike Road - Boundary Conditions
Attachments: 1055 Klondike Rd - Boundary Conditions.pdf

Hi Lucas,

Please find the attached boundary conditions. Just as a reminder I want to mention that the applicant is to connect the watermains along Klondike Road (stub near March Rd. to stub near Sandhill) and 2 connections to this watermain is required from the proposed development.

Regards,
Gabrielle

From: Lucas Wilson [mailto:l.wilson@novatech-eng.com]
Sent: Tuesday, January 30, 2018 9:29 AM
To: Schaeffer, Gabrielle <gabrielle.schaeffer@Ottawa.ca>
Cc: Mark Bissett <m.bissett@novatech-eng.com>
Subject: 1055 Klondike Road - Boundary Conditions

Gabrielle,

We are looking for boundary conditions for a residential development consisting of approximately 12 singles and 72 towns. The boundary condition is located at the intersection of Sandhill Road and Klondike Road with connection to the existing 400mm watermain (see attached figure).

Water demands are as follows:
Average Day Demand: 0.953L/s
Max Day Demand: 2.382L/s
Peak Hour Demand: 5.240L/s

Residential fire flow for singles and towns are being capped at 167L/s. Since this is for Draft Plan Approval, we do not have detailed lot layouts at this time so there may be condos replacing some townhouse units therefore an additional fire flow of 250L/s is anticipated for potential condo blocks.
Fire Flow (singles, towns): 167L/s
Fire Flow (condos): 250L/s (based on past experience with similar condo blocks)

I have attached PDF's of the water demand as well as a location map for your review.

Let me know if you need any additional information.

Thanks,
Lucas Wilson, P.Eng., Project Coordinator | Engineering
NOVATECH
Engineers, Planners & Landscape Architects | 200-240 Michael Cowpland Drive, Ottawa, ON K2M 1P6

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Office 613.254.9643 x282 | **Fax** 613.254.5867 | **Email** l.wilson@novatech-eng.com
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Boundary Conditions 1055 Klondike Road

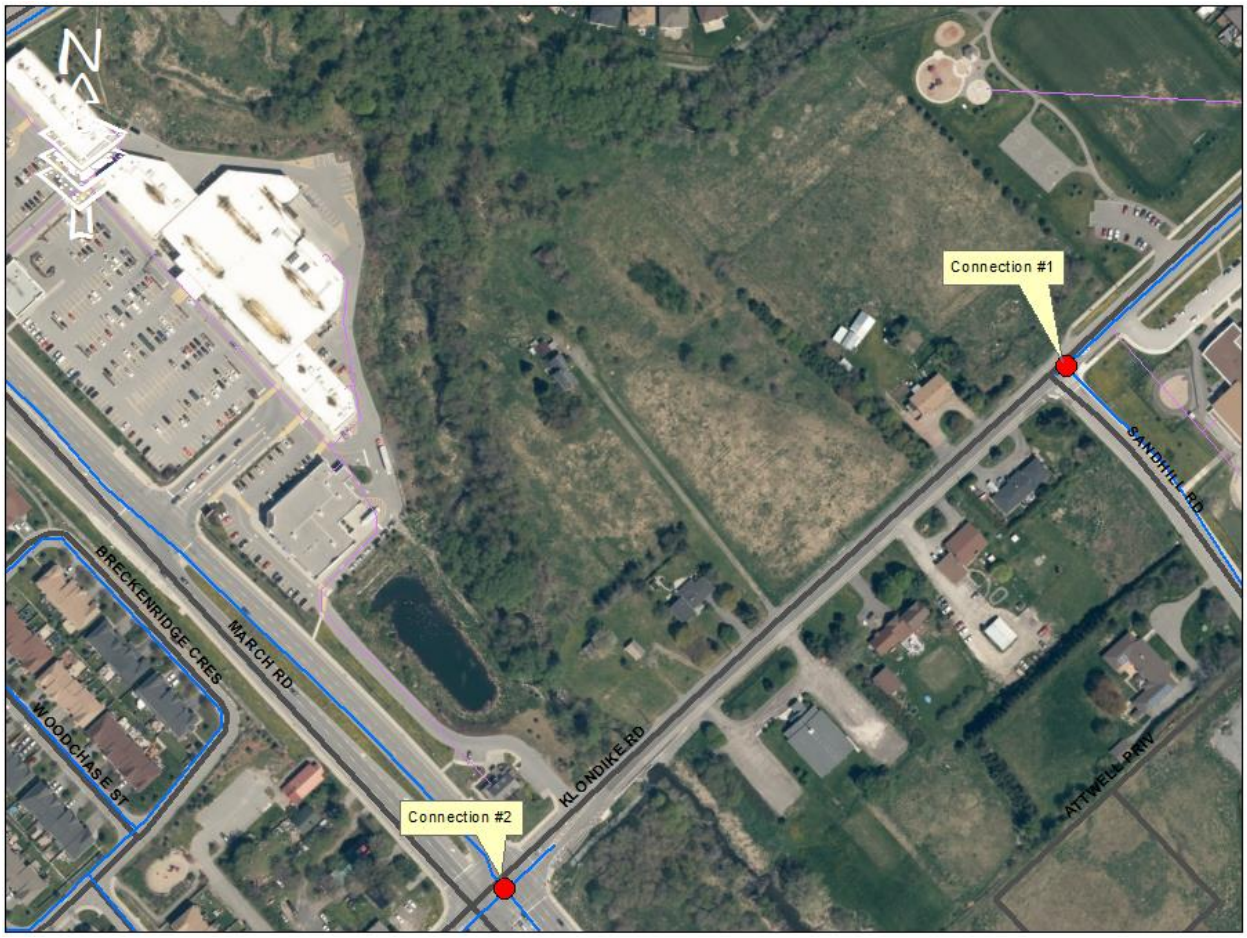
Information Provided

Date provided: 01 February 2018

Provided

Scenario	Demand	
	L/min	L/s
Average Daily Demand	57.18	1.0
Maximum Daily Demand	142.92	2.4
Peak Hour	314.4	5.2
Fire Flow Demand	10020	167.0
Fire Flow Demand	15000	250
# of connections	2	

Location



Results

Connection 1 - Klondike Rd and Sandhill Rd

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	131.5	80.7
Peak Hour	124.2	70.4
Max Day plus Fire (10,000 l/min)	122.0	67.2
Max Day plus Fire (15,000 l/min)	117.9	63.9

[1] Ground Elevation = 74.73 m

Connection 2 - March Rd and Klondike Rd

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	131.5	76.1
Peak Hour	124.2	65.7
Max Day plus Fire (10,000 l/min)	122.8	63.9
Max Day plus Fire (15,000 l/min)	117.9	61.4

[1] Ground Elevation = 77.920 m

Notes:

1. For the proposed number of housing units, two connections to city watermain are required according to City of Ottawa – Design Guidelines Water Distribution System.

Disclaimer

The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation. Fire Flow analysis is a reflection of available flow in the watermain; there may be additional restrictions that occur between the watermain and the hydrant that the model cannot take into account.

FUS - Fire Flow Calculations

As per 1999 Fire Underwriter's Survey Guidelines

NOVATECH
Engineers, Planners & Landscape Architects

Novatech Project #: 117034
Project Name: 1055 Klondike Road
Date: 26/07/2019
Input By: Lucas Wilson
Reviewed By: Mark Bissett

Building Description: Semi-Detached
Wood frame

Step			Input		Value Used	Total Fire Flow (L/min)
Base Fire Flow						
1	**Construction Material**			**Multiplier**		
	Coefficient related to type of construction **C**	Wood frame	Yes	1.5	1.5	
		Ordinary construction		1		
		Non-combustible construction		0.8		
		Modified Fire resistive construction (2 hrs)		0.6		
		Fire resistive construction (> 3 hrs)		0.6		
2	**Floor Area**					
	A	Building Footprint (m^2)	205			
		Number of Floors/Storeys	2			
		Area of structure considered (m^2)			**410**	
	F	**Base fire flow without reductions**				**7,000**
		F = 220 **C** (**A**)$^{0.5}$				
Reductions or Surcharges						
3	**Occupancy hazard reduction or surcharge**			**Reduction/Surcharge**		
	(1)	Non-combustible		-25%	-15%	**5,950**
		Limited combustible	Yes	-15%		
		Combustible		0%		
		Free burning		15%		
		Rapid burning		25%		
4	**Sprinkler Reduction**			**Reduction**		
	(2)	Adequately Designed System (NFPA 13)		-30%		**0**
		Standard Water Supply		-10%		
		Fully Supervised System		-10%		
				Cumulative Total	**0%**	
5	**Exposure Surcharge (cumulative %)**				**Surcharge**	
	(3)	North Side	0 - 3 m		25%	**3,570**
		East Side	20.1 - 30 m		10%	
		South Side	0 - 3 m		25%	
		West Side	> 45.1m		0%	
				Cumulative Total	**60%**	
Results						
6	**(1) + (2) + (3)**	**Total Required Fire Flow, rounded to nearest 1000L/min**			**L/min**	**10,000**
		(2,000 L/min < Fire Flow < 45,000 L/min)		or	L/s	**167**
				or	USGPM	2,642
7	**Storage Volume**	Required Duration of Fire Flow (hours)			Hours	2
		Required Volume of Fire Flow (m^3)			m^3	1200

FUS - Fire Flow Calculations

As per 1999 Fire Underwriter's Survey Guidelines

NOVATECH
Engineers, Planners & Landscape Architects

Novatech Project #: 117034
Project Name: 1055 Klondike Road
Date: 26/07/2019
Input By: Lucas Wilson
Reviewed By: Mark Bissett

Building Description: 4-Unit Townhouse Block
Wood frame

Step			Input		Value Used	Total Fire Flow (L/min)
Base Fire Flow						
1	**Construction Material**			**Multiplier**		
	Coefficient related to type of construction **C**	Wood frame	Yes	1.5	1.5	
		Ordinary construction		1		
		Non-combustible construction		0.8		
		Modified Fire resistive construction (2 hrs)		0.6		
		Fire resistive construction (> 3 hrs)		0.6		
2	**Floor Area**					
	A	Building Footprint (m^2)	375			
		Number of Floors/Storeys	2			
		Area of structure considered (m^2)			**750**	
	F	**Base fire flow without reductions**				**9,000**
		F = 220 **C** (**A**)$^{0.5}$				
Reductions or Surcharges						
3	**Occupancy hazard reduction or surcharge**			**Reduction/Surcharge**		
	(1)	Non-combustible		-25%	-15%	**7,650**
		Limited combustible	Yes	-15%		
		Combustible		0%		
		Free burning		15%		
		Rapid burning		25%		
4	**Sprinkler Reduction**			**Reduction**		
	(2)	Adequately Designed System (NFPA 13)		-30%		**0**
		Standard Water Supply		-10%		
		Fully Supervised System		-10%		
				Cumulative Total	**0%**	
5	**Exposure Surcharge (cumulative %)**				**Surcharge**	
	(3)	North Side	30.1- 45 m		5%	**4,590**
		East Side	3.1 - 10 m		20%	
		South Side	20.1 - 30 m		10%	
		West Side	0 - 3 m		25%	
				Cumulative Total	**60%**	
Results						
6	**(1) + (2) + (3)**	**Total Required Fire Flow, rounded to nearest 1000L/min**			**L/min**	**12,000**
		(2,000 L/min < Fire Flow < 45,000 L/min)		or	L/s	**200**
				or	USGPM	3,170
7	**Storage Volume**	Required Duration of Fire Flow (hours)			Hours	2.5
		Required Volume of Fire Flow (m^3)			m^3	1800

FUS - Fire Flow Calculations

As per 1999 Fire Underwriter's Survey Guidelines

NOVATECH
Engineers, Planners & Landscape Architects

Novatech Project #: 117034
Project Name: 1055 Klondike Road
Date: 26/07/2019
Input By: Lucas Wilson
Reviewed By: Mark Bissett

Building Description: 6-Unit Townhouse Block
Wood frame

Step			Input		Value Used	Total Fire Flow (L/min)
Base Fire Flow						
1	**Construction Material**			**Multiplier**		
	Coefficient related to type of construction **C**	Wood frame	Yes	1.5	1.5	
		Ordinary construction		1		
		Non-combustible construction		0.8		
		Modified Fire resistive construction (2 hrs)		0.6		
		Fire resistive construction (> 3 hrs)		0.6		
2	**Floor Area**					
	A	Building Footprint (m^2)	565			
		Number of Floors/Storeys	2			
		Area of structure considered (m^2)			**1,130**	
	F	**Base fire flow without reductions**				**11,000**
		F = 220 **C** (**A**)$^{0.5}$				
Reductions or Surcharges						
3	**Occupancy hazard reduction or surcharge**			**Reduction/Surcharge**		
	(1)	Non-combustible		-25%	-15%	**9,350**
		Limited combustible	Yes	-15%		
		Combustible		0%		
		Free burning		15%		
		Rapid burning		25%		
4	**Sprinkler Reduction**			**Reduction**		
	(2)	Adequately Designed System (NFPA 13)		-30%		**0**
		Standard Water Supply		-10%		
		Fully Supervised System		-10%		
				Cumulative Total	**0%**	
5	**Exposure Surcharge (cumulative %)**				**Surcharge**	
	(3)	North Side	0 - 3 m		25%	**6,545**
		East Side	10.1 - 20 m		15%	
		South Side	0 - 3 m		25%	
		West Side	30.1- 45 m		5%	
				Cumulative Total	**70%**	
Results						
6	**(1) + (2) + (3)**	**Total Required Fire Flow, rounded to nearest 1000L/min**			**L/min**	**16,000**
		(2,000 L/min < Fire Flow < 45,000 L/min)		or	L/s	**267**
				or	USGPM	4,227
7	**Storage Volume**	Required Duration of Fire Flow (hours)			Hours	3.5
		Required Volume of Fire Flow (m^3)			m^3	3360

FUS - Fire Flow Calculations

As per 1999 Fire Underwriter's Survey Guidelines

NOVATECH
Engineers, Planners & Landscape Architects

Novatech Project #: 117034
Project Name: 1055 Klondike Road
Date: 26/07/2019
Input By: Lucas Wilson
Reviewed By: Mark Bissett

Building Description: Condo Block
Wood frame

Step			Input		Value Used	Total Fire Flow (L/min)
Base Fire Flow						
1	**Construction Material**			**Multiplier**		
	Coefficient related to type of construction **C**	Wood frame	Yes	1.5	1.5	
		Ordinary construction		1		
		Non-combustible construction		0.8		
		Modified Fire resistive construction (2 hrs)		0.6		
		Fire resistive construction (> 3 hrs)		0.6		
2	**Floor Area**					
	A	Building Footprint (m^2)	485			
		Number of Floors/Storeys	3			
		Area of structure considered (m^2)			**1,455**	
	F	**Base fire flow without reductions**				**13,000**
		F = 220 **C** (**A**)$^{0.5}$				
Reductions or Surcharges						
3	**Occupancy hazard reduction or surcharge**			**Reduction/Surcharge**		
	(1)	Non-combustible		-25%	-15%	**11,050**
		Limited combustible	Yes	-15%		
		Combustible		0%		
		Free burning		15%		
		Rapid burning		25%		
4	**Sprinkler Reduction**			**Reduction**		
	(2)	Adequately Designed System (NFPA 13)		-30%		**0**
		Standard Water Supply		-10%		
		Fully Supervised System		-10%		
				Cumulative Total	**0%**	
5	**Exposure Surcharge (cumulative %)**				**Surcharge**	
	(3)	North Side	10.1 - 20 m		15%	**3,868**
		East Side	10.1 - 20 m		15%	
		South Side	> 45.1m		0%	
		West Side	30.1- 45 m		5%	
				Cumulative Total	**35%**	
Results						
6	**(1) + (2) + (3)**	**Total Required Fire Flow, rounded to nearest 1000L/min**			**L/min**	**15,000**
		(2,000 L/min < Fire Flow < 45,000 L/min)		or	L/s	**250**
				or	USGPM	3,963
7	**Storage Volume**	Required Duration of Fire Flow (hours)			Hours	3
		Required Volume of Fire Flow (m^3)			m^3	2700

1055 KLONDIKE ROAD
Water Demand

	Area (ha)	Units	Population	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)
Semi-Detached	N/A	12	41	0.132	0.331	0.727
Towns	N/A	46	124	0.403	1.006	2.214
Condo	N/A	56	101	0.327	0.817	1.797
Total	**0.00**	**114**	**266**	**0.861**	**2.153**	**4.738**

Water Demand Parameters

Singles	3.4	ppl/unit
Towns	2.7	ppl/unit
Condo	1.8	ppl/unit
Residential Demand	280	L/c/day
Residential Max Day	2.5	x Avg Day
Residential Peak Hour	2.2	x Max Day
Residential Fire Flow	167/250	L/s

1055 Klondike Road - Watermain Demand

Node	Semi-Detached	Towns	Condo	Total Population	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)	Fire Flow (L/s)
NODE1				0	0.000	0.000	0.000	N/A
NODE2		24		65	0.210	0.525	1.155	167
NODE3		12		32	0.105	0.263	0.578	167
NODE4	12	10		68	0.220	0.549	1.208	167
NODE5				0	0.000	0.000	0.000	N/A
NODE6			56	101	0.327	0.817	1.797	250
Total	**12**	**46**	**56**	**266**	**0.861**	**2.153**	**4.738**	

Water Demand Parameters

Singles	3.4	Residential Max Day	2.5	x Avg Day
Towns	2.7	Residential Peak Hour	2.2	x Max Day
Condo	1.8	Residential Fire Flow	167	L/s
Residential Demand	280	Condo Fire Flow	250	L/s

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1055 Klondike Road - Watermain Analysis

Network Table - Nodes - (Peak Hour)

Node ID	Elevation m	Demand LPS	Head m	Pressure m	Pressure kPa	Pressure psi
Junc NODE1	77.8	0	124.2	46.45	455.67	66.09
Junc NODE2	77.6	1.15	124.2	46.6	457.15	66.30
Junc NODE3	77	0.58	124.19	47.19	462.93	67.14
Junc NODE4	76.65	1.21	124.19	47.54	460.00	66.72
Junc NODE5	77.6	0	124.2	46.6	450.00	65.27
Junc NODE6	78	1.8	124.2	46.2	453.22	65.73
Resvr RES1	124.2	-4.74	124.2	0	0.00	0.00

Network Table - Links - (Peak Hour)

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe P1	117	400	120	4.74	0.04	0.01	0.036
Pipe P2	43	204	110	2.94	0.09	0.08	0.041
Pipe P3	78	204	110	1.79	0.05	0.03	0.044
Pipe P4	40	204	110	1.21	0.04	0.02	0.047
Pipe P5	54	400	120	1.80	0.01	0.00	0.047
Pipe P6	75	204	110	-1.80	0.05	0.03	0.044

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1055 Klondike Road - Watermain Analysis

Network Table - Nodes - (Max Pressure Check)

Node ID	Elevation m	Demand LPS	Head m	Pressure m	Pressure kPa	Pressure psi	Age Hours
Junc NODE1	77.75	0	131.5	53.75	527.29	76.48	4.74
Junc NODE2	77.6	0.21	131.5	53.9	528.76	76.69	5.47
Junc NODE3	77	0.1	131.5	54.5	534.65	77.54	7.65
Junc NODE4	76.65	0.22	131.5	54.85	538.08	78.04	9.3
Junc NODE5	77.6	0	131.5	53.9	528.76	76.69	10.45
Junc NODE6	78	0.33	131.5	53.5	524.84	76.12	13.09
Resvr RES1	131.5	-0.86	131.5	0	0.00	0.00	0

Network Table - Links - (Max Pressure Check)

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe P1	117	400	120	0.86	0.01	0.00	0.040
Pipe P2	43	204	110	0.53	0.02	0.00	0.055
Pipe P3	78	204	110	0.33	0.01	0.00	0.058
Pipe P4	40	204	110	0.22	0.01	0.00	0.062
Pipe P5	54	400	120	0.33	0.00	0.00	0.202
Pipe P6	75	204	110	-0.33	0.01	0.00	0.055

1055 Klondike Road - Watermain Analysis

Network Table - Nodes - (Fire Flow Summary)

Fire Flow		Minimum Pressure		
Node	Flow (L/s)	Pressure (kPa)	Pressure (PSI)	Node
NODE2	167	348.06	50.48	NODE3
NODE3	167	249.08	36.13	NODE4
NODE4	167	240.84	34.93	NODE4
NODE6	250	142.93	20.73	NODE6

1055 Klondike Road - Watermain Analysis

Network Table - Nodes (Max Day + FF 'Node2')

Node ID	Elevation m	Demand LPS	Head m	Pressure m	Pressure kPa	Pressure psi
Junc NODE1	77.75	0	121.43	43.68	428.50	62.15
Junc NODE2	77.6	95.53	114.97	37.37	366.60	53.17
Junc NODE3	77	72.26	112.48	35.48	348.06	50.48
Junc NODE4	76.65	0.55	112.48	35.83	351.49	50.98
Junc NODE5	77.6	0	121.43	43.83	429.97	62.36
Junc NODE6	78	0.82	121.43	43.43	426.05	61.79
Resvr RES1	122	-169.15	122	0	0.00	0.00

Network Table - Links (Max Day + FF 'Node2')

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe P1	117	400	120	169.15	1.35	4.86	0.021
Pipe P2	43	204	110	168.34	5.15	150.33	0.023
Pipe P3	78	204	110	72.81	2.23	31.84	0.026
Pipe P4	40	204	110	0.55	0.02	0.00	0.053
Pipe P5	54	400	120	0.82	0.01	0.00	0.032
Pipe P6	75	204	110	-0.82	0.02	0.01	0.050

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1055 Klondike Road - Watermain Analysis

Network Table - Nodes (Max Day + FF 'Node3')

Node ID	Elevation m	Demand LPS	Head m	Pressure m	Pressure kPa	Pressure psi
Junc NODE1	77.75	0	121.43	43.68	428.50	62.15
Junc NODE2	77.6	0.52	114.97	37.37	366.60	53.17
Junc NODE3	77	95.26	103.31	26.31	258.10	37.43
Junc NODE4	76.65	72.55	102.04	25.39	249.08	36.13
Junc NODE5	77.6	0	121.43	43.83	429.97	62.36
Junc NODE6	78	0.82	121.43	43.43	426.05	61.79
Resvr RES1	122	-169.15	122	0	0.00	0.00

Network Table - Links (Max Day + FF 'Node3')

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe P1	117	400	120	169.15	1.35	4.86	0.021
Pipe P2	43	204	110	168.34	5.15	150.33	0.023
Pipe P3	78	204	110	167.81	5.13	149.46	0.023
Pipe P4	40	204	110	72.55	2.22	31.63	0.026
Pipe P5	54	400	120	0.82	0.01	0.00	0.032
Pipe P6	75	204	110	-0.82	0.02	0.01	0.050

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Engineers, Planners & Landscape Architects

1055 Klondike Road - Watermain Analysis

Network Table - Nodes (Max Day + FF 'Node4')

Node ID	Elevation m	Demand LPS	Head m	Pressure m	Pressure kPa	Pressure psi
Junc NODE1	77.75	0	121.43	43.68	428.50	62.15
Junc NODE2	77.6	0.52	114.97	37.37	366.60	53.17
Junc NODE3	77	72.26	103.31	26.31	258.10	37.43
Junc NODE4	76.65	95.55	101.2	24.55	240.84	34.93
Junc NODE5	77.6	0	121.43	43.83	429.97	62.36
Junc NODE6	78	0.82	121.43	43.43	426.05	61.79
Resvr RES1	122	-169.15	122	0	0.00	0.00

Network Table - Links (Max Day + FF 'Node4')

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe P1	117	400	120	169.15	1.35	4.86	0.021
Pipe P2	43	204	110	168.34	5.15	150.33	0.023
Pipe P3	78	204	110	167.81	5.13	149.46	0.023
Pipe P4	40	204	110	95.55	2.92	52.67	0.025
Pipe P5	54	400	120	0.82	0.01	0.00	0.032
Pipe P6	75	204	110	-0.82	0.02	0.01	0.050

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1055 Klondike Road - Watermain Analysis

Network Table - Nodes (Max Day + FF 'Node6')

Node ID	Elevation m	Demand LPS	Head m	Pressure m	Pressure kPa	Pressure psi
Junc NODE1	77.75	0	116.71	38.96	382.20	55.43
Junc NODE2	77.6	0.52	116.71	39.11	383.67	55.65
Junc NODE3	77	0.26	116.71	39.71	389.56	56.50
Junc NODE4	76.65	0.55	116.71	40.06	392.99	57.00
Junc NODE5	77.6	0	116.17	38.57	378.37	54.88
Junc NODE6	78	250.82	92.57	14.57	142.93	20.73
Resvr RES1	117.9	-252.15	117.9	0	0.00	0.00

Network Table - Links (Max Day + FF 'Node6')

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe P1	117	400	120	252.15	2.01	10.18	0.020
Pipe P2	43	204	110	1.34	0.04	0.02	0.046
Pipe P3	78	204	110	0.81	0.02	0.01	0.050
Pipe P4	40	204	110	0.55	0.02	0.00	0.053
Pipe P5	54	400	120	250.82	2.00	10.08	0.020
Pipe P6	75	204	110	-250.82	7.67	314.61	0.021

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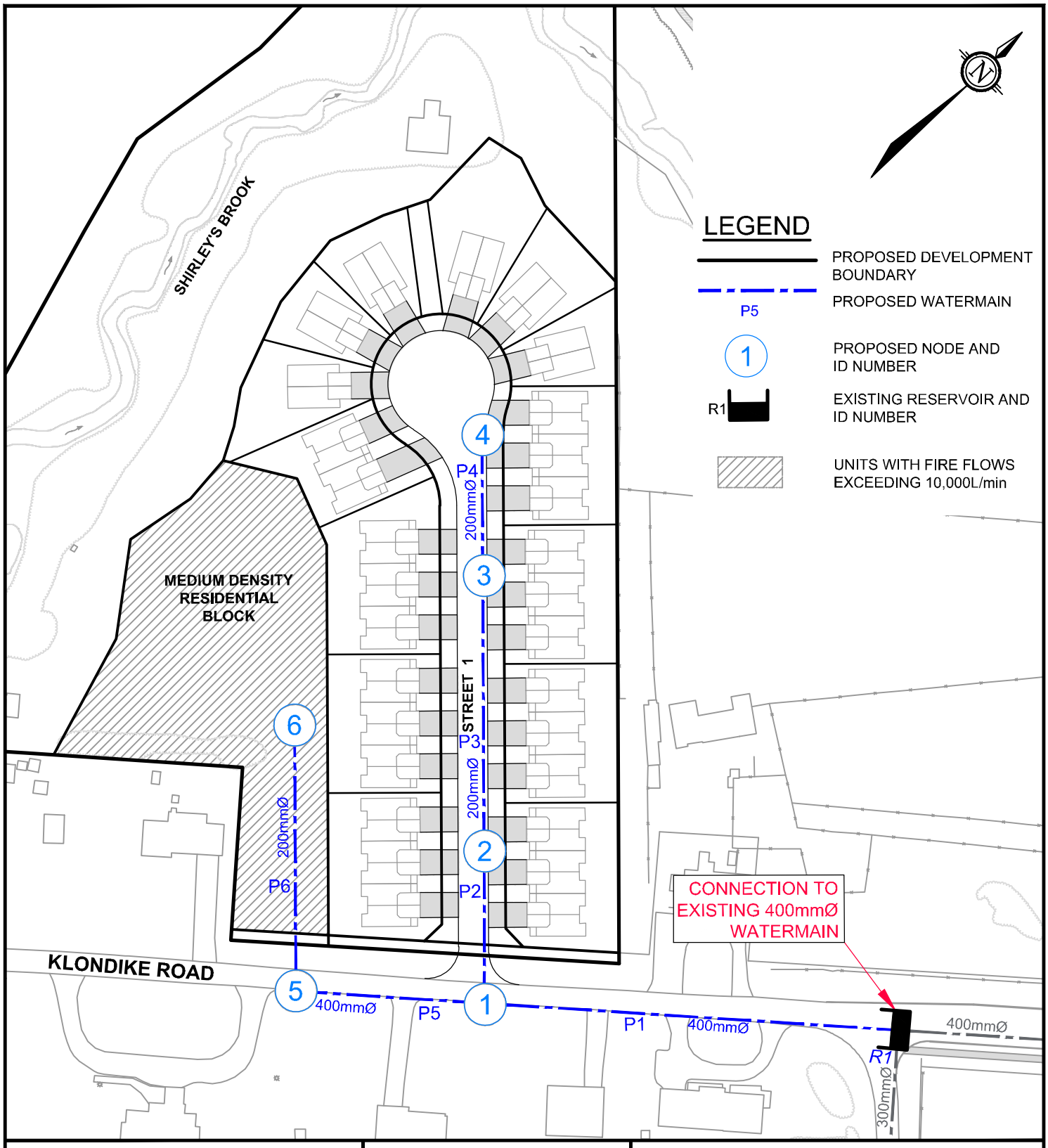

NOVATECH
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Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

CITY OF OTTAWA
1055 KLONDIKE ROAD

HYDRAULIC ANALYSIS LAYOUT

SCALE 1 : 1500 (0, 15, 30, 45, 60)

DATE	JOB	FIGURE
JULY 2019	117034	FIG-WM

SHT8X11.DWG - 216mmx279mm

M:\2017\117034\CAD\Design\Figures\Design Brief\117034-NodeNetwork.dwg, WM, Jul 24, 2019 - 3:20pm, lwilson

Appendix D

STM Design Sheets, SWM Excerpts &
PCSWMM Modelling Info

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
12.	AS-BUILT	JAN 16/14	MAB
11.	ISSUED WITH MOE APPLICATION - PHASE 2	OCT 31/07	MAB
10.	PHASE 2 DESIGN REVISIONS	MAY 02/07	MAB
9.	BRIAR RIDGE DRAINAGE AREA ADDED	NOV 17/06	MAB
8.	ISSUED FOR MOE APPROVAL	NOV 09/06	MAB
7.	ISSUED TO CLIENT	OCT 10/06	MAB
6.	ISSUED FOR CONSTRUCTION	AUG 17/06	MAB
5.	ISSUED WITH MOE APPLICATION	AUG 08/06	MAB
4.	ISSUED FOR TENDER	MAY 26/06	MAB
3.	ISSUED FOR MOE APPROVAL	MAY 01/06	MAB
2.	REVISED PER CITY COMMENTS	APR 24/06	MAB
1.	ISSUED TO CITY FOR REVIEW	MAR 20/06	MAB

LICENSED PROFESSIONAL ENGINEER — M.A. BISSETT — PROVINCE OF ONTARIO

REGISTERED PROFESSIONAL ENGINEER — J.G. RIDDELL — PROVINCE OF ONTARIO

NOVATECH ENGINEERING CONSULTANTS LTD.
ENGINEERS & PLANNERS
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada
K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Email: novainfo@novatech-eng.com

DESIGN	MAB
CHECKED	SAY
DRAWN	SM
CHECKED	MAB
APPROVED	JGR

SCALE 1:2000

CITY OF OTTAWA

BROOKSIDE SUBDIVISION

SWM FACILITIES
STORM DRAINAGE AREA PLAN

PROJECT No. 103106-0

DATE AUGUST 2005

DRAWING No. 103106-STMI

PLANBLDWG - 1000mmX707mm

Drawing:M:\2003\103106\CAD\design\103106stm.dwg Layout:STM Updated: MAY 01, 2007 at 4:28pm by: smatheson

STORM SEWER: HYDRAULIC GRADE LINE ANALYSIS (100-YEAR EVENT - ULTIMATE CONDITION)

This spreadsheet uses the Darcy-Weisbach equation to calculate hydraulic losses through a pipe network with a specified flow rate. Minor losses are accounted for including both pipe bend losses and structure losses.
The spreadsheet returns the upstream hydraulic grade line if surcharged, or the pipe obvert if free flow conditions exist. The slope of the HGL is calculated and the minimum USF elevations can be established +0.30m above the HGL.
The theoretical 100-year event storm sewer peak flows will be controlled to the actual 5-year flow rates using various roadway inlet controls within CBs. Additional flows will be directed using overland flow routes.
The Ultimate Condition accounts for the entire drainage areas flowing through the completed storm sewer network.

LOCATION	MANHOLE		INVERT ELEVATION		GROUND ELEVATION	COVER	PIPE PARAMETERS			TOTAL FLOW	Q_{cap}	Q_{in}/Q_{cap}	COMPUTATIONAL COLUMNS					HEAD LOSS	SURCHARGE	HGL			PIPE SLOPE	MIN. USF ELEVATION
	Upstream	Downstream	U/S (m)	D/S (m)	Upstream (m)	Upstream (m)	Dia (mm)	Length (m)	'n'	(m^3/s)	(m^3/s)		Pipe Area (m^2)	L/D	Friction Factor (f)	Velocity V (m/s)	$V^2/2g$	HL (m)	Upstream (m)	U/S (m)	D/S (m)	SLOPE (%)	(%)	Upstream (m)
KLONDIKE ROAD																				67.57	<- OUTLET TO POND			
	FUT.MH C	OUTLET	65.93	65.90	67.95	0.670	1350	13.80	0.013	1.714	2.596	0.66	1.478	10	0.01905	1.16	0.07	0.05	0.34	67.62	67.57	0.35	0.14	67.92
	FUT.MH B	FUT.MH C	66.02	65.93	68.55	1.180	1350	51.00	0.013	1.738	2.339	0.74	1.478	38	0.01905	1.18	0.07	0.09	0.34	67.71	67.62	0.17	0.13	68.01
	FUT.MH A	FUT.MH B	66.24	66.05	68.87	1.280	1350	117.00	0.013	1.797	2.244	0.80	1.478	87	0.01905	1.22	0.08	0.14	0.26	67.85	67.71	0.12	0.13	68.15
	MH 153	FUT.MH A	66.40	66.24	70.01	2.260	1350	108.50	0.013	1.447	2.138	0.68	1.478	80	0.01905	0.98	0.05	0.09	0.19	67.94	67.85	0.08	0.13	68.24
	MH 154	MH 153	66.63	66.55	70.18	2.350	1200	39.90	0.013	1.441	1.821	0.79	1.167	33	0.01981	1.23	0.08	0.07	0.17	68.00	67.94	0.17	0.20	68.30
PHASE2																								
	MH 163	MH 154	66.97	66.90	70.25	2.380	900	65.0	0.013	0.180	0.620	0.29	0.657	72	0.02181	0.27	0.00	0.01	0.14	68.01	68.00	0.01	0.11	68.31
	MH 164	MH 163	67.33	67.27	69.82	1.890	600	41.5	0.013	0.159	0.244	0.65	0.292	69	0.02496	0.54	0.02	0.04	0.12	68.05	68.01	0.09	0.14	68.35
	MH 165	MH 164	67.59	67.41	70.15	2.035	525	110.0	0.013	0.161	0.181	0.89	0.223	210	0.02610	0.72	0.03	0.15	0.09	68.20	68.05	0.14	0.16	68.50
	MH 166	MH 165	67.87	67.67	70.50	2.180	450	90.3	0.013	0.126	0.140	0.90	0.164	201	0.02747	0.77	0.03	0.19	0.08	68.40	68.20	0.21	0.22	68.70
	MH 167	MH 166	68.25	68.02	70.50	1.950	300	66.4	0.013	0.045	0.059	0.75	0.073	221	0.03145	0.61	0.02	0.13	0.00	68.55	68.40	0.23	0.35	68.85
KLONDIKE ROAD																								
	MH 155	MH 154	66.78	66.63	70.12	2.140	1200	117.00	0.013	1.335	1.456	0.92	1.167	98	0.01981	1.14	0.07	0.14	0.17	68.15	68.00	0.11	0.13	68.45
	MH 156	MH 155	66.90	66.78	70.39	2.290	1200	91.30	0.013	1.279	1.475	0.87	1.167	76	0.01981	1.10	0.06	0.10	0.15	68.25	68.15	0.11	0.13	68.55
	MH 157	MH 156	67.03	66.90	70.29	2.060	1200	97.00	0.013	1.214	1.489	0.82	1.167	81	0.01981	1.04	0.06	0.10	0.12	68.35	68.25	0.10	0.13	68.65
MARCONI AVENUE																								
	MH 160	MH 157	68.08	67.78	70.64	2.110	450	120.00	0.013	0.129	0.149	0.87	0.164	267	0.02747	0.79	0.03	0.28	0.10	68.63	68.35	0.23	0.25	68.93
	MH 161	MH 160	68.35	68.23	70.87	2.220	300	23.90	0.013	0.023	0.071	0.32	0.073	80	0.03145	0.32	0.01	0.01	0.00	68.65	68.63	0.10	0.50	68.95
	MH 162	MH 161	68.50	68.38	71.50	2.700	300	24.60	0.013	0.000	0.070	0.00	0.073	82	0.03145	0.00	0.00	0.00	0.00	68.80	68.68	0.49	0.49	69.10
KLONDIKE ROAD																								
	MH 158	MH 157	68.30	67.40	71.78	2.655	825	120.00	0.013	1.064	1.297	0.82	0.552	145	0.02245	1.93	0.19	0.66	0.00	69.13	68.35	0.65	0.75	69.43
	MH 159	MH 158	68.90	68.30	74.79	5.065	825	94.00	0.013	0.932	1.196	0.78	0.552	114	0.02245	1.69	0.15	0.40	0.00	69.73	69.13	0.64	0.64	70.03
TER LEVEL at Outlet = 67.57m																								

1055 Klondike Road
Maple Leaf Homes
Project No.: 117034

STORM SEWER DESIGN SHEET
(Maple Leaf Homes)
FLOW RATES BASED ON RATIONAL METHOD

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LOCATION				AREA (ha)			FLOW							TOTAL FLOW	SEWER DATA							
Street	Catchment ID	From Manhole	To Manhole	Area (ha)	C	AC (ha)	Indiv 2.78 AC	Accum 2.78 AC	Time of Concentration	Rainfall Intensity 2 Year (mm/hr)	Rainfall Intensity 5 Year (mm/hr)	Rainfall Intensity 10 Year (mm/hr)	Peak Flow (L/s)	Total Peak Flow, Q (L/s)	Dia. (m) Actual	Dia. (mm)	Type	Slope (%)	Length (m)	Capacity (L/s)	Velocity (m/s)	Flow Time (min)	Ratio Q/Q full
						0.00	0.000	0.000	10.00													
Street 1	**A1**	8	6	0.72	0.57	0.41	1.141	1.141	10.00		104.19		118.9	118.9	0.381	375	PVC	1.00	21.9	182.8	1.60	0.23	65%
						0.00	0.000	0.000	10.00													
						0.00	0.000	0.000	10.23													
Street 1	**A2, A3, A6**	6	4	0.65	0.50	0.33	0.904	2.044	10.23		103.01		210.6	210.6	0.533	525	Conc	0.50	57.5	317.0	1.42	0.68	66%
						0.00	0.000	0.000	10.23													
						0.00	0.000	0.000	10.90													
Street 1	**A3, A4**	4	2	0.44	0.72	0.32	0.881	2.925	10.90		99.65		291.5	291.5	0.610	600	Conc	0.40	101.7	404.9	1.39	1.22	72%
						0.00	0.000	0.000	10.90													
						0.00	0.000	0.000	10.00													
	A8	12	10	0.60	0.80	0.48	1.334	1.334	10.00		104.19		139.0	139.0	0.457	450	Conc	0.40	89.9	188.0	1.14	1.31	74%
						0.00	0.000	0.000	10.00													
						0.00	0.000	0.000	11.31													
Klondike Road		10	2			0.00	0.000	1.334	11.31		97.75		130.4	130.4	0.533	525	Conc	1.00	53.4	448.4	2.01	0.44	29%
						0.00	0.000	0.000	11.31													
						0.00	0.000	0.000	12.13													
Klondike Road	**EXT-1**	2	EXMH 159	0.36	0.65	0.23	0.651	4.910	12.13		94.17		462.4	462.4	0.686	675	Conc	1.00	117.1	876.4	2.37	0.82	53%
						0.00	0.000	0.000	12.13													
									12.95													

Q = 2.78 AIC, where	**Consultant:**		**Novatech**
Q = Peak Flow in Litres per Second (L/s)	**Date:**		July 26, 2019
A = Area in hectares (ha)	**Design By:**		Lucas Wilson
I = Rainfall Intensity (mm/hr), 5 year storm	**Client:**	**Dwg. Reference:**	**Checked By:**
C = Runoff Coefficient	Maple Leaf Homes	Figure 7 - Storm Sewer Layout (Design Brief)	MAB

Legend:

*	Indicates 100 Year intensity for storm sewers
10.00	Storm sewers designed to the 2 year event (without ponding) for local roads
10.00	Storm sewers designed to the 5 year event (without ponding) for collector roads
10.00	Storm sewers designed to the 10 year event (without ponding) for arterial roads

1055 Klondike - Maple Leaf Homes (117034)
PCSWMM Subcatchment Parameters

NOVATECH
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Area ID	Catchment Area (ha)	Runoff Coefficient	Percent Impervious (%)	Zero Impervious (%)	Equivalent Width (m)	Flow Length (m)	Average Slope (%)
A01	0.72	0.57	53.0	50	365	19.7	1.0
A02	0.17	0.68	68.0	50	80	21.3	1.0
A03	0.31	0.72	74.0	50	175	17.7	1.0
A04	0.14	0.69	70.0	50	75	18.7	1.0
A05	0.21	0.46	37.0	90	125	16.8	1.0
A06	0.27	0.46	37.0	90	160	16.9	1.0
A07	0.02	0.55	50.0	0	20	10.0	3.0
A08	0.60	0.80	86.0	50	215	27.9	1.0
Total	**2.44**	**0.64**	**62.6**	-	-	-	-

1055 Klondike - Maple Leaf Homes (117034)
Conceptual PCSWMM Model: Equivalent Orifice Sizing (85 L/s/ha)

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Equivalent Orifice Sizing for 85 L/s/ha Flow Rate (allowable release rate)

Name	Inlet / Outlet Node	Area ID	Drainage Area (ha)	85 L/s/ha Flow Rate[1] (L/s)	Static Ponding Depth (m)	Artificial Orifice Dia.[2] (m)
Orifices (Inlets In-Sag's / RYCB's)						
OR-CB07	CB07	A01	0.72	61.2	0.28	0.149
OR-CB03/04	CB03/04	A03	0.31	26.4	0.10	0.101
OR-CBMH169	CBMH169	A05	0.21	17.9	0.30	0.080
OR-CBMH172	CBMH172	A06	0.27	23.0	0.30	0.091
OR-Site_Plan_CB	Site_Plan_CB	A08	0.60	51.0	0.30	0.136
Orifices (Inlets On-Grade)						
OUT-CB05/06	CB05/06	A02	0.17	14.5	-	-
OUT-CB01/02	CB01/02	A04	0.14	11.9	-	-
TOTAL			**2.42**	**205.7**		**-**

[1] *Flow rate = drainage area (ha) x 85 L/s/ha (allowable release rate)*

[2] *Equivalent orifice diameter corresponding to 85 L/s/ha flow rate; based on 1.40m + static ponding depth.*

1055 Klondike – Maple Leaf Homes (117034)
PCSWMM Model Schematic

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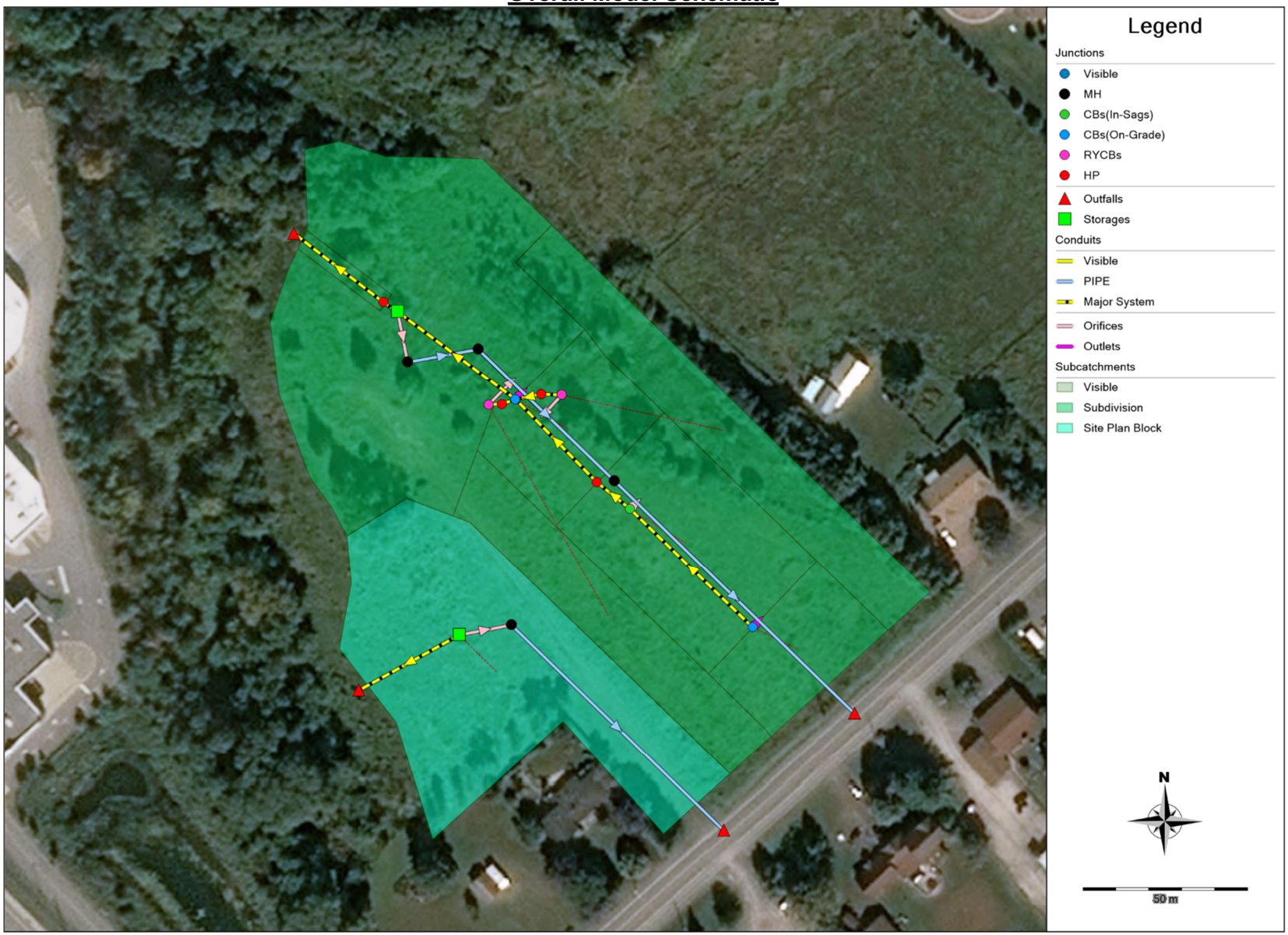
Overall Model Schematic



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1055 Klondike – Maple Leaf Homes (117034)
PCSWMM Model Schematic

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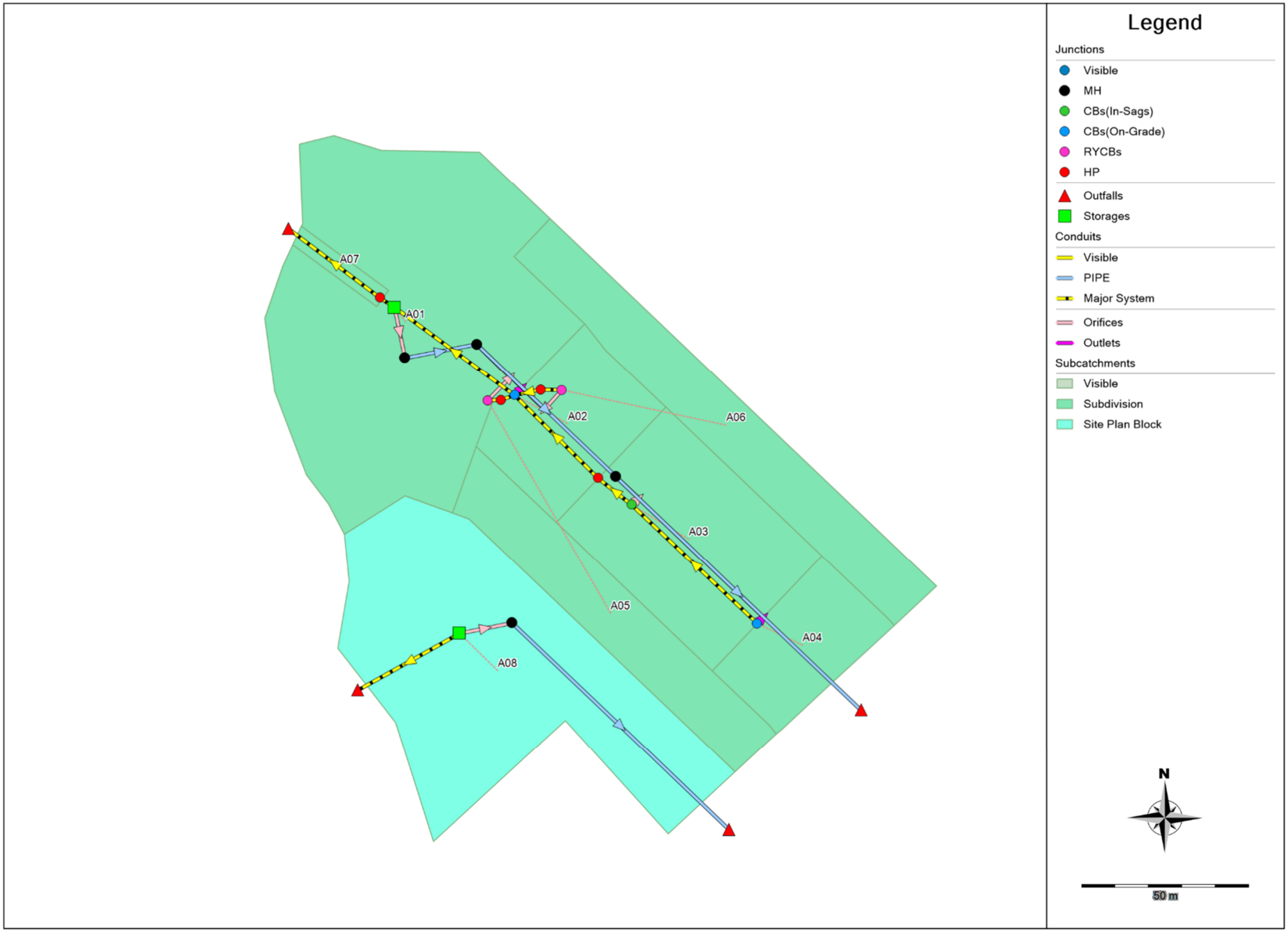
Subcatchments (ID's)



Date: 2019-07-26
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1055 Klondike – Maple Leaf Homes (117034)
PCSWMM Model Schematic

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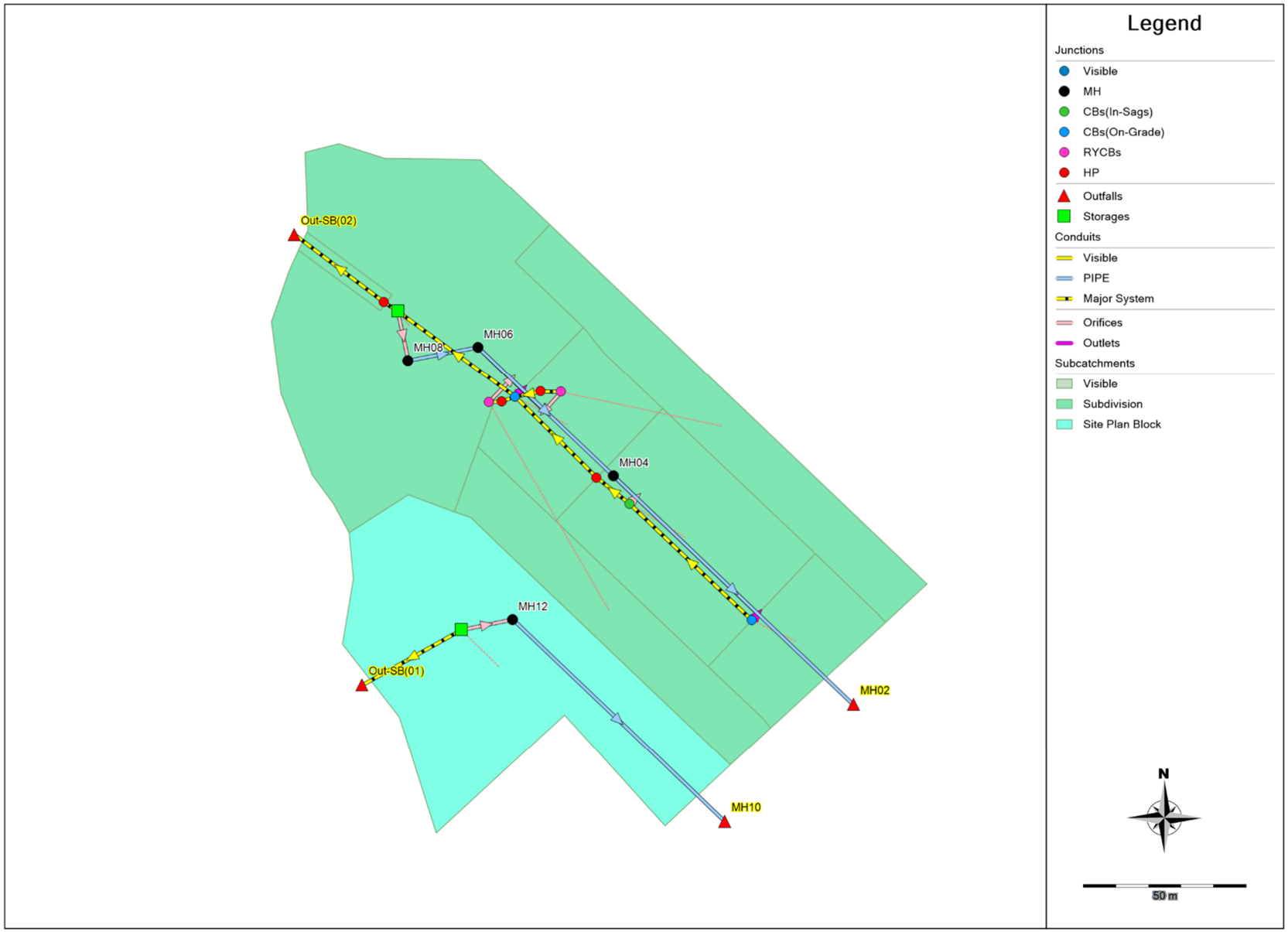
Nodes (MH ID's)



Date: 2019-07-26
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```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.013)
--------------------------------------------------------------

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WARNING 02: maximum depth increased for Node CB03/04

*************
Element Count
*************
Number of rain gages ...... 1
Number of subcatchments ... 8
Number of nodes ........... 19
Number of links ........... 22
Number of pollutants ...... 0
Number of land uses ....... 0


****************
Raingage Summary
****************
                                                 Data       Recording
Name                 Data Source                 Type       Interval
------------------------------------------------------------------------
Raingage             C3hr-100yr                  INTENSITY   10 min.


********************
Subcatchment Summary
********************
Name                         Area     Width   %Imperv    %Slope Rain Gage            Outlet
------------------------------------------------------------------------------------------------
A01                          0.72    365.00     53.00    1.0000 Raingage             CB07
A02                          0.17     80.00     68.00    1.0000 Raingage             CB05/06
A03                          0.31    175.00     74.00    1.0000 Raingage             CB03/04
A04                          0.14     75.00     70.00    1.0000 Raingage             CB01/02
A05                          0.21    125.00     37.00    1.0000 Raingage             CBMH169
A06                          0.27    160.00     37.00    1.0000 Raingage             CBMH172
A07                          0.02     20.00     50.00    3.0000 Raingage             HP01
A08                          0.60    215.00     86.00    1.0000 Raingage             Site_Plan_CB


************
Node Summary
************
```

```
                                    Invert      Max.    Ponded    External
Name                 Type            Elev.     Depth      Area    Inflow
------------------------------------------------------------------------
CB01/02              JUNCTION        77.55      1.00       0.0
CB03/04              JUNCTION        75.63      2.40       0.0
CB05/06              JUNCTION        76.74      1.00       0.0
CBMH169              JUNCTION        75.37      2.40       0.0
CBMH172              JUNCTION        75.59      2.40       0.0
HP01                 JUNCTION        76.43      1.00       0.0
HP02                 JUNCTION        77.13      1.00       0.0
HP-CBMH169           JUNCTION        77.07      1.00       0.0
HP-CBMH172           JUNCTION        77.29      1.00       0.0
MH04                 JUNCTION        70.65      6.54       0.0
MH06                 JUNCTION        71.00      5.65       0.0
MH08                 JUNCTION        71.38      4.99       0.0
MH12                 JUNCTION        71.29      7.01       0.0
MH02                 OUTFALL         70.25      0.60       0.0
MH10                 OUTFALL         70.93      0.45       0.0
Out-SB(01)           OUTFALL         78.30      1.00       0.0
Out-SB(02)           OUTFALL         75.35      1.00       0.0
CB07                 STORAGE         74.75      2.40       0.0
Site_Plan_CB         STORAGE         76.60      2.40       0.0


************
Link Summary
************
Name                 From Node        To Node          Type            Length    %Slope Roughness
---------------------------------------------------------------------------------------------------
1                    CBMH172          HP-CBMH172       CONDUIT            3.0  -10.0504    0.0350
2                    HP-CBMH172       CB05/06          CONDUIT            3.0   18.6494    0.0350
3                    CBMH169          HP-CBMH169       CONDUIT            3.0  -10.0504    0.0350
4                    HP-CBMH169       CB05/06          CONDUIT            3.0   11.0672    0.0350
6                    Site_Plan_CB     Out-SB(01)       CONDUIT            3.0  -10.0504    0.0150
MH04-MH02            MH04             MH02             CONDUIT          101.7    0.3932    0.0130
MH06-MH04            MH06             MH04             CONDUIT           57.5    0.5214    0.0130
MH08-MH06            MH08             MH06             CONDUIT           21.9    0.9594    0.0130
MH12-MH10            MH12             MH10             CONDUIT           89.9    0.4005    0.0130
MS-CB173             CB03/04          HP02             CONDUIT           13.0   -0.7693    0.2500
MS-CB19              CB05/06          CB07             CONDUIT           45.0    1.3112    0.2500
MS-CB23              CB07             HP01             CONDUIT            5.0   -5.6088    0.2500
MS-CB25              CB01/02          CB03/04          CONDUIT           52.0    1.0001    0.2500
MS-HP01              HP01             Out-SB(02)       CONDUIT           35.0    3.0872    0.0150
MS-HP02              HP02             CB05/06          CONDUIT           35.0    1.1144    0.2500
OR-CB03/04           CB03/04          MH04             ORIFICE
OR-CB07              CB07             MH08             ORIFICE
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OR-CBMH169	CBMH169	MH06	ORIFICE
OR-CBMH172	CBMH172	MH06	ORIFICE
OR-FUT01	Site_Plan_CB	MH12	ORIFICE
OUT-CB01/02	CB01/02	MH04	OUTLET
OUT-CB05/06	CB05/06	MH06	OUTLET

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
1	TRAPEZOIDAL	1.00	3.30	0.50	6.30	1	18784.58
2	TRAPEZOIDAL	1.00	3.30	0.50	6.30	1	25588.39
3	TRAPEZOIDAL	1.00	3.30	0.50	6.30	1	18784.58
4	TRAPEZOIDAL	1.00	3.30	0.50	6.30	1	19711.89
6	RECT_OPEN	1.00	6.00	0.86	6.00	1	114431.65
MH04-MH02	CIRCULAR	0.60	0.28	0.15	0.60	1	385.02
MH06-MH04	CIRCULAR	0.53	0.22	0.13	0.53	1	310.55
MH08-MH06	CIRCULAR	0.38	0.11	0.09	0.38	1	171.74
MH12-MH10	CIRCULAR	0.45	0.16	0.11	0.45	1	180.44
MS-CB173	18mROW	1.00	15.42	7.47	18.00	1	20665.58
MS-CB19	18mROW	1.00	15.42	7.47	18.00	1	26980.58
MS-CB23	18mROW	1.00	15.42	7.47	18.00	1	55801.76
MS-CB25	18mROW	1.00	15.42	7.47	18.00	1	23562.63
MS-HP01	RECT_OPEN	1.00	6.00	0.75	6.00	1	58019.63
MS-HP02	18mROW	1.00	15.42	7.47	18.00	1	24872.80

****
Transect Summary
****

Transect 18mROW
Area:

0.0008	0.0034	0.0076	0.0136	0.0219
0.0328	0.0461	0.0605	0.0758	0.0919
0.1090	0.1269	0.1458	0.1655	0.1862
0.2077	0.2301	0.2533	0.2767	0.3000
0.3233	0.3466	0.3699	0.3933	0.4166
0.4399	0.4632	0.4866	0.5099	0.5332
0.5566	0.5799	0.6032	0.6266	0.6499
0.6732	0.6966	0.7199	0.7432	0.7666
0.7899	0.8133	0.8366	0.8599	0.8833
0.9066	0.9300	0.9533	0.9767	1.0000

Hrad:

0.0013	0.0026	0.0039	0.0051	0.0072
0.0108	0.0163	0.0239	0.0327	0.0427
0.0539	0.0662	0.0795	0.0938	0.1091
0.1252	0.1421	0.1639	0.1905	0.2174
0.2445	0.2718	0.2991	0.3265	0.3538
0.3812	0.4084	0.4356	0.4627	0.4896
0.5165	0.5432	0.5698	0.5963	0.6226
0.6488	0.6749	0.7008	0.7265	0.7521
0.7776	0.8029	0.8281	0.8531	0.8779
0.9026	0.9272	0.9516	0.9759	1.0000

Width:

0.0728	0.1455	0.2183	0.3006	0.4114
0.5222	0.5967	0.6350	0.6733	0.7116
0.7499	0.7882	0.8265	0.8648	0.9031
0.9414	0.9797	0.9989	0.9989	0.9990
0.9990	0.9990	0.9991	0.9991	0.9991
0.9992	0.9992	0.9992	0.9993	0.9993
0.9994	0.9994	0.9994	0.9995	0.9995
0.9995	0.9996	0.9996	0.9996	0.9997
0.9997	0.9997	0.9998	0.9998	0.9998
0.9999	0.9999	0.9999	1.0000	1.0000

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... LPS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... YES
  Water Quality ..... NO
Infiltration Method ..... HORTON
Flow Routing Method ..... DYNWAVE
Surcharge Method ..... EXTRAN

```
Starting Date ............ 07/22/2019 00:00:00
Ending Date .............. 07/23/2019 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:01:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 2.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 4
Head Tolerance ........... 0.001500 m


*********************
Control Actions Taken
*********************
```

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	0.175	71.667
Evaporation Loss	0.000	0.000
Infiltration Loss	0.043	17.491
Surface Runoff	0.131	53.806
Final Storage	0.001	0.449
Continuity Error (%)	-0.112	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.131	1.313
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.005	0.048
External Outflow	0.136	1.360
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.005	

```
*************************
Highest Continuity Errors
*************************
Node CB05/06 (-3.76%)
Node CB03/04 (1.75%)
Node CB07 (1.11%)


***************************
Time-Step Critical Elements
***************************
None


*******************************
Highest Flow Instability Indexes
*******************************
All links are stable.


************************
Routing Time Step Summary
************************
Minimum Time Step           :     0.51 sec
Average Time Step           :     1.99 sec
Maximum Time Step           :     2.00 sec
Percent in Steady State     :    -0.00
Average Iterations per Step :     2.00
Percent Not Converging      :     0.00


***************************
Subcatchment Runoff Summary
***************************
```

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff LPS	Runoff Coeff
A01	71.67	0.00	0.00	21.13	37.62	12.57	50.19	0.36	294.58	0.700
A02	71.67	0.00	0.00	14.28	48.26	8.67	56.93	0.10	76.30	0.794
A03	71.67	0.00	0.00	11.53	52.52	7.12	59.65	0.18	144.81	0.832
A04	71.67	0.00	0.00	13.34	49.68	8.18	57.86	0.08	64.08	0.807
A05	71.67	0.00	0.00	32.16	26.50	39.54	39.54	0.08	83.31	0.552
A06	71.67	0.00	0.00	32.16	26.50	39.54	39.54	0.11	106.99	0.552

A07	71.67	0.00	0.00	22.05	35.10	13.83	48.94	0.01	9.07	0.683
A08	71.67	0.00	0.00	6.19	61.02	3.85	64.87	0.39	289.17	0.905

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
CB01/02	JUNCTION	0.00	0.12	77.67	0 01:10	0.12
CB03/04	JUNCTION	0.10	1.64	77.27	0 01:11	1.64
CB05/06	JUNCTION	0.01	0.17	76.91	0 01:11	0.17
CBMH169	JUNCTION	0.05	1.80	77.17	0 01:10	1.80
CBMH172	JUNCTION	0.05	1.81	77.40	0 01:10	1.81
HP01	JUNCTION	0.00	0.03	76.46	0 01:13	0.03
HP02	JUNCTION	0.01	0.13	77.26	0 01:15	0.13
HP-CBMH169	JUNCTION	0.00	0.08	77.15	0 01:10	0.08
HP-CBMH172	JUNCTION	0.00	0.08	77.37	0 01:10	0.08
MH04	JUNCTION	0.02	0.29	70.94	0 01:13	0.29
MH06	JUNCTION	0.02	0.22	71.22	0 01:12	0.22
MH08	JUNCTION	0.01	0.17	71.55	0 01:13	0.17
MH12	JUNCTION	0.03	0.16	71.45	0 01:08	0.16
MH02	OUTFALL	0.02	0.27	70.52	0 01:13	0.27
MH10	OUTFALL	0.03	0.16	71.09	0 01:08	0.16
Out-SB(01)	OUTFALL	0.00	0.02	78.32	0 01:06	0.02
Out-SB(02)	OUTFALL	0.00	0.03	75.38	0 01:13	0.03
CB07	STORAGE	0.11	1.76	76.51	0 01:13	1.76
Site_Plan_CB	STORAGE	0.13	1.74	78.34	0 01:06	1.73

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
CB01/02	JUNCTION	64.08	64.08	0 01:10	0.081	0.081	-5.591
CB03/04	JUNCTION	144.81	180.76	0 01:10	0.185	0.218	1.781
CB05/06	JUNCTION	76.30	232.47	0 01:10	0.0968	0.24	-3.622
CBMH169	JUNCTION	83.31	83.31	0 01:10	0.083	0.083	0.005
CBMH172	JUNCTION	106.99	106.99	0 01:10	0.107	0.107	0.007
HP01	JUNCTION	9.07	227.08	0 01:13	0.00978	0.193	-0.005
HP02	JUNCTION	0.00	87.54	0 01:11	0	0.0643	7.116
HP-CBMH169	JUNCTION	0.00	65.10	0 01:10	0	0.0371	-0.021
HP-CBMH172	JUNCTION	0.00	83.42	0 01:10	0	0.0478	-0.018
MH04	JUNCTION	0.00	155.94	0 01:12	0	0.731	0.046
MH06	JUNCTION	0.00	116.74	0 01:12	0	0.527	-0.063
MH08	JUNCTION	0.00	61.19	0 01:13	0	0.346	-0.001
MH12	JUNCTION	0.00	50.83	0 01:06	0	0.348	0.029
MH02	OUTFALL	0.00	155.91	0 01:13	0	0.731	0.000
MH10	OUTFALL	0.00	50.65	0 01:08	0	0.347	0.000
Out-SB(01)	OUTFALL	0.00	268.63	0 01:06	0	0.138	0.000
Out-SB(02)	OUTFALL	0.00	227.00	0 01:13	0	0.193	0.000
CB07	STORAGE	294.58	447.32	0 01:10	0.361	0.535	1.126
Site_Plan_CB	STORAGE	289.17	289.17	0 01:10	0.389	0.437	-0.001

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow LPS
CB07	0.002	4	0	0	0.052	100	0 01:09	285.19
Site_Plan_CB	0.003	4	0	0	0.073	100	0 01:06	319.41

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
MH02	20.19	44.65	155.91	0.731
MH10	99.17	4.24	50.65	0.347
Out-SB(01)	95.30	2.13	268.63	0.138
Out-SB(02)	12.34	20.60	227.00	0.193
System	56.75	71.61	227.00	1.408

****
Link Flow Summary
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Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
1	CONDUIT	83.42	0 01:10	0.32	0.00	0.25
2	CONDUIT	83.42	0 01:10	1.01	0.00	0.13
3	CONDUIT	65.10	0 01:10	0.26	0.00	0.24
4	CONDUIT	65.08	0 01:10	0.79	0.00	0.13
6	CONDUIT	268.63	0 01:06	0.25	0.00	0.18
MH04-MH02	CONDUIT	155.91	0 01:13	1.21	0.40	0.46
MH06-MH04	CONDUIT	116.73	0 01:12	1.28	0.38	0.44
MH08-MH06	CONDUIT	61.19	0 01:13	1.35	0.36	0.43
MH12-MH10	CONDUIT	50.65	0 01:08	0.97	0.28	0.36
MS-CB173	CHANNEL	87.54	0 01:11	0.09	0.00	0.18
MS-CB19	CHANNEL	171.20	0 01:11	0.08	0.01	0.26
MS-CB23	CHANNEL	224.00	0 01:13	0.16	0.00	0.20
MS-CB25	CHANNEL	37.06	0 01:10	0.03	0.00	0.18
MS-HP01	CONDUIT	227.00	0 01:13	1.18	0.00	0.03
MS-HP02	CHANNEL	51.52	0 01:15	0.07	0.00	0.15
OR-CB03/04	ORIFICE	27.32	0 01:11			1.00
OR-CB07	ORIFICE	61.19	0 01:13			1.00
OR-CBMH169	ORIFICE	18.04	0 01:10			1.00
OR-CBMH172	ORIFICE	23.37	0 01:10			1.00
OR-FUT01	ORIFICE	50.83	0 01:06			1.00
OUT-CB01/02	DUMMY	11.90	0 01:00			
OUT-CB05/06	DUMMY	14.50	0 01:00			

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
1	1.00	0.98	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
2	1.00	0.52	0.45	0.00	0.02	0.01	0.00	0.00	0.96	0.00
3	1.00	0.98	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
4	1.00	0.52	0.45	0.00	0.02	0.00	0.00	0.00	0.96	0.00
6	1.00	0.04	0.01	0.00	0.05	0.00	0.00	0.90	0.03	0.00
MH04-MH02	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.84	0.00
MH06-MH04	1.00	0.01	0.00	0.00	0.04	0.02	0.00	0.94	0.04	0.00
MH08-MH06	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
MH12-MH10	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.91	0.00
MS-CB173	1.00	0.04	0.00	0.00	0.05	0.00	0.00	0.91	0.01	0.00
MS-CB19	1.00	0.52	0.00	0.00	0.06	0.00	0.00	0.42	0.05	0.00
MS-CB23	1.00	0.85	0.00	0.00	0.06	0.00	0.00	0.09	0.94	0.00
MS-CB25	1.00	0.76	0.00	0.00	0.05	0.00	0.00	0.19	0.05	0.00
MS-HP01	1.00	0.85	0.00	0.00	0.03	0.11	0.00	0.00	0.07	0.00
MS-HP02	1.00	0.01	0.04	0.00	0.96	0.00	0.00	0.00	0.04	0.00

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Fri Jul 26 13:00:32 2019
Analysis ended on: Fri Jul 26 13:00:33 2019
Total elapsed time: 00:00:01

Appendix E

Erosion and Sediment Control, F-1004

EROSION AND SEDIMENT CONTROL PLAN, MONITORING, AND MEASURES

Scope of Work

The work under the applicable items includes the preparation, implementation and monitoring of an Erosion and Sediment Control Plan to prevent sediment-laden runoff resulting from the Contractor's construction operations from entering all sewers and watercourses both within and downstream from the Working Area. The plan shall include management and monitoring of water discharged from dewatering operations. The specification is limited to the management of sediment laden water and the management of contaminants such as hydrocarbons and volatile organic compounds present within groundwater at the site shall be managed as described elsewhere in the contract documents.

General

The Contractor acknowledges that surface erosion and sediment runoff resulting from construction operations has potential to cause a detrimental impact to any downstream watercourse, and that all construction operations that may impact upon water quality shall be carried out in a manner that strictly meets the requirements of all applicable legislation and regulations.

Accordingly, the Contractor shall be responsible for determining and conforming to the requirements of the Ontario Ministry of the Environment (MOE), the Ontario Ministry of Natural Resources, the City of Ottawa, applicable Conservation Authorities and any other Governmental Regulatory Agencies (collectively "Regulatory Agencies") having jurisdiction in the Working Area or over any potentially affected watercourses.

Erosion and Sediment Control Plan

Before commencing the Work, the Contractor shall submit to the Contract Administrator six copies of a detailed Erosion and Sediment Control Plan. The ESC Plan will consist of a written description and detailed drawings indicating the on-site activities and measures to be used to control erosion and sediment movement for each step of the Work. The written description shall be signed by, and the drawings shall bear the stamp and signature of a qualified Professional Engineer licensed in Ontario, herein designated as the Engineer of Record (EOR).

The Contractor acknowledges that the scheduling of the implementation of erosion and sediment controls is the key component for successful sediment control. Accordingly, the ESC Plan will contain a detailed schedule which identifies the following:

- Phasing of the steps for the installation of all control measures.
- Inspection, monitoring and maintenance of all control measures during construction.

EROSION AND SEDIMENT CONTROL PLAN, MONITORING, AND MEASURES

- Phasing of the removal and disposal of the control measures.

The Contractor acknowledges that no one measure is likely to be 100% effective for erosion protection and controlling sediment runoff and water discharges from the site. Therefore, where necessary the ESC Plan will implement sequential measures arranged in such a manner so as to mitigate sediment release from construction operations and achieve specific maximum permitted criteria where applicable. Suggested on-site measures may include, but shall not be limited to, the following methods: sediment ponds, filter bags, pump filters, settling tanks, silt fences, straw bales, filter cloths, check dams and/or berms, or other recognized technologies and methods available at the time of construction. Specific measures shall be installed in accordance with the requirements of OPSS 805 where appropriate, or in accordance with manufacturer's recommendations.

Inspection and Monitoring of Mitigation Measures

The Contractor shall be solely responsible for inspecting, monitoring and maintaining the effectiveness of the ESC Plan upon implementation. The Contractor shall submit to the Contract Administrator weekly inspection reports demonstrating the performance of the installed measures, identifying deficiencies and indentifying required maintenance issues. These reports shall be prepared, signed by the EOR and provided to the Contract Administrator within 48 hours of the inspection.

- Maintenance issues are defined as any measure which is not functioning to the satisfaction of the EOR and in the opinion of the EOR may be repaired by the contractor with subsequent re-inspection at the next scheduled EOR site inspection.
- Deficiencies are defined as any measure or lack of measure which has potential to cause an adverse environmental impact at the site given the current/forecasted conditions and schedule of the work.

Maintenance issues which have previously been identified but not adequately corrected shall be considered deficiencies.

Deficiencies shall be immediately corrected. Corrective actions shall be re-inspected and documented by the EOR. Re-inspection reports shall be specific to the deficiency observed and may be written field reports.

EOR monitoring reports submitted shall include:

- The date and time of the inspection and monitoring.
- General description of the mitigating measures being utilized at the site.
- Confirmation as to the effectiveness of the measures inspected.

EROSION AND SEDIMENT CONTROL PLAN, MONITORING, AND MEASURES

- Description of any maintenance issue which requires minor repair, improvement or maintenance.
- Description of any deficiency observed including timeline for correction and re-inspection.
- Deficiency re-inspection reports outstanding for the site.

The Contractor shall notify the Contract Administrator in all situations where a regulatory agency has identified deficiencies in erosion/sediment control measures, quality of runoff or quality of water quality discharged from dewatering operation.

Where in the opinion of the Contract Administrator either the proof of performance submitted is or the measures implemented are considered inadequate, the Contractor shall have the EOR review measures in the presence of the Contract Administrator within 24 hours of being notified in writing.

The Contractor shall monitor all weather forecasts and schedule the Work in order to minimize the risk of sediment-laden water from entering any watercourse or sewer system. The ESC Plan shall contain a Contingency Plan to include the provision of additional labour, equipment or materials to install additional control measures, and detail an emergency response plan in case of an accidental event. As such, the Contractor shall have additional control materials on site at all times which are easily accessible and may be implemented at a moment's notice.

Contractor's Responsibilities

The Contractor shall ensure that all workers, including sub-contractors, in the Working Area are aware of the importance of the erosion and sediment control measures and informed of the consequences of the failure to comply with the requirements of all Regulatory Agencies and the specifications detailed herein.

The Contractor shall periodically, and when requested by the Contract Administrator or EOR, clean out accumulated sediment deposits as required at the sediment control devices, including those deposits that may originate from outside the construction area. Accumulated sediment shall be removed in such a manner that prevents the deposition of this material into any sewer or watercourse and avoids damage to the control measure. The sediment shall be removed from the site at the Contractor's expense and managed in compliance with the requirements for excess earth material, as specified elsewhere in the Contract.

The Contractor shall immediately report to applicable regulatory agencies and the Contract Administrator any accidental discharges of sediment material into either the watercourse or the storm sewer system. Failure to report will be constitute a breach of this specification and the Contractor may also be subject to the penalties imposed by any

EROSION AND SEDIMENT CONTROL PLAN, MONITORING, AND MEASURES

applicable Regulatory Agency. Appropriate response measures, including any repairs to existing control measures or the implementation of additional control measures, shall be carried out by the Contractor without delay.

The sediment control measures shall be removed when, in the opinion of the EOR, the measure(s) is no longer required. No control measure may be permanently removed without prior written authorization from the EOR. All sediment and erosion control measures shall be removed in a manner that avoids the entry of sediment or debris into any sewer or watercourse within or downstream of the Working Area. All accumulated sediment shall be removed from the Working Area at the Contractor's expense and managed in compliance with the requirements for excess earth material, as specified elsewhere in the Contract. Any seeding and mulching, temporary cover, sodding or original turf cover that is disturbed by the removal of the control measures and accumulated sediment, shall be brought to final grade and restored. Payment for the supply and placing of ground cover at these locations shall be made under the applicable items listed elsewhere in the Contract.

Where, in the opinion of either the Contract Administrator or a Regulatory Agency, any of the terms specified herein have either not been complied with or not performed in a suitable manner, the Contract Administrator or Regulatory Agency has the right to immediately withdraw its permission to continue the work but may renew its permission upon being satisfied that the defaults and/or deficiencies in the performance of this specification by the Contractor have been remedied. No compensation will be made to the Contractor for the withdrawal of permission to do the work resulting from non-compliance with the requirements of this specification and the Regulatory Agencies.

In addition to any other remedy and/or penalty provided by law, where there has been default or non-compliance with any of the terms specified herein and the Contractor refuses to perform or rectify same within forty-eight (48) hours of the receipt of the written demand of the Contract Administrator to do so, the Owner is hereby entitled to enter upon the Working Area and either complete the work in conformity with the Contract or have the work done that it considers necessary to complete the Work to its intended condition, whichever, in the Owner's sole opinion, is the most reasonable course of action. The Contractor and the Owner further agree that the costs incurred for any such work shall be retained by the Owner from monies otherwise due to the Contractor.

Monitoring of Water Quality Impacts and Point Source Discharges

The Contractor shall monitor runoff quality and quantity of water discharged from dewatering operations. The work shall include turbidity monitoring of impacts to watercourses (upstream vs downstream conditions), total suspended solids (TSS) monitoring of point sources such as those from dewatering operations. Discharge shall be in accordance with site specific constraints, regulatory requirements and sewer use bylaw

EROSION AND SEDIMENT CONTROL PLAN, MONITORING, AND MEASURES

requirements. Where no specific criteria has otherwise been identified, the contractor shall meet the following discharge objective.

Source	Objective	Monitoring Frequency (min)
Watercourse Impacts	Downstream turbidity not to exceed upstream levels by greater than 25%	Minimum of daily for first three days of operation Minimum of twice weekly on an ongoing basis Daily for situations where the work is being conducted within 20 metres of a watercourse.
Discharge from Dewatering Operations	TSS maximum level of 25 mg/L	Minimum of daily for first three days of operation Minimum of twice weekly on an ongoing basis

Monitoring frequency to increase where scheduled construction operations have potential to impair water quality.

Mitigation and Action by Contractor Where Monitoring Indicates Water Impacts or Discharges Over Criteria or Objectives

Where site specific criteria or objectives are not attained, the Contractor and/or EOR shall immediately notify applicable regulatory agency of the monitoring results and possible impacts to sewers and watercourses. The Contractor shall implement an Action/Mitigation Plan acceptable to the EOR and applicable regulatory agency prior to continuing or resuming construction activities.

Measurement and Basis of Payment

Item – Erosion and Sediment Control Plan and Monitoring

Payment at the Contract price for the item “Erosion and Sediment Control Plan and Monitoring” shall be full compensation for the preparation and monitoring of the Erosion and Sediment Control Plan.

Payment shall be based upon the following schedule:

a) 25% upon satisfactory submission and implementation of the ESC Plan; and,
b) 75% pro-rated into equal payments over the term of the contract.

EROSION AND SEDIMENT CONTROL PLAN, MONITORING, AND MEASURES

This payment schedule may only be modified as agreed upon in writing between the Contractor and the Contract Administrator.

Item – Erosion and Sediment Control Measures

Payment at the Contract price for the item “Erosion and Sediment Control Measures” shall be full compensation for the implementation and maintenance of erosion and sediment control measures required for the site, and shall include all labour, equipment and materials to supply, construct, monitor and maintain all erosion and sediment control measures detailed therein.

Payment shall be based upon the following schedule:

a) 20% upon satisfactory installation of the control measures;
b) 70% pro-rated into equal payments over the term of the contract; and,
c) 10% upon successful completion and removal of the ESC Plan protection measures.

This payment schedule may only be modified as agreed upon in writing between the Contractor and the Contract Administrator.

Warrant: For work which is conducted in close proximity to watercourses or environmentally sensitive areas.

SHIRLEY'S BROOK

SHIRLEY'S BROOK

REMOVE TREES & VEGETATION (TYP.)

REMOVE EXISTING STRUCTURES

SILT FENCE PER OPSD 219.110

REMOVE EXISTING STRUCTURES

SILT FENCE PER OPSD 219.110

REMOVE TREES & VEGETATION (TYP.)

REMOVE UTILITY POLE

SILT FENCE PER OPSD 219.110

REMOVE TREES & VEGETATION (TYP.)

REMOVE EXISTING ACCESS ROAD

REMOVE TREES & VEGETATION (TYP.)

REMOVE UTILITY POLE

1055 KLONDIKE ROAD

SILT FENCE PER OPSD 219.110

STRAW BALE FLOW CHECK PER OPSD 219.180

KLONDIKE ROAD

STRAW BALE FLOW CHECK PER OPSD 219.180

EX. DITCH

EX. DITCH

UP

UP

UP

UP

71.00 72.00 73.00 74.00 75.00 76.00 77.00 78.00

NOVATECH
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Ottawa, Ontario, Canada K2M 1P6

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- DEBRIS AND RUBBLE FROM DEMOLISHED STRUCTURE
- X — REMOVALS
- SILT FENCE PER OPSD 219.110
- STRAW BALE FLOW CHECK PER OPSD 219.180

CITY OF OTTAWA
1055 KLONDIKE ROAD

REMOVALS & EROSION CONTROL

SCALE 1 : 750 (0 10 20 30)

DATE JULY 26, 2019 | JOB 117034 | FIGURE 117034-ESC

SHT11X17.DWG - 279mmX432mm

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Appendix F

Shirley's Brook SWM Facility 'C' Detailed Design Report

Prepared by Novatech (November 2006)

SHIRLEY'S BROOK
SWM FACILITY 'C'
DETAILED DESIGN REPORT

Prepared By:

NOVATECH ENGINEERING CONSULTANTS LTD.
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario
K2M 1P6

Submitted: May 2006
Revised November 2006

Novatech File: 103106-0
City File No: D07-16-04-0014
Ref: R-2006-105

NOVATECH
ENGINEERING
CONSULTANTS LTD.

November 9, 2006

City of Ottawa
Planning and Growth Management Department
Planning and Infrastructure Approvals Branch
110 Laurier Avenue West, 4th Floor
Ottawa, Ontario
K1P 1J1

Attention: **Mr. Stuart Moxley**
Infrastructure Approvals Officer

Dear Sir:

Reference: **Shirley's Brook – SWM Facility 'C'**
Detailed Design Report
Our File No.: 103106

Please find enclosed four (4) copies of the detailed design report for Shirley's Brook SWM Facility 'C'. The report has been amended pursuant to City of Ottawa comments. The facility has been designed in accordance with the criteria established in the *Shirley's Brook Floodplain Analysis & Stormwater Management Report* (NECL, November 2006).

Please do not hesitate to contact us if you have any questions or concerns regarding this report.

Yours truly,

NOVATECH ENGINEERING CONSULTANTS LTD.

Michael Petepiece, P.Eng
Project Engineer

Suite 200, 240 Michael Cowpland Dr., Ottawa ON K2M 1P6 Tel: (613) 254-9643 Fax: (613) 254-5867
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Consulting Engineers & Planners

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	Storm Sewer Design Sheet	(5-Year Event) – Ultimate Conditions
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Appendix B:
SWMHYMO Modeling Parameters
SWMHYMO Input Data Files
SWMHYMO Summary Output Files
SWM Facility Inlet & Outlet Calculations
Stage-storage Curves
Forebay Design Calculations
Stage-storage Curves
EPA SWMM Model Schematics
EPA SWMM Model Output
EPA SWMM Flow Splitter Model Output (25mm / 100 yr)

Appendix C:	103106-SWM	Overall Plan
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	103106-SWM-C2	SWM Pond 'C' - Sections
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1.0 INTRODUCTION

SWM Facility 'C' is one of three proposed SWM facilities intended to provide stormwater management for the Klondike Road Lands (refer to Figure 1) and will be located on the south shore of Shirley's Brook on the west side of March Valley Road.

The Klondike Road Lands are identified as collection Area W-2 in the *City of Ottawa Area-Specific Development Charge Background Study for Individual Stormwater Management Ponds and Drainage Systems* (C.N. Watson, June 2004).

SWM Facility 'C' will service a tributary drainage area of approximately 26.2 ha, comprised primarily of low and medium density residential dwellings west of the OCR, and industrial development east of the OCR. The proposed land use plan is shown on Figure 2. The storm drainage area plan is shown on Figure 3.

2.0 KLONDIKE ROAD LANDS TRIBUTARY TO SWMF 'C'

Stormwater management for the Klondike Road Lands has been designed pursuant to the major-minor system concept:

- Storm sewers will capture and convey minor system flows from the upstream drainage area to SWM facility 'C' for quality and quantity control;
- Storage for runoff that that exceeds the capacity of the minor system will be provided in road sags;
- Runoff volumes that exceed the storage provided in road sags will be conveyed overland along defined major system flow routes and outlet directly to Shirley's Brook. The exception is at Klondike Road, where major overland flow east of Area C-103 (refer to Figure 3) will bypass into the inlet channel for the Duck Club Pond.

2.1 Minor System

The Klondike Road storm sewers have been designed with the Rational Method using an initial time of concentration of 20 minutes. This assumes a 15 minute initial time of concentration within the residential development blocks, and 5 minutes of travel time within the upstream storm sewers at a velocity of 1 m/s. Storm design sheets are included in Appendix A. The Storm Drainage Area Plan is provided as Figure 3.

The sewers were sized to permit free flow conveyance of the runoff generated from a 5-year design storm. The design criteria used to determine the size of the storm sewers required to service the proposed development are as follows:

Minimum pipe size	=	300 mm diameter
Minimum velocity	=	0.8 m/s
Maximum velocity	=	3.0 m/s

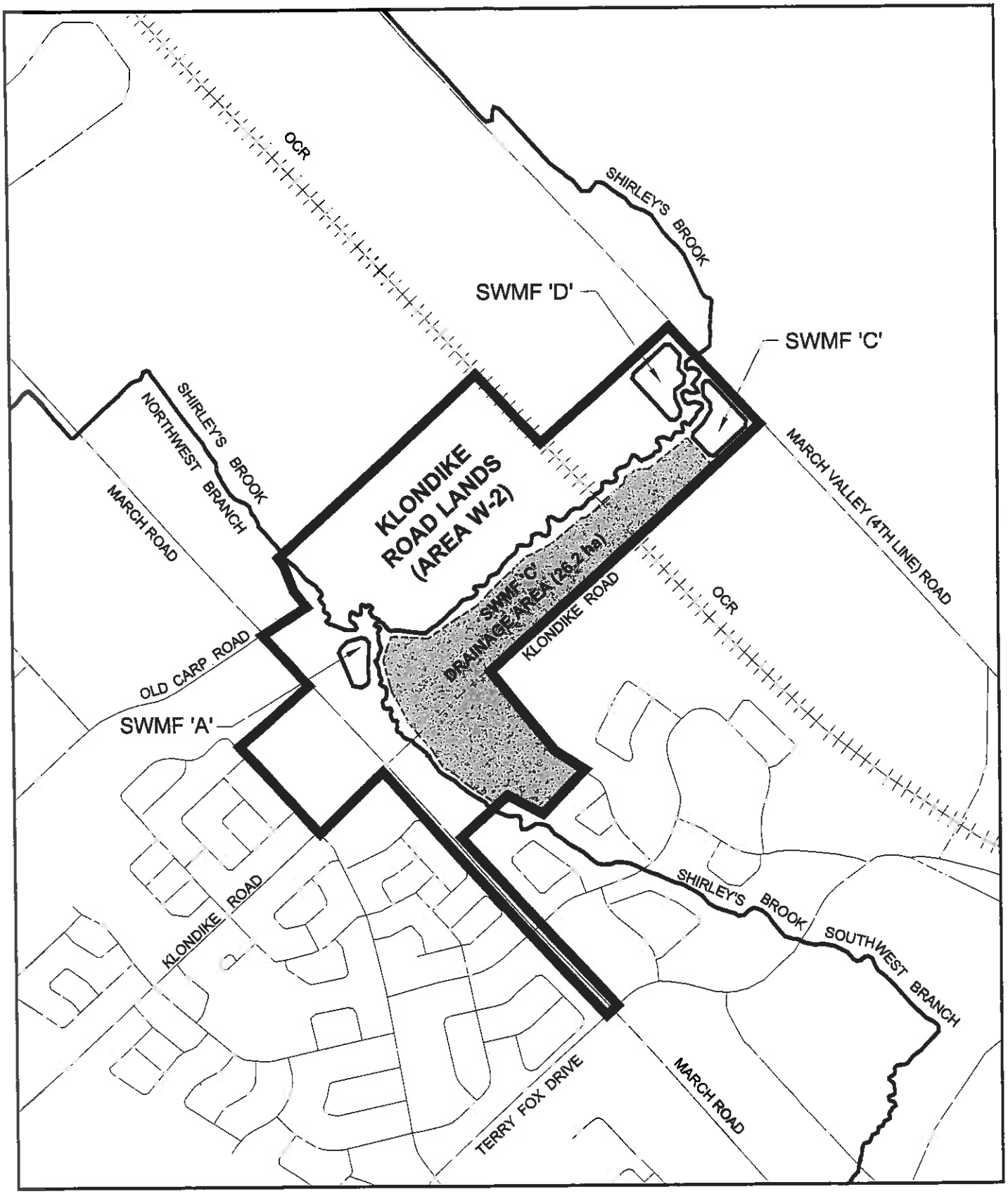

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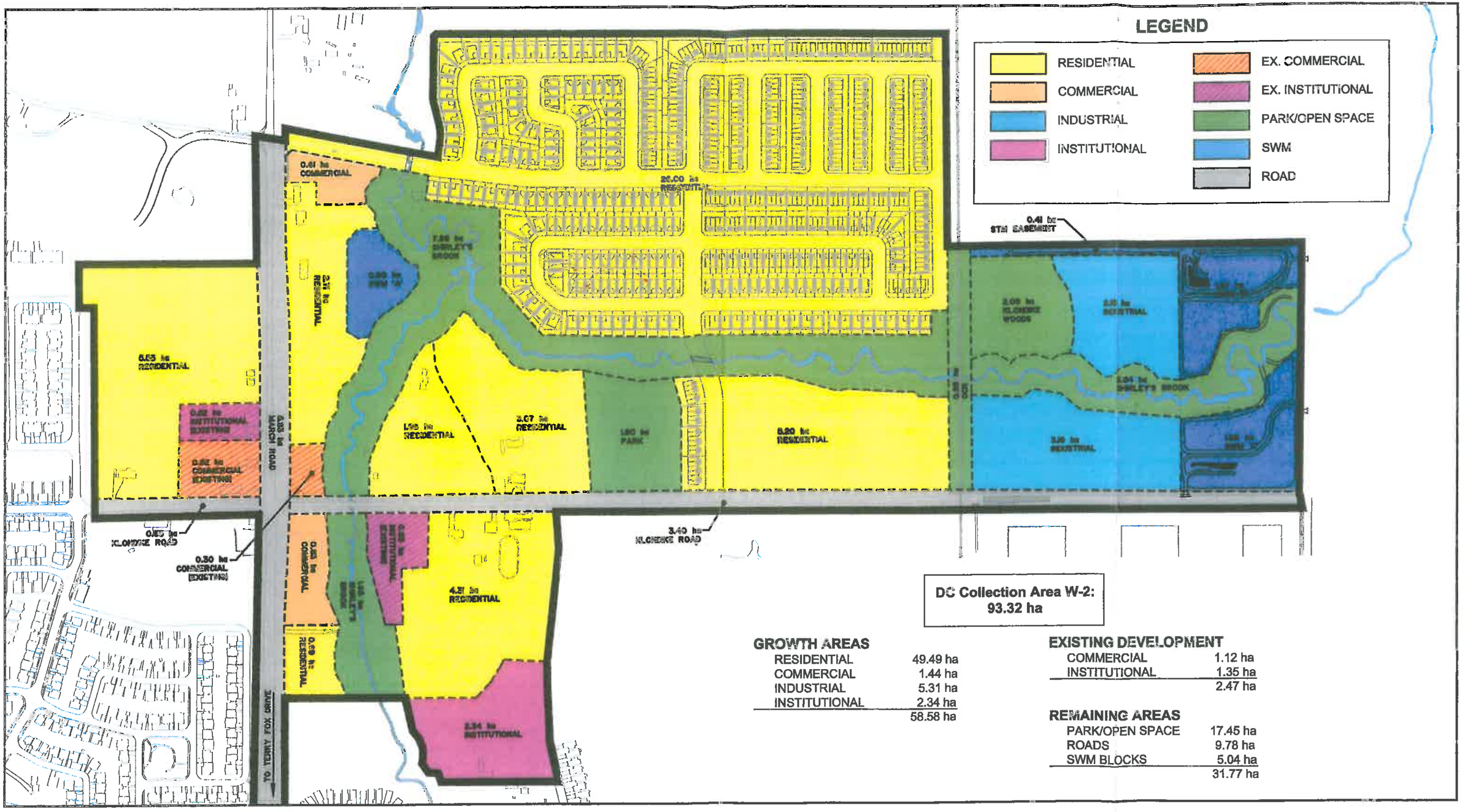
FIGURE 1
KLONDIKE ROAD LANDS / SWMF 'C'
KEY PLAN

103106 MAY 2006 N.T.S.

SHT8XII.DWG - 215mmX278mm



DC Collection Area W-2: 93.32 ha

GROWTH AREAS

RESIDENTIAL	49.49 ha
COMMERCIAL	1.44 ha
INDUSTRIAL	5.31 ha
INSTITUTIONAL	2.34 ha
	58.58 ha

EXISTING DEVELOPMENT

COMMERCIAL	1.12 ha
INSTITUTIONAL	1.35 ha
	2.47 ha

REMAINING AREAS

PARK/OPEN SPACE	17.45 ha
ROADS	9.78 ha
SWM BLOCKS	5.04 ha
	31.77 ha

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FIGURE 2
KLONDIKE ROAD LANDS
LAND USE PLAN (AREA W-2)
103106 APRIL 2006 N.T.S.

SHTIIX17.DWG - 278mmX431mm

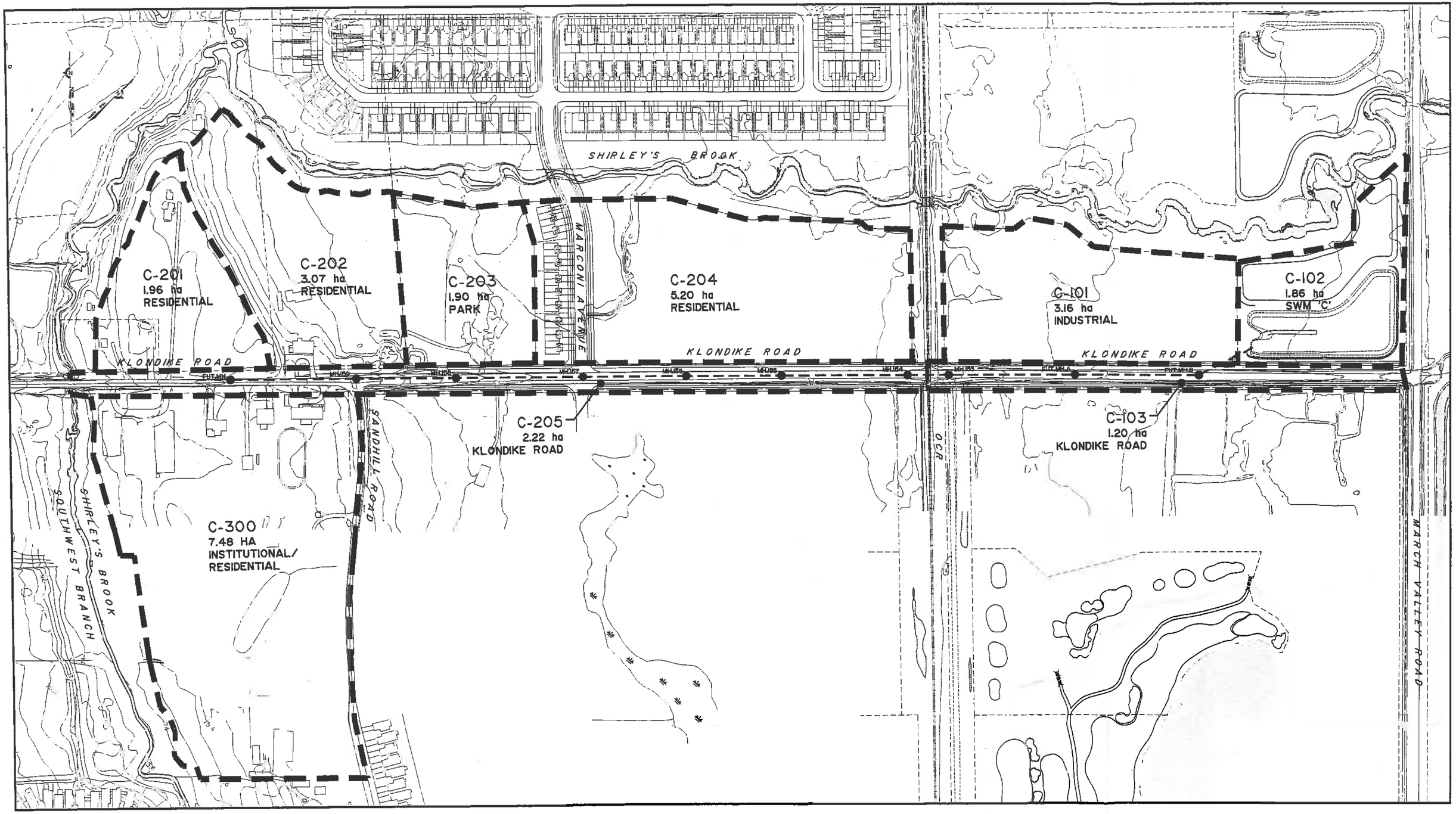

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FIGURE 3
STORM DRAINAGE AREAS
TO SWM FACILITY 'C'

103106 MAY 2006 N.T.S.

SHTIIX17.DWG - 279mmX431mm

2.2 Major System

Major system flows will be conveyed overland within the public ROW and outlet into Shirley's Brook. Inlet control devices (ICDs) will be installed in the roadway catch basins to ensure flow into the storm sewer system does not exceed the 5-year runoff rates. Each pair of road catchbasins will be interconnected and will operate as a single inlet. Ponding will be restricted to a maximum depth of 0.30m in the right-of-way.

Major overland flow routes will be designed using open channel principles to ensure that the product of the velocity (m/s) x depth (m) within the right-of-ways does not exceed 0.6.

2.3 Hydraulic Grade Line Analysis

The hydraulic grade line in the Klondike Road storm sewer was calculated for the 1:100 year design event. The HGL elevations will be used in the grading design for the tributary drainage areas to ensure at least 0.30m of freeboard is provided between the design HGL and the underside of footing elevations.

The HGL elevations were calculated under steady-state conditions using the Darcy-Weisbach equation to calculate friction losses in the pipe network for a specified flow rate. Minor losses were accounted for at pipe bends using the Sewer Bend Loss Coefficients Design Chart from the City of Ottawa Sewer Design Guidelines. Additionally, entrance and exit structure losses were accounted for at each manhole. The detailed spreadsheet calculations are provided in Appendix A.

Under ultimate development conditions, the HGL in the Klondike Road Storm sewer was calculated starting from an HGL elevation of 67.57 at the inlet headwall to SWMF 'C'. Under interim development conditions, the HGL was calculated starting from an HGL elevation of 67.57 at the outlet headwall to the temporary drainage ditch just downstream of the OCR rail line. The starting HGL elevations were determined using the EPA SWMM hydraulic model. Additional details on the hydraulic modeling of the SWM facility is provided in Section 5.0.

3.0 HYDROLOGIC MODELING

The SWMHYMO hydrologic model was used to generate runoff hydrographs for the drainage areas tributary to SWM Facility 'C', and then separate the runoff hydrographs into major and minor system flows.

- Inflows to the minor system have been modeled at a maximum capture rate of 85 L/s/ha;
- On-site major system storage has been estimated at 50 m^3/ha;
- Major system flows that exceed the on-site storage will be conveyed overland to Shirley's Brook;
- Minor system flows will be conveyed by the Klondike Road storm sewer to SWMF 'C'.

3.1 Subcatchment Data

The modeling parameters used in the SWMHYMO analysis are representative of the proposed development within that subcatchment. Subcatchment areas are shown on Figure 3. SWMHYMO modeling data is provided in Appendix B.

3.2 Design Storms

The performance of the major and minor systems was modeled for the 25mm event, the 1:5 year event and the 1:100 year event using a 3-hour Chicago distribution.

The 3-hour Chicago distribution was used for the subdivision analysis, as short duration/high-intensity storms tend to produce higher peak flows from urban areas and are generally the critical events with regard to the design of the stormwater conveyance system.

The IDF parameters used to generate the design storms were taken from the City of Ottawa Sewer Design Guidelines.

3.3 Methodology

The SWMHYMO model was used to calculate the runoff, major and minor system flows, and major system storage for each subcatchment identified on the SWMHYMO Schematic (103106-SWM). The methodology used in the analysis is summarized below.

1. SWMHYMO calculates a total runoff hydrograph for a given subcatchment.
2. Is peak flow greater than inlet capacity?
    a. If yes, then calculate major system hydrograph (go to step 3).
    b. If no, then all flow is captured by minor system.
3. Does major system hydrograph volume exceed available storage volume?
    a. If yes, then calculate overland flow to next downstream subcatchment.
    b. If no, then all flow eventually enters minor system at inlet.
4. Add subcatchment minor system hydrograph (from Step 2b or Step 3b) to total minor system flow.
5. Calculate local runoff hydrograph for downstream subcatchment.
6. Add overland flow hydrographs from upstream catchments (from Step 3a - if any) to local runoff hydrograph.
7. Go to step 1.

3.4 Results – Hydrology

The results of the hydrologic analysis are summarized in Table 3.4-1. The minor system hydrographs generated using SWMHYMO were used in the hydraulic analysis of the pond. Additional details on the hydraulic analysis of SWM Facility 'C' are provided in Section 5.0.

Table 3.4-1

Return Period	Minor System Peak Flow (m^3/s)	
	Interim Development Conditions (23.0 ha)	Ultimate Development Conditions (26.2 ha)
25 mm	1.56	1.90
1:5 year	2.01	2.42
1:100 year	2.17	2.57

4.0 SWM FACILITY 'C' - DESIGN

SWM Facility 'C' has been sized to provide water quality and erosion control for a tributary drainage area of 26.2 ha. Hydrologic modeling of Shirley's Brook has demonstrated that quantity control is not required for storms greater than the 1:5 year event, as major system flows from the development areas will precede the peak flow in Shirley's Brook and will not increase peak flows within Shirley's Brook.

Refer to the *Shirley's Brook Floodplain Analysis & Stormwater Management Report* (NECL, November 2006) for additional details on the hydrologic analysis of Shirley's Brook.

4.1 Design Criteria

The criteria used in the design of SWM Facility 'C' are as follows:

- The SWM Facility will have a permanent pool and extended detention storage sized to provide a *Normal* level of water quality control for the upstream drainage area, as recommended in the *Shirleys Brook and Watts Creek Subwatershed Study*;
- Provide erosion control storage to limit outflows from the pond to a release rate of between 8-14 L/s/ha for the 1:5 year event, as per the Target Flow Rates listed in Table 4 of the *Kanata North EMP*;
- The forebay will have maximum side slopes of 3:1 (H:V), with a 1.0 m wide safety bench at the normal water level;
- The main cell of the SWM facility will have side slopes of 6:1 (H:V) below the normal water level;
- The active storage portions of the main cell will have maximum side slopes of 4:1;
- The sediment forebay will be sized to provide sufficient storage for 10 years of sediment accumulation;
- The dry pond will provide a net increase in both riparian and total floodplain storage in the reach of Shirley's Brook between the OCR and March Valley Road for all design events (2yr-100yr) to compensate for infilling of the pre-development floodplain through this reach; and
- The pond outlet will be subject to a range of tailwater conditions in Shirley's Brook and must be designed to operate effectively under backwater or submerged conditions for the full range of design events (up to the 1:100 year event).

4.2 Service Road

Access to SWM Facility 'C' will be provided by a 4.0 m wide service road constructed of 150mm of granular 'A' overtop of 300mm of granular 'B' and covered with a minimum of 10cm of seeded topsoil with accesses from March Valley Road and Klondike Road.

4.3 Inlet Structure

The inlet to SWM facility 'C' has been designed for both interim and ultimate development conditions. Until such time as Klondike Road is urbanized from the OCR to March Valley Road, the Klondike Road storm sewer will outlet to an open channel running parallel to Klondike Road, which will convey flows from the upstream drainage area to SWM Facility 'C'.

Once Klondike Road is urbanized from the OCR crossing to March Valley Road, the Klondike Road storm sewer will be extended to SWM Facility 'C' and the open channel along Klondike Road will be abandoned.

4.3.1 Permanent SWM Inlet

The permanent inlet to the SWM facility will be a 1350 mm storm pipe connecting the Klondike Road storm sewer to a flow splitter manhole (STM MH 3). This manhole will have two inlets to the SWM facility set at different elevations:

- The first inlet will be an 825 mm pipe that will convey flows from frequent storms (up to the 25 mm event) to the sediment forebay.
- The second inlet will be a 750 mm pipe set 825 mm above the invert of the forebay inlet. This inlet will allow high flows to bypass the sediment forebay and discharge directly to the main cell of SWM Facility 'C'.

Inlet from Klondike Road Storm Sewer:	40m - 1350 mm STM @ 0.13%	
	U/S INV	= 66.06
Inlet to Forebay:	15.8m - 825mm STM @ 1.6%	
	U/S INV	= 66.00
	D/S INV	= 65.75
Bypass to Main Cell:	8.3m – 750mm STM @ 5.0%	
	U/S INV	= 66.83
	D/S INV	= 66.41

The peak inflow to the SWM facility for the 100-year storm event will be 2.57 m^3/s. The peak inflow to the SWM facility for the 25mm storm event will be 1.90 m^3/s, which represents approximately 74% of the 100-year inflow to SWM facility.

The forebay inlet has been sized to convey the 25mm peak flow to the forebay, and the bypass to the main cell has been sized to convey the balance of the 100-year peak flow (2.57 - 1.90 = 0.670 m^3/s). The required sizes and elevations of the SWM facility inlets have been determined using the EPA SWMM hydraulic model, as the design head on the structures will vary continuously as water levels in the wet pond and in Shirley's Brook rise and fall. Refer to Section 5.0 for additional details on the hydraulic analysis. Inflow & Pipe Capacity output graphs from EPA SWMM are provided in Appendix B for the 25mm and 100yr events.

4.3.2 Temporary SWM Inlet

Under interim conditions, lands downstream of the OCR will be undeveloped and will sheet drain overland directly to Shirley's Brook. A 240 m open channel running parallel to Klondike Road will convey minor system flows from the drainage area upstream of the OCR to SWM Facility 'C'. A temporary headwall will be installed at the downstream end of the open channel and will be connected to a 1350 mm pipe leading to the flow splitter manhole. Details for the temporary SWM inlet are shown on Drawing 103106-SWM-C2.

4.4 Sediment Forebay

The sediment forebay has been sized using design guidelines provided in the *MOE SWM Planning and Design Manual* (March 2003). A submerged berm set 0.3 m below the normal water level will separate the forebay from the main cell of the pond. The forebay will have a length of 72 m. The outlet from the forebay will consist of a submerged rock check dam.

The upstream drainage area to the SWM Facility (26.2 ha) has an average imperviousness of 52%. For a *Normal* level of protection (70% long-term TSS removal), the required permanent pool volume is approximately 1,830 m^3. SWM Facility 'C' will have a permanent pool volume of approximately 4,500 m^3, and will consequently provide a sediment removal efficiency of more than 80% (refer to design calculations in Appendix B).

Annual sediment loading to the SWM facility from the upstream drainage area has been estimated at approximately 44.1 m^3/yr (see design calculations in Appendix B). If the SWM facility provides a long-term TSS removal rate of 80%, then sediment accumulation can be estimated at 0.80 x 44.1 = 35.3 m^3/yr.

The forebay has been designed to allow for a minimum of 10 years of sediment accumulation. At a sediment loading rate of 35.3 m^3/yr, this corresponds to a sediment volume of 353 m^3 over a period of 10 years. The forebay in SWMF 'C' provides a storage volume of approximately 360 m^3 at a depth of 0.55 m, and has a total volume of approximately 530 m^3 at the top of the submerged berm between the forebay and the main cell.

4.5 SWM Outlet

Outflows from SWMF 'C' will be conveyed by a 450 mm reverse slope pipe to the outlet structure which has been designed to provide both extended detention and erosion control for the tributary drainage area. Refer to Drawings 103106-SWM-C1 and 103106-SWM-C2 for details of the outlet structure.

4.5.1 Extended Detention

Extended detention will be provided for the first 0.40 m of active storage to allow for settling of suspended sediment in the pond. The extended detention volume will be released over a period of 24 hours through a 180 mm orifice with an invert elevation set at the normal water level of 66.05m. The orifice will be inserted into a 250 mm storm pipe embedded in a concrete weir built into the base of the outlet structure. Flows that exceed the extended detention storage volume will spill over the weir crest at an elevation of 66.45, bypassing the extended detention orifice and outflows will instead be regulated by the erosion control outlet.

4.5.2 Erosion Control

The main outlet from the control structure will be a 600 mm pipe equipped with a sluice gate. Under normal operating conditions the sluice gate will be opened to a height of 300 mm (50% open) and will act as an orifice to provide erosion control during storm events that exceed the maximum extended detention storage in the facility. The sluice gate will allow for easy adjustment of the size of the outlet opening and can be closed completely during maintenance of the pond to prevent any backwater from Shirley's Brook from entering the facility.

4.5.3 Overflow Spillway

SWM Facility 'C' has been sized to provide sufficient storage to meet extended detention and erosion control criteria for storms up to the 1:5 year event. Runoff from larger storm events will exceed the maximum storage provided in the facility and the excess runoff will bypass the primary outlet structure and be conveyed by the overflow spillway to the adjacent dry pond. The overflow spillway will be 40 m wide broad crested weir with a crest elevation of 67.25. The spillway has been sized to allow the conveyance of the 100-year peak flow from the SWM facility to Shirley's Brook at a minimal head. Refer to Appendix B for design calculations.

4.6 SWM Facility 'C' Wet Pond

The stage-storage curve for the wet pond component of SWM Facility 'C' is provided in Table 4.6-1. Calculations are provided in Appendix B.

Table 4.6-1 SWM Facility 'C' – Wet Pond Stage-Storage Curve

Component	Elevation (m)	Volume				Release Rate * (L/s)
		Forebay (m^3)	Main Cell (m^3)	Total Volume (m^3)	Active Volume (m^3)	
Pond Bottom	65.00	0	0	0	0	-
	65.55	360	1,580	1,940	0	-
Top of Forebay Berm	65.75	530	2,320	2,850	0	-
Normal Water Level	66.05	-	3,570	4,370	0	-
	66.25	-	5,430	5,430	1,060	23
Extended Detention	66.45	-	6,270	6,270	1,900	39
	66.75	-	8,380	8,380	4,010	275
	67.00	-	10,000	10,000	5,630	378
Erosion Control (1:5 year)	67.25	-	11,720	11,720	7,350	425
	67.50	-	13,540	13,540	9,170	468

* The release rates listed in Table 4.6-1 represent free outlet conditions. The SWM facility has been modeled using EPA SWMM to account for high tailwater conditions in Shirley's Brook at the SWM facility outlet. Refer to Section 5.0 for additional details.

4.7 SWM Facility 'C' Dry Pond

Floodplain storage lost due to infilling of the floodplain between the OCR culvert and March Valley Road will be fully compensated for within two proposed dry ponds (dry ponds 'C' and 'D') upstream of March Valley Road. These dry ponds have been designed to provide a net increase in both riparian storage and total floodplain storage in this reach above existing conditions for all storm events (2-100 year).

The stage-storage curve for the dry pond component of SWM Facility 'C' is provided in Table 4.7-1. Refer to the *Shirley's Brook Floodplain Analysis & Stormwater Management Report* (NECL, November 2006) for details on the calculation of storage requirements for the proposed dry ponds. The dry ponds are not intended to provide any form of quantity control and will have an unrestricted outlet back into Shirley's Brook.

Table 4.7-1 SWM Facility 'C' – Dry Pond Stage-Storage Curve

Component	Elevation (m)	Stage Volume (m^3)	Total Volume (m^3)
Dry Pond Outlet @ Shirley's Brook	65.75	0	0
	66.00	80	80
	66.25	1,110	1,190
	66.50	1,690	2,880
	66.75	1,790	4,670
	67.00	1,900	6,570
	67.25	2,020	8,590

5.0 SWM FACILITY 'C' – HYDRAULIC MODELING

The normal water level in SWM Facility 'C' (NWL=66.05) will be approximately 0.20m above the normal water level in Shirley's Brook (NWL=65.85±) at the SWM facility outlet. However, Shirley's Brook is subject to periodic flooding during the spring freshet and moderate storm events. Consequently, the outlet from SWM facility 'C' will be periodically submerged and will need to operate effectively under a range of tailwater conditions.

5.1 Methodology

The EPA SWMM model was used to perform a dynamic hydraulic analysis of SWM Facility 'C' to confirm the size of the pond and the configuration of the inlet and outlet structures. Inflow hydrographs from the tributary drainage areas (generated using SWMHYMO) were routed through the facility with outflows dependant on varying water surface elevations in Shirley's Brook at the outlet.

5.1.1 Shirley's Brook Water Levels

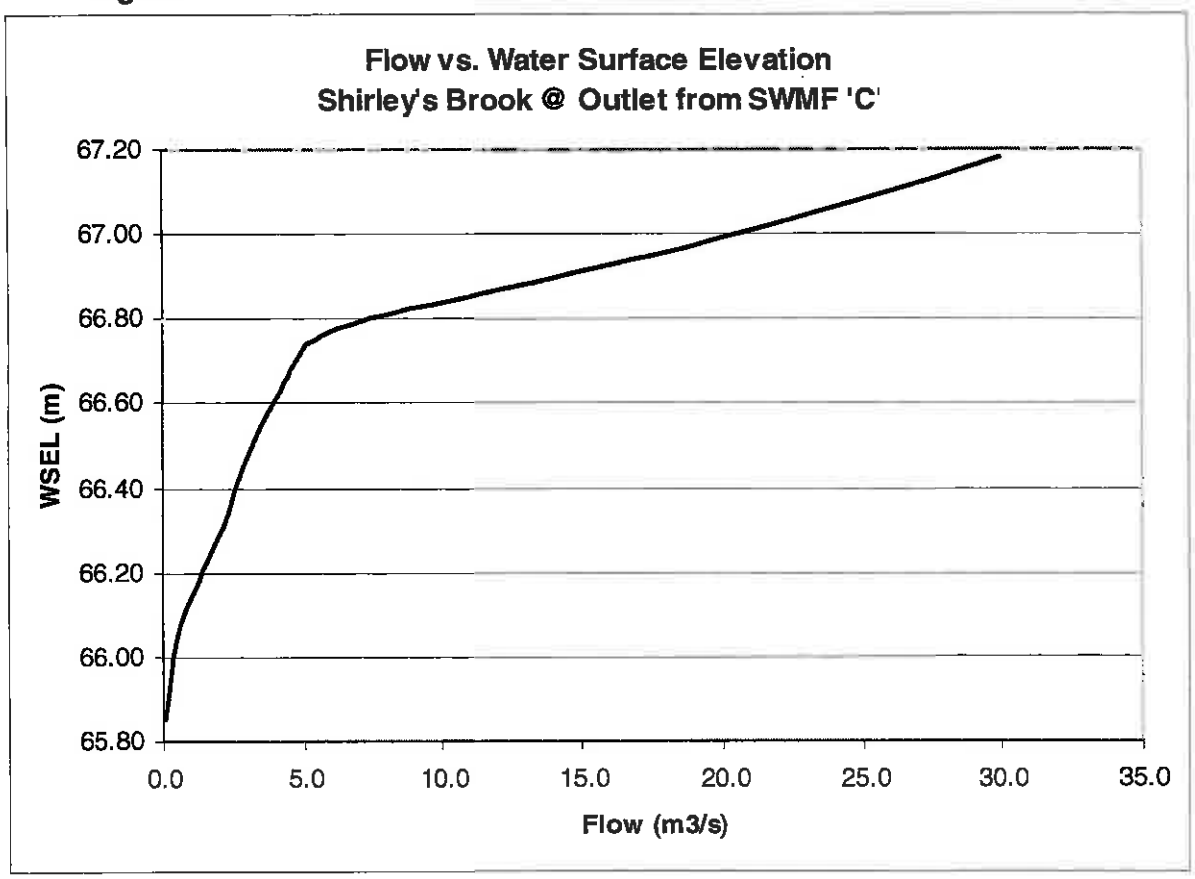
Through discussions with the City of Ottawa, MVCA, MNR and DFO, the HEC-RAS model used to establish flood elevations in Shirley's Brook has been updated and modified to reflect post-development conditions in Shirley's Brook between March Road and March Valley Road. Modifications to the model include floodplain infilling, additional culvert crossings and channel improvements.

The design flows used in the original HEC-RAS model were developed by A.J. Robinson in 1988 using the OTTHYMO hydrologic model. The OTTHYMO model has been imported into SWMHYMO and updated to include any additional existing development since the completion of the original model, as well as all known future development in the upstream drainage area.

The updated HEC-RAS model of Shirley's Brook was used to establish a relationship between flow and water surface elevation in Shirley's Brook at the outlet from the SWM facility (refer to Figure 4).

Further details on the hydrologic and hydraulic analysis of Shirley's Brook are provided in the *Shirley's Brook Floodplain Analysis & Stormwater Management Report* (NECL, November 2006).

Figure 4



5.1.2 SWM Facility 'C'

The flow vs. water surface elevation relationship shown by Figure 4 was used to establish a time series of flood levels at the outlet from SWM Facility 'C' for the 25mm, 1:5 year, and 1:100 year storm events.

The stage-storage curve and the inlet and outlet structures for SWM Facility 'C' were input into the EPA SWMM model.

Inflow hydrographs from the tributary drainage areas were input into the EPA SWMM model and routed through the facility for the 25mm, 1:5 year, and 1:100 year design events.

Separate models were created to represent both interim development conditions and ultimate development conditions:

- Under interim conditions, the inlet to the SWM facility will be from the open channel along Klondike Road. The inflow hydrographs do not include contributions from Area C-101 (KRP Industrial lands), which will be undeveloped and will sheet drain directly to Shirley's Brook.
- Under ultimate development conditions, the inlet to the SWM facility will be a 1350 mm pipe from the Klondike Road storm sewer.

5.2 Results

Once setup was complete, the EPA SWMM model was run to determine the outflows, maximum storage volumes and maximum water surface elevations in the SWM facility for each of the design events. Simulation results are summarized in Table 5.2-1 and illustrated graphically by Figure 5 through 10. Model input and output files are provided in Appendix B.

Table 5.2-1 EPA SWMM Modeling Results – SWM Facility 'C'

Storm Event	Peak Inflow (m^3/s)	Peak Outflow (m^3/s)	Max Storage (m^3)	Max WSEL (m)
Interim Conditions				
25mm	1.56	0.200	3,213	66.62
5yr-3hr Chicago	2.01	0.290	5,426	66.97
100yr-3hr Chicago	2.17	0.420	7,394	67.26
Ultimate Development Conditions				
25mm	1.90	0.240	3,584	66.68
5yr-3hr Chicago	2.42	0.330	5,727	67.02
100yr-3hr Chicago	2.57	1.890	7,692	67.30

The EPA SWMM model results indicate that SWM Facility 'C' will meet the design criteria identified in Section 5.1 for both interim and ultimate development conditions:

- SWM Facility 'C' will provide in excess of 24 hours of extended detention for the 25mm storm event;
- Outflows from SWM Facility 'C' will meet the erosion control target of 8-14 L/s/ha from the Kanata North EMP for the 1:5 year storm event.

Figure 5

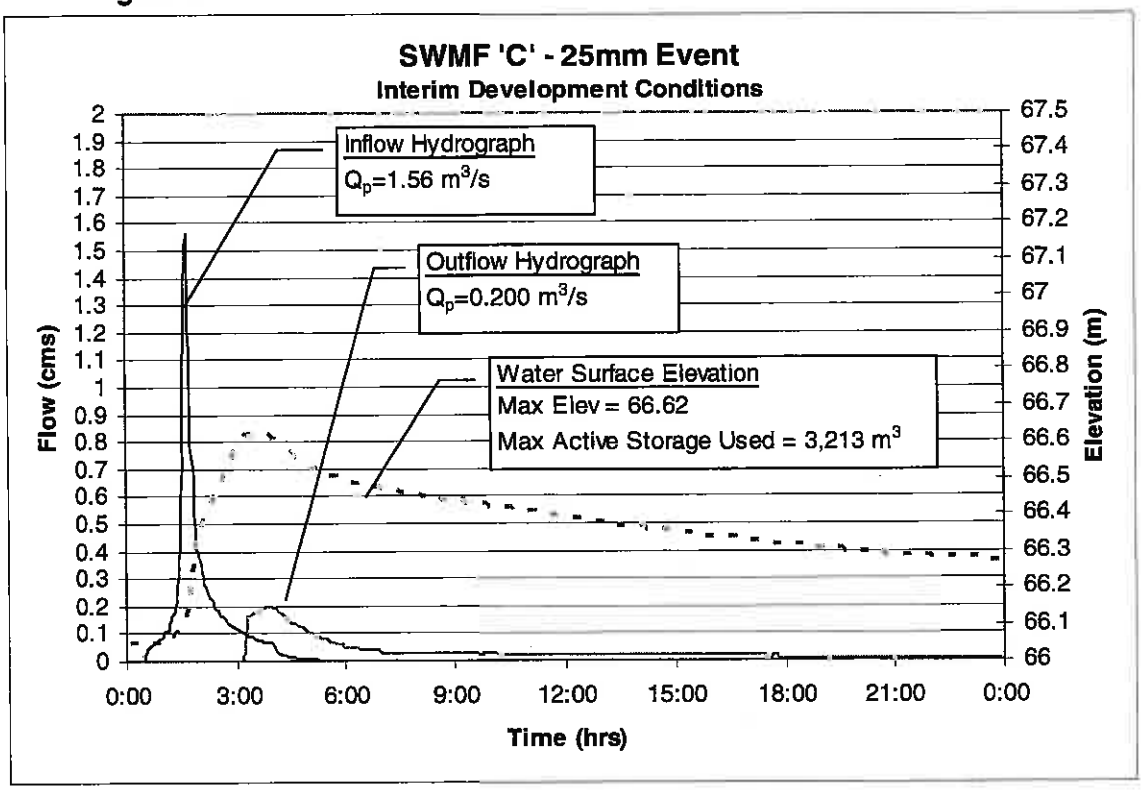


Figure 6

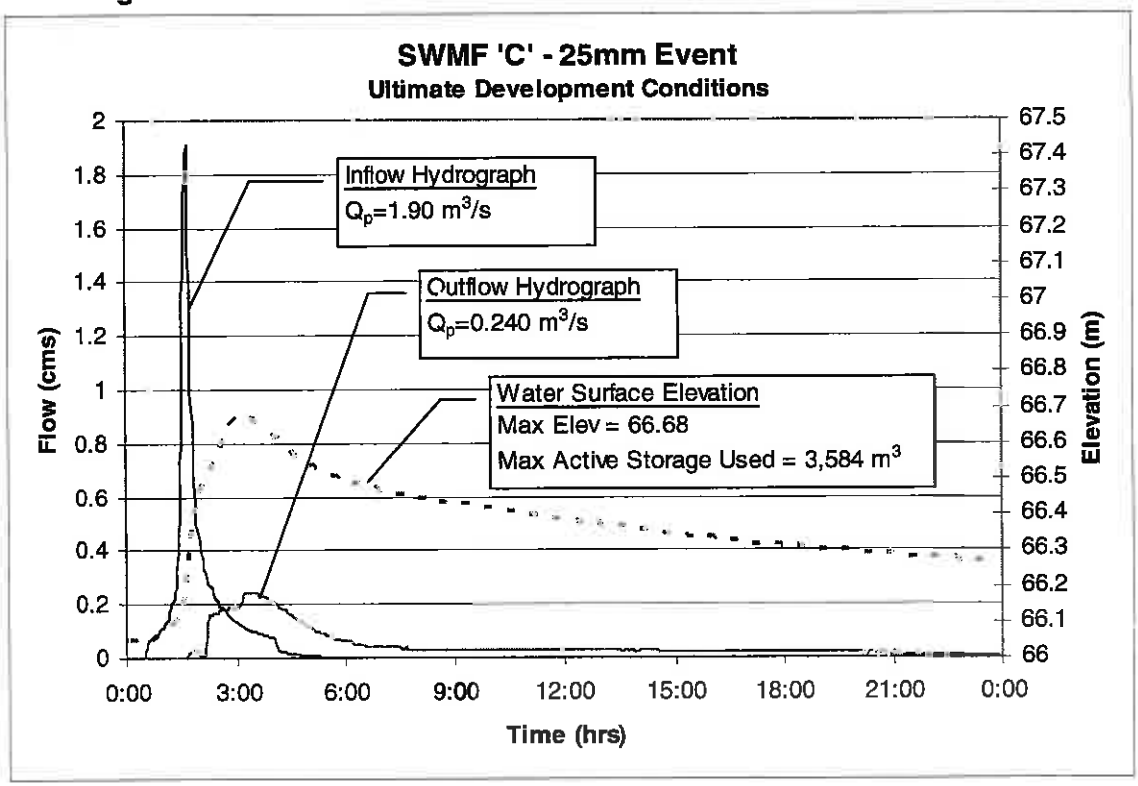


Figure 7

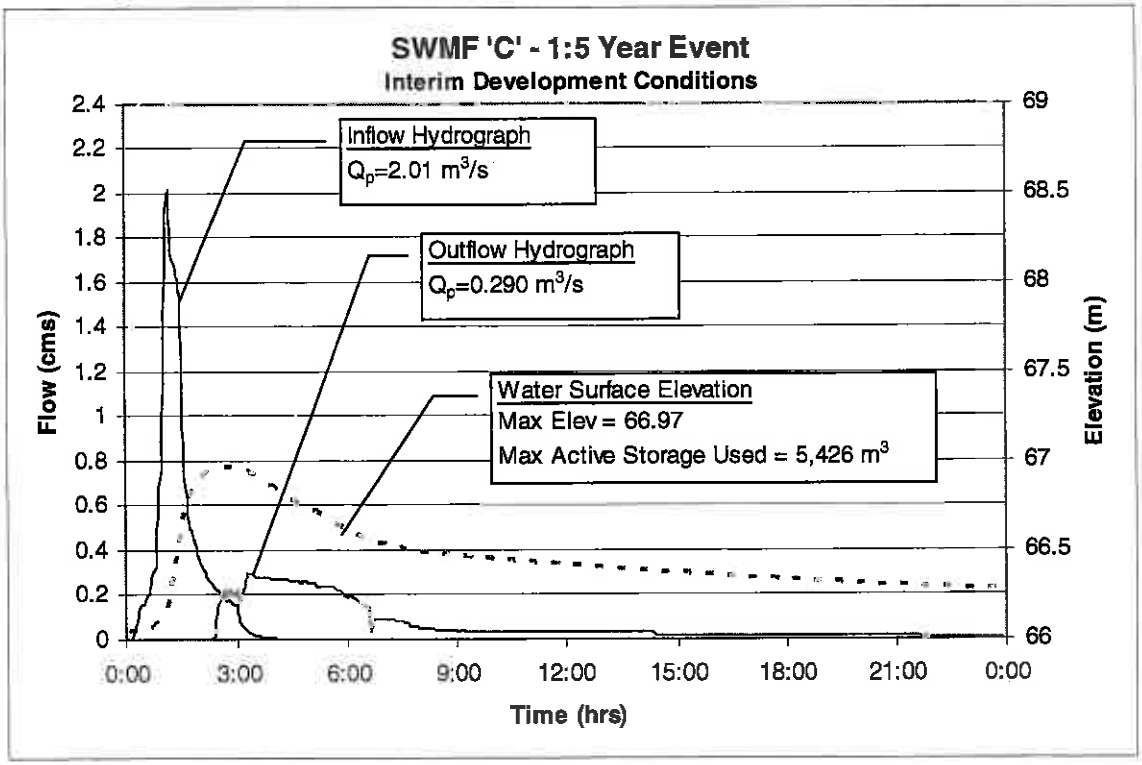


Figure 8

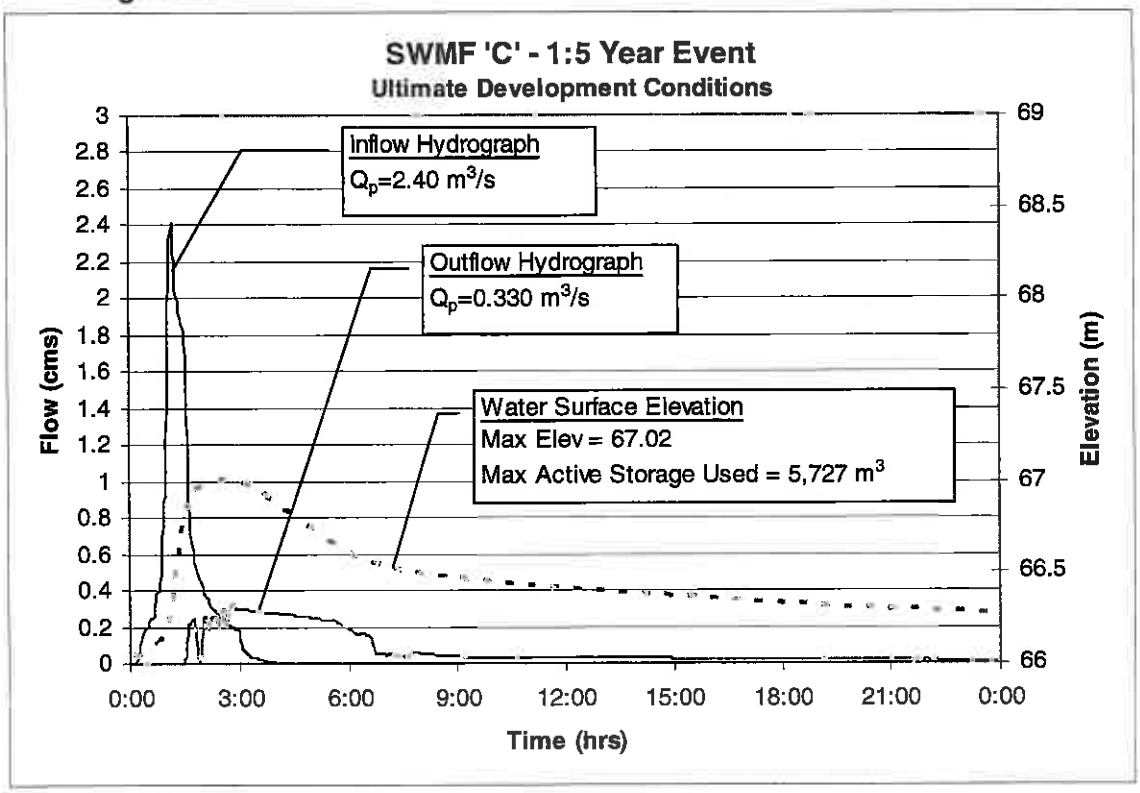


Figure 9

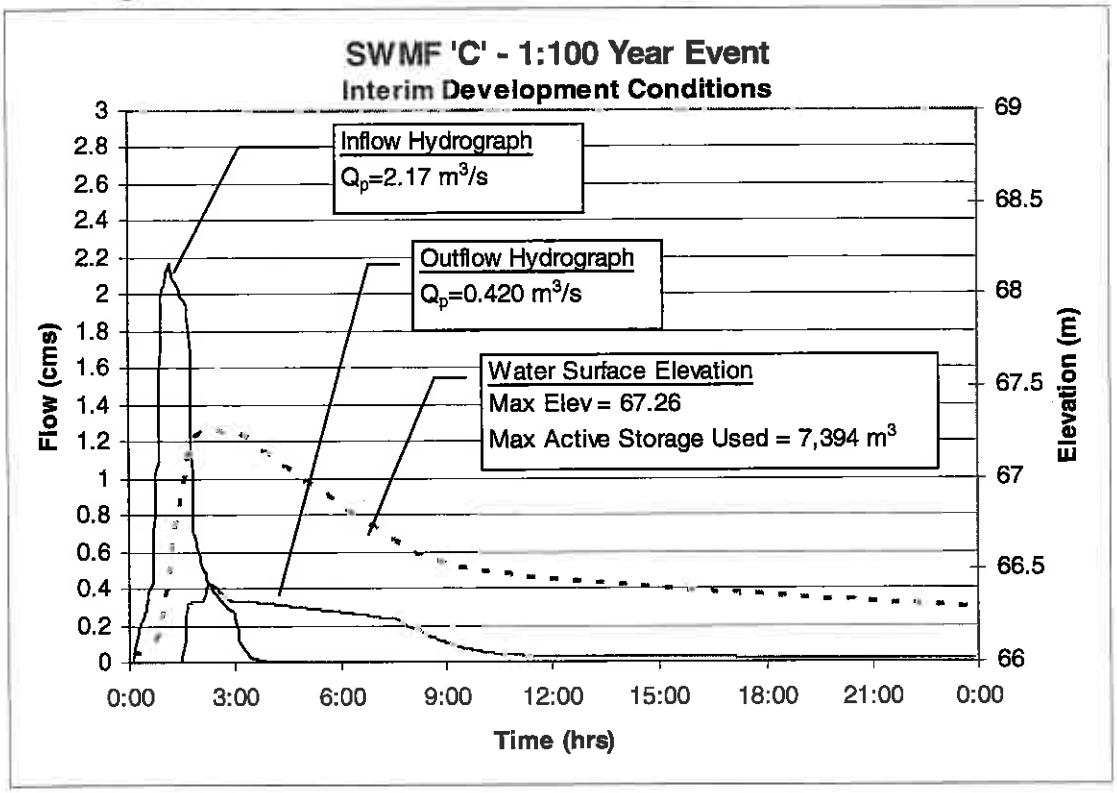
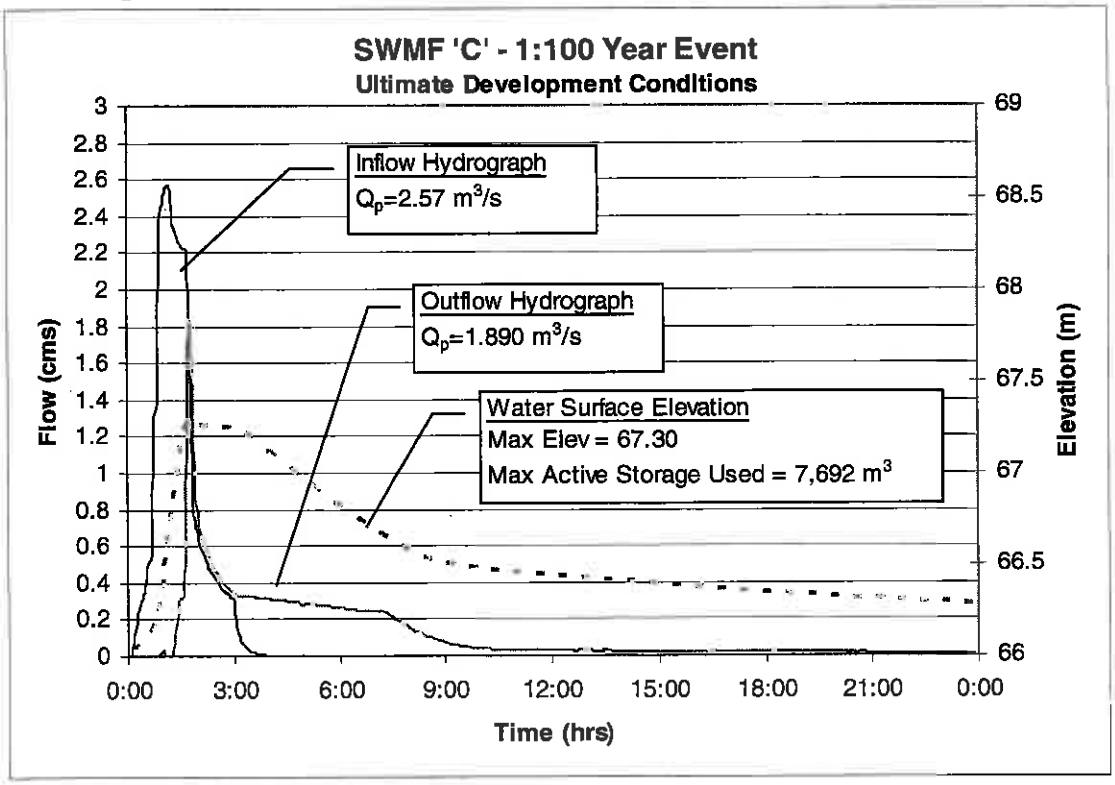


Figure 10



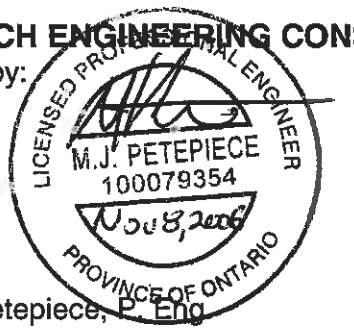
7.0 CONCLUSIONS

The results of the hydrologic and hydraulic modeling indicate that SWM Facility 'C' will meet all applicable stormwater management criteria for the subject lands.

- The storm sewers tributary to SWM facility 'C' will be designed to restrict minor system inflows to 85 L/s/ha.
    - Major system storage will be provided in roadway sags and parking lot areas.
    - The major overland system will be designed to ensure that major system flows are contained within the municipal ROW.
- SWM Facility 'C' will provide an *Enhanced* level of water quality control (80% long-term TSS removal) for a tributary drainage area of 26.2 ha through extended detention of the first 1,900 m^3 of runoff over a period of 24 hours.
- SWM Facility 'C' will have a maximum release rate of 293 L/s during the 1:5 year storm event under ultimate development conditions, which corresponds to a release rate of 11.2 L/s/ha and meets the erosion control target of 8-14 L/s/ha identified in the Kanata North EMP.
- Flows that exceed the maximum storage available in SWM Facility 'C' will spill over into the adjacent dry pond via a 40 m wide overflow spillway with a crest elevation of 67.25.
- The top of bank elevation for SWM Facility 'C' has been established at 67.75, which represents a freeboard of 0.45 m above the 1:100 year ponding elevation of 67.30 under ultimate development conditions.

NOVATECH ENGINEERING CONSULTANTS LTD

Prepared by:



Michael Petepiece, P. Eng
Project Engineer

APPENDIX A

Klondike Road Storm Sewer: Design Sheets

Storm Sewer Design Sheet	(5-Year Event) – Interim Conditions
HGL Design Sheet	(100-Year Event) – Interim Conditions
Storm Sewer Design Sheet	(5-Year Event) – Ultimate Conditions
HGL Design Sheet	(100-Year Event) – Ultimate Conditions

SWM FACILITY 'C' - KLONDIKE ROAD
STORM SEWER DESIGN SHEET (5-YEAR EVENT - ULTIMATE CONDITION)

The spreadsheet uses the Rational Method to calculate theoretical 5-year event storm sewer flows (see peak flow column).
The Ultimate Condition accounts for the entire drainage areas flowing through the completed storm sewer network.

LOCATION					Area (ha)							FLOW					SEWER DATA								
Street	Catchment	Dev't	From Node	To Node	R= 0.30	R= 0.40	R= 0.45	R= 0.50	R= 0.60	R= 0.65	R= 0.70	Indiv 2.78 AC	Accum 2.78 AC	Time of Conc.	Rainfall Intensity	Peak Flow Q (l/s)	Dia. (m) Actual	Dia. (mm) Nominal	Type	Slope (%)	Length (m)	Capacity (l/s)	Velocity (m/s)	Time of Flow (min)	Ratio Q/Q full
KLONDIKE ROAD																									
	C-201	MDR	-	FUT. MH				1.96				2.72	2.72	20.00	70.25	191.4	0.610	600	CONC	0.14		239.5	0.82	0.00	80%
			FUT. MH	MH 159						0.34		0.61	3.34	20.00	70.25	234.6	0.610	600	CONC	1.87	120.0	875.4	3.00	0.67	27%
	C202/C300	MDR	MH 159	MH 158			4.48	3.13		0.14		10.21	13.55	20.67	68.82	932.3	0.838	825	CONC	0.64	94.0	1,197.4	2.17	0.72	78%
	C203	PRK	MH 158	MH 157	1.88					0.38		2.25	15.80	21.39	67.34	1,061.1	0.838	825	CONC	0.75	120.0	1,296.2	2.35	0.85	82%
MARCONI AVENUE																									
	C204a	MDR	MH 162	MH 161					0.19			0.32	0.32	20.00	70.25	22.3	0.305	300	CONC	0.50	24.6	71.3	0.98	0.42	31%
			MH 161	MH 160					0.06			0.10	0.42	20.42	69.34	28.9	0.305	300	CONC	0.50	23.9	71.3	0.98	0.41	41%
			MH 160	MH 157					0.62			1.03	1.45	20.83	68.49	99.4	0.457	450	CONC	0.25	120.0	148.6	0.91	2.21	67%
				Area C204a					0.87																
KLONDIKE ROAD																									
			MH 157	MH 156						0.52		0.94	18.19	23.04	64.22	1,168.8	1.219	1200	CONC	0.13	97.0	1,465.9	1.26	1.29	80%
			MH 156	MH 155						0.31		0.56	18.75	24.32	62.00	1,162.6	1.219	1200	CONC	0.13	91.3	1,465.9	1.26	1.21	79%
			MH 155	MH 154	0.30					0.59		1.32	20.07	25.54	60.05	1,205.2	1.219	1200	CONC	0.13	117.0	1,465.9	1.26	1.55	82%
	C204b	MDR	MH 154	MH 153					4.15			6.92	26.99	27.09	57.75	1,558.8	1.219	1200	CONC	0.20	39.9	1,818.2	1.56	0.43	86%
			MH 153	FUT.MH A						0.21		0.38	27.37	27.52	57.15	1,564.3	1.372	1350	CONC	0.13	108.4	2,006.9	1.36	1.33	78%
	C101a	IND	FUT.MH A	FUT.MH B						0.45	3.19	7.02	34.39	28.85	55.37	1,904.6	1.372	1350	CONC	0.13	117.0	2,006.9	1.36	1.44	95%
			FUT.MH B	FUT.MH C								0.00	34.39	30.28	53.59	1,842.9	1.372	1350	CONC	0.13	51.0	2,006.9	1.36	0.63	92%
			FUT.MH C	OUTLET								0.00	34.39	30.91	52.85	1,817.5	1.372	1350	CONC	0.14	7.3	2,082.7	1.41	0.09	87%

Definitions:
Q=2.78 AIR, where
Q=Peak Flow in Litres per Second (l/s)
A=Area in hectares (ha)
I=Rainfall Intensity (mm/hr)
R=Runoff Coefficient

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min Pipe Velocity =0.60 m/s
3) Tc=15 min (subdivision)

Design: MAB
Check: JGR
Date: June 28, 2006

PROJECT: Brookside Subdivision
CLIENT: Klondike Developments
File Ref: 103106-0
Dwg. Reference:

STORM SEWER DESIGN SHEET (5-YEAR EVENT - INTERIM CONDITION)

The spreadsheet uses the Rational Method to calculate theoretical 5-year event storm sewer flows (see peak flow column).
Interim Condition - Prior to complete construction of Klondike Road, flows will be diverted to Pond 'C' via temporary swale.

LOCATION					Area (ha)							FLOW					SEWER DATA								
Street	Catchment	Dev't	From Node	To Node	R= 0.30	R= 0.40	R= 0.45	R= 0.50	R= 0.60	R= 0.65	R= 0.70	Indiv 2.78 AC	Accum 2.78 AC	Time of Conc.	Rainfall Intensity	Peak Flow Q (l/s)	Dia. (m) Actual	Dia. (mm) Nominal	Type	Slope (%)	Length (m)	Capacity (l/s)	Velocity (m/s)	Time of Flow (min)	Ratio Q/Q full
KLONDIKE ROAD																									
	C-201	MDR	-	FUT. MH				1.96				2.72	2.72	20.00	70.25	191.4	0.610	600	CONC	0.14		239.5	0.82	0.00	80%
			FUT. MH	MH 159						0.23		0.42	3.14	20.00	70.25	220.6	0.610	600	CONC	1.87	120.0	675.4	3.00	0.67	25%
	C202/C300	MDR	MH 159	MH 158			4.48	3.13		0.24		10.39	13.53	20.67	68.82	931.1	0.838	825	CONC	0.64	94.0	1,197.4	2.17	0.72	78%
	C203	PRK	MH 158	MH 157	1.88					0.39		2.27	15.80	21.39	67.34	1,064.1	0.838	825	CONC	0.75	120.0	1,296.2	2.35	0.85	82%
MARCONI AVENUE																									
	C204a	MDR	MH 162	MH 161					0.19			0.32	0.32	20.00	70.25	22.3	0.305	300	CONC	0.50	24.6	71.3	0.98	0.42	31%
			MH 161	MH 160					0.06			0.10	0.42	20.42	69.34	28.9	0.305	300	CONC	0.50	23.9	71.3	0.98	0.41	41%
			MH 160	MH 157					0.62			1.03	1.45	20.83	68.49	98.4	0.457	450	CONC	0.25	120.0	148.6	0.91	2.21	67%
KLONDIKE ROAD																									
			MH 157	MH 156						0.52		0.94	18.19	23.04	64.22	1,168.3	1.219	1200	CONC	0.13	97.0	1,465.9	1.26	1.29	80%
			MH 156	MH 155						0.31		0.56	18.75	24.32	62.00	1,162.6	1.219	1200	CONC	0.13	91.3	1,465.9	1.26	1.21	79%
			MH 155	MH 154	0.30					0.59		1.32	20.07	25.54	60.05	1,205.2	1.219	1200	CONC	0.13	117.0	1,465.9	1.26	1.55	82%
	C204b	MDR	MH 154	MH 153					4.15			6.92	26.99	27.09	57.75	1,558.8	1.219	1200	CONC	0.20	39.9	1,818.2	1.56	0.43	86%
	(see note 4)		MH 153	HEADWALL								0.00	26.99	27.52	57.15	1,542.6	1.372	1350	CONC	0.20	32.2	2,489.3	1.68	0.32	62%

Definitions:
Q=2.78 AIR, where
Q=Peak Flow in Litres per Second (l/s)
A=Area in hectares (ha)
I=Rainfall Intensity (mm/hr)
R=Runoff Coefficient

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min Pipe Velocity =0.80 m/s
3) Tc=15 min (subdivision)
4) Industrial zone (C-101a) area not included

Design: MAB
Check: JGR
Date: April 17, 2006

PROJECT: Brookside Subdivision
CLIENT: Klondike Developments
File Ref: 103106-0
Dwg. Reference:

SWM FACILITY 'C' - KLONDIKE ROAD
STORM SEWER: HYDRAULIC GRADE LINE ANALYSIS (100-YEAR EVENT - ULTIMATE CONDITION)

This spreadsheet uses the Darcy-Weisbach equation to calculate hydraulic losses through a pipe network with a specified flow rate. Minor losses are accounted for including both pipe bend losses and structure losses.
The spreadsheet returns the upstream hydraulic grade line if surcharged, or the pipe obvert if free flow conditions exist. The slope of the HGL is calculated and the minimum USF elevations can be established +0.30m above the HGL.
The theoretical 100-year event storm sewer peak flows will be controlled to the actual 5-year flow rates using various roadway inlet controls within CBs. Additional flows will be directed using overland flow routes.
The Ultimate Condition accounts for the entire drainage areas flowing through the completed storm sewer network.

LOCATION	MANHOLE		INVERT ELEVATION		GROUND ELEVATION	COVER	PIPE PARAMETERS			TOTAL FLOW	Q_{cap} (m^3/s)	Q_{in}/Q_{cap}	COMPUTATIONAL COLUMNS					HEAD LOSS	SURCHARGE	HGL			SLOPE	MIN. USF ELEVATION
	Upstream	Downstream	U/S (m)	D/S (m)	Upstream (m)	Upstream (m)	Dia (mm)	Length (m)	'n'	(m^3/s)			Pipe Area (m^2)	L/D	Friction Factor (f)	Velocity V (m/s)	$V^2/2g$	HL (m)	Upstream (m)	U/S (m)	D/S (m)	SLOPE (%)	(%)	Upstream (m)
KLONDIKE ROAD																				67.57	<- OUTLET TO POND			
	FUT.MH C	OUTLET	65.93	65.90	67.95	0.670	1350	12.30	0.013	1.827	2.750	0.66	1.478	9	0.01905	1.24	0.08	0.05	0.34	67.62	67.57	0.43	0.24	67.92
	FUT.MH B	FUT.MH C	66.02	65.93	68.55	1.180	1350	42.30	0.013	1.843	2.568	0.72	1.478	31	0.01905	1.25	0.08	0.09	0.34	67.71	67.62	0.21	0.21	68.01
	FUT.MH A	FUT.MH B	66.24	66.05	68.87	1.280	1350	117.00	0.013	1.898	2.244	0.85	1.478	87	0.01905	1.28	0.08	0.16	0.28	67.87	67.71	0.13	0.16	68.17
	MH 153	FUT.MH A	66.40	66.24	70.01	2.260	1350	120.00	0.013	1.564	2.033	0.77	1.478	89	0.01905	1.06	0.06	0.11	0.23	67.98	67.87	0.10	0.13	68.28
	MH 154	MH 153	66.63	66.55	70.18	2.350	1200	39.90	0.013	1.559	1.821	0.86	1.167	33	0.01981	1.34	0.09	0.08	0.23	68.06	67.98	0.20	0.20	68.36
	MH 155	MH 154	66.78	66.63	70.12	2.140	1200	117.00	0.013	1.205	1.456	0.83	1.167	98	0.01981	1.03	0.05	0.12	0.20	68.18	68.06	0.10	0.13	68.48
	MH 156	MH 155	66.90	66.78	70.39	2.290	1200	91.30	0.013	1.163	1.475	0.79	1.167	76	0.01981	1.00	0.05	0.09	0.16	68.23	68.18	0.09	0.13	68.56
	MH 157	MH 156	67.03	66.90	70.29	2.060	1200	97.00	0.013	1.168	1.489	0.78	1.167	81	0.01981	1.00	0.05	0.09	0.12	68.35	68.26	0.09	0.13	68.65
MARCONI AVENUE																								
	MH 160	MH 157	68.08	67.78	70.64	2.110	450	120.00	0.013	0.099	0.149	0.67	0.164	267	0.02747	0.60	0.02	0.17	0.00	68.53	68.35	0.15	0.25	68.83
	MH 161	MH 160	68.35	68.23	70.87	2.220	300	23.90	0.013	0.029	0.071	0.41	0.073	80	0.03145	0.40	0.01	0.02	0.00	68.65	68.53	0.50	0.50	68.95
	MH 162	MH 161	68.50	68.38	71.50	2.700	300	24.60	0.013	0.022	0.070	0.31	0.073	82	0.03145	0.30	0.00	0.01	0.00	68.90	68.68	0.49	0.49	69.10
KLONDIKE ROAD																								
	MH 158	MH 157	68.30	67.40	71.78	2.655	825	120.00	0.013	1.064	1.297	0.82	0.552	145	0.02245	1.93	0.19	0.66	0.00	69.13	68.35	0.64	0.75	69.43
	MH 159	MH 158	68.90	68.30	74.79	5.065	825	94.00	0.013	0.931	1.196	0.78	0.552	114	0.02245	1.69	0.15	0.40	0.00	69.53	69.13	0.64	0.64	70.03
TER LEVEL at Outlet = 67.39m																								

DESIGN PARAMETERS

DOWNSTREAM WATER LEVEL at Outlet = 67.57m (EPA SWMM MAX HGL)
RETURN FREQUENCY = 100 YEARS CONTROLLED TO 5 YEARS
MINIMUM VELOCITY= 0.80 m/s
MANNING'S n= 0.013
MIN. HGL CLEARANCE = 0.30m

HGL=Major + Minor Losses
Major Loss= Pipe Friction (Darcy-Weisbach)
Minor Loss= Head loss correction for flow through MH, changes in pipe size, and pipe bends
Friction Factor= 8g/c^2, where c=(1/n)*(D/4)^1/6

Designed: MAB
Checked: JGR
Dwg. Reference:

PROJECT: Brookside Subdivision
CLIENT: Regional Group
Date: June 28, 2006

SWM FACILITY 'C' - KLONDIKE ROAD
STORM SEWER: HYDRAULIC GRADE LINE ANALYSIS (100-YEAR EVENT - INTERIM CONDITION)

This spreadsheet uses the Darcy-Weisbach equation to calculate hydraulic losses through a pipe network with a specified flow rate. Minor losses are accounted for including both pipe bend losses and structure losses.
The spreadsheet returns the upstream hydraulic grade line if surcharged, or the pipe obvert if free flow conditions exist. The slope of the HGL is calculated and the minimum USF elevations can be established +0.30m above the HGL.
The theoretical 100-year event storm sewer peak flows will be controlled to the actual 5-year flow rates using various roadway inlet controls within CBs. Additional flows will be directed using overland flow routes.
Interim Condition - Prior to complete construction of Klondike Road, flows will be diverted to Pond 'C' via temporary swale.

LOCATION	MANHOLE		INVERT ELEVATION		GROUND ELEVATION	COVER	PIPE PARAMETERS			TOTAL FLOW	Q_{cap} (m^3/s)	Q_{in}/Q_{cap}	COMPUTATIONAL COLUMNS					HEAD LOSS	SURCHARGE	HGL			SLOPE	MIN. USF ELEVATION
	Upstream	Downstream	U/S (m)	D/S (m)	Upstream (m)	Upstream (m)	Dia (mm)	Length (m)	'n'	(m^3/s)			Pipe Area (m^2)	L/D	Friction Factor (f)	Velocity V (m/s)	$V^2/2g$	HL (m)	Upstream (m)	U/S (m)	D/S (m)	SLOPE (%)	(%)	Upstream (m)
KLONDIKE ROAD																				67.57	<- OUTLET TO SWALE			
	MH 153	HEADWALL	66.40	66.33	70.01	2.260	1350	32.20	0.013	1.543	2.596	0.59	1.478	24	0.01905	1.04	0.06	0.10	0.00	67.75	67.68	0.22	0.22	68.05
	MH 154	MH 153	66.63	66.55	70.18	2.350	1200	39.90	0.013	1.559	1.821	0.86	1.167	33	0.01981	1.34	0.09	0.08	0.00	67.83	67.75	0.20	0.20	68.13
	MH 155	MH 154	66.78	66.63	70.12	2.140	1200	117.00	0.013	1.205	1.456	0.83	1.167	98	0.01981	1.03	0.05	0.12	0.00	67.96	67.83	0.13	0.13	68.28
	MH 156	MH 155	66.90	66.78	70.39	2.290	1200	91.30	0.013	1.163	1.475	0.79	1.167	76	0.01981	1.00	0.05	0.09	0.00	68.10	67.98	0.13	0.13	68.40
	MH 157	MH 156	67.03	66.90	70.29	2.060	1200	97.00	0.013	1.168	1.489	0.78	1.167	81	0.01981	1.00	0.05	0.09	0.00	68.23	68.10	0.13	0.13	68.53
MARCONI AVENUE																								
	MH 160	MH 157	68.08	67.78	70.64	2.110	450	120.00	0.013	0.099	0.149	0.67	0.164	267	0.02747	0.60	0.02	0.17	0.00	68.53	68.23	0.25	0.25	68.83
	MH 161	MH 160	68.35	68.23	70.87	2.220	300	23.90	0.013	0.029	0.071	0.41	0.073	80	0.03145	0.40	0.01	0.02	0.00	68.65	68.53	0.50	0.50	68.95
	MH 162	MH 161	68.50	68.38	71.50	2.700	300	24.60	0.013	0.022	0.070	0.31	0.073	82	0.03145	0.30	0.00	0.01	0.00	68.80	68.68	0.49	0.49	69.10
KLONDIKE ROAD																								
	MH 158	MH 157	68.30	67.40	71.78	2.655	825	120.00	0.013	1.064	1.297	0.82	0.552	145	0.02245	1.93	0.19	0.66	0.00	69.19	68.23	0.75	0.75	69.43
	MH 159	MH 158	68.90	68.30	74.79	5.065	825	94.00	0.013	0.931	1.196	0.78	0.552	114	0.02245	1.69	0.15	0.40	0.00	69.73	69.13	0.64	0.64	70.03

DESIGN PARAMETERS

RETURN FREQUENCY = 100 YEARS CONTROLLED TO 5 YEARS
MINIMUM VELOCITY= 0.80 m/s
DOWNSTREAM WATER LEVEL at Outlet = 67.57m (EPA SWMM MAX HGL)
MIN. HGL CLEARANCE = 0.30m

HGL=Major + Minor Losses
Major Loss= Pipe Friction (Darcy-Weisbach)
Minor Loss= Head loss correction for flow through MH, changes in pipe size, and pipe bends
Friction Factor= 8g/c^2, where c=(1/n)*(D/4)^1/6

Designed: MAB
Checked: JGR
Dwg. Reference:

PROJECT:
Brookside Subdivision
CLIENT:
Regional Group
Date: August 4, 2006

APPENDIX B

SWM Facility 'C': Design Calculations & Modeling Files

SWMHYMO Modeling Parameters
SWMHYMO Input Files
Summary Output Files

SWM Facility Inlet & Outlet Calculations
SWM Facility Stage-Storage Curves
Forebay Design Calculations
EPA SWMM Model Schematics
EPA SWMM Model Output
EPA SWMM Flow Splitter Model Output (25mm / 100 yr)

Drainage Area Klondike & Adjacent Lands (Post-Development)	Subarea ID	Drainage Area (ha)	HYD	XIMP	TIMP	Slope (%) (perv / imp	Length (m) perv / imp	IA (mm) perv / imp)	CN	TP (hrs)
March Road (40m ROW + road widening)	A-MR1	5.83	STANDHY	0.70	0.80	0.4			65	
Commercial / Residential	A-400	3.62	STANDHY	0.58	0.68	1.0			65	
SWMF A		0.90								
Commercial / Residential	A-500	1.52	STANDHY	0.58	0.68	1.0			65	
Lands to SWMF 'C'										
Future Development (Mixed)	C-300	7.48	STANDHY	0.30	0.37	1.0			65	
Medium Density Residential	C-201	1.96	STANDHY	0.57	0.64	1.5			65	
Medium Density Residential	C-202	3.07	STANDHY	0.57	0.64	1.0			65	
Park	C-203	1.90	STANDHY	0.24	0.30	1.0			65	
Medium Density Residential	C-204	5.20	STANDHY	0.57	0.64	1.0			65	
Klondike Road R.O.W. U/S OCR	C-205	2.22	STANDHY	0.70	0.80	1.0			65	
Industrial	C-101	3.16	STANDHY	0.70	0.70	0.6			65	
SWMF 'C'	C-102	0.90	NASHYD						80	0.17
Klondike Road R.O.W. D/S OCR	C-103	1.20	STANDHY	0.70	0.80	1.0			65	
Low Density Residential	D-101	6.70	STANDHY	0.30	0.37	1.0			65	
Medium Density Residential	D-102	7.70	STANDHY	0.57	0.65	1.0			65	
Low/Med Density Residential	D-201	9.64	STANDHY	0.40	0.50	1.0			65	
Klondike Woods	D-301	2.09	NASHYD						55	0.17
Industrial	D-302	2.15	STANDHY	0.70	0.70	0.6			65	
SWMF 'D' & Inlet Channel	D-303	1.40	NASHYD						80	0.17
Shirley's Brook U/S of Klondike Rd	S-100	1.65								
Shirley's Brook U/S of Marconi Ave	S-101	8.40	NASHYD						80	0.17
Shirley's Brook U/S of OCR	S-102	3.49								
Shirley's Brook U/S of March Valley Road	S-200	5.67	NASHYD						80	0.17

Area to SWMF 'C': **27.1 ha**
26.2 ha (not including SWMF 'C' - used in water quality calculations)

```
2     Metric units
*#*************************************************************************
*#  Project Name: [Shirley's Brook - SWMF C]          Project Number: [103106]
*#  Date        : 05-28-2008
*#  Modeller    : (M.Petepiece)
*#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
*#  License #   :  5320763
*#
*# Post-Development Conditions to SWM Facility 'C'
*# Interim conditions - Klondike Road not urbanized east of OCR
*#                    - KRP Industrial lands not developed - sheet drain
*#                      directly to Shirley's Brook.
*#*************************************************************************
START                TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[1]
                     C25mm-3.stm
*
READ STORM           STORM_FILENAME=["storm.001"]
*=========================================================================
*
*                          KLONDIKE ROAD SUBDIVISION
*                            LANDS TO SWM FACILITY C
*                              INTERIM CONDITIONS
*
*=========================================================================
* Klondike Area C-300
* (Institutional/Residential)
*   7.48 ha x 85 L/s/ha = 636 L/s
*   7.48 ha @ 50 m3/ha  = 374 m3
* ------------------------------
DESIGN STANDHYD      ID=[1], NHYD=["C-300"], DT=[5]min, AREA=[7.48](ha),
                     XIMP=[0.30], TIMP=[0.37], DWF=[0](cms), LOSS=[2], CN=[65],
                     SLOPE=[1.0](%), END=-1
*
COMPUTE DUALHYD      IDin=[1], CINLET=[0.636](cms), NINLET=[1],
                     MAJID=[2], MajNHYD=["C-3maj"],
                     MINID=[9], MinNHYD=["C-3min"],
                     TMJSTO=[374](cu-m)
*
*%-----------------|-------------------------------------------------------|
* Klondike Area C-201
* medium density residential)
* ------------------------------
DESIGN STANDHYD      ID=[1], NHYD=["C-201"], DT=[5]min, AREA=[1.96](ha),
                     XIMP=[0.57], TIMP=[0.64], DWF=[0](cms), LOSS=[2], CN=[65],
                     SLOPE=[1.5](%), END=-1
*
* Klondike Area C-202
* (medium density residential)
* ------------------------------
DESIGN STANDHYD      ID=[2], NHYD=["C-202"], DT=[5]min, AREA=[3.07](ha),
                     XIMP=[0.57], TIMP=[0.64], DWF=[0](cms), LOSS=[2], CN=[65],
                     SLOPE=[1.0](%), END=-1
*
* Klondike Area C-203
* (park)
* ------------------------------
DESIGN STANDHYD      ID=[3], NHYD=["C-203"], DT=[5]min, AREA=[1.90](ha),
                     XIMP=[0.24], TIMP=[0.30], DWF=[0](cms), LOSS=[2], CN=[65],
                     SLOPE=[1.0](%), END=-1
*
* Klondike Area C-204
* (medium density residential)
* ------------------------------
DESIGN STANDHYD      ID=[4], NHYD=["C-204"], DT=[5]min, AREA=[5.20](ha),
                     XIMP=[0.57], TIMP=[0.64], DWF=[0](cms), LOSS=[2], CN=[65],
                     SLOPE=[1.0](%), END=-1
*
* Klondike Area C-205
* (Klondike Road U/S of OCR)
* ------------------------------
DESIGN STANDHYD      ID=[5], NHYD=["C-205"], DT=[5]min, AREA=[2.22](ha),
                     XIMP=[0.70], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[65],
                     SLOPE=[1.0](%), END=-1
*
* Klondike Area C-2 (ALL)
* ------------------------------
ADD HYD              IDsum=[6], NHYD=["C-2"], IDs to add=[1,2,3,4,5]
*
* Minor System Capture for Area C-2:
*  14.35 ha @ 85 L/s/ha = 1220 L/s
*  14.35 ha @ 50 m3/ha  =  718 m3
* ------------------------------------------
COMPUTE DUALHYD      IDin=[6], CINLET=[1.220](cms), NINLET=[1],
                     MAJID=[7], MajNHYD=["C2maj"],
                     MINID=[8], MinNHYD=["C2min"],
                     TMJSTO=[718](cu-m)
*%-----------------|-------------------------------------------------------|
* Klondike Area C-103 (Klondike Road D/S of OCR - rural)
* ------------------------------
DESIGN STANDHYD      ID=[6], NHYD=["C-103"], DT=[5]min, AREA=[1.20](ha),
                     XIMP=[0.30], TIMP=[0.40], DWF=[0](cms), LOSS=[2], CN=[65],
                     SLOPE=[1.0](%), END=-1
*%-----------------|-------------------------------------------------------|
* Klondike Area C-102 (SWMF C)
* ------------------------------
DESIGN NASHYD        ID=[5], NHYD=["C-102"], DT=[5]min, AREA=[0.90](ha),
                     DWF=[0](cms), CN/C=[80], TP=[0.17]hrs,
                     RAINFALL=[ ,  ,  ,  ,  ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------|
*
ADD HYD              IDsum=[10], NHYD=["C_IN_T"], IDs to add=[5,6,8,9]
*
* ------------------------------------------------
* SWMF C
* ------------------------------------------------
* Drainage Area :     26.2 ha (not incl. SWMF C)
* Extended Detention: Q=  29 L/s max
* Erosion Control:    Q= 162 L/s (10 L/s/ha)
* >5yr Storm:         Qin=Qout
* ------------------------------------------------
ROUTE RESERVOIR      IDout=[1],   NHYD=["C_OUT_T"],  IDin=[10],
                     RDT=[5](min),
                          TABLE of ( OUTFLOW-STORAGE ) values
                                   (cms) - (ha-m)
                                  [ 0.000 , 0.0000 ]
                                  [ 0.020 , 0.1030 ]
                                  [ 0.029 , 0.1860 ]
                                  [ 0.060 , 0.3910 ]
                                  [ 0.100 , 0.4200 ]
                                  [ 0.160 , 0.5460 ]
                                  [ 0.262 , 0.7090 ]
                                  [ 3.000 , 0.7430 ]
                                  [   -1  ,   -1   ]  (max twenty pts)
*%-----------------|-------------------------------------------------------|
SAVE HYD             ID=[10],   # OF PCYCLES=[1],  ICMSsh=[-1]
                     HYD_FILENAME=["C_IN_T"]
                     HYD_COMMENT=["Inflow to SWMF C - interim"]
*%-----------------|-------------------------------------------------------|
START                TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[2]
                     C5-3.stm
*
START                TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[3]
                     C100-3.stm
*
START                TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[4]
                     S100-12.stm
*
FINISH
```

```
SSSSS  W    W  M    M  H    H  Y    Y  M    M   000        999    888  ==========
S      W    W  MM  MM  H    H   Y  Y   MM MM  O   O      9   9  8   8  ==========
SSSSS  W    W  M MM M  HHHHH    Y      M MM M  O   O  ##  9   9  8   8  Ver.  4.0
    S  W WW W  M    M  H    H    Y      M    M  O   O       9999  888   Sept 1998
SSSSS   W W   M    M  H    H    Y      M    M   000            9  8   8  ==========
                                                           9   9  8   8  # 5320763
     StormWater Management HYdrologic Model                999    888  ==========

*************************************************************************
*************************** SWMHYMO-98  Ver/4.0 ***************************
*******  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) 727-5199           *******
*******                  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:  15000         *******
*******          Max. number of flow points    :  15000         *******
*************************************************************************

*** 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: 2003-11-09      TIME: 15:15:25      RUN COUNTER: 000480     *
*************************************************************************
* Input   filename: M:\2003\103105\DATA\CALCUL~1\SWMHYMO\SMWFC~1\SWM_C1.da*
* Output  filename: M:\2003\103106\DATA\CALCUL~1\SWMHYMO\SMWFC~1\SWM_C1.ou*
* Summary filename: M:\2003\103106\DATA\CALCUL~1\SWMHYMO\SMWFC~1\SWM_C1.su*
* User comments:                                                         *
* 1:_____________________________________________________________________*
* 2:_____________________________________________________________________*
* 3:_____________________________________________________________________*
*************************************************************************

#*************************************************************************
#  Project Name: [Shirley's Brook - SWMF C]            Project Number: [103106]
#  Date        : 05-28-2004
#  Modeller    : [M.Petepiece]
#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
#  License #   :  5320763
#
# Post-Development Conditions to SWM Facility 'C'
# Interim conditions - Klondike Road not urbanized east of OCR
#                    - KRP Industrial lands not developed - sheet drain
#                      directly to Shirley's Brook.
#*************************************************************************
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  = City of Ottawa:  25mm-3hr Chicago (10 minute time step)
     [SDT=10.00:SDUR=   3.00:PTOT=  25.00]
001:0003---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    DESIGN STANDHYD     01:C-300       7.48      .343 No_date    1:10     9.93 .397
     [XIMP=.30:TIMP=.37]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
001:0004---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD     01:C-300       7.48      .343 No_date    1:10     9.93  n/a
       Major System /   02:C-3maj       .00      .000 No_date    0:00      .00  n/a
       Minor System \   09:C-3min      7.48      .343 No_date    1:10     9.93  n/a
     {MjSysSto=.0000E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
001:0005---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     01:C-201       1.96      .185 No_date    1:10    15.55 .622
     [XIMP=.57:TIMP=.64]
     [SLP=1.50:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
001:0006---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     02:C-202       3.07      .280 No_date    1:10    15.55 .622
     [XIMP=.57:TIMP=.64]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
001:0007---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     03:C-203       1.90      .075 No_date    1:10     8.64 .346
     [XIMP=.24:TIMP=.30]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
001:0008---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     04:C-204       5.20      .460 No_date    1:10    15.55 .622
     [XIMP=.57:TIMP=.64]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
001:0009---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     05:C-205       2.22      .252 No_date    1:10    18.44 .738
     [XIMP=.70:TIMP=.80]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
001:0010---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ADD HYD             01:C-201       1.96      .185 No_date    1:10    15.55  n/a
                      + 02:C-202       3.07      .280 No_date    1:10    15.55  n/a
                      + 03:C-203       1.90      .075 No_date    1:10     8.64  n/a
                      + 04:C-204       5.20      .460 No_date    1:10    15.55  n/a
                      + 05:C-205       2.22      .252 No_date    1:10    18.44  n/a
     [DT= 5.00]  SUM=  06:C-2         14.35     1.252 No_date    1:10    15.08  n/a
001:0011---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD     06:C-2         14.35     1.252 No_date    1:10    15.08  n/a
       Major System /   07:C2maj        .00      .000 No_date    0:00      .00  n/a
       Minor System \   08:C2min      14.35     1.220 No_date    1:10    15.02  n/a
     {MjSysSto=.9866E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
001:0012---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     06:C-103       1.20      .060 No_date    1:10    10.05 .402
     [XIMP=.30:TIMP=.40]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
001:0013---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    DESIGN NASHYD       05:C-102        .90      .022 No_date    1:20     6.35 .254
     [CN= 80.0: N= 3.00]
     [Tp=  .17:DT= 5.00]
001:0014---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ADD HYD             05:C-102        .90      .022 No_date    1:20     6.35  n/a
                      + 06:C-103       1.20      .060 No_date    1:10    10.05  n/a
                      + 08:C2min      14.35     1.220 No_date    1:10    15.02  n/a
                      + 09:C-3min      7.48      .343 No_date    1:10     9.93  n/a
     [DT= 5.00]  SUM=  10:C_IN_T      23.93     1.640 No_date    1:10    12.85  n/a
001:0015---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ROUTE RESERVOIR -> 10:C_IN_T     23.93     1.640 No_date    1:10    12.85  n/a
     [RDT= 5.00] out<- 01:C_OUT      23.93      .042 No_date    3:05    12.55  n/a
     {MxStoUsed=.2732E+00}
001:0016---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    SAVE HYD            10:C_IN_T     23.93     1.640 No_date    1:10    12.85  n/a
     fname :M:\2003\103106\DATA\CALCUL~1\SWMHYMO\SMWFC-1\C_IN_T.001
     remark:Inflow to SWMF C - interim
 ** 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: [Shirley's Brook - SWMF C]            Project Number: [103106]
#  Date        : 05-28-2004
#  Modeller    : [M.Petepiece]
#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
#  License #   :  5320763
#
# Post-Development Conditions to SWM Facility 'C'
# Interim conditions - Klondike Road not urbanized east of OCR
#                    - KRP Industrial lands not developed - sheet drain
#                      directly to Shirley's Brook.
#*************************************************************************
002:0002----------------------------------------------------------------------
    READ STORM
     Filename = storm.001
     Comment  = City of Ottawa:  5yr-3hr Chicago (10 minute time step)
     [SDT=10.00:SDUR=   3.00:PTOT=  40.51]
002:0003---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     01:C-300       7.48      .658 No_date    1:10    19.73 .464
     [XIMP=.30:TIMP=.37]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
002:0004---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD     01:C-300       7.48      .658 No_date    1:10    19.73  n/a
       Major System /   02:C-3maj       .00      .000 No_date    0:00      .00  n/a
       Minor System \   09:C-3min      7.48      .636 No_date    1:10    19.69  n/a
     {MjSysSto=.8347E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
002:0005---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     01:C-201       1.96      .334 No_date    1:10    28.47 .670
     [XIMP=.57:TIMP=.64]
     [SLP=1.50:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
002:0006---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     02:C-202       3.07      .506 No_date    1:10    28.47 .670
     [XIMP=.57:TIMP=.64]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
002:0007---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     03:C-203       1.90      .144 No_date    1:10    17.70 .416
     [XIMP=.24:TIMP=.30]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
002:0008---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     04:C-204       5.20      .841 No_date    1:10    28.47 .670
     [XIMP=.57:TIMP=.64]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
002:0009---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     05:C-205       2.22      .455 No_date    1:10    33.09 .759
     [XIMP=.70:TIMP=.80]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
002:0010---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ADD HYD             01:C-201       1.96      .334 No_date    1:10    28.47  n/a
                      + 02:C-202       3.07      .506 No_date    1:10    28.47  n/a
                      + 03:C-203       1.90      .144 No_date    1:10    17.70  n/a
                      + 04:C-204       5.20      .841 No_date    1:10    28.47  n/a
                      + 05:C-205       2.22      .455 No_date    1:10    33.09  n/a
     [DT= 5.00]  SUM=  06:C-2         14.35     2.280 No_date    1:10    27.76  n/a
002:0011---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD     06:C-2         14.35     2.280 No_date    1:10    27.76  n/a
       Major System /   07:C2maj        .00      .000 No_date    0:00      .00  n/a
       Minor System \   08:C2min      14.35     1.220 No_date    1:05    27.83  n/a
```

```
    [MjSysSto=.4700E+03, TotOvfVol=.0000E+00, N-Ovf=    1, TotDurOvf=    0.hrs
003:0012----------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD    06:C-103       1.20      .112 No_date    1:10   20.02 .471
     [XIMP=.30:TIMP=.40]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
002:0013----------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    DESIGN NASHYD      05:C-102        .90      .057 No_date    1:15   16.09 .375
     [CN= 80.0: N= 3.00]
     [Tp=  .17:DT= 5.00]
002:0014----------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ADD HYD            05:C-102        .90      .057 No_date    1:15   16.09  n/a
                   +  06:C-103       1.20      .112 No_date    1:10   20.02  n/a
                   +  08:C2min      14.35     1.220 No_date    1:05   27.83  n/a
                   +  09:C-3min      7.48      .636 No_date    1:10   19.65  n/a
     [DT= 5.00]  SUM=  10:C_IN_T    23.93     2.014 No_date    1:10   24.44  n/a
002:0015----------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ROUTE RESERVOIR -> 10:C_IN_T    23.93     2.014 No_date    1:10   24.44  n/a
     [RDT= 5.00] out<- 01:C_OUT_    23.93      .138 No_date    3:00   24.44  n/a
     {MxStoUsed=.4926E+00}
002:0016----------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    SAVE HYD           10:C_IN_T    23.93     2.014 No_date    1:10   24.44  n/a
     fname :M:\2003\103106\DATA\CALCUL-1\SWMHYMO\SMWFC-1\C_IN_T.002
     remark:Inflow to SWMF C - interim
 ** 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: [Shirley's Brook - SWMF C]          Project Number: [103106]
#  Date        : 05-28-2006
#  Modeller    : [M.Petepiece]
#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
#  License #   :  5320763
#
# Post-Development Conditions to SWM Facility 'C'
# Interim conditions - Klondike Road not urbanized east of OCR
#                    - KRP Industrial lands not developed - sheet drain
#                      directly to Shirley's Brook.
#**********************************************************************
003:0002----------
    READ STORM
     Filename = storm.001
     Comment  = City of Ottawa:  100yr-3hr Chicago (10 minute time step)
     [SDT=10.00:SDUR=   3.00:PTOT=  71.65]
003:0003----------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD    01:C-300       7.48     1.313 No_date    1:10   39.14 .546
     [XIMP=.30:TIMP=.37]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
003:0004----------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:C-300       7.48     1.313 No_date    1:10   39.14  n/a
      Major System /   02:C-3maj       .12      .086 No_date    1:25   39.11  n/a
      Minor System \   09:C-3min      7.36      .636 No_date    1:05   39.12  n/a
     {MjSysSto=.3740E+03, TotOvfVol=.4518E+02, N-Ovf=    1, TotDurOvf=    0.hrs
003:0005----------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD    01:C-201       1.96      .628 No_date    1:10   51.90 .724
     [XIMP=.57:TIMP=.64]
     [SLP=1.50:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
003:0006----------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD    02:C-202       3.07      .925 No_date    1:10   51.90 .724
     [XIMP=.57:TIMP=.64]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
003:0007----------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD    03:C-203       1.90      .292 No_date    1:10   56.12 .504
     [XIMP=.24:TIMP=.30]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
003:0008----------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD    04:C-204       5.20     1.548 No_date    1:10   51.90 .724
     [XIMP=.57:TIMP=.64]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
003:0009----------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD    05:C-205       2.22      .835 No_date    1:10   58.84 .821
     [XIMP=.70:TIMP=.80]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
003:0010----------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ADD HYD            01:C-201       1.96      .628 No_date    1:10   51.90  n/a
                   +  02:C-202       3.07      .925 No_date    1:10   51.90  n/a
                   +  03:C-203       1.90      .292 No_date    1:10   56.12  n/a
                   +  04:C-204       5.20     1.548 No_date    1:10   51.90  n/a
                   +  05:C-205       2.22      .835 No_date    1:10   58.84  n/a
     [DT= 5.00]  SUM=  06:C-2       14.35     4.228 No_date    1:10   50.89  n/a
003:0011----------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    06:C-2         14.35     4.228 No_date    1:10   50.89  n/a
      Major System /   07:C2maj        2.59     1.933 No_date    1:15   50.87  n/a
      Minor System \   08:C2min      11.76     1.220 No_date    1:05   51.22  n/a
     {MjSysSto=.7180E+03, TotOvfVol=.1517E+04, N-Ovf=    1, TotDurOvf=    0.hrs
003:0012----------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD    06:C-103       1.20      .247 No_date    1:10   39.73 .554
     [XIMP=.30:TIMP=.40]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
003:0013----------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    DESIGN NASHYD      05:C-102        .90      .139 No_date    1:15   36.82 .514
     [CN= 80.0: N= 3.00]
     [Tp=  .17:DT= 5.00]
003:0014----------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ADD HYD            05:C-102        .90      .139 No_date    1:15   36.82  n/a
                   +  06:C-103       1.20      .247 No_date    1:10   39.73  n/a
                   +  08:C2min      11.76     1.220 No_date    1:05   51.22  n/a
                   +  09:C-3min      7.36      .636 No_date    1:05   39.12  n/a
     [DT= 5.00]  SUM=  10:C_IN_T    21.23     2.215 No_date    1:10   45.76  n/a
003:0015----------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ROUTE RESERVOIR -> 10:C_IN_T    21.23     2.216 No_date    1:10   45.76  n/a
     [RDT= 5.00] out<- 01:C_OUT_    21.23     1.524 No_date    1:55   45.75  n/a
     {MxStoUsed=.7337E+00}
003:0016----------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    SAVE HYD           10:C_IN_T    21.23     2.216 No_date    1:10   45.76  n/a
     fname :M:\2003\103106\DATA\CALCUL-1\SWMHYMO\SMWFC-1\C_IN_T.003
     remark:Inflow to SWMF C - interim
 ** END OF RUN :   3

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



RUN:COMMAND#
004:0001----------
    START
     [TZERO =     .00 hrs on        0]
     [METOUT=   2     (1=imperial, 2=metric output)]
     [NSTORM=   1 ]
     [NRUN  =   4 ]
#**********************************************************************
#  Project Name: [Shirley's Brook - SWMF C]          Project Number: [103106]
#  Date        : 05-28-2006
#  Modeller    : [M.Petepiece]
#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
#  License #   :  5320763
#
# Post-Development Conditions to SWM Facility 'C'
# Interim conditions - Klondike Road not urbanized east of OCR
#                    - KRP Industrial lands not developed - sheet drain
#                      directly to Shirley's Brook.
#**********************************************************************
004:0002----------
    READ STORM
     Filename = storm.001
     Comment  = City of Ottawa:  100yr-12hr SCS Type II (10 min time step)
     [SDT=10.00:SDUR=  12.00:PTOT=  96.00]
004:0003----------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD    01:C-300       7.48      .922 No_date    6:00   57.36 .598
     [XIMP=.30:TIMP=.37]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
004:0004----------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:C-300       7.48      .922 No_date    6:00   57.36  n/a
      Major System /   02:C-3maj       .00      .000 No_date    0:00    .00  n/a
      Minor System \   09:C-3min      7.48      .636 No_date    5:45   57.27  n/a
     {MjSysSto=.2175E+03, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
004:0005----------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD    01:C-201       1.96      .331 No_date    6:00   72.71 .757
     [XIMP=.57:TIMP=.64]
     [SLP=1.50:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
004:0006----------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD    02:C-202       3.07      .512 No_date    6:00   72.71 .757
     [XIMP=.57:TIMP=.64]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
004:0007----------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD    03:C-203       1.90      .220 No_date    6:00   53.69 .559
     [XIMP=.24:TIMP=.30]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
004:0008----------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD    04:C-204       5.20      .865 No_date    6:00   72.71 .757
     [XIMP=.57:TIMP=.64]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
004:0009----------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD    05:C-205       2.22      .423 No_date    6:00   81.18 .846
     [XIMP=.70:TIMP=.80]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
004:0010----------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ADD HYD            01:C-201       1.96      .331 No_date    6:00   72.71  n/a
                   +  02:C-202       3.07      .512 No_date    6:00   72.71  n/a
                   +  03:C-203       1.90      .220 No_date    6:00   53.69  n/a
                   +  04:C-204       5.20      .865 No_date    6:00   72.71  n/a
                   +  05:C-205       2.22      .423 No_date    6:00   81.18  n/a
     [DT= 5.00]  SUM=  06:C-2       14.35     2.352 No_date    6:00   71.50  n/a
004:0011----------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    06:C-2         14.35     2.352 No_date    6:00   71.50  n/a
      Major System /   07:C2maj        1.03     1.088 No_date    6:00   71.50  n/a
      Minor System \   08:C2min      13.32     1.220 No_date    5:35   71.50  n/a
     {MjSysSto=.7180E+03, TotOvfVol=.7364E+03, N-Ovf=    1, TotDurOvf=    0.hrs
004:0012----------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD    06:C-103       1.20      .154 No_date    6:00   58.19 .606
     [XIMP=.30:TIMP=.40]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
004:0013----------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    DESIGN NASHYD      05:C-102        .90      .129 No_date    6:00   56.52 .582
     [CN= 80.0: N= 3.00]
     [Tp=  .17:DT= 5.00]
004:0014----------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ADD HYD            05:C-102        .90      .129 No_date    6:00   56.52  n/a
                   +  06:C-103       1.20      .154 No_date    6:00   58.19  n/a
                   +  08:C2min      13.32     1.220 No_date    5:35   71.50  n/a
                   +  09:C-3min      7.48      .636 No_date    5:45   57.27  n/a
     [DT= 5.00]  SUM=  10:C_IN_T    22.90     2.139 No_date    6:00   65.57  n/a
004:0015----------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ROUTE RESERVOIR -> 10:C_IN_T    22.90     2.139 No_date    6:00   65.57  n/a
     [RDT= 5.00] out<- 01:C_OUT_    22.90     2.135 No_date    6:20   65.56  n/a
     {MxStoUsed=.7345E+00}
004:0016----------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    SAVE HYD           10:C_IN_T    22.90     2.139 No_date    6:00   65.57  n/a
     fname :M:\2003\103106\DATA\CALCUL-1\SWMHYMO\SMWFC-1\C_IN_T.004
     remark:Inflow to SWMF C - interim
004:0002----------
    FINISH
----------------------------------------------------------------------
**********************************************************************
    WARNINGS / ERRORS / NOTES
    -------------------------
001:0005 DESIGN STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
001:0006 DESIGN STANDHYD
```

```
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
001:0007 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
001:0008 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
001:0009 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
001:0012 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0003 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0005 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0006 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0007 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0008 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0009 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0012 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
003:0003 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
003:0005 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
003:0006 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
003:0007 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
003:0008 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
003:0009 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
003:0012 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
004:0003 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
004:0005 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
004:0006 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
004:0007 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
004:0008 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
004:0009 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
004:0012 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
  Simulation ended on 2006-11-09     at 15:15:30
================================================================================
```

```
2     Metric units
*#**************************************************************************
*#  Project Name: (Shirley's Brook - SWMF C)            Project Number: [103106]
*#  Date        : 05-28-2006
*#  Modeller    : [M.Petepiece]
*#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
*#  License #   :  5320763
*#
*# Post-Development Conditions to SWM Facility 'C'
*#**************************************************************************
START                 TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[1]
                      C25mm-3.stm
*
READ STORM            STORM_FILENAME=["storm.001"]
*==========================================================================
*
*                           KLONDIKE ROAD SUBDIVISION
*                            LANDS TO SWM FACILITY C
*                              ULTIMATE CONDITIONS
*
*==========================================================================
* Klondike Area C-300
* (Institutional/Residential)
*   7.48 ha x 85 L/s/ha = 636 L/s
*   7.48 ha @ 50 m3/ha  = 374 m3
* ---------------------------------
DESIGN STANDHYD       ID=[1], NHYD=["C-300"], DT=[5]min, AREA=[7.48](ha),
                      XIMP=[0.30], TIMP=[0.37], DWF=[0](cms), LOSS=[2], CN=[65],
                      SLOPE=[1.0](%), END=-1
*
COMPUTE DUALHYD       IDin=[1], CINLET=[0.636](cms), NINLET=[1],
                      MAJID=[2], MajNHYD=["C-3maj"],
                      MINID=[9], MinNHYD=["C-3min"],
                      TMJSTO=[374](cu-m)
*
*%-----------------|-------------------------------------------------------|
* Klondike Area C-201
* medium density residential)
* -------------------------------
DESIGN STANDHYD       ID=[1], NHYD=["C-201"], DT=[5]min, AREA=[1.96](ha),
                      XIMP=[0.57], TIMP=[0.64], DWF=[0](cms), LOSS=[2], CN=[65],
                      SLOPE=[1.5](%), END=-1
*
* Klondike Area C-202
* (medium density residential)
* -------------------------------
DESIGN STANDHYD       ID=[2], NHYD=["C-202"], DT=[5]min, AREA=[3.07](ha),
                      XIMP=[0.57], TIMP=[0.64], DWF=[0](cms), LOSS=[2], CN=[65],
                      SLOPE=[1.0](%), END=-1
*
* Klondike Area C-203
* (park)
* -------------------------------
DESIGN STANDHYD       ID=[3], NHYD=["C-203"], DT=[5]min, AREA=[1.90](ha),
                      XIMP=[0.24], TIMP=[0.30], DWF=[0](cms), LOSS=[2], CN=[65],
                      SLOPE=[1.0](%), END=-1
*
* Klondike Area C-204
* (medium density residential)
* -------------------------------
DESIGN STANDHYD       ID=[4], NHYD=["C-204"], DT=[5]min, AREA=[5.20](ha),
                      XIMP=[0.57], TIMP=[0.64], DWF=[0](cms), LOSS=[2], CN=[65],
                      SLOPE=[1.0](%), END=-1
*
* Klondike Area C-205
* (Klondike Road U/S of CCR)
* -------------------------------
DESIGN STANDHYD       ID=[5], NHYD=["C-205"], DT=[5]min, AREA=[2.22](ha),
                      XIMP=[0.70], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[65],
                      SLOPE=[1.0](%), END=-1
*
* Klondike Area C-2 (ALL)
* -------------------------------
ADD HYD               IDsum=[6], NHYD=["C-2"], IDs to add=[1,2,3,4,5]
*
* Minor System Capture for Area C-2:
*  14.35 ha @ 85 L/s/ha = 1220 L/s
*  14.35 ha @ 50 m3/ha  =  718 m3
* ---------------------------------------
COMPUTE DUALHYD       IDin=[6], CINLET=[1.220](cms), NINLET=[1],
                      MAJID=[7], MajNHYD=["C2maj"],
                      MINID=[8], MinNHYD=["C2min"],
                      TMJSTO=[718](cu-m)
*%-----------------|-------------------------------------------------------|
* Klondike Area C-101
* (Industrial)
* -------------------------------
DESIGN STANDHYD       ID=[1], NHYD=["C-101"], DT=[5]min, AREA=[3.16](ha),
                      XIMP=[0.70], TIMP=[0.70], DWF=[0](cms), LOSS=[2], CN=[65],
                      SLOPE=[0.6](%), END=-1
*
* 3.16 ha @ 85 L/s/ha = 269 L/s
* 3.16 ha @ 50 m3/ha  = 158 m3
* -------------------------------
COMPUTE DUALHYD       IDin=[1], CINLET=[0.269](cms), NINLET=[1],
                      MAJID=[2], MajNHYD=["C101ma"],
                      MINID=[7], MinNHYD=["C101mi"],
                      TMJSTO=[158](cu-m)
*%-----------------|-------------------------------------------------------|
* Klondike Area C-103 (Klondike Road D/S of CCR)
* -------------------------------
DESIGN STANDHYD       ID=[6], NHYD=["C-103"], DT=[5]min, AREA=[1.20](ha),
                      XIMP=[0.70], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[65],
                      SLOPE=[1.0](%), END=-1
*%-----------------|-------------------------------------------------------|
* Klondike Area C-102 (SWMF C)
* -------------------------------
DESIGN NASHYD         ID=[5], NHYD=["C-102"], DT=[5]min, AREA=[0.90](ha),
                      LNF=[0](cms), CN/C=[80], TP=[0.17]hrs,
                      RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------|
*
ADD HYD               IDsum=[10], NHYD=["SWMC_IN"], IDs to add=[5,6,7,8,9]
*
* -------------------------------
* SWMF C
* -------------------------------
* Drainage Area :     26.2 ha (not incl. SWMF C)
* Extended Detention: Q=  29 L/s max
* Erosion Control:    Q= 262 L/s (10 L/s/ha)
* 25yr Storm:         Qin=Qout
* -------------------------------
ROUTE RESERVOIR       IDout=[11],   NHYD=["SWMC_OUT"],  IDin=[10],
                      RDT=[5](min),
                            TABLE of ( OUTFLOW-STORAGE ) values
                                     (cms) - (ha-m)
                                   ( 0.000 , 0.0000 )
                                   ( 0.020 , 0.1030 )
                                   ( 0.029 , 0.1860 )
                                   ( 0.060 , 0.3910 )
                                   ( 0.100 , 0.4200 )
                                   ( 0.160 , 0.5460 )
                                   ( 0.262 , 0.7090 )
                                   ( 3.000 , 0.7430 )
                                   (  -1   ,  -1    )  (max twenty pts)
*%-----------------|-------------------------------------------------------|
SAVE HYD              ID=[10],   # OF CYCLES=[1],  ICASEsh=[-1]
                      HYD_FILENAME=["SWMC_IN"]
                      HYD_COMMENT=["Inflow to SWMF C"]
*%-----------------|-------------------------------------------------------|
START                 TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[2]
                      C5-3.stm
*
START                 TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[3]
                      C100-3.stm
*
START                 TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[4]
                      S100-12.stm
*
FINISH
```

```
SSSSS  W    W  H   M   H   H  Y   Y  M   M   OOO        999     888  ==========
S      W W W  M M MM  H   H   Y Y   MM MM  O   O      9   9   8   8  ==========
SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##   9   9   8   8  Ver. 4.0
    S  W W W  M   M  H   H    Y    M   M  O   O       9999    889   Sept 1998
SSSSS   W W   M   M  H   H    Y    M   M   OOO            9   8   8  ==========
                                                      9   9   8   8  # 5320763
     StormWater Management HYdrologic Model            999     888  ==========

*******************************************************************************
*************************** SWMHYMO-98  Ver/4.0 ***************************
*******  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) 727-5199          *******
*******                   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:  15000               *******
*******          Max. number of flow points    :  15000               *******
*******************************************************************************

*** DESCRIPTION SUMMARY TABLE HEADERS (units depend on METOUT in START) ***
*****************************************************************************
***    ID:  Hydrograph IDentification numbers, (1-10).                    ***
***  HYD:  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: 2006-10-05      TIME: 09:39:06      RUN COUNTER: 000419         *
*******************************************************************************
* Input   filename: M:\2003\103106\DATA\CALCUL~1\SWMHYMO\SMWFC~1\SWM_C.dat     *
* Output  filename: M:\2003\103106\DATA\CALCUL~1\SWMHYMO\SMWFC~1\SWM_C.out     *
* Summary filename: M:\2003\103106\DATA\CALCUL~1\SWMHYMO\SMWFC~1\SWM_C.sum     *
* User comments:                                                              *
* 1:_____________________________________________________________________     *
* 2:_____________________________________________________________________     *
* 3:_____________________________________________________________________     *
*******************************************************************************


#*****************************************************************************
#  Project Name: [Shirley's Brook - SWMF C]            Project Number: [103106]
#  Date        : 05-28-2006
#  Modeller    : [M.Petepiece]
#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
#  License #   :  5320763
#
# Post-Development Conditions to SWM Facility 'C'
#*****************************************************************************
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  = City of Ottawa:  25mm storm (Chicago distribution - 10 minut
     [SDT=10.00:SDUR=   4.00:PTOT=  24.98]
001:0003---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    DESIGN STANDHYD     01:C-300       7.48      .319 No_date    1:40     9.92 .397
     [XIMP=.30:TIMP=.37]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
001:0004---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD     01:C-300       7.48      .319 No_date    1:40     9.92 n/a
      Major System /    02:C-3maj       .00      .000 No_date    0:00      .00 n/a
      Minor System \    03:C-3min      7.48      .319 No_date    1:40     9.92 n/a
     {MjSysSto=.0000E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
001:0005---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     01:C-201       1.96      .173 No_date    1:40    15.54 .622
     [XIMP=.57:TIMP=.64]
     [SLP=1.50:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
001:0006---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     02:C-202       3.07      .261 No_date    1:40    15.54 .622
     [XIMP=.57:TIMP=.64]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
001:0007---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     03:C-203       1.90      .070 No_date    1:40     8.63 .346
     [XIMP=.24:TIMP=.30]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
001:0008---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     04:C-204       5.20      .428 No_date    1:40    15.54 .622
     [XIMP=.57:TIMP=.64]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
001:0009---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     05:C-205       2.22      .235 No_date    1:40    18.43 .738
     [XIMP=.70:TIMP=.80]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
001:0010---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ADD HYD             01:C-201       1.96      .173 No_date    1:40    15.54  n/a
                      + 02:C-202       3.07      .261 No_date    1:40    15.54  n/a
                      + 03:C-203       1.90      .070 No_date    1:40     3.63  n/a
                      + 04:C-204       5.20      .428 No_date    1:40    15.54  n/a
                      + 05:C-205       2.22      .235 No_date    1:40    18.43  n/a
     [DT= 5.00]  SUM=  02:C-2        14.35     1.166 No_date    1:40    15.07  n/a
001:0011---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD     06:C-2         14.35     1.166 No_date    1:40    15.07  n/a
      Major System /    07:C2maj        .00      .000 No_date    0:00      .00  n/a
      Minor System \    08:C2min      14.35     1.166 No_date    1:40    15.07  n/a
     {MjSysSto=.0000E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
001:0012---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     01:C-101       3.16      .317 No_date    1:40    17.96 .719
     [XIMP=.70:TIMP=.70]
     [SLP= .60:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
001:0013---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD     01:C-101       3.16      .317 No_date    1:40    17.96  n/a
      Major System /    07:C101ma       .00      .000 No_date    0:00      .00  n/a
      Minor System \    07:C101mi      3.16      .269 No_date    1:40    17.63  n/a
     {MjSysSto=.8342E+01, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
001:0014---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     06:C-103       1.20      .130 No_date    1:40    18.43 .738
     [XIMP=.70:TIMP=.80]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
001:0015---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    DESIGN NASHYD       05:C-102        .90      .020 No_date    1:45     6.34 .254
     [CN= 80.0: N= 3.00]
     [Tp=  .17:DT= 5.00]
001:0016---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ADD HYD             05:C-102        .90      .020 No_date    1:45     6.34  n/a
                      + 06:C-103       1.20      .130 No_date    1:40    18.43  n/a
                      + 07:C101mi      3.16      .269 No_date    1:40    17.63  n/a
                      + 08:C2min      14.35     1.166 No_date    1:40    15.07  n/a
                      + 09:C-3min      7.48      .319 No_date    1:40     9.92  n/a
     [DT= 5.00]  SUM=  10:SWMC_I     27.09     1.900 No_date    1:40    13.81  n/a
001:0017---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ROUTE RESERVOIR -> 10:SWMC_I     27.09     1.900 No_date    1:40    13.81  n/a
     [RDT= 5.00] out<- 01:SWMC_O     27.09      .050 No_date    4:05    13.81  n/a
     {MaxStoUsed=.3270E+00}
001:0018---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    SAVE HYD            10:SWMC_I     27.09     1.900 No_date    1:40    13.81  n/a
     fname :M:\2003\103106\DATA\CALCUL~1\SWMHYMO\SMWFC~1\SWMC_IN.001
     remark:Inflow to SWMF C
 ** 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: [Shirley's Brook - SWMF C]            Project Number: [103106]
#  Date        : 05-28-2006
#  Modeller    : [M.Petepiece]
#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
#  License #   :  5320763
#
# Post-Development Conditions to SWM Facility 'C'
#*****************************************************************************
002:0002------------------------------------------------------------------------
    READ STORM
     Filename = storm.001
     Comment  = City of Ottawa:  5yr-3hr Chicago (DT=10 min, TPRAT=0.4, Peak
     [SDT=10.00:SDUR=   3.00:PTOT=  42.50]
002:0003---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     01:C-300       7.48      .657 No_date    1:10    19.73 .464
     [XIMP=.30:TIMP=.37]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
002:0004---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD     01:C-300       7.48      .657 No_date    1:10    19.73  n/a
      Major System /    02:C-3maj       .00      .000 No_date    0:00      .00  n/a
      Minor System \    09:C-3min      7.48      .636 No_date    1:10    19.65  n/a
     {MjSysSto=.7624E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
002:0005---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     01:C-201       1.96      .334 No_date    1:10    28.47 .670
     [XIMP=.57:TIMP=.64]
     [SLP=1.50:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
002:0006---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     02:C-202       3.07      .505 No_date    1:10    28.47 .670
     [XIMP=.57:TIMP=.64]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
002:0007---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     03:C-203       1.90      .143 No_date    1:10    17.70 .416
     [XIMP=.24:TIMP=.30]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
002:0008---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     04:C-204       5.20      .840 No_date    1:10    28.47 .670
     [XIMP=.57:TIMP=.64]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
002:0009---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     05:C-205       2.22      .454 No_date    1:10    33.09 .778
     [XIMP=.70:TIMP=.80]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
002:0010---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ADD HYD             01:C-201       1.96      .334 No_date    1:10    28.47  n/a
                      + 02:C-202       3.07      .505 No_date    1:10    28.47  n/a
                      + 03:C-203       1.90      .143 No_date    1:10    17.70  n/a
                      + 04:C-204       5.20      .840 No_date    1:10    28.47  n/a
                      + 05:C-205       2.22      .454 No_date    1:10    33.09  n/a
```

```
     [DT= 5.00]  SUM=  06:C-2       14.35    2.276 No_date    1:10   27.76  n/a
002:0011--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    06:C-2       14.35    2.276 No_date    1:10   27.76  n/a
      Major System /  07:C2maj        .00     .000 No_date    0:00     .00  n/a
      Minor System \  08:C2min      14.35    1.220 No_date    1:05   27.79  n/a
     {MjSysSto=.4711E+03, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
002:0012--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD    01:C-101      3.16     .614 No_date    1:10   32.03 .754
     [XIMP=.70:TIMP=.70]
     [SLP= .60:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
002:0013--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:C-101      3.16     .614 No_date    1:10   32.03  n/a
      Major System /  02:C101ma       .05     .047 No_date    1:15   32.03  n/a
      Minor System \  07:C101mi      3.11     .269 No_date    1:05   31.82  n/a
     {MjSysSto=.1580E+03, TotOvfVol=.1685E+02, N-Ovf=    1, TotDurOvf=    0.hrs
002:0014--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD    06:C-103      1.20     .248 No_date    1:10   33.09 .778
     [XIMP=.70:TIMP=.80]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
002:0015--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    DESIGN NASHYD      05:C-102       .90     .058 No_date    1:15   16.09 .379
     [CN= 80.0: N= 3.00]
     [Tp=  .17:DT= 5.00]
002:0016--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ADD HYD            05:C-102       .90     .058 No_date    1:15   16.09  n/a
                   +   06:C-103      1.20     .248 No_date    1:10   33.09  n/a
                   +   07:C101mi     3.11     .269 No_date    1:05   31.82  n/a
                   +   08:C2min     14.35    1.220 No_date    1:05   27.79  n/a
                   +   09:C-3min     7.48     .636 No_date    1:10   19.65  n/a
     [DT= 5.00]  SUM=  10:SWMC_I    27.04    2.419 No_date    1:10   25.84  n/a
002:0017--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ROUTE RESERVOIR -> 10:SWMC_I    27.04    2.419 No_date    1:10   25.84  n/a
     [RDT= 5.00] out<- 01:SWMC_O    27.04     .184 No_date    2:55   25.84  n/a
     {MxStoUsed=.5850E+00}
002:0018--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    SAVE HYD           10:SWMC_I    27.04    2.419 No_date    1:10   25.84  n/a
     fname :M:\2003\103106\DATA\CALCUL~1\SWMHYMO\SMWFC~1\SWMC_IN.002
     remark:Inflow to SWMF C
 ** 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: [Shirley's Brook - SWMF C]            Project Number: [103106]
#  Date        : 05-28-2006
#  Modeller    : [M.Petepiece]
#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
#  License #   :  5320763
#
# Post-Development Conditions to SWM Facility 'C'
*******************************************************************************
003:0002--------------------------------------------------------------------
    READ STORM
     Filename = storm.001
     Comment  = City of Ottawa:  100yr-3hr Chicago (10 minute time step - 20
     [SDT=10.00:SDUR=   3.00:PTOT=  71.67]
003:0003--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD    01:C-300      7.48    1.076 No_date    1:10   39.16 .546
     [XIMP=.30:TIMP=.37]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
003:0004--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:C-300      7.48    1.076 No_date    1:10   39.16  n/a
      Major System /  02:C-3maj       .00     .000 No_date    0:00     .00  n/a
      Minor System \  09:C-3min     7.48     .636 No_date    0:55   39.26  n/a
     {MjSysSto=.3154E+03, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
003:0005--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD    01:C-201      1.96     .444 No_date    1:10   51.92 .725
     [XIMP=.57:TIMP=.64]
     [SLP=1.50:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
003:0006--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD    02:C-202      3.07     .654 No_date    1:10   51.92 .725
     [XIMP=.57:TIMP=.64]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
003:0007--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD    03:C-203      1.90     .247 No_date    1:10   36.14 .504
     [XIMP=.24:TIMP=.30]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
003:0008--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD    04:C-204      5.20    1.121 No_date    1:10   51.92 .725
     [XIMP=.57:TIMP=.64]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
003:0009--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD    05:C-205      2.22     .578 No_date    1:10   58.86 .821
     [XIMP=.70:TIMP=.80]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
003:0010--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ADD HYD            01:C-201      1.96     .444 No_date    1:10   51.92  n/a
                   +   02:C-202      3.07     .654 No_date    1:10   51.92  n/a
                   +   03:C-203      1.90     .247 No_date    1:10   36.14  n/a
                   +   04:C-204      5.20    1.121 No_date    1:10   51.92  n/a
                   +   05:C-205      2.22     .578 No_date    1:10   58.86  n/a
     [DT= 5.00]  SUM=  06:C-2       14.35    3.053 No_date    1:10   50.91  n/a
003:0011--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    06:C-2       14.35    3.053 No_date    1:10   50.91  n/a
      Major System /  07:C2maj        2.28    1.748 No_date    1:10   50.91  n/a
      Minor System \  08:C2min      12.07    1.220 No_date    0:55   51.44  n/a
     {MjSysSto=.7180E+03, TotOvfVol=.1161E+01, N-Ovf=    1, TotDurOvf=    0.hrs
003:0012--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD    01:C-101      3.16     .755 No_date    1:10   55.74 .792
     [XIMP=.70:TIMP=.70]
     [SLP= .60:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
003:0013--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:C-101      3.16     .755 No_date    1:10   56.74  n/a
      Major System /  02:C101ma       .67     .475 No_date    1:10   56.74  n/a
      Minor System \  07:C101mi      2.49     .269 No_date    0:55   57.52  n/a
     {MjSysSto=.1580E+03, TotOvfVol=.3793E+03, N-Ovf=    1, TotDurOvf=    0.hrs
003:0014--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD    06:C-103      1.20     .313 No_date    1:10   58.86 .821
     [XIMP=.70:TIMP=.80]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
003:0015--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    DESIGN NASHYD      05:C-102       .90     .132 No_date    1:10   36.83 .514
     [CN= 80.0: N= 3.00]
     [Tp=  .17:DT= 5.00]
003:0016--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ADD HYD            05:C-102       .90     .132 No_date    1:10   36.83  n/a
                   +   06:C-103      1.20     .313 No_date    1:10   58.86  n/a
                   +   07:C101mi     2.49     .269 No_date    0:55   57.52  n/a
                   +   08:C2min     12.07    1.220 No_date    0:55   51.44  n/a
                   +   09:C-3min     7.48     .636 No_date    0:55   39.26  n/a
     [DT= 5.00]  SUM=  10:SWMC_I    24.14    2.570 No_date    1:10   48.12  n/a
003:0017--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ROUTE RESERVOIR -> 10:SWMC_I    24.14    2.570 No_date    1:10   48.12  n/a
     [RDT= 5.00] out<- 01:SWMC_O    24.14    2.313 No_date    1:40   48.12  n/a
     {MxStoUsed=.7360E+00}
003:0018--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    SAVE HYD           10:SWMC_I    24.14    2.570 No_date    1:10   48.12  n/a
     fname :M:\2003\103106\DATA\CALCUL~1\SWMHYMO\SMWFC~1\SWMC_IN.003
     remark:Inflow to SWMF C
 ** END OF RUN :   3

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



RUN:COMMAND#
004:0001--------------------------------------------------------------------
    START
     [TZERO =    .00 hrs on       0]
     [METOUT=   2    (1=imperial, 2=metric output)]
     [NSTORM=   1 ]
     [NRUN  =   4 ]
*******************************************************************************
#  Project Name: [Shirley's Brook - SWMF C]            Project Number: [103106]
#  Date        : 05-28-2006
#  Modeller    : [M.Petepiece]
#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
#  License #   :  5320763
#
# Post-Development Conditions to SWM Facility 'C'
*******************************************************************************
004:0002--------------------------------------------------------------------
    READ STORM
     Filename = storm.001
     Comment  = City of Ottawa:  100yr-12hr SCS Type II (10 min time step)
     [SDT=10.00:SDUR=  12.00:PTOT=  90.00]
004:0003--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD    01:C-300      7.48     .922 No_date    6:00   57.36 .598
     [XIMP=.30:TIMP=.37]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
004:0004--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:C-300      7.48     .922 No_date    6:00   57.36  n/a
      Major System /  02:C-3maj       .00     .000 No_date    0:00     .00  n/a
      Minor System \  09:C-3min     7.48     .636 No_date    5:45   57.27  n/a
     {MjSysSto=.2175E+03, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
004:0005--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD    01:C-201      1.96     .331 No_date    6:00   72.71 .757
     [XIMP=.57:TIMP=.64]
     [SLP=1.50:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
004:0006--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD    02:C-202      3.07     .512 No_date    6:00   72.71 .757
     [XIMP=.57:TIMP=.64]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
004:0007--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD    03:C-203      1.90     .220 No_date    6:00   53.69 .559
     [XIMP=.24:TIMP=.30]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
004:0008--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD    04:C-204      5.20     .865 No_date    6:00   72.71 .757
     [XIMP=.57:TIMP=.64]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
004:0009--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD    05:C-205      2.22     .423 No_date    6:00   81.18 .846
     [XIMP=.70:TIMP=.80]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
004:0010--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ADD HYD            01:C-201      1.96     .331 No_date    6:00   72.71  n/a
                   +   02:C-202      3.07     .512 No_date    6:00   72.71  n/a
                   +   03:C-203      1.90     .220 No_date    6:00   53.69  n/a
                   +   04:C-204      5.20     .865 No_date    6:00   72.71  n/a
                   +   05:C-205      2.22     .423 No_date    6:00   81.18  n/a
     [DT= 5.00]  SUM=  06:C-2       14.35    2.352 No_date    6:00   71.50  n/a
004:0011--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    06:C-2       14.35    2.352 No_date    6:00   71.50  n/a
      Major System /  07:C2maj        1.03    1.088 No_date    6:00   71.50  n/a
      Minor System \  08:C2min      13.32    1.220 No_date    5:55   71.50  n/a
     {MjSysSto=.7180E+03, TotOvfVol=.7364E+03, N-Ovf=    1, TotDurOvf=    0.hrs
004:0012--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD    01:C-101      3.16     .562 No_date    6:00   78.22 .815
     [XIMP=.70:TIMP=.70]
     [SLP= .60:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
004:0013--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:C-101      3.16     .562 No_date    6:00   78.22  n/a
      Major System /  02:C101ma       .34     .287 No_date    6:00   78.22  n/a
      Minor System \  07:C101mi      2.82     .269 No_date    5:35   78.12  n/a
     {MjSysSto=.1580E+03, TotOvfVol=.1732E+03, N-Ovf=    1, TotDurOvf=    0.hrs
004:0014--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD    06:C-103      1.20     .232 No_date    6:00   81.18 .846
```

```
     [XIMP=.70:TIMP=.80]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
004:0015----------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    DESIGN NASHYD       05:C-102        .90     .129 No_date    6:00   56.52 .509
     [CN= 80.0: N= 3.00]
     [Tp=  .17:DT= 5.00]
004:0016----------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ADD HYD             05:C-102        .90     .129 No_date    6:00   56.52  n/a
                      + 06:C-103       1.20     .232 No_date    6:00   81.10  n/a
                      + 07:C101mi      2.82     .269 No_date    5:35   78.12  n/a
                      + 08:C2min      13.32    1.220 No_date    5:35   71.50  n/a
                      + 09:C-3min      7.48     .636 No_date    5:45   57.27  n/a
     [DT= 5.00]  SUM=  10:SWMC_I     25.72    2.486 No_date    6:00   68.02  n/a
004:0017----------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ROUTE RESERVOIR --> 10:SWMC_I     25.72    2.406 No_date    6:00   68.02  n/a
     [RDT= 5.00] out<- 01:SWMC_O      25.72    2.477 No_date    6:10   68.02  n/a
    {MxStoUsed=.7391E+00}
004:0018----------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    SAVE HYD            10:SWMC_I     25.72    2.486 No_date    6:00   68.02  n/a
     fname :M:\2003\103106\DATA\CALCUL~1\SWMHYD\SWMFC~1\SWMC_IN.004
     remark:Inflow to SWMF C
004:0002----------------------------------------------------------------------
     FINISH
-------------------------------------------------------------------------------
*******************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
001:0005 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
001:0006 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
001:0007 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
001:0009 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
001:0009 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
001:0012 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
001:0014 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0003 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0005 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0006 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0007 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0009 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0009 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0012 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0014 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
003:0003 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
003:0005 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
003:0006 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
003:0007 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
003:0009 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
003:0009 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
003:0012 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
003:0014 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
004:0003 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
004:0005 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
004:0006 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
004:0007 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
004:0009 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
004:0009 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
004:0012 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
004:0014 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
  Simulation ended on 2006-10-05     at 09:39:07
-------------------------------------------------------------------------------
```

SWMF 'C' - Outlet Strucutre

Head vs. Discharge Curves (for use in EPA SWMM Model)

Outlet Details	EXT.DET	EROSION CONTROL		OVERFLOW SPILLWAY (WEIR)	
Dia	*180 mm*	*Dia*	*600 mm*	*Length*	*40 m*
Inv	*66.05 m*	*Inv*	*66.05 m*	*Crest Elev*	*67.25*
C/L Elev	*66.14*	*C/L Elev*	*66.35 m*	*Weir Coeff:*	*1.847*
Area	*0.025 m^2*				
		Slide Gate Set at Height of 300 mm			
		Area	*0.141 m^2*		

Head vs. Discharge Curves

	EXT.DET		EROSION CONTROL		OVERFLOW SPILLWAY	
Elev (m)	Head (m)	Q (m^3/s)	Head (m)	Q (m^3/s)	Head (m)	Q (m^3/s)
66.05	0.00	0.000	0.00	0.000	0.00	0
66.1	0.05	0.007	0.05	0.000	0.00	0
66.15	0.10	0.012	0.10	0.000	0.00	0
66.2	0.15	0.020	0.15	0.000	0.00	0
66.25	0.20	0.023	0.20	0.000	0.00	0
66.35	0.30	0.032	0.30	0.213	0.00	0
66.45	0.40	0.039	0.40	0.246	0.00	0
66.55	0.50	0.045	0.50	0.275	0.00	0
66.65	0.60	0.050	0.60	0.301	0.00	0
66.75	0.70	0.055	0.70	0.325	0.00	0
66.85	0.80	0.059	0.80	0.347	0.00	0
66.95	0.90	0.063	0.90	0.368	0.00	0
67.05	1.00	0.067	1.00	0.388	0.00	0
67.15	1.10	0.070	1.10	0.407	0.00	0
67.25	1.20	0.074	1.20	0.425	0.00	0
67.3	1.25	0.075	1.25	0.434	0.05	0.83
67.5	1.45	0.081	1.45	0.468	0.25	9.24

SWMF 'C' - Inlet Strucutres

(refer to EPA SWMM output charts in back of Appendix B)

Inlet to Forebay

Dia=	825 mm
Area=	0.535 m2
Invert Elev =	66.00
Slope =	1.6%
Q_{cap} =	1,894 L/s (Manning's)
Q_{25mm} =	1,900 L/s

Forebay Bypass

Dia =	750 mm
Area =	0.442 m2
Invert Elev =	66.83

SWM Facility 'C'
Design Calculations

SWMF 'C' - Water Quality Requirements

Drainage Area	26.2	
% Impervious:	**0.52**	
Level 2 protection:		
Treatment Volume	110	m^3/ha
Active Storage:	40	m^3/ha
	1,048	m^3
Perm Pool:	70	m^3/ha required
	1,834	m^3 required
	4,370	m^3 provided
	167	m^3/ha provided
Extended Detention:	12.1	L/s average
	29	L/s max (2.4 x avg)
Erosion Control (14 L/s/ha for 5yr storm)	367	L/s
Erosion Control (8 L/s/ha for 5yr storm)	210	L/s

SWMF 'C' - Dry Pond Stage-Storage

Elevation (m)	Area (m^2)	Stage Volume (m^3)	Total Volume (m^3)
65.75	-	-	-
66.00	640	80	80
66.10	3,800	220	300
66.15	6,360	250	550
66.25	6,500	640	1,190
66.50	6,980	1,690	2,880
66.75	7,360	1,790	4,670
67.00	7,840	1,900	6,570
67.25	8,280	2,020	8,590

SWMF 'C' - Wet Pond Stage-Storage

Elevation (m)	Area		Stage Volume			Total Volume			
	All (m^2)	Forebay (m^2)	All (m^3)	Forebay (m^3)	Main Cell (m^3)	Forebay (m^3)	Main Cell (m^3)	All	Active Volume (m3)
65.00	2,810	520	0	0	0	0	0	0	
65.55	4,250	790	1,940	360	1,580	360	1,580	1,940	
65.75	4,890	940	910	170	740	530	2,320	2,850	
66.05	5,222	880	1,520	270	1,250	800	3,570	4,370	
66.25	5,350		1,060		1,060		5,430	5,430	1,060
66.40	5,790		840		840		6,270	6,270	1,900
66.75	6,250		2,110		2,110		8,380	8,380	4,010
67.00	6,690		1,620		1,620		10,000	10,000	5,630
67.25	7,050		1,720		1,720		11,720	11,720	7,350
67.50	7,470		1,820		1,820		13,540	13,540	9,170

SWM Facility 'C'
Design Calculations

SWMF 'C' - Required Forebay Length

Parameters:

Length to width ratio of forebay, r =	3.0:1
Peak outflow rate during 25 mm storm, Q_p =	0.240 m^3/s (24hr ext. det)
Target particle size =	150 mm
Settling velocity, V_s =	0.0003 m/s

Forebay Settling Length, Dist

$$Dist = \sqrt{\frac{rQ_p}{V_s}}$$

= 49 m

Check Dispersion Length, $Dist_2$

Desired velocity in forebay, V_f =	0.2 m/s
Inlet flowrate , Q =	1.900 m^3/s
Depth in forebay, d =	1.1 m

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

= 72 m

Therefore, the dispersion length of 72 m governs the design.

Provided Length:	**72 m**

SWMF 'C' - Sediment Loading Estimate

Table 6.3 - MOE SWM Planning & Design Manual

Catchment Imperviousness	Annual Loading (kg/ha)	Wet Density (kg/m^3)	Annual Loading (m^3/ha)
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:	26.2	ha
% Impervious:	52%	
Annual Sediment Loading:	2,071	kg/ha/yr
	1.68	m^3/ha/yr
	44.1	m^3/yr
Sediment Removal Efficiency:	80%	
	35.3	m^3/yr

Sediment Accumulation:

10yrs	353 m^3

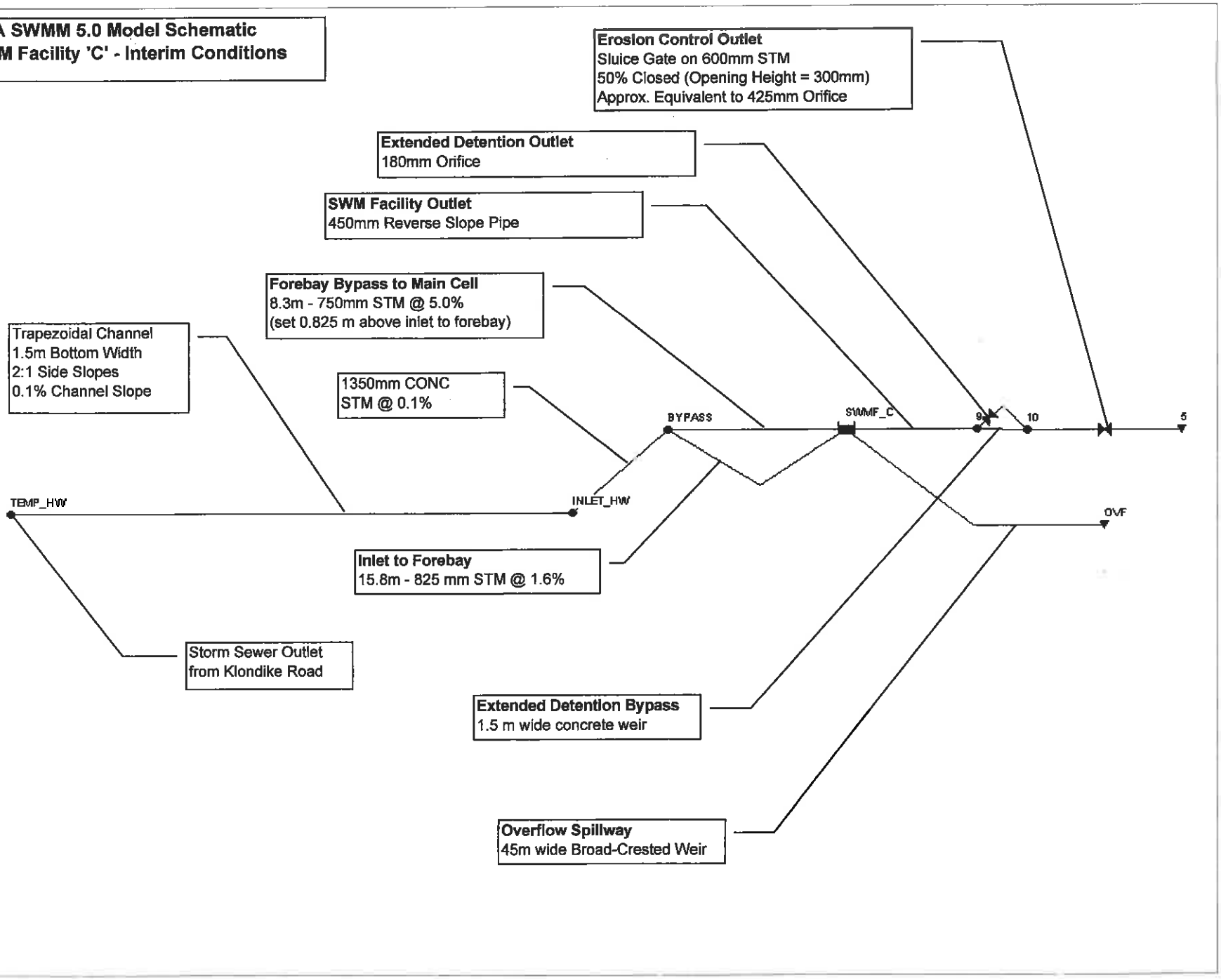
Volume Provided in Forebay:	530 m^3

SWMF C

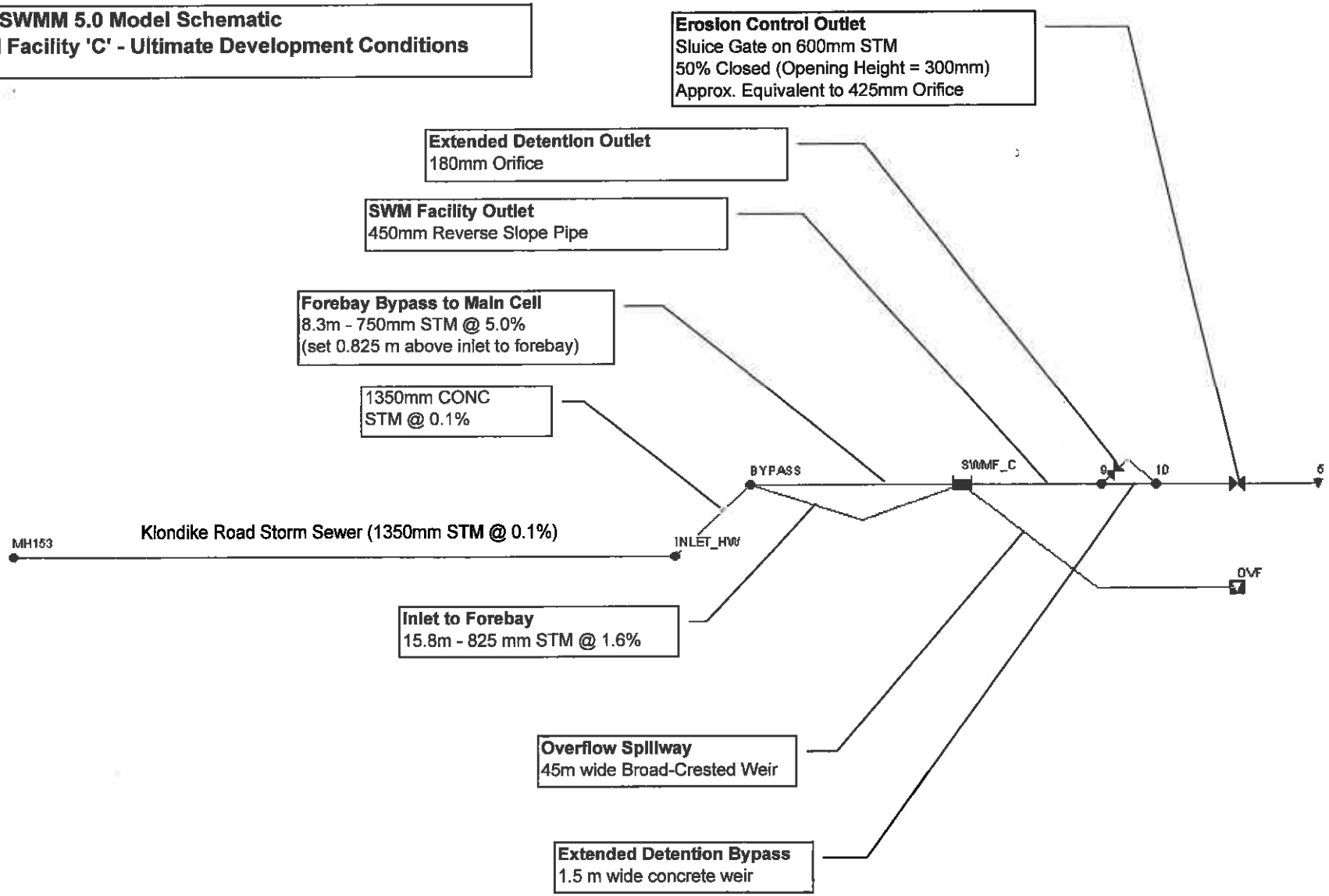
Drainage Area:	26.2 ha
Runoff Coefficient:	0.6
Estimate Influent TSS Level (max):	250 mg/L
(Long-term average):	150 mg/L
Sediment Density:	1,230 kg/m^3
Total Annual Precipitation:	907 mm
Total Annual Rain (Ice Free Period):	686 mm
Total Annual Runoff:	142,580 m^3
Runoff during Ice-free period:	107,839 m^3
Max Annual TSS Loading:	35,645 kg
(total precipitation)	29.0 m^3/yr
Max Annual TSS Loading:	26,960 kg
(precipitation during Ice-free period)	21.9 m^3/yr
Average Annual TSS Loading:	21,387 kg
(total precipitation)	17.4 m^3/yr
Average Annual TSS Loading:	16,176 kg
(precipitation during Ice-free period)	13.2 m^3/yr

Target 80% TSS Removal:	
Max:	23.2 m^3/yr
Min:	10.5 m^3/yr

EPA SWMM 5.0 Model Schematic
SWM Facility 'C' - Interim Conditions



EPA SWMM 5.0 Model Schematic
SWM Facility 'C' - Ultimate Development Conditions



SWM Facility 'C' – 25mm Storm Event
EPA SWMM Model Summary Output (Ultimate Development Conditions)

```
***************
  Analysis Options
  ***************
  Flow Units ..............  CMS
  Flow Routing Method ......  DYNWAVE
  Starting Date ...........  FEB-16-2006 00:00:00
  Ending Date .............  FEB-17-2006 00:00:00
  Antecedent Dry Days ......  0.0
  Report Time Step ........  00:05:00
  Routing Time Step ........  3.00 sec
```

Flow Routing Continuity	Volume hectare-m	Volume Mliters
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.000	0.000
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.425	4.252
External Outflow	0.308	3.077
Surface Flooding	0.000	0.000
Evaporation Loss	0.000	0.000
Initial Stored Volume	0.487	4.874
Final Stored Volume	0.606	6.057
Continuity Error (%)	-0.078	

Node Depth Summary

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Total Flooding ha-mm	Total Minutes Flooded
MH153	JUNCTION	0.08	1.04	67.42	0 01:40	0	0
BYPASS	JUNCTION	0.39	0.92	66.92	0 01:41	0	0
INLET_HW	JUNCTION	0.35	1.00	67.05	0 01:41	0	0
9	JUNCTION	0.47	0.83	66.73	0 03:03	0	0
10	JUNCTION	0.38	0.82	66.72	0 02:50	0	0
5	OUTFALL	0.18	1.00	66.75	0 02:45	0	0
OVF	OUTFALL	0.00	0.00	65.75	0 00:00	0	0
SWMF_C	STORAGE	1.48	1.78	66.68	0 03:09	0	0

Storage Volume Summary

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
SWMF_C	6.650	42	8.455	53	0 03:09	0.25

Link Flow Summary

Link	Type	Maximum Flow CMS	Time of Max Occurrence days	hr:min	Maximum Velocity m/sec	Length Factor	Max/ Full Flow	Total Minutes Surcharged
10	CONDUIT	0.00	0	00:00	0.00	3.65	0.00	0
20	CONDUIT	1.74	0	01:41	3.71	4.15	0.60	0
21	CONDUIT	1.81	0	01:41	1.67	1.00	0.92	0
22	CONDUIT	0.07	0	01:41	0.55	1.52	0.03	0
25	CONDUIT	1.85	0	01:40	1.63	1.00	0.93	0
26	CONDUIT	0.27	0	02:45	1.69	1.61	0.31	784
27	CONDUIT	0.28	0	02:51	1.36	1.77	0.45	0
1	ORIFICE	0.04	0	02:10				
2	DUMMY	0.27	0	02:45				

****
Flow Classification Summary
****

Conduit	--- Fraction of Time in Flow Class ---- Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Avg. Froude Number	Avg. Flow Change
10	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
20	0.00	0.00	0.00	0.98	0.02	0.00	0.00	0.06	0.0000
21	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.05	0.0001
22	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
25	0.00	0.04	0.00	0.96	0.00	0.00	0.00	0.05	0.0001
26	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.12	0.0002
27	0.74	0.00	0.00	0.05	0.00	0.00	0.21	0.15	0.0009

****
Highest Continuity Errors
****
Node INLET_HW (0.73%)
Node BYPASS (0.24%)
Node 10 (-0.13%)
Node SWMF_C (0.04%)

****
Time-Step Critical Elements
****
Link 20 (0.47%)
Node 10 (0.00%)

****
Routing Time Step Summary
****
Minimum Time Step : 2.84 sec
Average Time Step : 3.00 sec
Maximum Time Step : 3.00 sec
Percent in Steady State : 0.00
Average Iterations per Step : 3.10

Analysis begun on: Thu Oct 05 15:07:12 2006
Total elapsed time: 00:00:01

SWM Facility 'C' – 1:5 year Storm Event
EPA SWMM Model Summary Output (Ultimate Development Conditions)

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.0 (Build 5.0.007)
--------------------------------------------------------------

EPA SWMM 5.0 Model - SWM Facility 'C'

***************
Analysis Options
***************
Flow Units ..............  CMS
Flow Routing Method ......  DYNWAVE
Starting Date ...........  FEB-16-2006 00:00:00
Ending Date .............  FEB-17-2006 00:00:00
Antecedent Dry Days .....  0.0
Report Time Step ........  00:05:00
Routing Time Step .......  3.00 sec

*************************       Volume         Volume
Flow Routing Continuity       hectare-m       Mliters
*************************     ---------      ---------
Dry Weather Inflow .......        0.000          0.000
Wet Weather Inflow .......        0.000          0.000
Groundwater Inflow .......        0.000          0.000
RDII Inflow ..............        0.000          0.000
External Inflow ..........        0.725          7.252
External Outflow .........        0.609          6.092
Surface Flooding .........        0.000          0.000
Evaporation Loss .........        0.000          0.000
Initial Stored Volume ....        0.487          4.874
Final Stored Volume ......        0.612          6.117
Continuity Error (%) .....       -0.684

******************
Node Depth Summary
******************

-------------------------------------------------------------------------------------------
                                 Average  Maximum  Maximum  Time of Max      Total     Total
                                   Depth    Depth      HGL      Occurrence  Flooding   Minutes
Node                 Type         Meters   Meters   Meters    days hr:min     ha-mm   Flooded
-------------------------------------------------------------------------------------------
MH153                JUNCTION       0.16     1.31    67.69       0 01:10         0         0
BYPASS               JUNCTION       0.48     1.06    67.06       0 01:31         0         0
INLET_HW             JUNCTION       0.44     1.17    67.22       0 01:10         0         0
9                    JUNCTION       0.55     1.39    67.29       0 02:49         0         0
10                   JUNCTION       0.47     1.30    67.20       0 02:49         0         0
5                    OUTFALL        0.44     1.20    66.95       0 02:20         0         0
OVF                  OUTFALL        0.05     1.20    66.95       0 02:20         0         0
SWMF_C               STORAGE        1.57     2.12    67.02       0 02:41         0         0

**********************
Storage Volume Summary
**********************

-------------------------------------------------------------------------------------------
                         Average     Avg       Maximum     Max    Time of Max     Maximum
                          Volume    Pcnt        Volume    Pcnt     Occurrence     Outflow
Storage Unit            1000 m3    Full       1000 m3    Full     days hr:min         CMS
-------------------------------------------------------------------------------------------
SWMF_C                    7.191      45        10.599      66       0 02:41        0.49

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

Link Flow Summary
****

Link	Type	Maximum Flow CMS	Time of Max Occurrence days	hr:min	Maximum Velocity m/sec	Length Factor	Max/ Full Flow	Total Minutes Surcharged
10	CONDUIT	0.00	0	00:00	0.00	3.65	0.00	0
20	CONDUIT	1.94	0	01:10	3.94	4.15	0.66	184
21	CONDUIT	2.40	0	01:10	1.91	1.00	1.21	15
22	CONDUIT	0.53	0	01:31	2.02	1.52	0.22	0
25	CONDUIT	2.40	0	01:10	1.75	1.00	1.21	15
26	CONDUIT	0.30	0	02:54	1.91	1.61	0.35	930
27	CONDUIT	1.52	0	01:38	1.44	1.77	2.50	0
1	ORIFICE	0.05	0	01:38				
2	DUMMY	0.35	0	02:49				

****
Flow Classification Summary
****

Conduit	--- Fraction of Time in Flow Class ---- Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Avg. Froude Number	Avg. Flow Change
10	0.96	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
20	0.00	0.00	0.00	0.97	0.03	0.00	0.00	0.07	0.0001
21	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.04	0.0001
22	0.00	0.86	0.00	0.14	0.00	0.00	0.00	0.05	0.0000
25	0.00	0.01	0.00	0.99	0.00	0.00	0.00	0.04	0.0001
26	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.21	0.0003
27	0.63	0.00	0.00	0.18	0.00	0.00	0.18	0.16	0.0078

****
Highest Continuity Errors
****
Node 10 (-1.50%)
Node INLET_HW (0.40%)
Node BYPASS (0.13%)
Node SWMF_C (0.02%)

****
Time-Step Critical Elements
****
Link 27 (3.62%)
Link 20 (0.81%)

****
Routing Time Step Summary
****
Minimum Time Step : 0.50 sec
Average Time Step : 2.99 sec
Maximum Time Step : 3.00 sec
Percent in Steady State : 0.00
Average Iterations per Step : 3.12

Analysis begun on: Thu Oct 05 15:04:15 2006

SWM Facility 'C' – 1:100 year Storm Event
EPA SWMM Model Summary Output (Ultimate Development Conditions)

```
  EPA STORM WATER MANAGEMENT MODEL - VERSION 5.0 (Build 5.0.007)
  --------------------------------------------------------------

  EPA SWMM 5.0 Model - SWM Facility 'C'

  ***************
  Analysis Options
  ***************
  Flow Units ..... CMS
  Flow Routing Method ..... DYNWAVE
  Starting Date ..... FEB-16-2006 00:00:00
  Ending Date ..... FEB-17-2006 00:00:00
  Antecedent Dry Days ..... 0.0
  Report Time Step ..... 00:05:00
  Routing Time Step ..... 3.00 sec


Flow Routing Continuity        hectare-m       Mliters
  *************************     ---------      ---------
  Dry Weather Inflow .....          0.000          0.000
  Wet Weather Inflow .....          0.000          0.000
  Groundwater Inflow .....          0.000          0.000
  RDII Inflow ............          0.000          0.000
  External Inflow ........          1.173         11.734
  External Outflow .......          1.042         10.424
  Surface Flooding .......          0.000          0.000
  Evaporation Loss .......          0.000          0.000
  Initial Stored Volume ....        0.487          4.874
  Final Stored Volume ....          0.618          6.183
  Continuity Error (%) ....         0.007


  ******************
  Node Depth Summary
  ******************

  ------------------------------------------------------------------------------------------
                                   Average  Maximum  Maximum  Time of Max      Total    Total
                                     Depth    Depth      HGL  Occurrence   Flooding  Minutes
  Node                 Type       Meters   Meters   Meters  days hr:min      ha-mm  Flooded
  ------------------------------------------------------------------------------------------
  MH153                JUNCTION     0.26     1.72    68.10       0 01:39          0        0
  BYPASS               JUNCTION     0.58     1.57    67.57       0 01:40          0        0
  INLET_HW             JUNCTION     0.54     1.62    67.67       0 01:39          0        0
  9                    JUNCTION     0.48     1.25    67.30       0 01:28          0        0
  10                   JUNCTION     0.40     1.17    67.22       0 01:29          0        0
  5                    OUTFALL      0.72     1.52    67.07       0 02:49          0        0
  OVF                  OUTFALL      0.16     1.27    67.07       0 02:49          0        0
  SWMF_C               STORAGE      1.66     2.40    67.30       0 01:44          0        0

  **********************
  Storage Volume Summary
  **********************

  ------------------------------------------------------------------------------------------
                           Average     Avg       Maximum     Max     Time of Max     Maximum
                            Volume    Pcnt        Volume    Pcnt      Occurrence     Outflow
  Storage Unit           1000 m3    Full       1000 m3    Full    days hr:min         CMS
  ------------------------------------------------------------------------------------------
  SWMF_C                   7.774      49        12.564      79       0 01:44        1.90
```

****
Link Flow Summary
****

Link	Type	Maximum Flow CMS	Time of Max Occurrence days	hr:min	Maximum Velocity m/sec	Length Factor	Max/ Full Flow	Total Minutes Surcharged
10	CONDUIT	1.56	0	01:44	1.33	3.44	0.03	0
20	CONDUIT	1.94	0	00:58	3.88	4.15	0.66	296
21	CONDUIT	2.54	0	01:08	1.94	1.00	1.29	54
22	CONDUIT	0.89	0	01:30	2.44	1.52	0.37	0
25	CONDUIT	2.56	0	01:10	1.81	1.00	1.29	52
26	CONDUIT	0.34	0	01:40	2.15	1.72	0.36	492
27	CONDUIT	0.80	0	01:28	1.26	1.77	1.31	0
1	ORIFICE	0.04	0	01:28				
2	DUMMY	0.35	0	01:29				

****
Flow Classification Summary
****

Conduit	--- Fraction of Time in Flow Class --- Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Avg. Froude Number	Avg. Flow Change
10	0.87	0.06	0.00	0.06	0.01	0.00	0.00	0.03	0.0000
20	0.00	0.00	0.00	0.96	0.04	0.00	0.00	0.08	0.0001
21	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.05	0.0001
22	0.00	0.78	0.00	0.22	0.01	0.00	0.00	0.06	0.0000
25	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.04	0.0001
26	0.00	0.01	0.00	0.92	0.07	0.00	0.00	0.32	0.0001
27	0.55	0.00	0.00	0.27	0.00	0.00	0.18	0.17	0.0043

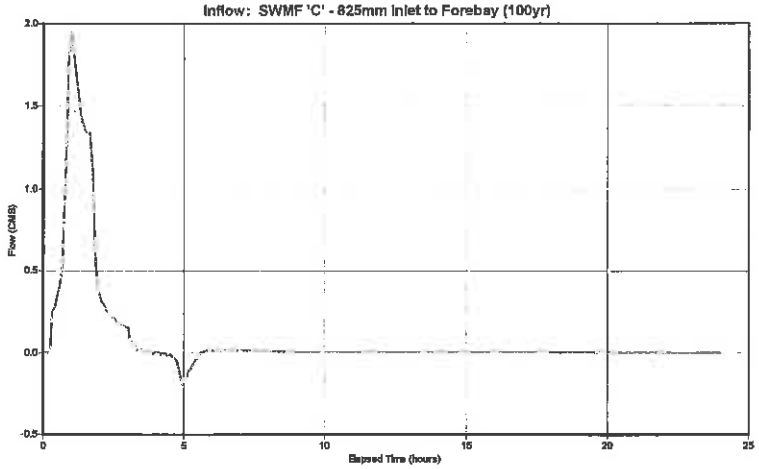
****
Highest Continuity Errors
****
Node INLET_HW (0.20%)
Node BYPASS (0.09%)
Node 10 (0.06%)
Node SWMF_C (0.01%)

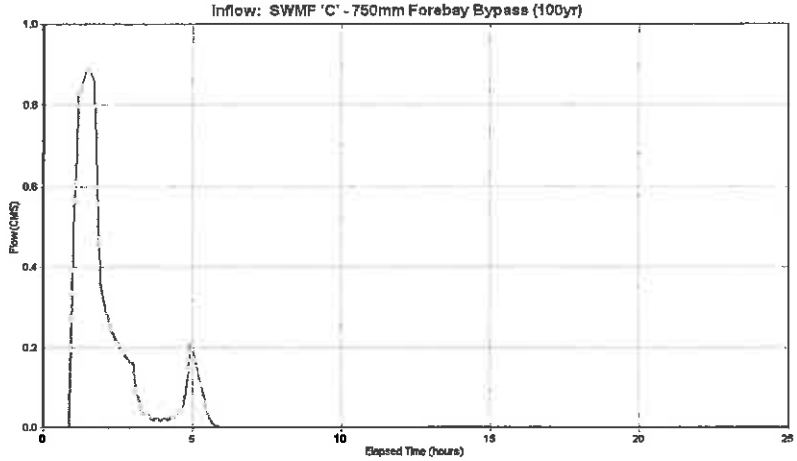
****
Time-Step Critical Elements
****
Link 27 (16.66%)
Link 20 (0.92%)

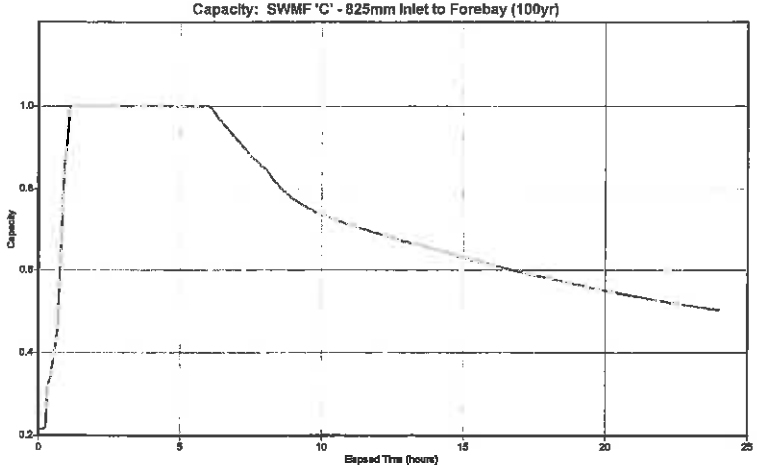
****
Routing Time Step Summary
****
Minimum Time Step : 1.62 sec
Average Time Step : 2.96 sec
Maximum Time Step : 3.00 sec
Percent in Steady State : 0.00
Average Iterations per Step : 2.97

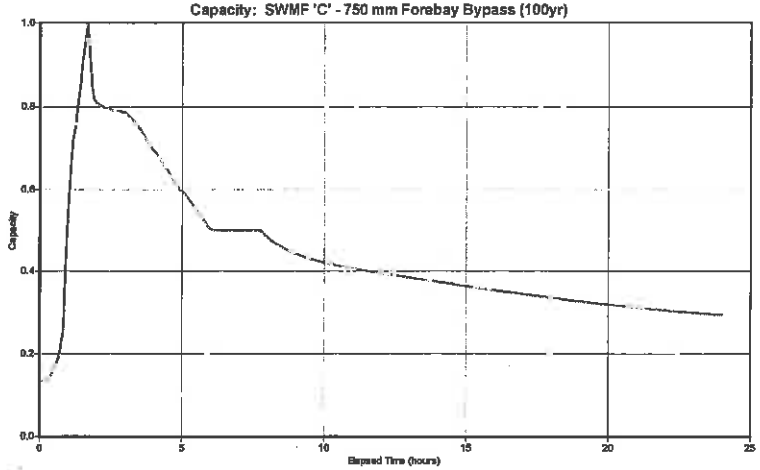
Analysis begun on: Wed Aug 02 18:12:35 2006
Total elapsed time: 00:00:01

EPA SWMM Model Output
SWM Facility 'C' Flow Splitter
(ultimate development conditions)

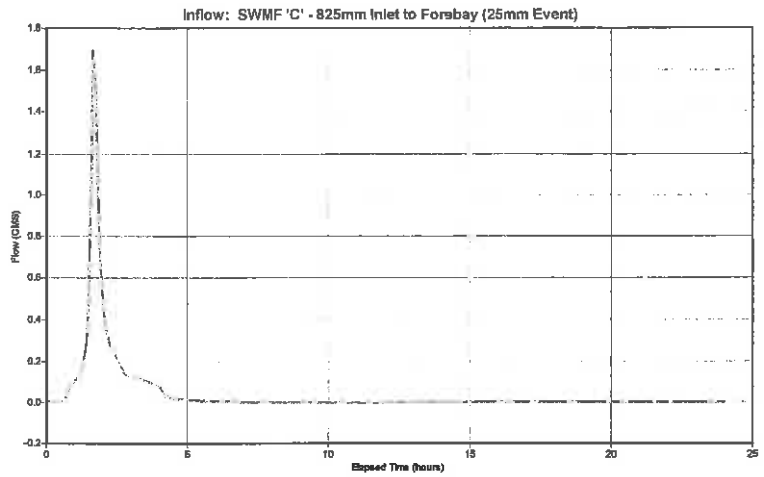


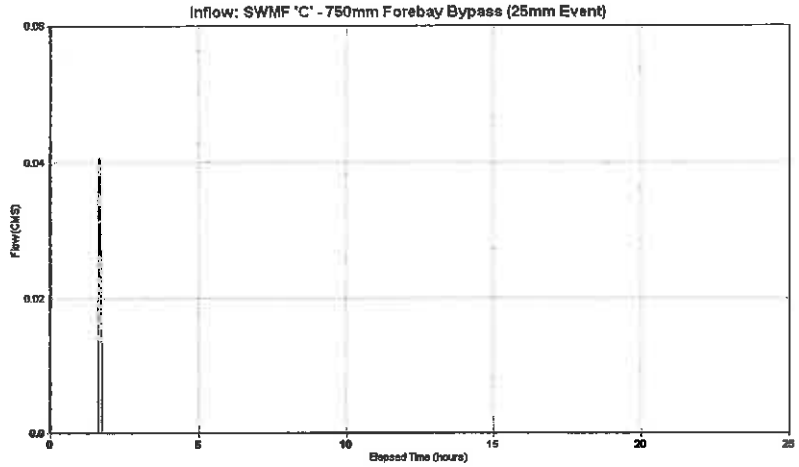


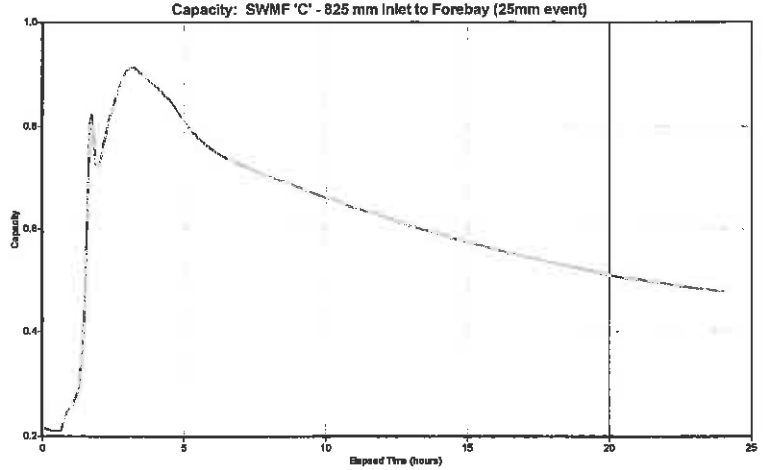


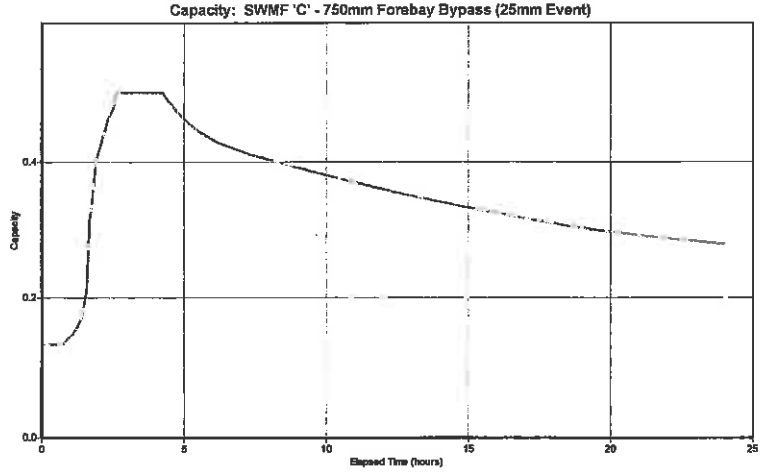


EPA SWMM Model Output
SWM Facility 'C' Flow Splitter
(ultimate development conditions)





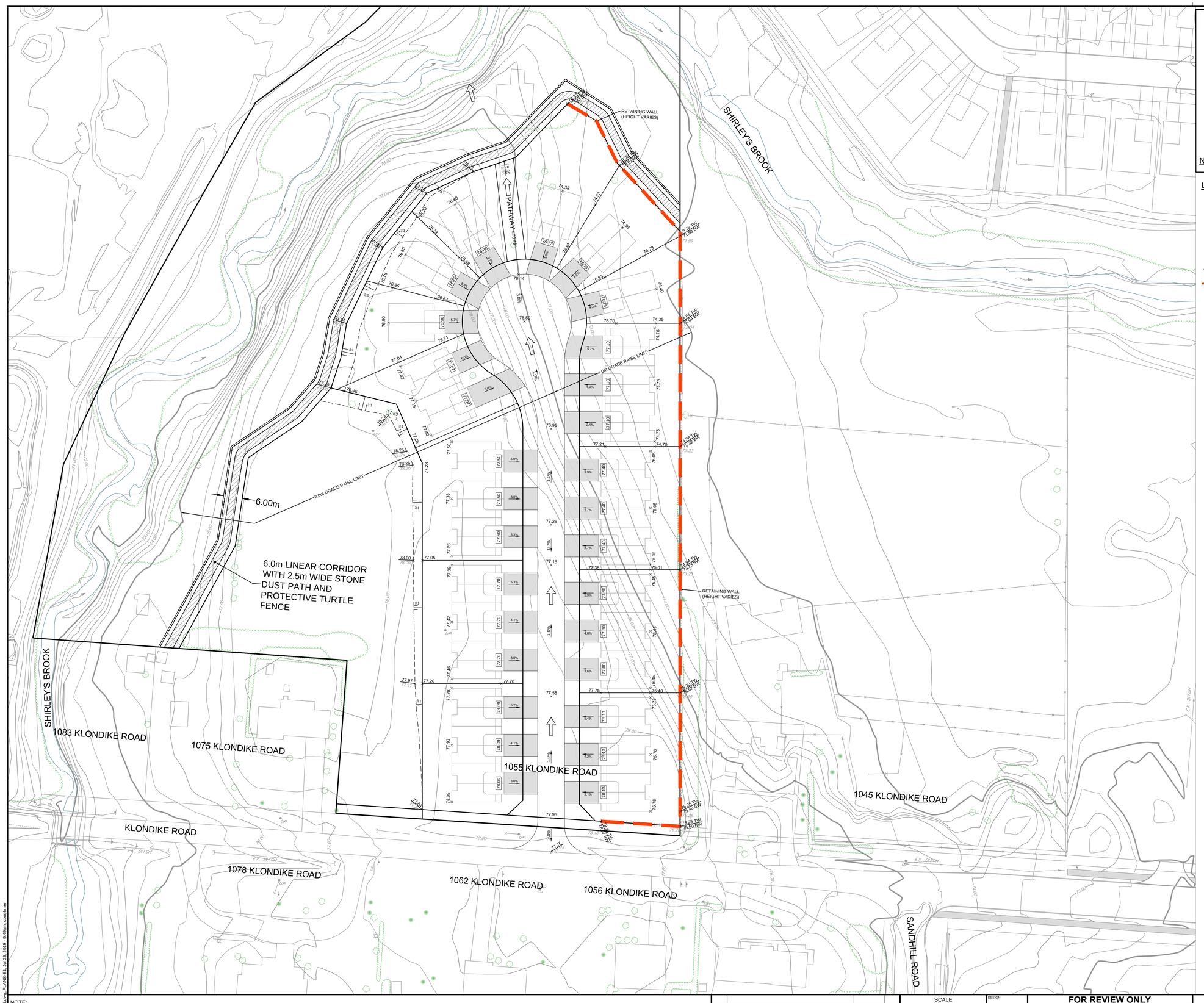


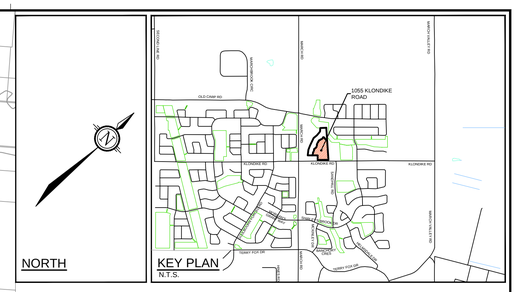


APPENDIX C

Plans:

103106-SWM	Overall Plan
103106-SWM-C1	SWM Pond 'C' - Layout
103106-SWM-C2	SWM Pond 'C' - Sections
103106-GR8	SWM Pond 'C' - Temporary Open Channel





LEGEND

- PROPOSED GRADE AND DIRECTION OF FLOW
- PROPOSED ELEVATION
- PROPOSED ELEVATION / EXISTING ELEVATION
- PROPOSED TOP OF WALL ELEVATION / PROPOSED BOTTOM OF WALL ELEVATION
- EXISTING ELEVATION
- TERRACING (3:1 MAX)
- PROPOSED RETAINING WALL
- MAJOR OVERLAND 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
1.	DRAFT PLAN SUBMISSION	JUL 26/19	MAB

SCALE 1:500

1:500
0 5 10 15 20

DESIGN LRW
CHECKED MAB
DRAWN DTD
CHECKED MAB
APPROVED JGR

FOR REVIEW ONLY

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Website www.novatech-eng.com

CITY OF OTTAWA
1055 KLONDIKE ROAD

PRELIMINARY GRADING PLAN

PROJECT No. 117034-0
REV REV # 1
DRAWING No. 117034-GR

M:\2017\117034\CAD\Design\117034-GR.dwg PLANS B1 - 24 25, 2019 - 9:48am cbeithner