THAMES CREST PHASES 2 & 3

Preliminary

Stormwater Management and Servicing Report

Project Location:
Lot 15, Thames Concession and Lots 15 & 16, Concession 17
St. Marys, Ontario

Prepared for:
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March 11, 2019

MTE File: 35499-200

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1.0 INTRODUCTION

1.1 Overview

MTE Consultants Inc. was retained by Thames Crest Development Corp to complete a Preliminary Servicing and Stormwater Management Report, in support of Draft Plan approval for their lands known as Thames Crest Phases 2 & 3. The subject lands are legally described as lot 15, Thames Concession and Lots 15 & 16, 17th Concession, located in the Town of St. Marys (formerly in the Township of Blanshard). The Phase 2 lands are roughly 22.2 ha in size with an additional 9.6 ha within Phase 3. The lands in Phases 2 & 3 are being considered along with approximately 26.3 ha of future developable lands. The combined area of approximately 58 ha (hereafter 'the site') consists entirely of agricultural field and is generally bounded by James Street N. to the east, the Grand Trunk Trail to the south, Emily Street to the west and existing agricultural lands to the north, as shown on Figure 1.

Glass Street bisects the site and is currently built to a rural cross-section. The proposed Phase 2 lands comprise the majority of the area south of the Glass Street extension and are generally situated toward the east and west sides of the site. The Phase 3 lands comprise the middle portion of the area south of Glass Street. With the exception of the areas directly fronting onto Glass Street, the lands within the site which are located north of Glass Street are not anticipated to be developed in the near future as they are currently designated for agricultural or recreational uses in the Town's official plan. The future developable lands north of Glass Street are considered in this report only in a conceptual manner to determine possible future impacts which may affect the design of Phases 2 & 3.

Complete buildout of Phases 2 & 3, and the future developable lands to the north is hereafter referred to in this report as the 'Ultimate Condition' of the site. Buildout of Phases 2 & 3 is referred to as the 'Interim Condition'. As noted above, it is proposed that the area south of Glass Street will be developed in two phases (Thames Crest Phases 2 & 3), it is anticipated that each phase will proceed in stages. The Phase 2 lands are proposed to proceed in five stages (stages A1, A2, & B1-B3) while Phase 3 staging has yet to be determined. Proposed phase and staging limits are illustrated on Figure 2.

The property will be developed as a residential subdivision along with park and amenity areas. The majority of residential units proposed will be single detached dwellings with some medium density town homes located in the south east corner of the site. As development proceeds, Glass Street will be reconstructed between Emily Street and James Street as a 26.0m urban cross-section in consultation with the Town of St. Marys. The Draft Plan of Subdivision for the proposed development has been prepared by MTE Consultants Inc. and forms the basis for the proposed servicing concepts (See Appendix "A").

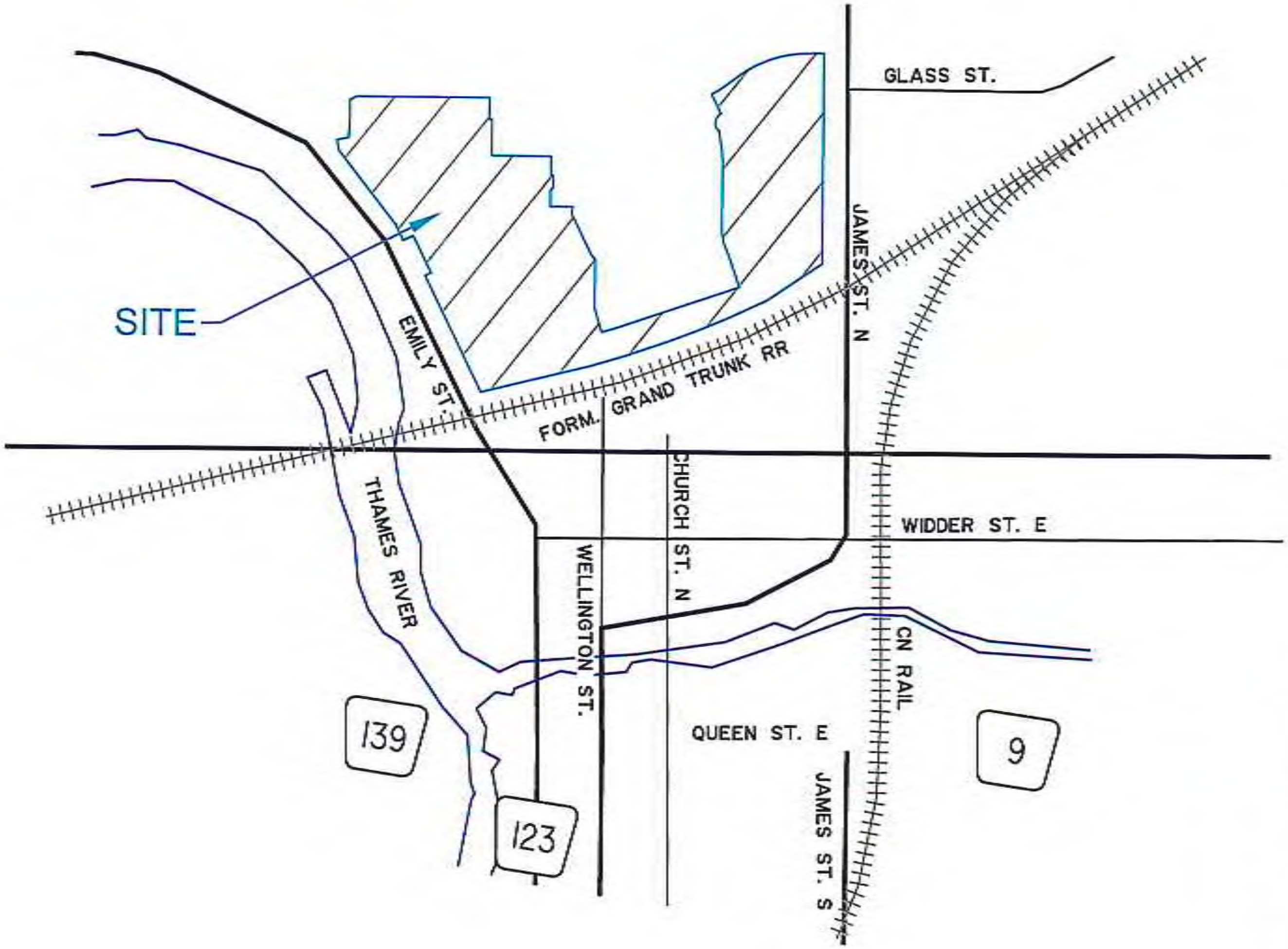

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FIGURE 1 : LOCATION PLAN

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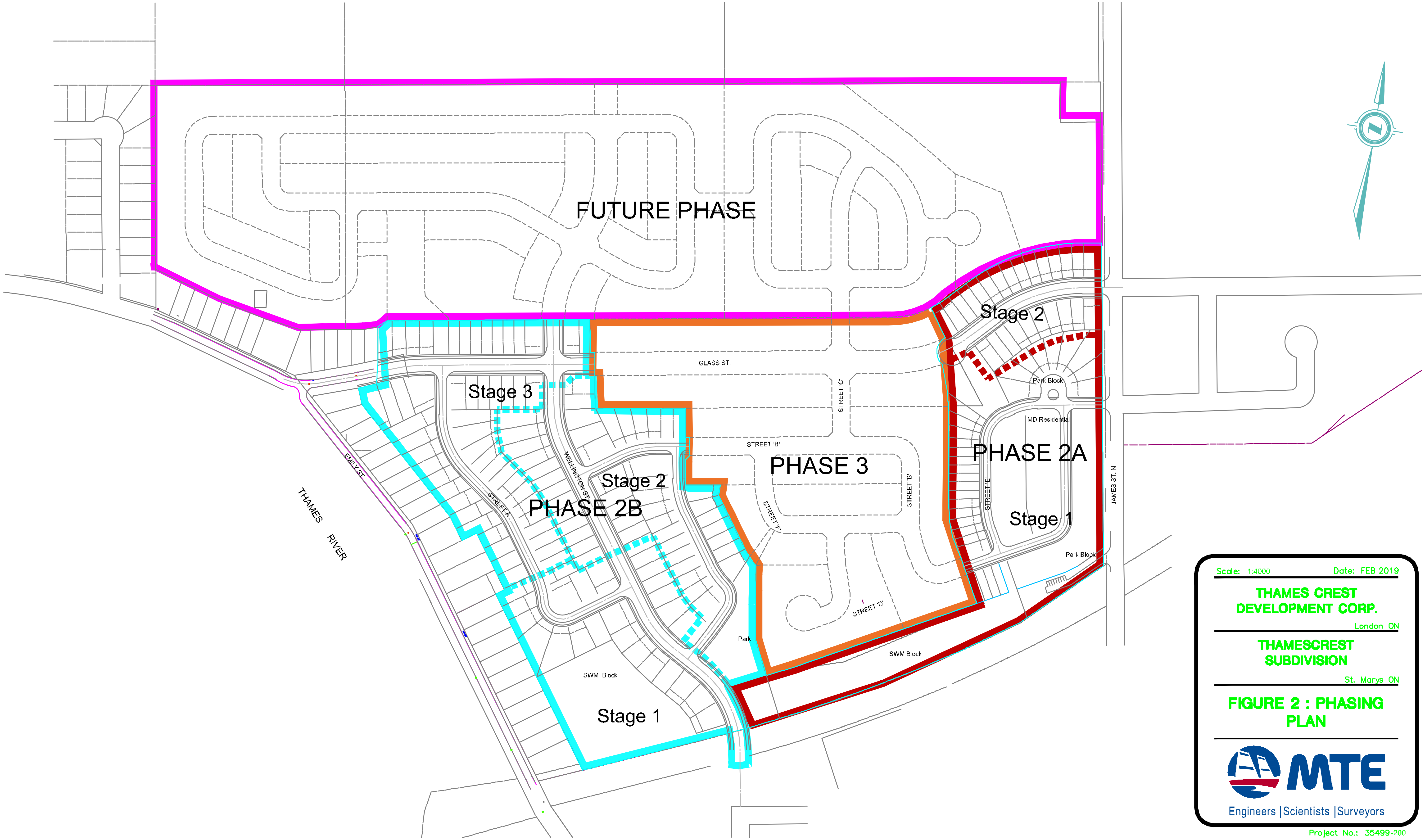

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FIGURE 2 : PHASING PLAN

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1.1 Purpose of Study

The purpose of this study is to show that the proposed interim development condition of the site (i.e. Phases 2 & 3) can be adequately serviced by existing infrastructure. The report will also address the impacts of the ultimate development condition. Additionally, this report will develop a comprehensive stormwater management (SWM) strategy for the development proposal which is acceptable to the Town of St. Marys and the Upper Thames River Conservation Authority (UTRCA).

1.2 Objectives

The primary objectives of this study are as follows:

- Evaluate the ability of existing municipal infrastructure to adequately service the proposed development
- Establish criteria for the management of stormwater runoff from this site;
- Assess impacts of development on the peak flow runoff from the site;
- Assess the impact of development on the volume of infiltration to groundwater from the site;
- Recommend a comprehensive plan for controlling the quantity and quality of stormwater runoff from the study area;
- Recommend a comprehensive strategy for controlling the volume of infiltration to groundwater;

2.0 MUNCIPAL SERVICING

2.1 Water Distribution

The Town of St. Marys operates largely as one pressure zone. The Town is fed by three wells with a permitted capacity of 180l/s and has a water tower which maintains pressure within the system and provides storage for fire flow conditions. The operating range of the tower is between 365.8 and 356.6 masl. A booster pump services industrial areas in the south portion of the town during emergency (i.e. fire flow) conditions to maintain pressure in the system.

The Town's Master Servicing Study (Burnside, 2012) indicates that the system was operating fairly well under then existing conditions. The available water supply was sufficient for the projected 2021 population but was anticipated to be inadequate by the year 2031. Available storage was noted as being tight even under minimum fire flow allowances and likely to soon become insufficient. A municipal class EA for the water system was completed in 2016 and concluded that if anticipated industrial development in the Perth South lands is limited to 'dry industrial activities' the current water supply will be sufficient for the 50 year design period. The Town has advised that additional storage for the system is being constructed and is anticipated to be completed in 2019.

The Town's water distribution system was modelled as part of the 2012 study and found to be operating well given average day demand conditions. The system was able to meet max day demands but relied on storage during flows above max day requirements. Under the fire flow scenarios, much of the developments on the north side of the Town dropped below the minimum required pressure.

To ameliorate the low pressures on the north side of the Town, it was recommended that the existing 150mm watermain on Emily Street be upgraded to a 200mm main and that a 200mm main be constructed between Emily Street and James Street to create a loop in the system in the North end of the Town. These proposed upgrades have since been completed.

Water supply for the proposed interim development will be provided by five (5) connection points to the existing municipal water distribution system:

- Three (3) connections to the existing 200mm Glass Street watermain;
- One (1) connection to the existing 150mm James Street watermain and,
- The extension of the existing 150mm Wellington Street watermain into the site.

Under ultimate conditions a minimum of two (2) additional connections will be made to the Glass Street watermain to service the area north of Glass Street.

Additional looping will be provided to the system by the proposed Phase 2 development by the extension of the Wellington Street watermain from Egan Avenue to Glass Street and an additional connection to the James Street watermain through the proposed park block just north of the Grand Trunk Trail. Watermains will be further connected across the site upon completion of Phase 3.

Some preliminary modeling of the built-out condition of Phases 2 & 3 was completed as part of a servicing study specific to the site completed by R.J. Burnside and Assoc. Ltd. in March of 2012. The study focused on the site and nearby developments only and assumed the Emily Street upgrades and construction of the Glass Street watermain between Emily Street and James Street had been completed. The study showed that upon build-out of Phases 2 & 3, pressure problems in the communities on the north end of the Town had been ameliorated, though not completely resolved (Refer to Appendix "B").

Based on the above it is anticipated that the interim developed condition of the site can be adequately serviced by the existing water distribution system. However, it is recommended that hydrant flow tests be completed and the site modeled based on the proposed draft plan layout, phasing/staging of construction, and measured flow rates at the time of detailed design to confirm the serviceability of the interim condition and any potential impacts of the ultimate development condition on the system.

2.1 Sanitary Servicing

Ultimately, the majority of the sanitary sewage from the proposed development will outlet to the existing 300mm diameter sanitary sewer on Emily Street. A 250mm connection to the Emily Street sewer has been provided for the site in the south-western corner and has been sized to accept drainage from 46ha with a population of 1238 persons. Effluent within the existing Emily Street sanitary sewer flows south to Water Street then continues south along Water Street crossing under Trout Creek. The Water Street sewers continue south through the downtown area to Thames Avenue/Victoria Street where the effluent is directed west, crosses beneath the Thames River, joins with flows from Thomas Street, and flows south to the St. Marys Wastewater Treatment Plant. It is proposed that 45.6 ha of the site will ultimately drain to this outlet while the remaining 12.5 ha will be directed toward the existing 200mm sanitary sewer on James Street which flows south to Station Street then west until it joins the Water Street sewer just north of Trout Creek. A connection to the James Street sewer will be constructed as part of Phase 2 of the development project.

Under the proposed interim condition, approximately 22.9 ha of the site will be directed to the Emily Street sewer and 8.9 ha directed toward James Street. The Town's sanitary model was obtained and updated with the proposed interim development condition assuming 13 units/ha. The model indicates that under interim development conditions, none of the existing downstream pipes will be flowing over capacity. It was noted that all existing pipes were utilizing less than 90% of their theoretical full flow capacity. Pipe P134-133 (located beneath Trout Creek) was flowing at approximately 65.7% capacity.

Under the ultimate developed conditions, the lands north of Glass Street will be developed and sanitary effluent from 22.7 ha of the development will be directed to the Emily Street sewer while the remaining 3.6 ha will outlet to the James Street sewer. The Town's sanitary model was updated with the future developable lands assuming 13 units/ha and indicated that under ultimate conditions all pipes remained at less than 90% capacity. Pipe P134-133 increased to approximately 89.0% of its theoretical capacity under the ultimate scenario. Sanitary design sheets based on the Town's sewer model have been prepared for both the interim and ultimate buildout conditions and are included in Appendix 'C'. Preliminary sanitary drainage areas are indicated on Figure 3

2.2 Storm Servicing

Storm servicing for the proposed development will be provided through a combination of minor (piped) and major (overland) drainage systems. The proposed development area will drain via storm sewers to the proposed downstream SWM facilities while overland flow routes generally follow the proposed road allowances. The storm sewer system will be designed for the Town of St. Marys 1:5 year design storm event. The Town of St. Marys utilizes IDF parameters from Stratford, ON. as given by the UTRCA.

As drainage from the north portion of the site will be draining to the proposed storm sewer uncontrolled in the interim condition, provision has been made in the storm sewers to transport the 5 year runoff from the property north of Glass Street to a proposed SWM facility located in the south-western corner of the site. (Refer to Section 3.0 for more detail)

2.3 Road Works

Utilizing the proposed road layout, center line road grades and associated lot grading will be designed to generally meet the following criteria:

- Match existing road grades at subdivision accesses;
- Match existing and proposed boundary grades around the perimeter of the site;
- Ensure adequate cover is provided over municipal services;
- Ensure "major" overland flow routes are directed to downstream SWM facilities, and;
- Comply with municipal standards for minimum and maximum road grades.

Preliminary centerline road grades range from 0.5% (minimum) to 6.0% (maximum) and generally slope from the site boundaries to the proposed downstream SWM facilities. Preliminary lot grades range from 2.0% (minimum) to 33.0% (maximum) with a combination of traditional back to front drainage, split drainage, and walk-out type lots.

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FIGURE 3 : SANITARY DRAINAGE PLAN

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Thames Crest PH2 roadways will be constructed to a full urban cross-section including asphalt pavement, concrete curb and gutters, concrete sidewalks, roadway illumination and boulevard landscaping all in accordance with the Town of St. Marys standards.

A preliminary geotechnical investigation for the proposed development was completed by MTE Inc. in December 2018. The proposed pavement structure is based on the recommendations included in MTE's Geotech Report and the Town's minimum standards. The proposed pavement structure is summarized in Table 2.1.

Table 2.1 – Proposed Pavement Structure

Pavement Structure	Local Streets (mm)	Collector Streets (mm)
HL3 Asphalt	40	40
HL8 Asphalt	50	50
Granular 'A' Base	150	150
Granular 'B' Sub-base	350	375

2.4 Utility Servicing

Utility servicing of the proposed development will be through the connection to and extension of existing services along Emily Street, Glass Street, and James Street.

Festival Hydro (electrical), Bell Canada (telephone), Union Gas (gas) and Rogers Cable (cable TV) will need to be contacted to confirm that the proposed development can be adequately serviced.

2.5 Grand Trunk Trail Crossing

The proposed extension of Wellington Street will necessitate crossing the Grand Trunk Trail. It is proposed that the crossing be made a Level 2 Pedestrian crossing Type D as described in MTO Book 15: Pedestrian Crossing Treatments. Detailed design of the crossing will be carried out in consultation with the Town during detailed design of the proposed subdivision. A conceptual crossing design is included at the back of this report.

3.0 STORMWATER MANAGEMENT

3.1 Existing Conditions and Background information.

3.1.1 Topographical Information

A topographical survey of the site was completed by True Line Surveying Inc. in 2011. Some follow up surveying was completed by MTE in 2018. The site topography is rolling with elevations ranging from approximately 329 masl in the north east corner to 317 masl in the south west corner. Approximately 16.85 ha of the northern portion of the property drains north to the abutting agricultural lands while the remaining area drains to a 'T' shaped draw which directs runoff to the south and ultimately to a ravine that runs parallel to the Grand Trunk Trail (GTT). The ravine directs flows to an existing 1400mm CSP culvert which runs beneath Emily Street and outlets to a small creek which is tributary to the Thames River.

3.1.2 Pre-Development Conditions

The pre-development conditions of the site were modelled using SWMHYMO 99 v4.05 modelling software (SWMHYMO). The pre-development models were used to estimate the existing flow rates to the immediate receivers during design storm events. The estimated pre-development flow rates serve as target release rates under post-development conditions. Under pre-development conditions the site was delineated into four sub-catchments representing the middle (101), west (102), and east (103) portions of the site which contribute to the GTT ravine. Sub-catchment 111 represents the area of the site which contributes runoff to the agricultural lands north of the site. The Time to peak ratio for the storms was assumed to be 0.4 and the time of concentration for each catchment was calculated using the airport method. The parameters used to model the pre-development catchments are summarized in Table 3.1. Pre-development drainage catchments are illustrated in Figure 4

Table 3.1 – Pre-Development Hydraulic Model Parameters

Catchment ID	Area (ha)	CN	Initial Abstraction (mm)	Time to Peak (hrs)	Description
101	24.80	82	7	0.18	Agricultural Field
102	11.50	82	7	0.24	Agricultural Field
103	6.74	82	7	0.21	Agricultural Field
111	16.85	82	7	0.38	Agricultural Field

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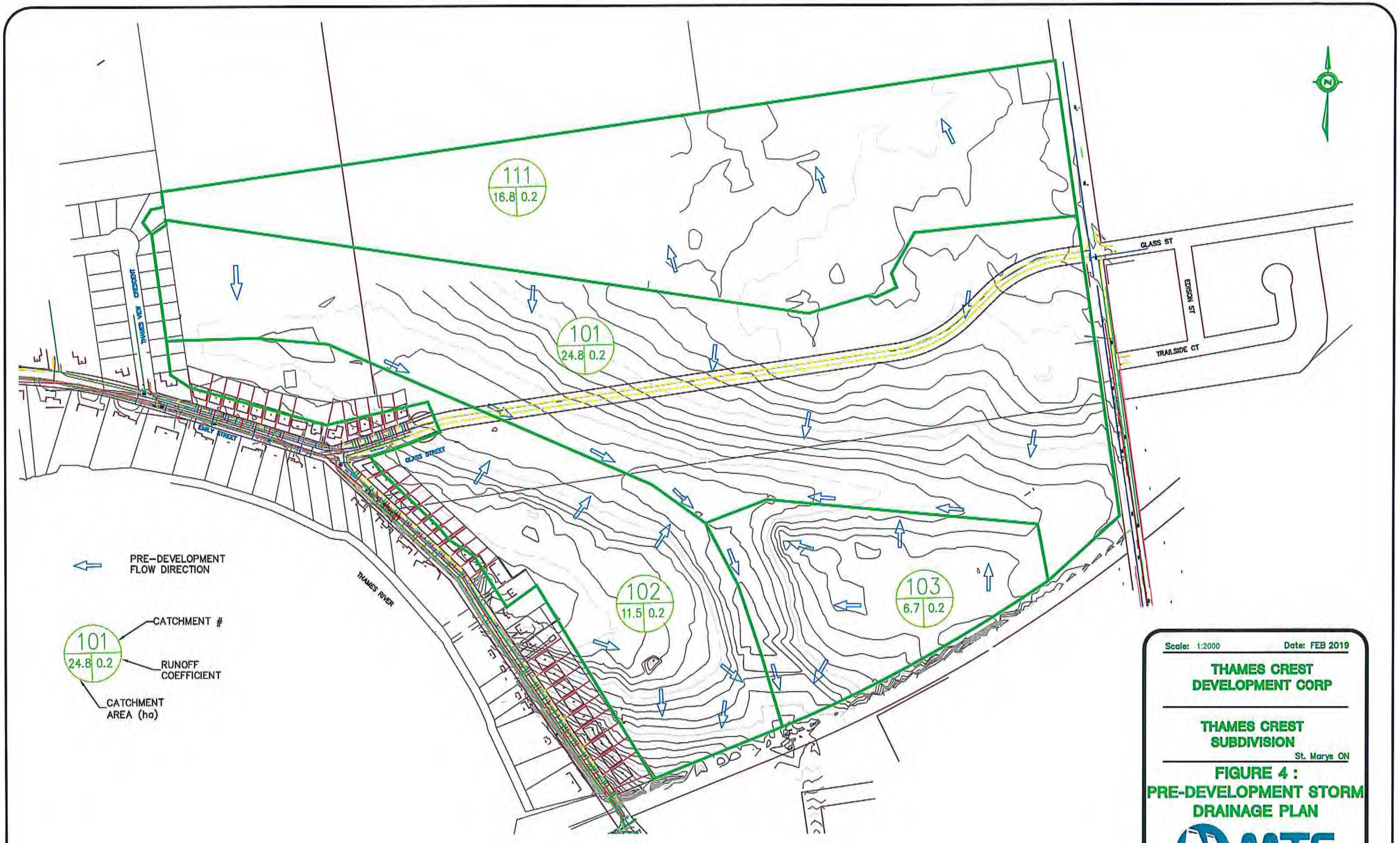

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FIGURE 4 : PRE-DEVELOPMENT STORM DRAINAGE PLAN

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The design storms were modelled as 3-hr Chicago storms with the exception of the 250 year and 25mm events which were assigned a duration of 24 and 4 hours respectively. IDF parameters for Stratford Ontario were utilized for the modelling and obtained from the *Reference Manual on the Use of Design Storms in the Upper Thames River Watershed* published by the UTRCA. Parameters for the 25mm storm are not specified by the UTRCA, thus, parameters which have been accepted by the UTRCA in the past were utilized. IDF Parameters used to model the storms are included in Table 3.2.

Table 3.2 - Chicago Storm IDF Parameters

Storm	A	B	C
25mm	509.000	6.000	0.799
2YR	595.248	4.841	0.766
5YR	860.463	7.382	0.759
10YR	1060.397	8.954	0.760
25YR	1336.383	10.833	0.763
50YR	1546.625	11.945	0.766
100YR	1717.698	12.472	0.764
250YR	2075.001	14.000	0.770

Each design storm was modelled using the design parameters noted in Table 3.1. Resulting runoff estimates are summarized in Table 3.3 below.

Table 3.3 – Pre-development Flow Rates

Storm	Runoff to the Grand Trunk Trail Ravine (m^3/s)	Runoff to External Areas (m^3/s)
25mm	0.552	0.144
2	1.022	0.267
5	2.250	0.599
10	3.200	0.861
25	4.518	1.228
50	5.515	1.508
100	6.553	1.798
250	10.438	1.069

3.1.3 Geotechnical Information

In December of 2018, MTE carried out a preliminary geotechnical investigation for the proposed subdivision. The fieldwork for this investigation included eight boreholes on the subject property including three monitoring wells to allow for measurement of stabilized groundwater levels.

Based on the results of MTE's geotechnical investigation, the subsurface stratigraphy at the site generally consists of 0.4-1.1m (average ~0.5m) of topsoil overlying native deposits of glacial till. The native till ranges in composition from clayey silt with some sand and trace gravel to gravely silt with some sand and trace clay. The stiffness of the till ranged from very loose to very dense with stiffness generally increasing with depth. A particle size distribution analysis was performed for each of three samples of till taken from separate BHs and found that clay and silt comprised 60-80% of the till's make-up. The hydraulic conductivity of the till samples was measured and found to range between 4.7E-10 to 9.7E-09 m/sec with associated infiltration rates of 5 to 12.5 mm/hr (unfactored). Due to the low permeability of the native soils, at-source infiltration is not recommended on this site.

Perched groundwater was noted within gravely-silt and sandy-silt layers of the till. Stabilized groundwater elevations were measured in the monitoring wells at depths ranging from 1.2 to 3.8 mbgs. For further geotechnical information refer to MTE's geotechnical report (see Appendix "F").

3.1.4 Drainage Outlets

During the recent reconstruction of Emily Street, a 1050mm storm outlet was provided in the south west corner of the site. The pipe was sized to accommodate a 5 year flow of 1.930m^3/s from the proposed site to the Emily Street storm sewer which outlets to the 1400mm CSP culvert beneath Emily Street. The 1050mm outlet was designed with a 0.79% grade and has a full flow capacity of 2.427m^3/s. This sewer will be the sole outlet for effluent from the SWM facility located in the south-west corner of the site.

The SWM facility proposed in the south-eastern portion of the site will outlet to both the storm sewer outlet and an existing ditch along the north side of the Grand Trunk Trail. The existing ditch directs flows west to two existing culvert structures which allow flows to cross under the trail and flow into the GTT ravine. The GTT ravine runs along the south side of the Grand Trunk Trail and directs runoff west to a culvert beneath Emily Street and ultimately to the Thames River. Due to erosion concerns within the GTT ravine, only minor flows will be released to the ditch. During larger storm events, surplus runoff will be diverted from the ditch and directed to the storm sewer outlet.

The stage-storage-discharge controls for the southwest and southeastern SWM facilities have been designed such that the design capacity of the 1050mm outlet sewer is not exceeded during the 250yr storm event.

3.2 Stormwater Management Criteria

New developments are required to provide stormwater management in accordance with provincial and municipal policies. The SWM criteria for the site were established in consultation with the Town of St. Marys and the Upper Thames River Conservation Authority.

3.2.1 Quantity Control

Quantity control for the site must be provided for the 25mm, 2yr, 5yr, 10yr, 25yr, 50yr, 100yr and regional design storm events. The UTRCA uses a 24 hour 250yr design storm for the regional event.

The majority of the existing site contributes runoff to the GTT ravine while approximately 16.9 ha of the north portion of the site drains north to the abutting agricultural lands. It is anticipated that under the ultimate development condition the majority of the site will be directed to the outlet in the south-west corner of the site. Total post-development flow rates from the site under the ultimate development condition will be controlled to be less than the predevelopment rates currently draining to the GTT ravine.

3.2.2 Quality Control

Runoff from the site contributes to the Thames River. An enhanced level of quality control, as defined by the Ministry of the Environment, Conservation, and Parks (MOE), will be provided for the development.

3.3 Proposed Development and SWM Strategy

3.3.1 Post-Development Conditions

Under post-development conditions quality and quantity control will be provided by three SWM facilities. Facilities 1 and 2 will be constructed as part of the interim development phases servicing the west and east portions of the site respectively. Facility 3 will be constructed at the time the future lands to the north are developed and will provide quality and quantity control for the majority of those lands. Facilities 1 and 3 will operate in series with each other and parallel to Facility 2.

The post-development site was delineated into 5 sub-catchments representing the portion of the site directly contributing to Pond 1 (201A, 201B), the east portion of the site contributing to Pond 2 (202A, 202B) and the future lands to the north which will be controlled by Pond 3 (300). Parameters used to model runoff from the catchments are summarized in Table 3.4. Post development catchment areas are illustrated in Figure 5

Table 3.4 - Post-Development Modeling Parameters

Catch-ment ID	Area (ha)	Impervious (%)		Initial Abstraction (mm)		Flow Length (m)		Manning's "n"		Slope (%)	
		TIMP	XIMP	Perv	Imperv	Perv	Imperv	Perv	Imperv	Perv	Imperv
201A	13.3	0.6	0.6	5.0	1.0	33	45	0.05	0.015	2.5	2.5
201B	9.6	0.6	0.6	5.0	1.0	33	45	0.05	0.015	2.5	2.5
202A	8.9	0.6	0.6	5.0	1.0	33	45	0.05	0.015	2.5	2.5
202B	3.6	CN = 80		5.0	-	Tc = 0.2 hrs		-	-	-	-
300	22.7	0.6	0.6	5.0	1.0	33	45	0.05	0.015	2.5	2.5

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FIGURE 5: POST DEVELOPMENT DRAINAGE STORM PLAN

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3.4 Stormwater Management Design

A hydrologic model was developed for the site to provide a quantitative estimate of flows from the site under proposed development conditions. SWMHYMO 99 v4.05 modelling software was used to simulate response to the 25mm, 2yr, 5yr, 10yr, 25yr, 50yr, 100yr and Regional storm events. The 3 hour Chicago rainfall distribution, using the intensity-duration-frequency parameters noted in Table 3.2 was used. As noted previously, the UTRCA uses a 24 hour 250 year storm for the regional event and the duration of the 25mm event was assumed to be 4 hours.

The hydrologic parameters noted in Table 3.4 were used to model the post-development conditions for each of the catchment areas. The SWMHYMO modelling output and hydrologic modelling schematics for the pre and post-development conditions are provided in Appendix "D".

3.4.1 Stormwater Quality Control

As noted previously, the site will ultimately be controlled by three SWM facilities.

- SWM Facility 1 will be located in the south western corner of the site and will provide quantity and quality control for approximately 22.9ha of the proposed interim development. Under interim conditions, pre-development runoff from a portion of the future development lands north of Glass Street will be routed through SWM Facility 1. Ultimately, the flows from the future developable lands will be controlled by SWM Facility 3 but will still be routed through Facility 1.

- SWM Facility 2 will be located along the south property line adjacent to the Grand Trunk Trail and provide control for flows from approximately 12.5ha of the site

- SWM Facility 3 will be constructed at the time the future development lands north of Glass Street are developed and will control flows from the lands north of Glass Street. As noted above, outflow from Facility 3 will be routed through Facility 1. Storm sewers along Wellington Street will be sized to transport the estimated 1:5 year post-development flow from the future development lands to Pond 1.

SWM facilities 1 and 2 have been designed as part of this SWM analysis while Facility 3 will be designed at the time the future development lands to the north are developed. Pond 1 has been designed as a wet pond with a permanent pool depth of 1.5m. Facility 2 is proposed as a constructed wetland with a permanent pool depth of 0.3m. These facilities offer the benefits of dilution and settling of sediment within the forebay and the permanent pool components. A planting scheme will be prepared for each facility that carefully selects plant species and their location in and around the basins to stabilize banks, mitigate temperature increases, deter waterfowl from nesting within the area, and provide aesthetics and safety benefits.

The proposed SWM facilities are each divided into two cells. The first cell consists of a sediment forebay that will accept minor storm event flows from the inlet sewer. The second cell consists of the main detention storage area of the pond. The sediment forebay for each facility has been provided at the inlet point to the facilities and designed with a maximum and minimum depth of 1.5m and 0.8m respectively. The maximum design depth is immediately following construction and after sediment clean-out operations. The minimum design operating depth of 0.8m is that which occurs prior to the required clean-out operations. Maintenance of at least the 0.8m of permanent pool in the forebays at all points in the sediment accumulation / clean-out cycle minimizes the potential for scour and re-suspension of previously settled sediments.

Since the majority of annual rainfall occurs in storms less than or equal to a 25mm event, the majority of water borne sediment is also transported to the SWM facilities in these less intense events. Therefore, the sediment forebays are designed targeting the smaller flows.

Forebay design is based on classic particle settling and flow dispersion equations as presented in the MOE 2003 *Stormwater Management Practices Planning and Design Manual*. The methodology presented in that document suggests that the design flow for the forebay should be taken as the peak outflow from the facility. A forebay is typically designed to treat minor storm flows. Therefore, the main pond will essentially be empty (or at its permanent pool level) and there will be no mass of water at the outlet of the forebay that would control the flow through the forebay to the main pond's discharge rate.

This being the case, the design of the forebay should be based on the notion that the flow into the forebay equals the flow through the forebay, which equals the flow out of the forebay. In using this approach, the recommended settling velocity of 0.0003m/s (from MOE 2003) results in extremely large and un-achievable forebay lengths. Therefore, the forebay is designed to satisfy the following four conditions:

- Settling length based on a settling velocity of 0.0003m/s using the main pond peak discharge for the 25mm event (as per MOE 2003).
- Settling length based on a settling velocity of 0.0055m/s using the forebay inflow/outflow for the 25mm event.
- Dispersion length such that, based on flow and depth of water, the velocity through the forebay is less than 0.5m/s.
- Velocity based on flow divided by cross-sectional area is less than 0.15m/s to prevent scouring.

The MOE 2003 document suggests that the clean-out frequency for the SWM facility be based on the sediment loading within the entire pond, however, it is recommended that the clean-out frequency be based on the loadings within the forebay only. While this typically results in more frequent clean-out, it is restricted to the forebay area only and avoids disturbance of the main pond. The clean-out frequency for the proposed SWM facility can be found in the forebay design calculations in Appendix "E".

Per the UTRCA's requirements, an Enhanced Level (formerly Level 1) of water quality protection is required. Quality control measures will take the form of the proposed wet pond and wetland facilities. The contributing area of each facility is assumed to be approximately 60% impervious. Per the MOE's SWM planning and design manual, an Enhanced Level of water quality control for a 60% impervious contributing area requires a storage volume of 201.7m^3/ha for a wet pond and 110.0m^3/ha for a wetland facility. Of the required storage volumes, all but 40 m3/ha represents the permanent pool requirement. Considering the total post-development drainage areas for Facilities 1 & 2 are 22.9ha and 12.5ha respectively, this equates to a required permanent pool volume of 4,618.17 m^3 and 875 m^3 for Facilities 1 & 2 respectively. Table 3.5 and Table 3.6 outline the design of proposed SWM Facilities 1 & 2. Appendix "E" contains design calculations for the sediment forebays and the main pond draw down calculations. Per the MOE design manual, the minimum required extended detention volume for SWM Facility 1 was doubled to 80 m^3/ha as this Facility will be downstream of future SWM Facility 3.

Table 3.5 - SMW Facility 1 Water Quality Control Details

General	Pond Characteristics
Wetpond Stormwater Management Facility	Enhanced Quality Control
Total Contributing Area	22.9ha
Imperviousness (of whole drainage area)	60%
Bottom Elevation (of wetpond)	313.40
Storage	
Unit Area Storage Volume Requirements as per SWMMP (MOE 2003)	241.7m^3/ha
Required Total Volume	5,534m^3
Permanent Pool	
Required Permanent Pool Volume	4,618m^3
Permanent Pool Volume Provided	5,861m^3
Permanent Pool Elevation	314.90
Extended Detention	
Minimum Required Volume (based on 80 m^3/ha)	1,832m^3
Extended Detention Volume Provided	1,848m^3
Approximate Drawdown Time	24.00hr
Extended Detention Elevation	315.20
Peak Release Rate for Extended Detention (Quality)	0.046m^3/s
Forebay	
Required Forebay Length	53.4m
Actual Forebay Length	75.0m
Permanent Pool Elevation	314.90
Bottom Elevation	313.40
Outlet Controls	
Extended Detention: Two 215x75mm Rectangular Orifices	Inv. 314.90
25mm-250yr events: Three 540x300mm Rectangular Orifices	Inv. 315.20

Table 3.6 - SWM Facility 2 Water Quality Control Details

General	**Pond Characteristics**
Wetland Stormwater Management Facility	Enhanced Quality Control
Total Contributing Area	12.5ha
Imperviousness (of whole drainage area)	44%
Bottom Elevation (of wetland)	321.00
Storage	
Unit Area Storage Volume Requirements as per SWMMP (MOE 2003)	91.6m^3/ha
Required Total Volume	1,145m^3
Permanent Pool	
Required Permanent Pool Volume	645m^3
Permanent Pool Volume Provided	1,332m^3
Permanent Pool Elevation	321.30
Extended Detention	
Minimum Required Volume (based on 40 m^3/ha)	500m^3
Extended Detention Volume Provided (based on 25 mm event)	836m^3
Approximate Drawdown Time	44hr
Extended Detention Elevation	32.11
Peak Release Rate for Extended Detention (Quality)	0.014m^3/s
Forebay	
Required Forebay Length	21.6m
Actual Forebay Length	22m
Permanent Pool Elevation	321.30
Bottom Elevation	321.00
Emily Street Sewer Outlet Controls	
Extended Detention: One 130mm Diameter Orifice	Inv. 321.30
25mm-250yr Events: Two 450x350mm Rectangular Orifices	Inv. 321.50

3.4.2 Stormwater Quantity Control

Flows for all storm events will be conveyed to the SWM facilities by a combination of storm sewers and overland flow routes (road right-of-way). Multi-stage outlet structures have been proposed for use in the SWM facilities. The structures will control flows from the pond to both the Emily Street sewer outlet and the GTT ravine.

The sewer outlet control for SWM Facility 1 will be provided by two vertical 215x75mm rectangular orifices and three vertical 540x300mm (H:V) rectangular orifices. The smaller orifices have been sized to provide control for the extended detention. During the 25mm-250yr events, flows will be controlled by the larger orifices. All effluent from SWM Facility 1 will be directed to the 1050mm storm sewer outlet.

The sewer outlet control for Facility 2 will be provided by one vertical 130mm circular orifice which will control the extended detention and two vertical 450x350mm rectangular orifices to control the 25mm-250yr storm events. Effluent from SWM Facility 2 will flow to a splitter structure which will direct minor flows toward the GTT ravine and divert larger flows to the 1050mm storm sewer outlet.

The outlet controls for Facilities 1 & 2 have been designed to ensure that the flow directed to the 1050mm storm sewer outlet will not exceed the sewer's full flow capacity under 250yr storm conditions. This will ensure that the outlet will not become surcharged and limit the ability of flows to exit the ponds. To prevent failure in the event that an outlet becomes blocked by debris, each facility has been equipped with an emergency overflow weir. Abridged stage-storage-discharge relationships for the proposed SWM facilities are shown below in Table 3.7. Detailed stage-storage-discharge relationships for the SWM facilities are provided in Appendix "E".

Table 3.7 - Stage-Storage-Discharge Information

Elevation (m)	Discharge (m^3/s)	Volume (m^3)	Remarks
SWM Facility 1			
314.90	0.000	0	Two 215x75mm Rectangular Orifices
315.20	0.046	1,848	Three 540x300mm Rectangular Orifices
315.40	0.347	3,173	Contour
315.60	0.751	4,574	Contour
315.80	0.993	6,050	Contour
316.00	1.186	7,601	Contour
316.20	1.352	9,228	Contour
316.40	1.499	10,929	Contour
316.60	1.632	12,705	Contour
316.80	1.756	14,557	Contour
317.00	1.871	16,484	Contour
317.20	1.980	18,495	Top of Ponding
317.50	-	-	Freeboard
SWM Facility 2			
321.30	0.000	0	130mm Diameter Orifice
321.50	0.014	836	450x320mm & 450x350mm Rectangular Orifices
321.70	0.180	1,771	Contour
321.90	0.432	2,806	Contour
322.10	0.585	3,940	Contour
322.30	0.705	5,174	Contour
322.50	0.807	6,507	Contour
322.70	0.898	7,939	Top of Ponding
323.00	-	-	Freeboard

Utilizing the above noted controls, the post-development peak flows can be attenuated to the SWM criteria as outlined in Section 3.2. A summary of the peak flows for the post-development condition is summarized in Table 3.8. Peak flow rates from each of the ponds as well as the total flow from the site are included for each design storm event. The peak flow rates to the Emily Street Storm Sewer and the Grand Trunk Trail Ravine during each event have been indicated as well.

Table 3.8 - Post-Development Peak Flow Rates (m^3/s)

Design Storm	POND 1	POND 2	POND 3	Total Flow From Site	Allowable Release Rate	Emily Str. Storm Sewer	GTT Ravine
25mm	0.285	0.065	0.138	0.350	0.552	0.285	0.065
2	0.577	0.149	0.280	0.726	1.022	0.577	0.149
5	0.945	0.338	0.457	1.281	2.250	0.945	0.338
10	1.145	0.451	0.572	1.591	3.200	1.145	0.451
25	1.359	0.563	0.676	1.917	4.518	1.455	0.462
50	1.491	0.633	0.729	2.119	5.515	1.650	0.469
100	1.612	0.697	0.790	2.302	6.553	1.826	0.475
250	1.975	0.891	1.000	2.861	10.438	2.366	0.495

It should be noted that Future Pond 3 has not been designed as part of this SWM analysis. Release rates from Pond 3 have been approximated and represent the upper limits of allowable flows assuming the layout and outlet controls of Facility 1 are designed as noted above. The SWMHYMO output for the quantity control can be found in Appendix "D". A summary of the maximum ponding elevations for the facilities is provided in Table 3.9.

Table 3.9 - Maximum Ponding Elevations

	SWM Facility 1		SWM Facility 2	
Storm Event	Max. Ponding Elevation (m)	Max. Detention Depth (m)	Max. Ponding Elevation (m)	Max. Detention Depth (m)
25mm	315.37	0.47	321.59	0.29
2	315.50	0.60	321.68	0.38
5	315.77	0.87	321.82	0.52
10	315.96	1.06	321.93	0.63
25	316.22	1.32	322.07	0.77
50	316.39	1.49	322.18	0.88
100	316.57	1.67	322.29	0.99
250	317.20	2.30	322.69	1.39

3.4.3 Stormwater Management Facilities

Details for the proposed SWM facilities are provided on MTE Drawings 35499-200 SW1.1, SW1.2 SW2.1 & SW2.2 which are included with this report. The following list of SWM facility design characteristics, read in conjunction with the above drawings, outlines all significant design aspects and rationales.

- As previously described in Section 3.4.1, the SWM facilities have been designed as a wet pond / wetland facilities with sufficient permanent and active storage volumes to achieve an Enhanced (formerly Level 1) degree of protection.
- Outlet control for the SWM facilities will be in the form of outlet control structures with orifice plates and weirs to control flows directed to the Emily Street storm sewer and the Grand Trunk Trail ravine. The outlet controls for the SWM facilities have been designed to provide a minimum of 24 hours of drawdown time for the extended detention volume for each facility.
- An access/maintenance road of 4m width has been incorporated into the design of the SWM facilities to ensure sufficient access to the inlet and outlet structures and forebays for ease of inspection and maintenance. The access roads will have an asphalt surface and have a maximum longitudinal grade of 10%, maximum cross-fall of 2% and a minimum inside radius of curvature not less than 10m.
- The design of the SWM facilities has incorporated internal side slopes of 5:1 (for safety) throughout the facilities above and below the permanent water level.
- Minimum freeboard of approximately 0.3m has been provided to the top of the berming around the SWM facilities above the 250 year high water level.
- Operation and maintenance of the SWM facilities will be the responsibility of the Town of St. Marys. Maintenance responsibilities include regular inspection of the basin. Sediment should be removed when the permanent pool depth is reduced to 0.8 within the forebay areas. It should be noted that the estimated sediment clean-out frequencies outlined in the forebay calculation sheets might be reduced during the interval prior to complete stabilization of the upstream contributing drainage areas.

3.5 Water Budget Analysis

Maintaining infiltration to groundwater is desirable in order to maintain groundwater base flows to the Thames River, and to reduce peak runoff rates. As noted previously, a geotechnical investigation has been completed for the site and soil conditions have been deemed unsuitable for infiltration purposes. Thus no infiltration measures are proposed on the site.

4.0 EROSION AND SEDIMENT CONTROL MEASURES

Available soils information indicates that the on-site surficial materials consist mainly of Clay Loam. Precautions will be taken during construction to limit erosion and sedimentation. Erosion and Sediment Control Plans will be prepared and will accompany the detailed design submission for the subject lands. The plans will illustrate the erosion and sediment control measures to be implemented during construction, which will limit impacts associated with site development.

Typically, the recommended construction sequence for erosion and sediment control measures will be as follows:

- Placement of all sediment control fencing where required;
- Construction of permanent and temporary stormwater management ponds which will serve as sedimentation basins for the site during construction;
- Construction of temporary swales to direct runoff to sedimentation basins, with rock check dams as required to control velocities;
- Stripping and strategic placement of topsoil stockpiles. Placement of sediment control fencing around all stockpile areas; and
- Re-vegetation of completed areas as soon as possible after construction, including those areas not slated for construction within 60 days.

Where rock check dams are proposed to promote sedimentation and reduce velocities, clean aggregate is to be placed perpendicular to the direction of flow in the swale, with a small volume of excavation on the upstream side to provide storage for accumulated sediment.

Sediment control fencing shall consist of filter fabric attached to paige wire fencing and sealed at ground level. It will be installed at the perimeter of the work areas and intermittently on sloped areas where required. Sediment control fencing will be placed around all topsoil stockpiles.

Access to topsoil or fill storage areas will be located on the upstream side of storage piles. This practice will ensure continuity of the sediment control fencing in the downslope direction which is most vulnerable to erosion and sediment deposition. Further, topsoil and hydroseed will be placed on all exposed areas following the completion of grading activities.

5.0 OPERATION AND MAINTENANCE

It is recommended that during construction of the SWM facilities monitoring and inspection of the erosion and sediment controls be conducted to ensure the satisfactory performance of these measures.

Reporting of the inspection and monitoring results should be distributed to the Upper Thames River Conservation Authority. If it is found that the erosion and sediment control measures are not working adequately, they shall be augmented to the satisfaction of the UTRCA and The Town of St. Marys, based on field decisions.

Furthermore, it is recommended that the owner initiate a post-construction monitoring program to ensure the long term effectiveness of the SWM facilities. The post construction monitoring program should include:

- Periodic inspection of the SWM control facilities and other erosion control works;
- Inspection of the SWM facilities and their outlets after significant rainfall events (generally in excess of 10 mm of rainfall);
- Removal of debris that may accumulate and hinder functioning of the SWM facilities;
- Implementation of remedial measures including erosion stabilization, repair of damaged vegetation and sediment removal, as required.

Frequency of the post construction monitoring will be at the discretion of the Town of St. Marys. It is recommended that a minimum of four (seasonal) inspections be made, annually. An Operation, Maintenance and Monitoring Report will be submitted to the Town of St. Marys under a separate cover.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The main findings of the preliminary servicing and stormwater management report for the proposed Thames Crest PH2 Development are:

1. It is anticipated that the proposed interim development can be adequately serviced through the extension of existing gravity sanitary sewers and municipal watermains. Ultimate buildout conditions have been accounted for conceptually but should be modelled at time of development to confirm available capacity.

2. A sanitary outlet connection to the existing Emily Street sewer is available. A connection to the James Street sanitary sewer will be constructed as part of the Phase 2 development. The Town's sanitary sewer model indicates that downstream sewers are constructed with adequate capacity to service the interim development condition.

3. Water supply for the proposed interim development will be provided by five connection points to the existing/future municipal water distribution system:

   - Three (3) connections to the Glass Street watermain;
   - One (1) connection to the James Street watermain; and,
   - One (1) connection to the Wellington Street Watermain.

   An additional two (2) connections to the Glass Street main will be made to service the future lands to the north. An analysis should be performed to determine available capacity at the time development of the northern lands proceeds.

4. Stormwater management for the development can be accommodated in the proposed downstream SWM facilities

   - Storm runoff from the site will be controlled by the proposed SWM facilities and outlet to the Upper Thames River Subwatershed
   - The storm outlet is constructed and available at Emily Street.

5. Overall site grading will provide for "major" overland flow conveyance to the downstream SWM facilities, provide adequate cover over municipal services and generally match existing road and boundary grades with appropriate slopes or retaining walls.

6. The availability of utility services to the site (i.e. hydro, gas, cable TV, and telephone) will be confirmed.

7. SWM Facilities 1 & 2 will be constructed as part of the interim development of the site. Facility 3 will be constructed at the time the lands to the north are developed. Flows from Facility 3 will contribute to Facility 1.

8. Stormwater quantity and quality controls have been provided to control flows from the site to pre-development levels and provide an enhanced level of treatment to the runoff.

9. All flows released from SWM Facility 1 will be directed to the Emily Street Sewer. Minor flows from SWM Facility 2 will be directed to the Grand Trunk Trail ravine while larger flows will be directed to the Emily Street Sewer.

10. The proposed outlet controls for SWM Facilities 1 & 2 will control flows to the Emily Street storm sewer to below the full flow capacity of the 1050mm outlet under 250yr design storm conditions.

11. Sediment and erosion controls are to be provided prior to the construction of the SWM Facilities to protect the downstream sewers, ravine, and ultimately the Thames River.

All of which is respectfully submitted,

MTE CONSULTANTS INC.

LICENSED PROFESSIONAL ENGINEER
Mar 12/19
J. J. MONSTER
100190546
PROVINCE OF ONTARIO

Josh Monster, P.Eng
Design Engineer

REGISTERED PROFESSIONAL ENGINEER
W.H. VEITCH
Mar 12/19
PROVINCE OF ONTARIO

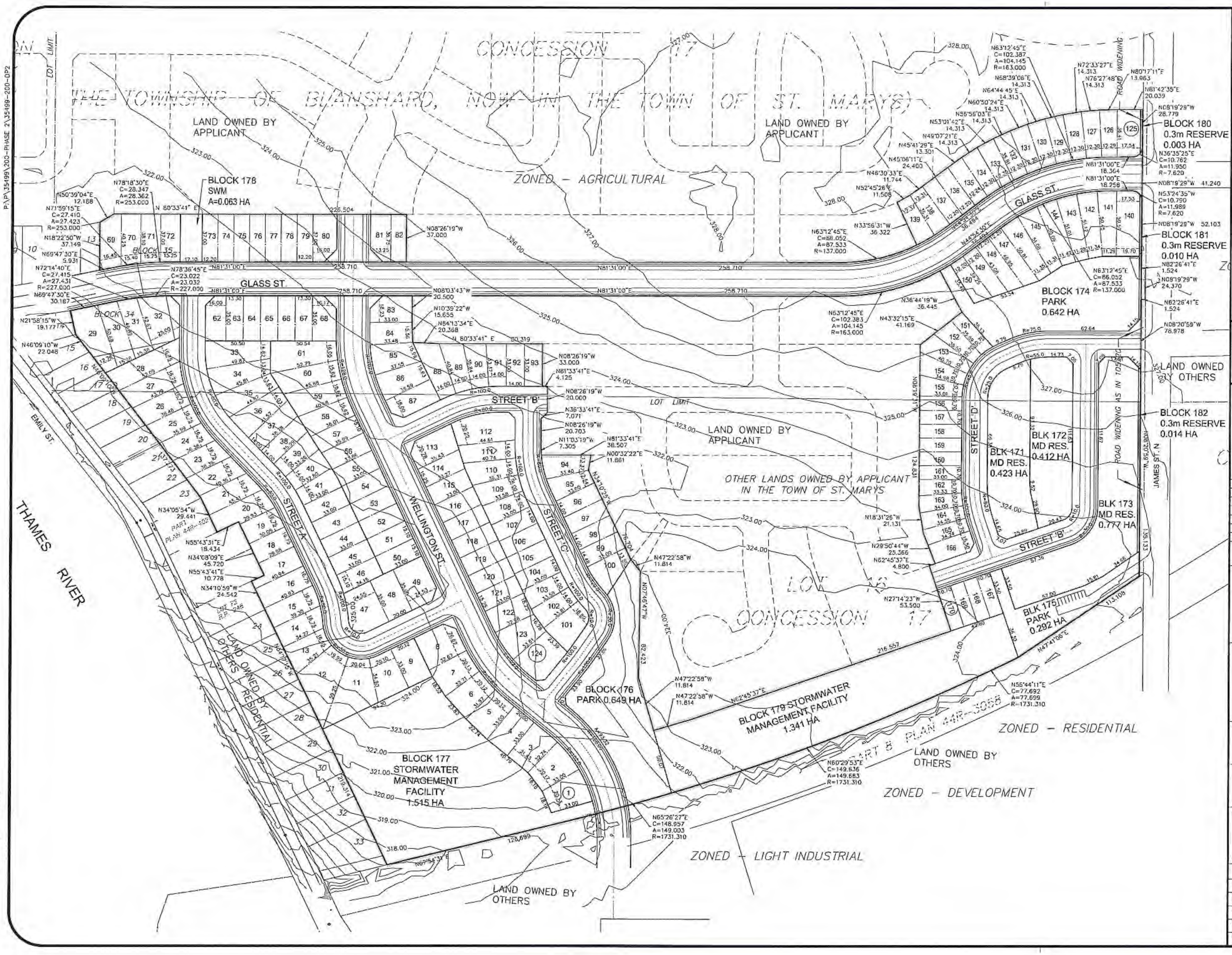
Bill Veitch, P.Eng.
Design Engineer

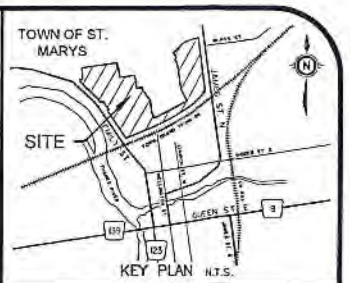
APPENDIX A

DRAFT PLAN OF SUBDIVISION
(REDUCED)

35499-200-DP1.1

MTE FILE No. P:\P\35499\200-PHASE 2\35499-200-DP2





OWNER'S CERTIFICATE

I HEREBY AUTHORIZE:
MTE CONSULTANTS INC.
TO PREPARE AND SUBMIT THIS DRAFT PLAN OF SUBDIVISION TO THE CITY OF STRATFORD

THAMESCREST DEVELOPMENTS DATE
LLOYD DAVINPORT

SURVEYOR'S CERTIFICATE

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

GAVIN P.T. SEAMAN DATE
ONTARIO LAND SURVEYOR

REQUIREMENTS of SECTION 51(17) of the PLANNING ACT

(A) SEE PLAN	(E) SEE PLAN	(I) SILTY LOAM 50% POROSITY
(B) SEE PLAN	(F) SEE PLAN	(J) SEE PLAN
(C) SEE PLAN	(G) SEE PLAN	(K) FULL MUNICIPAL SERVICES
(D) SEE PLAN	(H) MUNICIPAL WATER	(L) NONE

	(IN Ha)
LOTS 1-170- SINGLE FAMILY RESIDENTIAL	9.863 ha
BLOCKS 171-173 - MED. DENSITY RESIDENTIAL	1.612 ha
BLOCKS 174-176 - PARK AREAS	1.583 ha
BLOCKS 177-179 - SWM BLOCKS	2.919 ha
BLOCKS 180-182 - 0.3m RESERVES	0.027 ha
ROADS	3.830 ha
TOTAL	19.835 ha

No.	REVISION	BY	DATE
6.			
5.			
4.			
3.			
2.			
1.	ISSUED FOR REVIEW	SGS	7/MAR/19

TOWN of ST. MARYS

MTE
Engineers |Scientists |Surveyors
519-204-6510 www.mte85.com

OWNER
THAMES CREST DEVELOPMENTS INC.

PROJECT
THAMES CREST SUBDIVISION PHASE 1
SAINT MARYS ONT.

DRAWING
DRAFT PLAN OF SUBDIVISION

Project Manager WHV	Project No. 35499-200
Design By SGS	Checked By
Drawn By SGS	Checked By
Surveyed By MTE	Drawing No. DP1
Date Dec.03/18	
Scale 1:1250	Sheet 1 of 1

date – time – CADTAG

APPENDIX B

ST. MARYS SERVICING STUDY

Thames Crest Farms Development Water Servicing

R.J. Burnside & Associates Limited 3 Ronell Crescent Collingwood ON L9Y 4J6 Canada
telephone (705) 446-0515 **fax** (705) 446-2399 **web** www.rjburnside.com

BURNSIDE
[THE DIFFERENCE IS OUR PEOPLE]

Memorandum

Date: March 13, 2012 **File No.:** MSZ020926

Project: St. Marys Servicing Study – Thames Crest Farms Development Water Servicing

To: Sofia Polania, Town of St. Marys

From: Jennifer MacAdam, EIT

In conjunction with a Master Servicing Study, R.J. Burnside & Associates Limited (Burnside) has been requested by the Town of St. Marys to review the drinking water and fire flow servicing for a proposed subdivision located north of the Grand Trunk Trail, between Emily Street and James Street.

The development is proposed to be constructed in three phases:

Phase 1 – 35 units along the east side of Emily Street, and Glass Street
Phase 2 – 82 additional units in the undeveloped land east of Emily Street
Phase 3 – 187 additional units in the undeveloped land west of James Street, and block designated for multi-residential units

The theoretical demands of this area have been calculated under the following assumptions, and can be found in Table 1, below.

- 450 L/person/day (MOE Guidelines)
- 2.7 persons/unit (current density of St. Marys)
- 100 persons/ha (typical for multi-residential areas)
- Maximum Day Demand factor = 2.0 (MOE Guidelines)
- Peak Hour Demand factor = 3.0 (MOE Guidelines)

Table 1: Theoretical Demands for Thames Crest Farms Development

Phase	Total Units	Multi-Res (ha)	Population	Total ADD (L/s)	Total MDD (L/s)	Total PHD (L/s)
1	35	0	94.5	0.49	0.98	1.48
2	117	0	315.9	1.65	3.29	4.94
3	304	1.6	980.8	5.11	10.22	15.33

The MOE recommended pressures ranges for a distribution system can be seen in Table 2, below.

Table 2: MOE Recommended Pressures

Scenario	Optimum System Pressure	Max. System Pressure
Average Day	50 psi – 70 psi	100 psi
Maximum Day	50 psi – 70psi	100 psi
Peak Hour	40 psi – 70 psi	100 psi
Max. Day plus Fire Flow	20 psi minimum	100 psi

The minimum MOE recommended fire flow is 38 L/s. The St. Marys distribution system was likely designed based on a fire flow of this size. However, MOE currently recommends a fire flow of 189 L/s for a Town with a population of 6,000 - 10,000 people. Ultimately, it is the Town of St. Marys decision as to the amount of fire protection that is desired.

Existing Conditions

The existing system can be seen in Figure 1, attached.

Please note that it has been assumed in the model that the upsizing of the 150 mm diameter watermain to a 200 mm diameter from Parkview Drive to the Grand Trunk Trail (currently under design) is completed. It has also been assumed the 200mm diameter watermain on Parkview Drive from Water Street to Wellington Street has been completed (currently under design). In addition, these results assume there is no existing watermain on Water Street between Parkview Drive and the existing well south of Trout Creek.

The existing water system functions well under average day demand (ADD) conditions, maximum day demand (MDD) conditions, and peak hour demand (PHD) conditions in the area of Emily Street and James Street. The system pressures are within optimum range.

During a fire scenario, the north end of Emily Street does not have sufficient fire flow. Emily Street is currently a 150 mm diameter watermain with no looping (dead end). The pressure losses in this pipe are significant, and therefore the inability to deliver sufficient fire flow is not unexpected. In order to increase pressures and fire flow along Emily Street, the current pipe can be upsized, and/or additional watermain can be added to provide looping in this area.

Please see Table 3 below, summarizing the pressures and flow under each of the scenarios.

It should be noted that the hydraulic model results below indicate significantly higher pressures under fire flow conditions on Emily Street than those observed in the field during hydrant flushing, as provided by the Town. This is an indication that the friction factor ("C" value) in the existing pipe is in reality lower than the typical MOE recommended values used in the model, due to age, blockages and/or degraded condition. Although the standard 'C' value for a 150 mm watermain is 100, using a value of 60 results in pressures closer to those observed in the field. If this section of pipe is replaced, as recommended in the proceeding sections, the 'C' factor will increase to be more in line with MOE typical values. The results below are modeled using the standard C Factor of 100 for all of the 150mm diameter watermain.

Table 3: Existing Conditions

Junction	**Hydrant Number**	**Location**	**Pressures (psi)**			**Fire Flow Available (L/s)**	**Residual Pressure @ Fire Flow Node (psi)**
			ADD	**MDD**	**PHD**		
J-836	219	Emily Street (south of Grand Trunk Trail)	76.4	76.3	71.7	89.7	20
J-838	222	Emily Street and Glass Street (future)	58.0	57.9	53.2	23.5	20
J-593	225	Emily Street and Thamesview Cres.	71.4	71.3	66.6	25.1	20
J-851	N/A	James Street N. and Glass Street	51.0	50.9	46.2	70.6	20
J-586	224	Thamesview Crescent	57.1	57.0	52.2	20.5	20
J-590	226	Thamesview Crescent	70.2	70.1	65.4	24.5	20
J-594	227	Emily Street	77.5	77.4	72.7	25.6	20
J-595	228	Emily Street	80.5	80.4	75.7	23.9	20
J-876	229	Emily Street	78.6	78.5	73.8	22.3	20
J-596	230	Emily Street	76.4	76.3	71.6	20.7	20

Phase 1 Upgrades

The existing system plus Phase 1 of the development can be seen in Figure 2, attached.

Phase 1 of the development consists of the construction of 35 units along Emily Street and Glass Street. As seen above in the analysis of existing conditions, this area does not currently have sufficient fire flow. In order to increase the fire flow and decrease the pressure losses along this stretch of pipe, the main can be upsized to a 200 mm diameter pipe. To service the Phase 1 units, the pipe has been upsized from the existing 200 mm (just south of the Grand Trunk trail) to the intersection of Emily Street and Thamesview Crescent.

The upsized pipe is able to supply the minimum fire flow of 38 L/s to the proposed development. The network itself is not able to provide the recommended 189 L/s fire flow; for this to be possible major upgrades would be required to many areas of the network.

Please see Table 4 below for the effects this upsizing will have on the network.

Table 4: Phase 1 Conditions

Junction	Hydrant Number	Location	Pressures (psi)			Fire Flow Available (L/s)	Residual Pressure @ Fire Flow Node (psi)
			ADD	MDD	PHD		
J-836	219	Emily Street (south of Grand Trunk Trail)	76.4	76.3	71.5	97.1	20
J-838	222	Emily Street and Glass Street (future)	58.0	57.9	53.2	51.0	20
J-593	225	Emily Street and Thamesview Cres.	71.4	71.3	66.5	54.8	20
J-851	N/A	James Street N. and Glass Street	51.0	50.9	46.2	73.1	20
J-586	224	Thamesview Crescent	57.1	56.9	52.1	41.1	20
J-590	226	Thamesview Crescent	70.2	70.0	65.3	49.3	20
J-594	227	Emily Street	77.5	77.3	72.6	48.4	20
J-595	228	Emily Street	80.5	80.4	75.6	38.0	20
J-876	229	Emily Street	78.6	78.4	73.7	33.3	20
J-596	230	Emily Street	76.4	76.2	71.5	29.3	20

Phase 2 Upgrades

The existing system plus Phase 1 and 2 of the development can be seen in Figure 3, attached.

Phase 2 of the development consists of the construction of 82 units within the development area. For this scenario, it has been assumed the recommended upsizing of the Emily Street watermain to a 200 mm diameter for Phase 1 has been completed.

Option 1: Connection at James Street

To service the Phase 2 units, a 200 mm diameter watermain should be constructed, extending along Glass Street from Emily Street to James Street. In addition, to provide fire protection to the proposed lots at the south end of Wellington Street North, a 150 mm diameter watermain will be necessary, extending from Glass Street to Liahn Crescent, to provide looping.

Please see Table 5 below for the effects these upgrades will have on the network.

Table 5: Phase 2 Conditions, Option 1

Junction	**Hydrant Number**	**Location**	**Pressures (psi)**			**Fire Flow Available (L/s)**	**Residual Pressure @ Fire Flow Node (psi)**
			ADD	**MDD**	**PHD**		
J-836	219	Emily Street (south of Grand Trunk Trail)	77.5	77.2	72.4	132.6	20
J-838	222	Emily Street and Glass Street (future)	58.0	57.6	52.8	88.3	20
J-593	225	Emily Street and Thamesview Cres.	71.4	71.0	66.3	80.5	20
J-851	N/A	James Street N. and Glass Street	51.0	50.6	45.8	87.3	20
J-847	N/A	Glass Street and Street "A"	58.9	58.5	53.8	90.6	20
J-855	N/A	Liahn Cres. and Wellington St. N.	60.1	59.7	55.0	73.0	20
J-586	224	Thamesview Crescent	57.1	56.6	51.9	55.2	20
J-590	226	Thamesview Crescent	70.1	69.7	64.9	66.6	20
J-594	227	Emily Street	77.5	77.0	72.3	61.1	20
J-595	228	Emily Street	80.5	80.1	75.3	42.9	20
J-876	229	Emily Street	78.6	78.1	73.4	36.6	20
J-596	230	Emily Street	76.4	75.9	71.2	31.6	20

Option 2: Connection at Wellington Street North

As a second option to service the Phase 2 units, the proposed 150 mm diameter watermain on Wellington Street N. within the development can be extended south past the Grand Trunk Trail (GTT) to meet the existing Wellington Street North 150 mm diameter watermain. This option sufficiently services the Phase 2 units and delays the construction of the 200 mm diameter watermain along Glass Street from Emily Street to James Street until Phase 3 of construction.

Please see Table 6 below for the effects these upgrades will have on the network

Table 6: Phase 2 Conditions, Option 2

Junction	Hydrant Number	Location	Pressures (psi)			Fire Flow Available (L/s)	Residual Pressure @ Fire Flow Node (psi)
			ADD	MDD	PHD		
J-836	219	Emily Street (south of Grand Trunk Trail)	77.5	77.2	72.4	108.6	20
J-838	222	Emily Street and Glass Street (future)	58.0	57.6	52.8	65.1	20
J-593	225	Emily Street and Thamesview Cres.	71.4	71.0	66.3	66.1	20
J-851	N/A	James Street N. and Glass Street	51.0	50.6	45.8	69.8	20
J-847	N/A	Glass Street and Street "A"	58.9	58.7	53.7	63.7	20
J-855	N/A	Liahn Cres. and Wellington St. N.	60.1	59.9	54.9	60.0	20
J-846	N/A	Wellington St. N. (north of GTT)	62.0	61.7	56.8	63.7	20
J-586	224	Thamesview Crescent	57.1	56.8	51.7	47.6	20
J-590	226	Thamesview Crescent	70.1	69.8	64.8	57.4	20
J-594	227	Emily Street	77.5	77.2	72.2	54.7	20
J-595	228	Emily Street	80.5	80.2	75.2	40.6	20
J-876	229	Emily Street	78.6	78.3	73.3	35.1	20
J-596	230	Emily Street	76.4	76.1	71.1	30.5	20

Phase 3 Upgrades

The existing system plus full build out of the development can be seen in Figure 4, attached.

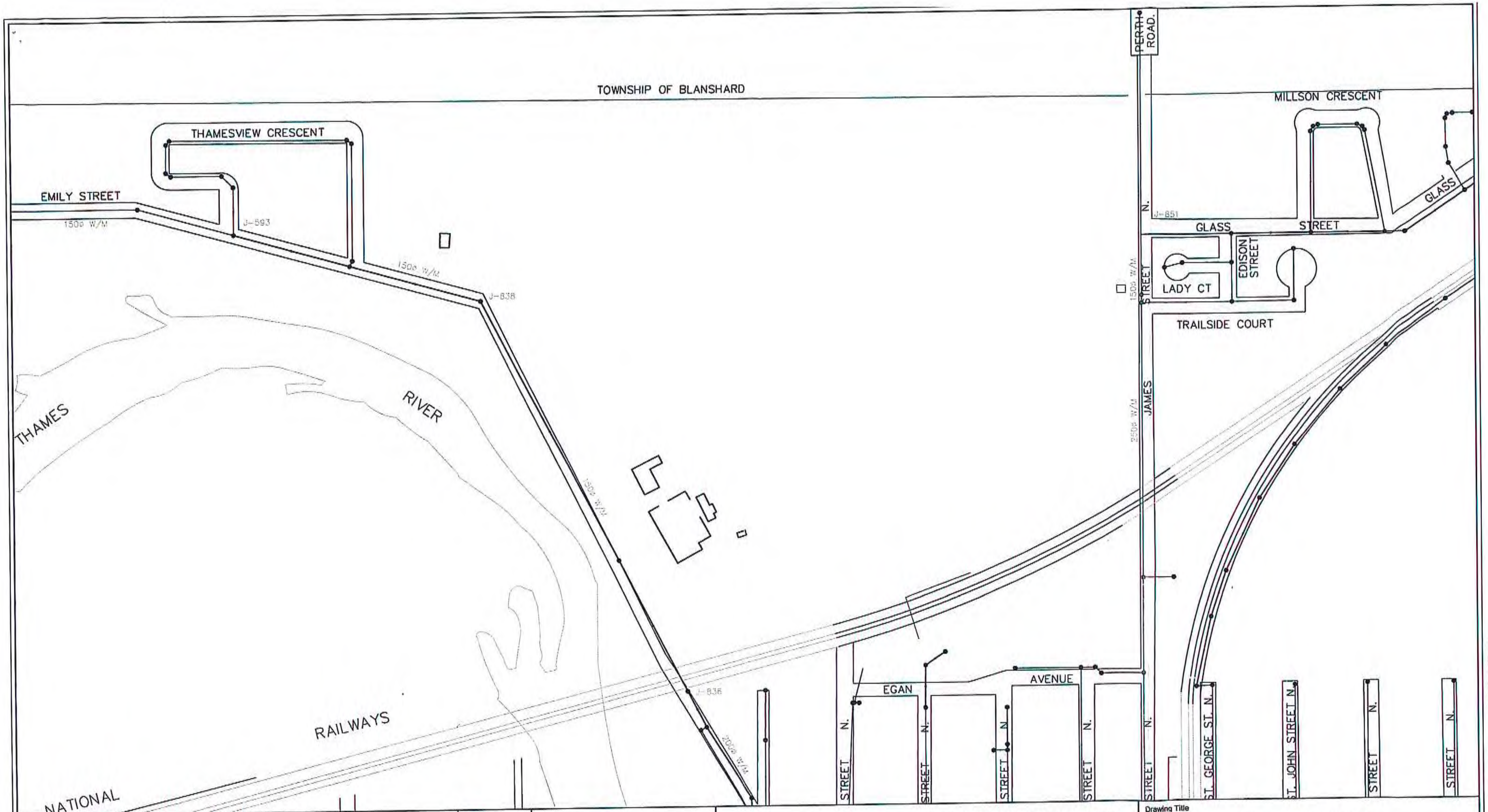
Phase 3 of the development consists of the construction of 187 units within the development area, as well a block zoned for multi-residential units. For this scenario, it has been assumed the recommended upgrades from Phase 1 and Phase 2 (Option 1) have been completed. To service the Phase 3 units, the balance of the 150 mm diameter internal watermain should be completed, which increases looping in the development.

Please see Table 7 below for the effects these upgrades will have on the network.

Table 7: Phase 3 Conditions

Junction	**Hydrant Number**	**Location**	**Pressures (psi)**			**Fire Flow Available (L/s)**	**Residual Pressure @ Fire Flow Node (psi)**
			ADD	**MDD**	**PHD**		
J-836	219	Emily Street (south of Grand Trunk Trail)	77.5	77.1	71.7	128.5	20
J-838	222	Emily Street and Glass Street (future)	57.9	57.5	51.6	87.9	20
J-593	225	Emily Street and Thamesview Cres.	71.3	70.9	65.1	80.1	20
J-851	N/A	James Street N. and Glass Street	50.9	50.5	44.7	84.7	20
J-847	N/A	Glass Street and Street "A"	58.8	58.4	52.5	91.1	20
J-855	N/A	Liahn Cres. and Wellington St. N.	60.0	59.6	53.7	81.9	20
J-846	N/A	Wellington St. N. (north of GTT)	61.9	61.4	55.5	58.4	20
J-856	N/A	Liahn Cres. (south east corner)	56.4	55.8	50.0	70.6	20
J-586	224	Thamesview Crescent	57.0	56.4	50.4	54.7	20
J-590	226	Thamesview Crescent	70.0	69.4	63.4	66.2	20
J-594	227	Emily Street	77.4	76.8	70.8	60.7	20
J-595	228	Emily Street	80.4	79.8	73.8	42.7	20
J-876	229	Emily Street	78.5	77.9	71.9	36.4	20
J-596	230	Emily Street	76.3	75.7	69.7	31.4	20

Enc.
Figure 1: Existing Site
Figure 2: Phase 1 Development
Figure 3: Phase 2 Development
Figure 4: Phase 3 Development



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NOT FOR CONSTRUCTION

No.	Issue / Revision	Date
1	ISSUED FOR REVIEW	DEC. 2011

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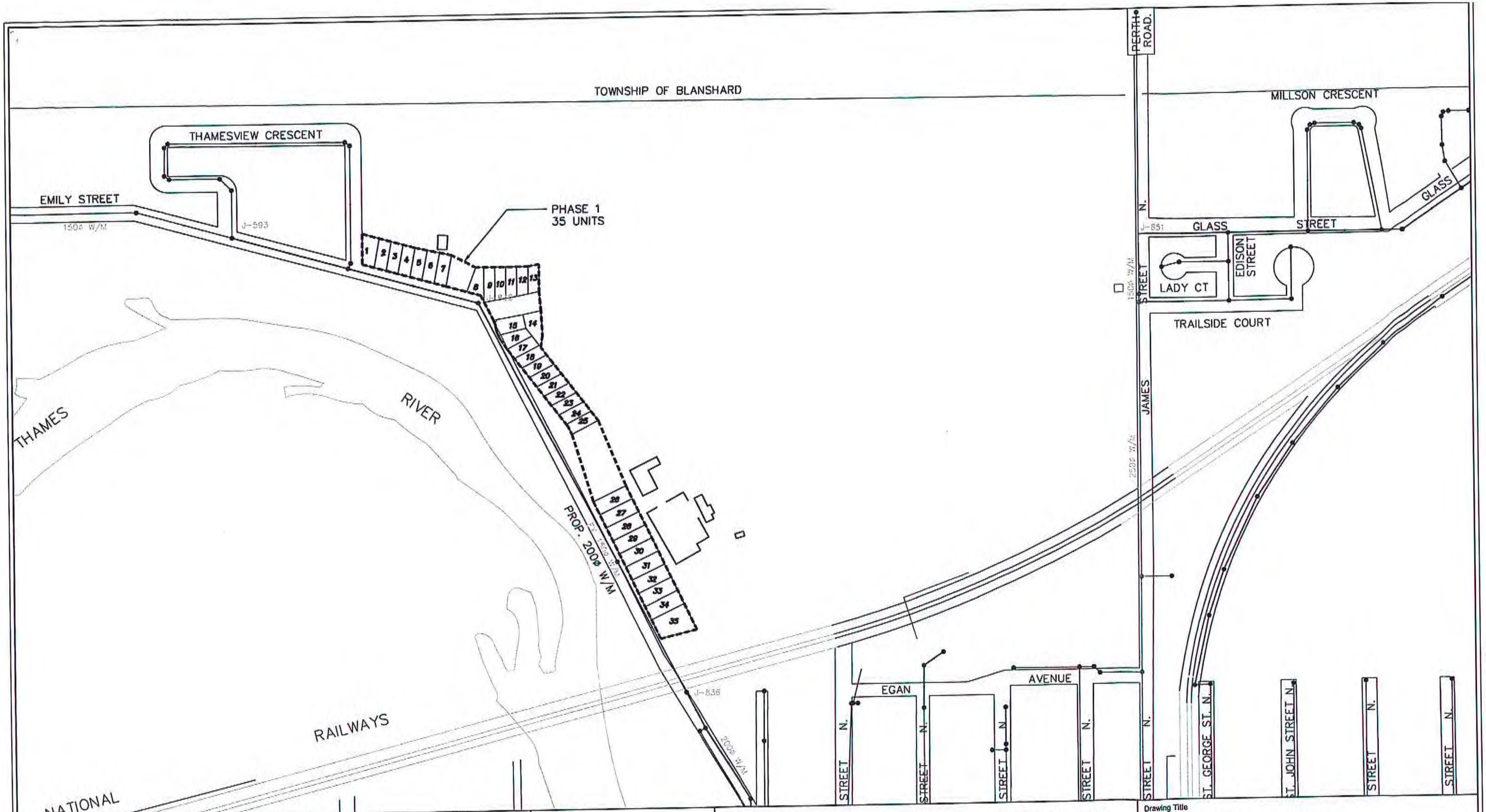
Client
TOWN OF ST. MARYS
408 James St. South
St. Marys, ON
N4X 1B6

Drawing Title
St Marys Hydraulic Water Model
EXISTING SITE PLAN

Rev. 0

Drawn: JM
Checked: JL
Designed: JM
Checked: JL
Drawing No. 1
Scale: 1:5000
Project No. MSZ020926
Date: 11/12/21

File Name: St Marys Water Model Dec 19 2011.dwg Date Plotted: December 20, 2011 - 11:10 AM



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St. Marys, ON
N4X 1B6

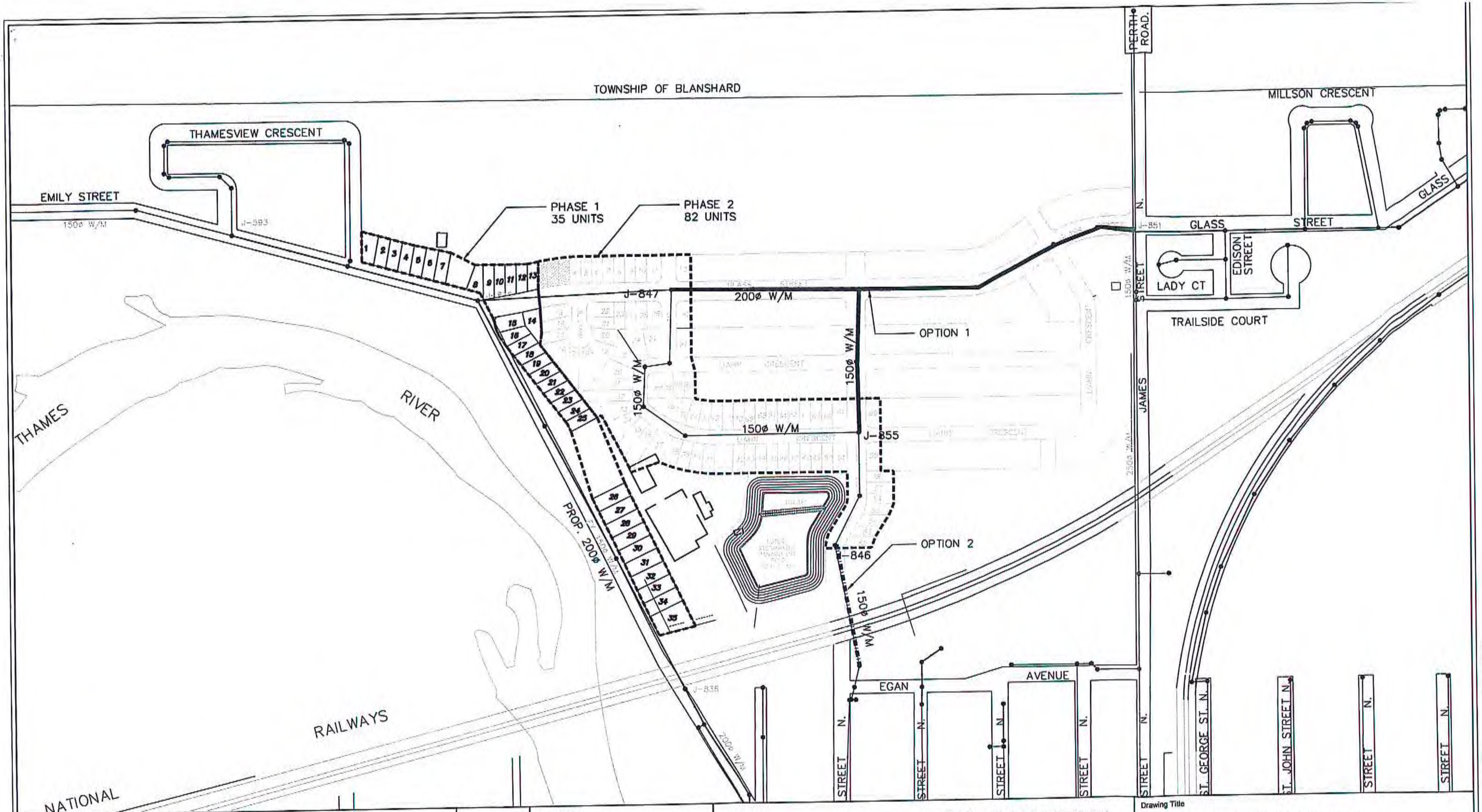
Drawing Title
St Marys Hydraulic Water Model

PHASE 1 DEVELOPMENT

Rev.
0

Drawn	Checked	Designed	Checked	Drawing No.
JM	JL	JM	JL	2
Scale	**Project No.**	**Date**		
1:5000	MSZ020926	11/12/21		

File Name: St Marys Water Model Dec 19 2011.dwg Date Plotted: December 20, 2011 - 11:15 AM



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St. Marys, ON
N4X 1B6

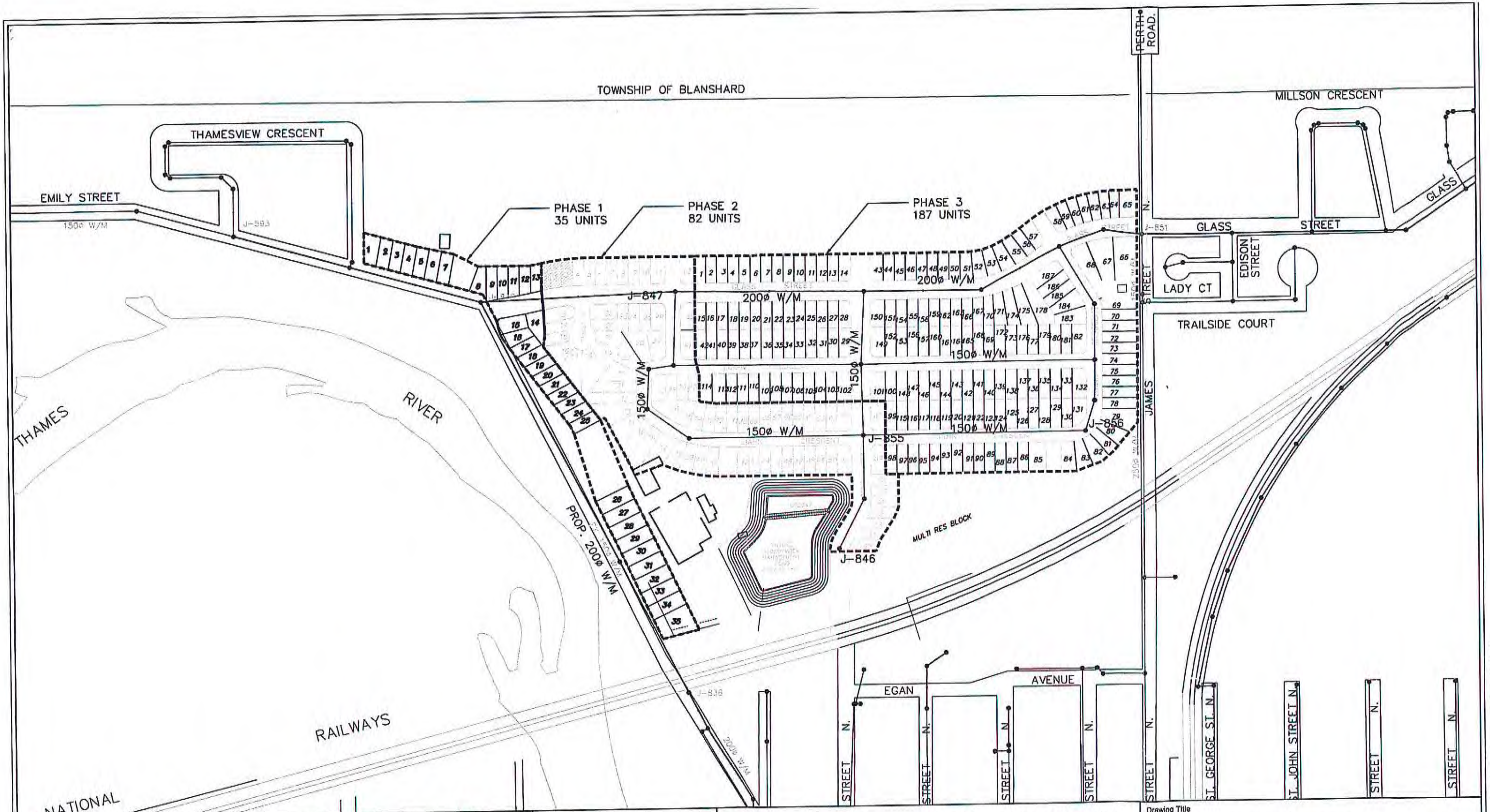
Drawing Title
St Marys Hydraulic Water Model

PHASE 2 DEVELOPMENT

Rev.
0

Drawn	Checked	Designed	Checked	Drawing No.
JM	JL	JM	JL	3
Scale	**Project No.**		**Date**	
1:5000	MSZ020926		11/12/21	

File Name: St Marys Water Model Dec 19 2011.dwg Date Plotted: December 21, 2011 - 5:40 PM



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No.	Issue / Revision	Date
1	ISSUED FOR REVIEW	12/8/2011

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St. Marys, ON
N4X 1B6

Drawing Title
St Marys Hydraulic Water Model

PHASE 3 DEVELOPMENT

Rev. 0

Drawn	Checked	Designed	Checked	Drawing No.
JM	JL	JM	JL	4

Scale	Project No.	Date
1:5000	MSZ020926	11/12/21

File Name: St Marys Water Model Dec 19 2011.dwg Date Plotted: December 20, 2011 - 11:19 AM

MTE

APPENDIX C

ST. MARYS SANITARY SEWER DESIGN SHEETS

THAMESCREST PH2
TOWN OF ST. MARYS

Project No.: 35499-200
Date: 11-Mar-19
Designed By: JJM
Checked By:
File: Q:\35499\200 (Phase 2)\Preliminary\SAN\35499-200 Sanitary Sewer Design Sheet Stratford_Rev2.xls

SANITARY SEWER DESIGN SHEET

ENGINEERING SERVICES

INTERIM DEVELOPMENT CONDITION

Design Parameters

Average Daily Flow

Residential:	0.004 L/s/p	n =	0.013	Population Densities (ppu)	
Commercial:	0.32 L/s/ha	Vmax =	3.00 m/s	Singles	2.84
Institutional:	0.32 L/s/ha	Vmin =	0.60 m/s	Semis	2.84
Industrial:	0.41 L/s/ha			Townhomes	2.10
Infiltration:	0.20 L/s/ha	Residentail Harmon Peaking Factor		Appartments	1.56

$M = 1 + 14/(4 + P^{0.5})$

LOCATION					RESIDENTIAL AREAS								INSTITUIONAL				COMMERCIAL				INDUSTRIAL					INFILTRATION			DESIGN						
STREET	AREA NO.	MANHOLE LOCATION		Existing Flow Rates As Per Town of St. Marys Pipe Capacity Model (Received Oct 17, 2018)	POPULATION DENSITY				POPUL.	ACCUM. POPUL.	PEAK FACTOR "PF"	PEAK RES. FLOW	HECTARES AND FLOW OF EACH ZONING												TOTALS C-I FLOW	AREA	ACCUM. AREA	INFIL FLOW	TOTAL VOLUME FLOW	LENGTH	SLOPE	PIPE SIZE	CAPACITY	FULL FLOW VELOCITY	ACTUAL VELOCITY
						No. of Units							0.32 L/s/ha				0.32 L/s/ha				0.41 L/s/ha														
		FROM MH	TO MH		Area (ha)	Singles/ Semis	Towns	Appts					AREA	ACCUM. AREA	PF	PEAK FLOW	AREA	ACCUM. AREA	PF	PEAK FLOW	AREA	ACCUM AREA	PF	PEAK FLOW											
				L/s					1000s	1000s		m^3/s	ha	ha		m^3/s	ha	ha		m^3/s	ha	ha		m^3/s	m^3/s	ha	ha	m^3/s	m^3/s	m	%	mm	m^3/s	m/s	m/s
Thamescrest PH2			147		22.90	298.00			0.846	0.846	3.8	0.0132		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	22.90	22.90	0.0046	0.0178						
		147	146	0					0.000	0.846	3.8	0.0132		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	22.90	0.0046	0.0178		2.99	300	0.1671	2.366	1.538
		146	145	0.3					0.000	0.846	3.8	0.0132		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	22.90	0.0046	0.0181		0.37	300	0.0588	0.832	0.732
		145	141	0.3					0.000	0.846	3.8	0.0132		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	22.90	0.0046	0.0181		0.42	300	0.0626	0.887	0.766
		141	140	0.6					0.000	0.846	3.8	0.0132		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	22.90	0.0046	0.0184		3.37	300	0.1774	2.511	1.620
		140	139	1.2					0.000	0.846	3.8	0.0132		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	22.90	0.0046	0.0190		8.17	300	0.2763	3.910	2.237
		139	138	1.3					0.000	0.846	3.8	0.0132		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	22.90	0.0046	0.0191		0.51	300	0.0690	0.977	0.834
		138	137	1.6					0.000	0.846	3.8	0.0132		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	22.90	0.0046	0.0194		0.56	300	0.0723	1.024	0.867
Thamescrest PH2			191		8.93	117.00			0.332	0.332	4.1	0.0055		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	8.93	8.93	0.0018	0.0072						
		191	190	6.3					0.000	0.332	4.1	0.0055		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	8.93	0.0018	0.0135		0.49	200	0.0229	0.731	0.758
		190	189	6.4					0.000	0.332	4.1	0.0055		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	8.93	0.0018	0.0136		0.60	200	0.0254	0.809	0.817
		189	188	7.2					0.000	0.332	4.1	0.0055		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	8.93	0.0018	0.0144		2.10	200	0.0475	1.513	1.327
		188	187	8.1					0.000	0.332	4.1	0.0055		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	8.93	0.0018	0.0153		3.28	200	0.0594	1.891	1.586
		187	186	8.1					0.000	0.332	4.1	0.0055		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	8.93	0.0018	0.0153		0.75	200	0.0284	0.904	0.915
		186	185	9.1					0.000	0.332	4.1	0.0055		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	8.93	0.0018	0.0163		0.93	200	0.0316	1.007	1.007
		185	184	9.4					0.000	0.332	4.1	0.0055		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	8.93	0.0018	0.0166		9.30	200	0.1000	3.184	2.359
		184	183	13.6					0.000	0.332	4.1	0.0055		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	8.93	0.0018	0.0208		1.82	300	0.1304	1.846	1.351
		183	178	13.6					0.000	0.332	4.1	0.0055		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	8.93	0.0018	0.0208		3.23	300	0.1737	2.459	1.656
		178	177	14.3					0.000	0.332	4.1	0.0055		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	8.93	0.0018	0.0215		0.64	300	0.0773	1.094	0.937
		177	171	14.5					0.000	0.332	4.1	0.0055		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	8.93	0.0018	0.0217		0.68	300	0.0797	1.128	0.960
		171	170	15.7					0.000	0.332	4.1	0.0055		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	8.93	0.0018	0.0229		0.36	350	0.0875	0.910	0.766
		170	163	15.9					0.000	0.332	4.1	0.0055		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	8.93	0.0018	0.0231		0.23	350	0.0699	0.727	0.653
		163	162	17.3					0.000	0.332	4.1	0.0055		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	8.93	0.0018	0.0245		0.30	350	0.0799	0.830	0.731
		162	156	17.5					0.000	0.332	4.1	0.0055		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	8.93	0.0018	0.0247		0.36	350	0.0875	0.910	0.782
		156	155	18.7					0.000	0.332	4.1	0.0055		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	8.93	0.0018	0.0259		0.36	350	0.0875	0.910	0.793
		155	154	18.7					0.000	0.332	4.1	0.0055		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	8.93	0.0018	0.0259		0.30	350	0.0799	0.830	0.742
		154	137	18.8					0.000	0.332	4.1	0.0055		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	8.93	0.0018	0.0260		0.41	350	0.0934	0.971	0.832
		137	136	20.4					0.000	1.179	3.8	0.0179		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	31.83	0.0064	0.0447		1.23	350	0.1617	1.681	1.436
		136	135	20.4					0.000	1.179	3.8	0.0179		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	31.83	0.0064	0.0447		0.30	350	0.0799	0.830	0.848
		135	134	20.5					0.000	1.179	3.8	0.0179		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	31.83	0.0064	0.0448		0.51	350	0.1041	1.083	1.035
		134	133	20.7					0.000	1.179	3.8	0.0179		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	31.83	0.0064	0.0450		0.22	350	0.0684	0.711	0.759
		133	132	27.1					0.000	1.179	3.8	0.0179		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	31.83	0.0064	0.0514		0.18	450	0.1209	0.761	0.725
		132	131	27.2					0.000	1.179	3.8	0.0179		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	31.83	0.0064	0.0515		0.20	450	0.1274	0.802	0.756
		131	130	29.7					0.000	1.179	3.8	0.0179		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	31.83	0.0064	0.0540		0.28	450	0.1508	0.949	0.869
		130	129	29.9					0.000	1.179	3.8	0.0179		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	31.83	0.0064	0.0542		0.17	450	0.1175	0.739	0.718
		129	128	30.6					0.000	1.179	3.8	0.0179		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	31.83	0.0064	0.0549		0.12	450	0.0987	0.621	0.633
		128	127	31					0.000	1.179	3.8	0.0179		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	31.83	0.0064	0.0553		0.09	450	0.0855	0.538	0.572
		127	126	31.4					0.000	1.179	3.8	0.0179		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	31.83	0.0064	0.0557		0.21	450	0.1306	0.821	0.784
		126	125B	87.9					0.000	1.179	3.8	0.0179		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	31.83	0.0064	0.1122		0.55	525	0.3188	1.473	1.344
		125B	105	88.3					0.000	1.179	3.8	0.0179		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	31.83	0.0064	0.1126		1.27	525	0.4844	2.239	1.823
		105	104	93.2					0.000	1.179	3.8	0.0179		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	31.83	0.0064	0.1175		0.37	500	0.2296	1.170	1.167
	**	104	103	93.2					0.000	1.179	3.8	0.0179		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	31.83	0.0064	0.1175		0.50	500	0.2669	1.360	1.307
		103	102	114.3					0.000	1.179	3.8	0.0179		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	31.83	0.0064	0.1386		0.79	675	0.7468	2.088	1.595
		102	101	114.3					0.000	1.179	3.8	0.0179		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	31.83	0.0064	0.1386		0.20	675	0.3757	1.051	0.971
		101	100	114.3					0.000	1.179	3.8	0.0179		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	31.83	0.0064	0.1386		0.28	675	0.4446	1.243	1.098

*Existing Flow Rates, Pipe Sizes, and Pipe Slopes Were Obtained From the Town of St. Marys Sanitary Pipe Capacity Model as Received Oct 17,2018

** The Slope of pipe 104-103 was modelled as 0.1% however the Town has advised that the slope is actually 0.5% (Per Jeff W. Feb. 2019)

THAMESCREST PH2
TOWN OF ST. MARYS

Project No.: 35499-200
Date: 11-Mar-19
Designed By: JJM
Checked By:
File: C:\Users\jmonster\Desktop\Mortgage Estimator.xlsx

SANITARY SEWER DESIGN SHEET

ENGINEERING SERVICES

ULTIMATE DEVELOPMENT CONDITION

Design Parameters

Average Daily Flow
Residential: 0.004 L/s/p
Commercial: 0.32 L/s/ha
Institutional: 0.32 L/s/ha
Industrial: 0.41 L/s/ha
Infiltration: 0.20 L/s/ha

n = 0.013
Vmax = 3.00 m/s
Vmin = 0.60 m/s

Residentail Harmon Peaking Factor
$M = 1 + 14/(4 + P^{0.5})$

Population Densities (ppu)
Singles 2.84
Semis 2.84
Townhomes 2.10
Appartments 1.56

LOCATION					RESIDENTIAL AREAS								INSTITUIONAL				COMMERCIAL				INDUSTRIAL					INFILTRATION			DESIGN						
		MANHOLE LOCATION			POPULATION DENSITY								HECTARES AND FLOW OF EACH ZONING																						
													0.32 L/s/ha				0.32 L/s/ha				0.41 L/s/ha														
STREET	AREA NO.	FROM MH	TO MH	Existing Flow Rates As Per Town of St. Marys Pipe Capacity Model (Received Oct 17, 2018)	Area (ha)	No. of Units			POPUL.	ACCUM. POPUL.	PEAK FACTO R "PF"	PEAK RES. FLOW	AREA	ACCUM. AREA	PF	PEAK FLOW	AREA	ACCUM. AREA	PF	PEAK FLOW	AREA	ACCUM AREA	PF	PEAK FLOW	TOTALS-C-I FLOW	AREA	ACCUM. AREA	INFIL FLOW	TOTAL VOLUME FLOW	LENGTH	SLOPE	PIPE SIZE	CAPACITY	FULL FLOW VELOCITY	ACTUAL VELOCITY
				L/s		Singles/ Semis	Towns	Appts	1000s	1000s		m^3/s	ha	ha		m^3/s	ha	ha		m^3/s	ha	ha		m^3/s	m^3/s	ha	ha	m^3/s	m^3/s	m	%	mm	m^3/s	m/s	m/s
Thamescrest PH2			147		45.60	593.00			1.684	1.684	3.6	0.0249		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	45.60	45.60	0.0091	0.0340						
		147	146	0					0.000	1.684	3.6	0.0249		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	45.60	0.0091	0.0340		2.99	300	0.1671	2.366	1.855
		146	145	0.3					0.000	1.684	3.6	0.0249		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	45.60	0.0091	0.0343		0.37	300	0.0588	0.832	0.860
		145	141	0.3					0.000	1.684	3.6	0.0249		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	45.60	0.0091	0.0343		0.42	300	0.0626	0.887	0.900
		141	140	0.6					0.000	1.684	3.6	0.0249		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	45.60	0.0091	0.0346		3.37	300	0.1774	2.511	1.946
		140	139	1.2					0.000	1.684	3.6	0.0249		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	45.60	0.0091	0.0352		8.17	300	0.2763	3.910	2.679
		139	138	1.3					0.000	1.684	3.6	0.0249		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	45.60	0.0091	0.0353		0.51	300	0.0690	0.977	0.974
		138	137	1.6					0.000	1.684	3.6	0.0249		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	45.60	0.0091	0.0356		0.56	300	0.0723	1.024	1.011
Thamescrest PH2			191		8.93	117.00			0.332	0.332	4.1	0.0055		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	8.93	8.93	0.0018	0.0072						
		191	190	6.3					0.000	0.332	4.1	0.0055		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	8.93	0.0018	0.0135		0.49	200	0.0229	0.731	0.758
		190	189	6.4					0.000	0.332	4.1	0.0055		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	8.93	0.0018	0.0136		0.60	200	0.0254	0.809	0.817
		189	188	7.2					0.000	0.332	4.1	0.0055		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	8.93	0.0018	0.0144		2.10	200	0.0475	1.513	1.327
		188	187	8.1					0.000	0.332	4.1	0.0055		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	8.93	0.0018	0.0153		3.28	200	0.0594	1.891	1.586
		187	186	8.1					0.000	0.332	4.1	0.0055		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	8.93	0.0018	0.0153		0.75	200	0.0284	0.904	0.915
		186	185	9.1					0.000	0.332	4.1	0.0055		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	8.93	0.0018	0.0163		0.93	200	0.0316	1.007	1.007
		185	184	9.4					0.000	0.332	4.1	0.0055		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	8.93	0.0018	0.0166		9.30	200	0.1000	3.184	2.359
		184	183	13.6					0.000	0.332	4.1	0.0055		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	8.93	0.0018	0.0208		1.82	300	0.1304	1.846	1.351
		183	178	13.6					0.000	0.332	4.1	0.0055		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	8.93	0.0018	0.0208		3.23	300	0.1737	2.459	1.656
		178	177	14.3					0.000	0.332	4.1	0.0055		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	8.93	0.0018	0.0215		0.64	300	0.0773	1.094	0.937
		177	171	14.5					0.000	0.332	4.1	0.0055		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	8.93	0.0018	0.0217		0.68	300	0.0797	1.128	0.960
		171	170	15.7					0.000	0.332	4.1	0.0055		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	8.93	0.0018	0.0229		0.36	350	0.0875	0.910	0.766
		170	163	15.9					0.000	0.332	4.1	0.0055		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	8.93	0.0018	0.0231		0.23	350	0.0699	0.727	0.653
		163	162	17.3					0.000	0.332	4.1	0.0055		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	8.93	0.0018	0.0245		0.30	350	0.0799	0.830	0.731
		162	156	17.5					0.000	0.332	4.1	0.0055		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	8.93	0.0018	0.0247		0.36	350	0.0875	0.910	0.782
		156	155	18.7					0.000	0.332	4.1	0.0055		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	8.93	0.0018	0.0259		0.36	350	0.0875	0.910	0.793
		155	154	18.7					0.000	0.332	4.1	0.0055		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	8.93	0.0018	0.0259		0.30	350	0.0799	0.830	0.742
		154	137	18.8					0.000	0.332	4.1	0.0055		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	8.93	0.0018	0.0260		0.41	350	0.0934	0.971	0.832
		137	136	20.4					0.000	2.016	3.6	0.0293		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	54.53	0.0109	0.0606		1.23	350	0.1617	1.681	1.560
		136	135	20.4					0.000	2.016	3.6	0.0293		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	54.53	0.0109	0.0606		0.30	350	0.0799	0.830	0.913
		135	134	20.5					0.000	2.016	3.6	0.0293		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	54.53	0.0109	0.0607		0.51	350	0.1041	1.083	1.119
		134	133	20.7					0.000	2.016	3.6	0.0293		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	54.53	0.0109	0.0609		0.22	350	0.0684	0.711	0.803
		133	132	27.1					0.000	2.016	3.6	0.0293		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	54.53	0.0109	0.0673		0.18	450	0.1209	0.761	0.776
		132	131	27.2					0.000	2.016	3.6	0.0293		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	54.53	0.0109	0.0674		0.20	450	0.1274	0.802	0.807
		131	130	29.7					0.000	2.016	3.6	0.0293		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	54.53	0.0109	0.0699		0.28	450	0.1508	0.949	0.923
		130	129	29.9					0.000	2.016	3.6	0.0293		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	54.53	0.0109	0.0701		0.17	450	0.1175	0.739	0.769
		129	128	30.6					0.000	2.016	3.6	0.0293		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	54.53	0.0109	0.0708		0.12	450	0.0987	0.621	0.675
		128	127	31					0.000	2.016	3.6	0.0293		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	54.53	0.0109	0.0712		0.09	450	0.0855	0.538	0.602
		127	126	31.4					0.000	2.016	3.6	0.0293		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	54.53	0.0109	0.0716		0.21	450	0.1306	0.821	0.835
		126	125B	87.9					0.000	2.016	3.6	0.0293		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	54.53	0.0109	0.1281		0.55	525	0.3188	1.473	1.388
		125B	105	88.3					0.000	2.016	3.6	0.0293		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	54.53	0.0109	0.1285		1.27	525	0.4844	2.239	1.892
		105	104	93.2					0.000	2.016	3.6	0.0293		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	54.53	0.0109	0.1334		0.37	500	0.2296	1.170	1.208
	**	104	103	93.2					0.000	2.016	3.6	0.0293		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	54.53	0.0109	0.1334		0.50	500	0.2669	1.360	1.348
		103	102	114.3					0.000	2.016	3.6	0.0293		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	54.53	0.0109	0.1545		0.79	675	0.7468	2.088	1.645
		102	101	114.3					0.000	2.016	3.6	0.0293		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	54.53	0.0109	0.1545		0.20	675	0.3757	1.051	0.995
		101	100	114.3					0.000	2.016	3.6	0.0293		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	54.53	0.0109	0.1545		0.28	675	0.4446	1.243	1.130

*Existing Flow Rates, Pipe Sizes, and Pipe Slopes Were Obtained From the Town of St. Marys Sanitary Pipe Capacity Model as Received Oct 17,2018
** The Slope of pipe 104-103 was modelled as 0.1% however the Town has advised that the slope is actually 0.5% (Per Jeff W. Feb. 2019)

APPENDIX D

HYDRAULIC MODELLING OUTPUT

PRE-DEVELOPMENT

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

 SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
 S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
 SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
     S   W W   M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
 SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9   =========
                                                      9   9  9   9   # 3057174
      StormWater Management HYdrologic Model           999    999    =========

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

+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++++++++ Licensed user: MTE Consultants Inc.                        +++++++++
+++++++++                in any City           SERIAL#:3057174       +++++++++
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

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


********************   D E T A I L E D   O U T P U T   ********************
*******************************************************************************
        DATE: 2018-11-06      TIME: 10:57:28      RUN COUNTER: 000080         *
*******************************************************************************
 Input   filename: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\PRE\25mmSTM.dat    *
 Output  filename: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\PRE\25mmSTM.out    *
 Summary filename: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\PRE\25mmSTM.sum    *
 User comments:                                                               *
 1:__________________________________________________________________________*
 2:__________________________________________________________________________*
 3:__________________________________________________________________________*
*******************************************************************************

--------------------------------------------------------------------------------
1:0001--------------------------------------------------------------------------
*******************************************************************************
  Project Name: [THAMESCREST PH2]     Project Number: [35499-200]
  Date          : SEPTEMBER 2018
  Modeller      : [JJM]
  Company       : MTE CONSULTANTS Inc.
  License #     : 5826103
*******************************************************************************
-------------------
START               |  Project  dir.: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\PRE\
-------------------    Rainfall dir.: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\PRE\
  TZERO =     .00 hrs on         0
  METOUT=    2 (output = METRIC)
  NRUN  = 001
  NSTORM=    0
--------------------------------------------------------------------------------
1:0002--------------------------------------------------------------------------
==============================================================================
:ITE IS APPROXIMATELY 60HA OF AGRICULTURAL FIELD
'ER THE PERTH COUNTY SOIL SURVEY, THE SITE IS MAINLY HURON CLAY LOAM

. FIELD TILE SYSTEM DRAINS THE NORTHERN PORTION OF THE FEILDS AND FLOWS TO THE
:OUTH. THE FLOW WAS ROUGHLY MEASURED DURING A SITE VISIT (OCT. 2, 2018) AND
IAS ESTIMATED TO BE APPROXIMATELY 20L/S. THIS FLOW WAS ADDED TO CATCHMENT 103

IORTHERN PORTION OF THE FEILD FLOWS NORTH/WEST WHILE THE REMAINDER FLOWS TO THE
```

```
*PROPOSED OUTLET IN THE SOUTH-WEST CORNER OF THE SITE.
*
*STORM PARAMETERS ARE TAKEN FROM THE 'REFERENCE MANUAL FOR THE USE OF
*PRECIPITATION DESIGN EVENTS IN THE UPPER THAMES WATERSHED'. STORMS ARE MODELED
*WITH 3HR DURATIONS EXCEPT FOR THE 250YR EVENTS WHICH HAS A DURATION OF 24HRS.
*
*TIME TO PEAK RATIO IS ASSUMED TO BE 40% OF THE TIME OF CONCENTRATION
*TIME OF CONCENTRATION CALCULATED USING THE AIRPORT FORMULA USING A 'C' VALUE
*OF 0.2 FOR THE FIELDS
*==============================================================================
--------------------
| CHICAGO STORM     |     IDF curve parameters: A= 543.870
| Ptotal= 25.00 mm  |                           B=   5.500
--------------------                            C=    .800
                          used in:   INTENSITY =  A / (t + B)^C

                          Duration of storm  =  3.00 hrs
                          Storm time step    =  5.00 min
                          Time to peak ratio =   .33

              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .08   2.040 |    .83  11.332 |   1.58   5.707 |   2.33   2.655
               .17   2.224 |    .92  26.706 |   1.67   5.028 |   2.42   2.514
               .25   2.449 |   1.00  82.898 |   1.75   4.501 |   2.50   2.389
               .33   2.730 |   1.08  34.509 |   1.83   4.079 |   2.58   2.277
               .42   3.095 |   1.17  18.938 |   1.92   3.734 |   2.67   2.176
               .50   3.586 |   1.25  12.311 |   2.00   3.447 |   2.75   2.084
               .58   4.284 |   1.33   9.781 |   2.08   3.203 |   2.83   2.001
               .67   5.360 |   1.42   7.882 |   2.17   2.995 |   2.92   1.924
               .75   7.238 |   1.50   6.613 |   2.25   2.813 |   3.00   1.854

--------------------------------------------------------------------------------
001:0003------------------------------------------------------------------------
*==============================================================================
*CATCHMENT 101 -> CENTER PORTION OF THE FIELD
*              -> REPRESENTATIVE FLOW LENGTH = 220m
*              -> REPRESENTATIVE SLOPE = 3.9%
*==============================================================================
----------------------
| CALIB NASHYD        |   Area    (ha)=   24.80   Curve Number    (CN)=82.00
| 01:101    DT= 5.00 |   Ia      (mm)=   7.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=     .180

     Unit Hyd Qpeak  (cms)=    5.262

     PEAK FLOW        (cms)=     .316 (i)
     TIME TO PEAK     (hrs)=    1.250
     RUNOFF VOLUME     (mm)=    4.391
     TOTAL RAINFALL    (mm)=   24.996
     RUNOFF COEFFICIENT   =      .176

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0004------------------------------------------------------------------------
*==============================================================================
*CATCHMENT 102 -> WEST PORTION OF THE FIELD
*              -> REPRESENTATIVE FLOW LENGTH = 190m
*              -> REPRESENTATIVE SLOPE = 1.4%
*==============================================================================
----------------------
| CALIB NASHYD        |   Area    (ha)=   11.50   Curve Number    (CN)=82.00
| 02:102    DT= 5.00 |   Ia      (mm)=   7.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.830

     PEAK FLOW        (cms)=     .127 (i)
     TIME TO PEAK     (hrs)=    1.333
     RUNOFF VOLUME     (mm)=    4.391
     TOTAL RAINFALL    (mm)=   24.996
     RUNOFF COEFFICIENT   =      .176

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

```
        ACTUAL QPEAK: PEAK(     .127) + QBASE(  .020) =     .147  (cms)
-------------------------------------------------------------------------------------
1:0005-------------------------------------------------------------------------------
================================================================================
ATCHMENT 103 -> EAST PORTION OF THE FIELD
             -> REPRESENTATIVE FLOW LENGTH = 120m
             -> REPRESENTATIVE SLOPE = 1.0%
================================================================================
--------------------
CALIB NASHYD         |   Area    (ha)=    6.74   Curve Number    (CN)=82.00
03:103    DT= 5.00 |   Ia      (mm)=   7.000   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=     .210

   Unit Hyd Qpeak  (cms)=     1.226

   PEAK FLOW        (cms)=      .079 (i)
   TIME TO PEAK     (hrs)=     1.333
   RUNOFF VOLUME     (mm)=     4.391
   TOTAL RAINFALL    (mm)=    24.996
   RUNOFF COEFFICIENT    =      .176

   (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

        ACTUAL QPEAK: PEAK(     .079) + QBASE(  .020) =     .099  (cms)
-------------------------------------------------------------------------------------
1:0006-------------------------------------------------------------------------------
---------------------
ADD HYD (999         ) | ID: NHYD            AREA      QPEAK    TPEAK    R.V.     DWF
---------------------                        (ha)      (cms)    (hrs)    (mm)    (cms)
                   ID1 01:101               24.80      .316     1.25     4.39     .000
                  +ID2 02:102               11.50      .127     1.33     4.39     .020
                  +ID3 03:103                6.74      .079     1.33     4.39     .020
                   ==================================================================
                   SUM 04:999               43.04      .512     1.25     4.39     .040

 NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
 ACTUAL TOTAL PEAK FLOW: PEAK (     .512) + BASE (    .040) =     .552  (cms).

-------------------------------------------------------------------------------------
1:0007-------------------------------------------------------------------------------
================================================================================
ATCHMENT 111 -> NORTH PORTION OF THE FIELD
             -> REPRESENTATIVE FLOW LENGTH = 335m
             -> REPRESENTATIVE SLOPE = 0.8%
================================================================================
--------------------
CALIB NASHYD         |   Area    (ha)=   16.85   Curve Number    (CN)=82.00
01:111    DT= 5.00 |   Ia      (mm)=   7.000   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=     .390

   Unit Hyd Qpeak  (cms)=     1.650

   PEAK FLOW        (cms)=      .144 (i)
   TIME TO PEAK     (hrs)=     1.583
   RUNOFF VOLUME     (mm)=     4.391
   TOTAL RAINFALL    (mm)=    24.996
   RUNOFF COEFFICIENT    =      .176

   (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------
1:0008-------------------------------------------------------------------------------
   FINISH
-------------------------------------------------------------------------------------
*************************************************************************************
   WARNINGS / ERRORS / NOTES
   -------------------------
 Simulation ended on 2018-11-06     at 10:57:28
=====================================================================================
```

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

 SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO         999   999    =========
 S      W W W  MM MM  H   H   Y Y   MM MM  O   O       9   9  9   9
 SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##   9   9  9   9  Ver  4.05
     S   W W   M   M  H   H    Y    M   M  O   O        9999   9999   Sept 2011
 SSSSS   W W   M   M  H   H    Y    M   M   OOO            9      9   =========
                                                       9   9  9   9  # 3057174
     StormWater Management HYdrologic Model             999   999    =========

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

+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++++++++ Licensed user: MTE Consultants Inc.                           +++++++++
++++++++                in any City            SERIAL#:3057174         +++++++++
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

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


********************  D E T A I L E D   O U T P U T  ****************************
*********************************************************************************
        DATE: 2018-11-06      TIME: 10:57:50      RUN COUNTER: 000083           *
*********************************************************************************
 Input   filename: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\PRE\2YRSTM.dat      *
 Output  filename: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\PRE\2YRSTM.out      *
 Summary filename: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\PRE\2YRSTM.sum      *
 User comments:                                                                 *
 1:_____________________________________________________________________________*
 2:_____________________________________________________________________________*
 3:_____________________________________________________________________________*
*********************************************************************************

-------------------------------------------------------------------------------------
1:0001-------------------------------------------------------------------------------
*********************************************************************************
  Project Name: [THAMESCREST PH2]    Project Number: [35499-200]
  Date         : SEPTEMBER 2018
  Modeller     : [JJM]
  Company      : MTE CONSULTANTS Inc.
  License #    : 5826103
*********************************************************************************
-------------------
START              |  Project  dir.: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\PRE\
-------------------   Rainfall dir.: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\PRE\
  TZERO =    .00 hrs on        0
  METOUT=    2 (output = METRIC)
  NRUN  = 001
  NSTORM=    0
-------------------------------------------------------------------------------------
1:0002-------------------------------------------------------------------------------
=================================================================================
ITE IS APPROXIMATELY 60HA OF AGRICULTURAL FIELD
ER THE PERTH COUNTY SOIL SURVEY, THE SITE IS MAINLY HURON CLAY LOAM

 FIELD TILE SYSTEM DRAINS THE NORTHERN PORTION OF THE FEILDS AND FLOWS TO THE
OUTH. THE FLOW WAS ROUGHLY MEASURED DURING A SITE VISIT (OCT. 2, 2018) AND
AS ESTIMATED TO BE APPROXIMATELY 20L/S. THIS FLOW WAS ADDED TO CATCHMENT 103

ORTHERN PORTION OF THE FEILD FLOWS NORTH/WEST WHILE THE REMAINDER FLOWS TO THE
```

```
*PROPOSED OUTLET IN THE SOUTH-WEST CORNER OF THE SITE.
*
*STORM PARAMETERS ARE TAKEN FROM THE 'REFERENCE MANUAL FOR THE USE OF
*PRECIPITATION DESIGN EVENTS IN THE UPPER THAMES WATERSHED'. STORMS ARE MODELED
*WITH 3HR DURATIONS EXCEPT FOR THE 250YR EVENTS WHICH HAS A DURATION OF 24HRS.
*
*TIME TO PEAK RATIO IS ASSUMED TO BE 40% OF THE TIME OF CONCENTRATION
*TIME OF CONCENTRATION CALCULATED USING THE AIRPORT FORMULA USING A 'C' VALUE
*OF 0.2 FOR THE FIELDS
*================================================================================
--------------------
| CHICAGO STORM    |     IDF curve parameters: A= 595.248
| Ptotal= 32.76 mm |                           B=   4.841
--------------------                           C=    .766
                         used in:   INTENSITY =  A / (t + B)^C

                         Duration of storm  =  3.00 hrs
                         Storm time step    =  5.00 min
                         Time to peak ratio =   .33

              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .08   3.019 |    .83  14.804 |   1.58   7.844 |   2.33   3.859
               .17   3.272 |    .92  33.313 |   1.67   6.977 |   2.42   3.669
               .25   3.579 |   1.00 103.283 |   1.75   6.298 |   2.50   3.499
               .33   3.961 |   1.08  42.687 |   1.83   5.750 |   2.58   3.345
               .42   4.451 |   1.17  23.980 |   1.92   5.298 |   2.67   3.206
               .50   5.102 |   1.25  16.727 |   2.00   4.919 |   2.75   3.080
               .58   6.016 |   1.33  12.916 |   2.08   4.596 |   2.83   2.965
               .67   7.401 |   1.42  10.573 |   2.17   4.317 |   2.92   2.858
               .75   9.769 |   1.50   8.988 |   2.25   4.073 |   3.00   2.761

-------------------------------------------------------------------------------------
001:0003-----------------------------------------------------------------------------
*================================================================================
*CATCHMENT 101 -> CENTER PORTION OF THE FIELD
*              -> REPRESENTATIVE FLOW LENGTH = 220m
*              -> REPRESENTATIVE SLOPE = 3.9%
*================================================================================
--------------------
| CALIB NASHYD       |   Area    (ha)=   24.80   Curve Number   (CN)=82.00
| 01:101   DT= 5.00 |   Ia      (mm)=   7.000   # of Linear Res.(N)= 3.00
--------------------    U.H. Tp(hrs)=    .180

     Unit Hyd Qpeak  (cms)=    5.262

     PEAK FLOW        (cms)=     .601 (i)
     TIME TO PEAK     (hrs)=    1.250
     RUNOFF VOLUME     (mm)=    8.142
     TOTAL RAINFALL    (mm)=   32.763
     RUNOFF COEFFICIENT    =     .249

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------
001:0004-----------------------------------------------------------------------------
*================================================================================
*CATCHMENT 102 -> WEST PORTION OF THE FIELD
*              -> REPRESENTATIVE FLOW LENGTH = 190m
*              -> REPRESENTATIVE SLOPE = 1.4%
*================================================================================
--------------------
| CALIB NASHYD       |   Area    (ha)=   11.50   Curve Number   (CN)=82.00
| 02:102   DT= 5.00 |   Ia      (mm)=   7.000   # of Linear Res.(N)= 3.00
--------------------    U.H. Tp(hrs)=    .240

     Unit Hyd Qpeak  (cms)=    1.830

     PEAK FLOW        (cms)=     .240 (i)
     TIME TO PEAK     (hrs)=    1.333
     RUNOFF VOLUME     (mm)=    8.142
     TOTAL RAINFALL    (mm)=   32.763
     RUNOFF COEFFICIENT    =     .249

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

```
        ACTUAL QPEAK: PEAK(     .240) + QBASE(  .020) =     .260  (cms)
-------------------------------------------------------------------------------
·1:0005------------------------------------------------------------------------
===========================================================================
:ATCHMENT 103 -> EAST PORTION OF THE FIELD
              -> REPRESENTATIVE FLOW LENGTH = 120m
              -> REPRESENTATIVE SLOPE = 1.0%
===========================================================================
---------------------
CALIB NASHYD         |  Area     (ha)=     6.74   Curve Number    (CN)=82.00
03:103     DT= 5.00  |  Ia       (mm)=    7.000   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=      .210

   Unit Hyd Qpeak  (cms)=     1.226

   PEAK FLOW        (cms)=      .150 (i)
   TIME TO PEAK     (hrs)=     1.250
   RUNOFF VOLUME     (mm)=     8.142
   TOTAL RAINFALL    (mm)=    32.763
   RUNOFF COEFFICIENT    =      .249

   (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

        ACTUAL QPEAK: PEAK(     .150) + QBASE(  .020) =     .170  (cms)
-------------------------------------------------------------------------------
·1:0006------------------------------------------------------------------------
----------------------
ADD HYD (999         ) | ID: NHYD          AREA     QPEAK    TPEAK    R.V.     DWF
----------------------                     (ha)     (cms)    (hrs)    (mm)    (cms)
                   ID1 01:101             24.80      .601     1.25    8.14     .000
                  +ID2 02:102             11.50      .240     1.33    8.14     .020
                  +ID3 03:103              6.74      .150     1.25    8.14     .020
                  ==============================================================
                   SUM 04:999             43.04      .982     1.25    8.14     .040

 NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
 ACTUAL TOTAL PEAK FLOW: PEAK (     .982) + BASE (   .040) =     1.022  (cms).

-------------------------------------------------------------------------------
·1:0007------------------------------------------------------------------------
===========================================================================
:ATCHMENT 111 -> NORTH PORTION OF THE FIELD
              -> REPRESENTATIVE FLOW LENGTH = 335m
              -> REPRESENTATIVE SLOPE = 0.8%
===========================================================================
---------------------
CALIB NASHYD         |  Area     (ha)=    16.85   Curve Number    (CN)=82.00
01:111     DT= 5.00  |  Ia       (mm)=    7.000   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=      .390

   Unit Hyd Qpeak  (cms)=     1.650

   PEAK FLOW        (cms)=      .267 (i)
   TIME TO PEAK     (hrs)=     1.583
   RUNOFF VOLUME     (mm)=     8.142
   TOTAL RAINFALL    (mm)=    32.763
   RUNOFF COEFFICIENT    =      .249

   (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
·1:0008------------------------------------------------------------------------
    FINISH
-------------------------------------------------------------------------------
*******************************************************************************
   WARNINGS / ERRORS / NOTES
   -------------------------
 Simulation ended on 2018-11-06     at 10:57:50
===============================================================================
```

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

 SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO          999    999    =========
 S       W W W  MM MM  H   H   Y Y   MM MM  O   O       9   9  9   9
 SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
     S   W W   M   M  H   H    Y    M   M  O   O        9999   9999   Sept 2011
 SSSSS   W W   M   M  H   H    Y    M   M   OOO            9      9   =========
                                                        9   9  9   9   # 3057174
      StormWater Management HYdrologic Model             999    999    =========

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

+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++++++++ Licensed user: MTE Consultants Inc.                         +++-+++++
++++++++                in any City          SERIAL#:3057174         ++++++++-+
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

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


*********************   D E T A I L E D   O U T P U T   *********************
*******************************************************************************
       DATE: 2018-11-06     TIME: 10:58:03     RUN COUNTER: 000085           *
*******************************************************************************
 Input   filename: Q:\35499\200(PH~1\PRELIM~1\SWM\SWMHYMO\PRE\5YRSTM.dat     *
 Output  filename: Q:\35499\200(PH~1\PRELIM~1\SWM\SWMHYMO\PRE\5YRSTM.out     *
 Summary filename: Q:\35499\200(PH~1\PRELIM~1\SWM\SWMHYMO\PRE\5YRSTM.sum     *
 User comments:                                                              *
 1:__________________________________________________________________________*
 2:__________________________________________________________________________*
 3:__________________________________________________________________________*
*******************************************************************************

--------------------------------------------------------------------------------
1:0001--------------------------------------------------------------------------
*******************************************************************************
  Project Name: [THAMESCREST PH2]    Project Number: [35499-200]
  Date          : SEPTEMBER 2018
  Modeller      : [JJM]
  Company       : MTE CONSULTANTS Inc.
  License #     : 5826103
*******************************************************************************
------------------
START              |  Project  dir.: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\PRE\
------------------    Rainfall dir.: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\PRE\
  TZERO =    .00 hrs on        0
  METOUT=    2 (output = METRIC)
  NRUN  = 001
  NSTORM=    0
--------------------------------------------------------------------------------
1:0002--------------------------------------------------------------------------
================================================================================
ITE IS APPROXIMATELY 60HA OF AGRICULTURAL FIELD
ER THE PERTH COUNTY SOIL SURVEY, THE SITE IS MAINLY HURON CLAY LOAM

 FIELD TILE SYSTEM DRAINS THE NORTHERN PORTION OF THE FEILDS AND FLOWS TO THE
OUTH. THE FLOW WAS ROUGHLY MEASURED DURING A SITE VISIT (OCT. 2, 2018) AND
AS ESTIMATED TO BE APPROXIMATELY 20L/S. THIS FLOW WAS ADDED TO CATCHMENT 103

ORTHERN PORTION OF THE FEILD FLOWS NORTH/WEST WHILE THE REMAINDER FLOWS TO THE
```

```
*PROPOSED OUTLET IN THE SOUTH-WEST CORNER OF THE SITE.
*
*STORM PARAMETERS ARE TAKEN FROM THE 'REFERENCE MANUAL FOR THE USE OF
*PRECIPITATION DESIGN EVENTS IN THE UPPER THAMES WATERSHED'. STORMS ARE MODELED
*WITH 3HR DURATIONS EXCEPT FOR THE 250YR EVENTS WHICH HAS A DURATION OF 24HRS.
*
*TIME TO PEAK RATIO IS ASSUMED TO BE 40% OF THE TIME OF CONCENTRATION
*TIME OF CONCENTRATION CALCULATED USING THE AIRPORT FORMULA USING A 'C' VALUE
*OF 0.2 FOR THE FIELDS
*==============================================================================
--------------------
| CHICAGO STORM    |     IDF curve parameters: A= 860.463
| Ptotal= 48.62 mm |                           B=   7.382
--------------------                           C=    .759
                      used in:    INTENSITY =  A / (t + B)^C

                      Duration of storm  =  3.00 hrs
                      Storm time step    =  5.00 min
                      Time to peak ratio =   .33

              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .08   4.783 |    .83  23.813 |   1.58  12.640 |   2.33   6.140
               .17   5.191 |    .92  50.533 |   1.67  11.225 |   2.42   5.832
               .25   5.687 |   1.00 127.439 |   1.75  10.114 |   2.50   5.557
               .33   6.306 |   1.08  63.318 |   1.83   9.219 |   2.58   5.309
               .42   7.101 |   1.17  37.807 |   1.92   8.482 |   2.67   5.085
               .50   8.162 |   1.25  26.841 |   2.00   7.863 |   2.75   4.881
               .58   9.655 |   1.33  20.838 |   2.08   7.337 |   2.83   4.695
               .67  11.918 |   1.42  17.076 |   2.17   6.883 |   2.92   4.525
               .75  15.772 |   1.50  14.506 |   2.25   6.488 |   3.00   4.368

--------------------------------------------------------------------------------
001:0003------------------------------------------------------------------------
*==============================================================================
*CATCHMENT 101 -> CENTER PORTION OF THE FIELD
*              -> REPRESENTATIVE FLOW LENGTH = 220m
*              -> REPRESENTATIVE SLOPE = 3.9%
*==============================================================================
----------------------
| CALIB NASHYD       |   Area    (ha)=   24.80   Curve Number   (CN)=82.00
| 01:101    DT= 5.00 |   Ia      (mm)=   7.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=     .180

     Unit Hyd Qpeak  (cms)=    5.262

     PEAK FLOW       (cms)=    1.343 (i)
     TIME TO PEAK    (hrs)=    1.250
     RUNOFF VOLUME    (mm)=   17.786
     TOTAL RAINFALL   (mm)=   48.616
     RUNOFF COEFFICIENT   =     .366

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0004------------------------------------------------------------------------
*==============================================================================
*CATCHMENT 102 -> WEST PORTION OF THE FIELD
*              -> REPRESENTATIVE FLOW LENGTH = 190m
*              -> REPRESENTATIVE SLOPE = 1.4%
*==============================================================================
----------------------
| CALIB NASHYD       |   Area    (ha)=   11.50   Curve Number   (CN)=82.00
| 02:102    DT= 5.00 |   Ia      (mm)=   7.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.830

     PEAK FLOW       (cms)=     .539 (i)
     TIME TO PEAK    (hrs)=    1.333
     RUNOFF VOLUME    (mm)=   17.786
     TOTAL RAINFALL   (mm)=   48.616
     RUNOFF COEFFICIENT   =     .366

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

```
        ACTUAL QPEAK: PEAK(     .539) + QBASE(  .020) =     .559  (cms)
---------------------------------------------------------------------------------
1:0005---------------------------------------------------------------------------
============================================================================
ATCHMENT 103 -> EAST PORTION OF THE FIELD
             -> REPRESENTATIVE FLOW LENGTH = 120m
             -> REPRESENTATIVE SLOPE = 1.0%
============================================================================
--------------------
CALIB NASHYD       |   Area    (ha)=    6.74   Curve Number   (CN)=82.00
03:103    DT= 5.00 |   Ia      (mm)=   7.000   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .210

   Unit Hyd Qpeak  (cms)=    1.226

   PEAK FLOW       (cms)=      .340 (i)
   TIME TO PEAK    (hrs)=    1.250
   RUNOFF VOLUME    (mm)=   17.786
   TOTAL RAINFALL   (mm)=   48.616
   RUNOFF COEFFICIENT   =     .366

   (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

        ACTUAL QPEAK: PEAK(     .340) + QBASE(  .020) =     .360  (cms)
---------------------------------------------------------------------------------
1:0006---------------------------------------------------------------------------
----------------------
ADD HYD (999       ) | ID: NHYD          AREA     QPEAK    TPEAK   R.V.     DWF
----------------------                   (ha)     (cms)    (hrs)   (mm)    (cms)
                  ID1 01:101            24.80     1.343     1.25  17.79     .000
                 +ID2 02:102            11.50      .539     1.33  17.79     .020
                 +ID3 03:103             6.74      .340     1.25  17.79     .020
                 =============================================================
                  SUM 04:999            43.04     2.210     1.25  17.79     .040

 NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
 ACTUAL TOTAL PEAK FLOW: PEAK (   2.210) + BASE (   .040) =    2.250  (cms).

---------------------------------------------------------------------------------
1:0007---------------------------------------------------------------------------
============================================================================
ATCHMENT 111 -> NORTH PORTION OF THE FIELD
             -> REPRESENTATIVE FLOW LENGTH = 335m
             -> REPRESENTATIVE SLOPE = 0.8%
============================================================================
--------------------
CALIB NASHYD       |   Area    (ha)=   16.85   Curve Number   (CN)=82.00
01:111    DT= 5.00 |   Ia      (mm)=   7.000   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .390

   Unit Hyd Qpeak  (cms)=    1.650

   PEAK FLOW       (cms)=      .599 (i)
   TIME TO PEAK    (hrs)=    1.500
   RUNOFF VOLUME    (mm)=   17.786
   TOTAL RAINFALL   (mm)=   48.616
   RUNOFF COEFFICIENT   =     .366

   (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---------------------------------------------------------------------------------
1:0008---------------------------------------------------------------------------
   FINISH
---------------------------------------------------------------------------------
*********************************************************************************
   WARNINGS / ERRORS / NOTES
   ------------------------
 Simulation ended on 2018-11-06     at 10:58:03
=================================================================================
```

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

 SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO         999    999    =========
 S       W W W  MM MM  H   H   Y Y   MM MM  O   O       9   9  9   9
 SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
     S   W W   M   M  H   H    Y    M   M  O   O        9999   9999   Sept 2011
 SSSSS   W W   M   M  H   H    Y    M   M   OOO            9      9   =========
                                                       9   9  9   9   # 3057174
       StormWater Management HYdrologic Model            999    999    =========

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

+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++++++++ Licensed user: MTE Consultants Inc.                         +++++++++
++++++++                in any City           SERIAL#:3057174       +++++++++
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

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


********************   D E T A I L E D   O U T P U T   **********************
*********************************************************************************
       DATE: 2018-11-06      TIME: 10:57:09      RUN COUNTER: 000078          *
*********************************************************************************
 Input   filename: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\PRE\10YRSTM.dat    *
 Output  filename: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\PRE\10YRSTM.out    *
 Summary filename: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\PRE\10YRSTM.sum    *
 User comments:                                                               *
 1:___________________________________________________________________________*
 2:___________________________________________________________________________*
 3:___________________________________________________________________________*
*********************************************************************************

------------------------------------------------------------------------------------
1:0001------------------------------------------------------------------------------
*********************************************************************************
  Project Name: [THAMESCREST PH2]     Project Number: [35499-200]
  Date          : SEPTEMBER 2018
  Modeller      : [JJM]
  Company       : MTE CONSULTANTS Inc.
  License #     : 5826103
*********************************************************************************
-------------------
START              |  Project  dir.: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\PRE\
-------------------  Rainfall dir.: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\PRE\
  TZERO =    .00 hrs on         0
  METOUT=    2 (output = METRIC)
  NRUN  = 001
  NSTORM=    0
------------------------------------------------------------------------------------
1:0002------------------------------------------------------------------------------
=================================================================================
ITE IS APPROXIMATELY 60HA OF AGRICULTURAL FIELD
ER THE PERTH COUNTY SOIL SURVEY, THE SITE IS MAINLY HURON CLAY LOAM

 FIELD TILE SYSTEM DRAINS THE NORTHERN PORTION OF THE FEILDS AND FLOWS TO THE
OUTH. THE FLOW WAS ROUGHLY MEASURED DURING A SITE VISIT (OCT. 2, 2018) AND
AS ESTIMATED TO BE APPROXIMATELY 20L/S. THIS FLOW WAS ADDED TO CATCHMENT 103

ORTHERN PORTION OF THE FEILD FLOWS NORTH/WEST WHILE THE REMAINDER FLOWS TO THE
```

```
*PROPOSED OUTLET IN THE SOUTH-WEST CORNER OF THE SITE.
*
*STORM PARAMETERS ARE TAKEN FROM THE 'REFERENCE MANUAL FOR THE USE OF
*PRECIPITATION DESIGN EVENTS IN THE UPPER THAMES WATERSHED'. STORMS ARE MODELED
*WITH 3HR DURATIONS EXCEPT FOR THE 250YR EVENTS WHICH HAS A DURATION OF 24HRS.
*
*TIME TO PEAK RATIO IS ASSUMED TO BE 40% OF THE TIME OF CONCENTRATION
*TIME OF CONCENTRATION CALCULATED USING THE AIRPORT FORMULA USING A 'C' VALUE
*OF 0.2 FOR THE FIELDS
*================================================================================
--------------------
| CHICAGO STORM     |     IDF curve parameters: A=1060.397
| Ptotal= 59.22 mm |                            B=   8.954
--------------------                            C=    .760
                          used in:   INTENSITY =  A / (t + B)^C

                          Duration of storm  =  3.00 hrs
                          Storm time step    =  5.00 min
                          Time to peak ratio =   .33

              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .08   5.944 |    .83  30.016 |   1.58  15.943 |   2.33   7.664
               .17   6.460 |    .92  61.817 |   1.67  14.140 |   2.42   7.272
               .25   7.089 |   1.00 143.553 |   1.75  12.724 |   2.50   6.923
               .33   7.874 |   1.08  76.578 |   1.83  11.582 |   2.58   6.610
               .42   8.884 |   1.17  47.123 |   1.92  10.642 |   2.67   6.326
               .50  10.235 |   1.25  33.785 |   2.00   9.854 |   2.75   6.069
               .58  12.137 |   1.33  26.312 |   2.08   9.184 |   2.83   5.834
               .67  15.023 |   1.42  21.574 |   2.17   8.607 |   2.92   5.619
               .75  19.921 |   1.50  18.316 |   2.25   8.105 |   3.00   5.421

------------------------------------------------------------------------------------
001:0003----------------------------------------------------------------------------
*================================================================================
*CATCHMENT 101 -> CENTER PORTION OF THE FIELD
*              -> REPRESENTATIVE FLOW LENGTH = 220m
*              -> REPRESENTATIVE SLOPE = 3.9%
*================================================================================
----------------------
| CALIB NASHYD       |    Area     (ha)=   24.80   Curve Number   (CN)=82.00
| 01:101    DT= 5.00 |    Ia       (mm)=   7.030   # of Linear Res.(N)= 3.00
----------------------    U.H. Tp(hrs)=     .180

     Unit Hyd Qpeak  (cms)=    5.262

     PEAK FLOW        (cms)=    1.916 (i)
     TIME TO PEAK     (hrs)=    1.250
     RUNOFF VOLUME     (mm)=   25.256
     TOTAL RAINFALL    (mm)=   59.222
     RUNOFF COEFFICIENT   =     .426

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------------
001:0004----------------------------------------------------------------------------
*================================================================================
*CATCHMENT 102 -> WEST PORTION OF THE FIELD
*              -> REPRESENTATIVE FLOW LENGTH = 190m
*              -> REPRESENTATIVE SLOPE = 1.4%
*================================================================================
----------------------
| CALIB NASHYD       |    Area     (ha)=   11.50   Curve Number   (CN)=82.00
| 02:102    DT= 5.00 |    Ia       (mm)=   7.030   # of Linear Res.(N)= 3.00
----------------------    U.H. Tp(hrs)=     .240

     Unit Hyd Qpeak  (cms)=    1.830

     PEAK FLOW        (cms)=     .771 (i)
     TIME TO PEAK     (hrs)=    1.333
     RUNOFF VOLUME     (mm)=   25.256
     TOTAL RAINFALL    (mm)=   59.222
     RUNOFF COEFFICIENT   =     .426

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

```
        ACTUAL QPEAK: PEAK(     .771) + QBASE(  .020) =     .791  (cms)
----------------------------------------------------------------------------------
1:0005----------------------------------------------------------------------------
==============================================================================
ATCHMENT 103 -> EAST PORTION OF THE FIELD
             -> REPRESENTATIVE FLOW LENGTH = 120m
             -> REPRESENTATIVE SLOPE = 1.0%
==============================================================================
--------------------
CALIB NASHYD        |   Area    (ha)=    6.74   Curve Number   (CN)=82.00
03:103    DT= 5.00  |   Ia      (mm)=   7.000   # of Linear Res.(N)= 3.00
--------------------    U.H. Tp(hrs)=    .210

   Unit Hyd Qpeak  (cms)=    1.226

   PEAK FLOW        (cms)=     .487 (i)
   TIME TO PEAK     (hrs)=    1.250
   RUNOFF VOLUME     (mm)=   25.256
   TOTAL RAINFALL    (mm)=   59.222
   RUNOFF COEFFICIENT   =     .426

   (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

        ACTUAL QPEAK: PEAK(     .487) + QBASE(  .020) =     .507  (cms)
----------------------------------------------------------------------------------
1:0006----------------------------------------------------------------------------
---------------------
ADD HYD (999         ) | ID: NHYD           AREA     QPEAK   TPEAK   R.V.    DWF
---------------------                        (ha)     (cms)   (hrs)   (mm)   (cms)
                  ID1 01:101                24.80    1.916    1.25  25.26    .000
                 +ID2 02:102                11.50     .771    1.33  25.26    .020
                 +ID3 03:103                 6.74     .487    1.25  25.26    .020
                 ===============================================================
                  SUM 04:999                43.04    3.160    1.25  25.26    .040

 NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
 ACTUAL TOTAL PEAK FLOW: PEAK (   3.160) + BASE (   .040) =    3.200  (cms).

----------------------------------------------------------------------------------
1:0007----------------------------------------------------------------------------
==============================================================================
ATCHMENT 111 -> NORTH PORTION OF THE FIELD
             -> REPRESENTATIVE FLOW LENGTH = 335m
             -> REPRESENTATIVE SLOPE = 0.8%
==============================================================================
--------------------
CALIB NASHYD        |   Area    (ha)=   16.85   Curve Number   (CN)=82.00
01:111    DT= 5.00  |   Ia      (mm)=   7.000   # of Linear Res.(N)= 3.00
--------------------    U.H. Tp(hrs)=    .390

   Unit Hyd Qpeak  (cms)=    1.650

   PEAK FLOW        (cms)=     .861 (i)
   TIME TO PEAK     (hrs)=    1.500
   RUNOFF VOLUME     (mm)=   25.256
   TOTAL RAINFALL    (mm)=   59.222
   RUNOFF COEFFICIENT   =     .426

   (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

----------------------------------------------------------------------------------
1:0008----------------------------------------------------------------------------
    FINISH
----------------------------------------------------------------------------------
**********************************************************************************
   WARNINGS / ERRORS / NOTES
   -------------------------
 Simulation ended on 2018-11-06     at 10:57:10
==================================================================================
```

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

 SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO       999   999    =========
 S      W W W  MM MM  H   H   Y Y   MM MM  O   O     9   9 9   9
 SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ## 9   9 9   9   Ver  4.05
     S   W W   M   M  H   H    Y    M   M  O   O      9999  9999   Sept 2011
 SSSSS   W W   M   M  H   H    Y    M   M   OOO          9     9   =========
                                                     9   9 9   9   # 3057174
     StormWater Management HYdrologic Model           999   999    =========

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

+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++++++++ Licensed user: MTE Consultants Inc.                         +++++++++
++++++++                in any City             SERIAL#:3057174      +++++++++
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

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


********************   D E T A I L E D   O U T P U T   **********************
*******************************************************************************
        DATE: 2018-11-06    TIME: 10:57:44     RUN COUNTER: 000082           *
*******************************************************************************
 Input   filename: Q:\35499\200(PH~1\PRELIM~1\SWM\SWMHYMO\PRE\25YRSTM.dat    *
 Output  filename: Q:\35499\200(PH~1\PRELIM~1\SWM\SWMHYMO\PRE\25YRSTM.out    *
 Summary filename: Q:\35499\200(PH~1\PRELIM~1\SWM\SWMHYMO\PRE\25YRSTM.sum    *
 User comments:                                                              *
 1:__________________________________________________________________________*
 2:__________________________________________________________________________*
 3:__________________________________________________________________________*
*******************************************************************************

---------------------------------------------------------------------------------
1:0001---------------------------------------------------------------------------
*******************************************************************************
  Project Name: [THAMESCREST PH2]    Project Number: [35499-200]
  Date         : SEPTEMBER 2018
  Modeller     : [JJM]
  Company      : MTE CONSULTANTS Inc.
  License #    : 5826103
*******************************************************************************
-------------------
START              |  Project  dir.: Q:\35499\200(PH~1\PRELIM~1\SWM\SWMHYMO\PRE\
-------------------   Rainfall dir.: Q:\35499\200(PH~1\PRELIM~1\SWM\SWMHYMO\PRE\
  TZERO =    .00 hrs on        0
  METOUT=    2 (output = METRIC)
  NRUN  = 001
  NSTORM=    0
---------------------------------------------------------------------------------
1:0002---------------------------------------------------------------------------
================================================================================
ITE IS APPROXIMATELY 60HA OF AGRICULTURAL FIELD
ER THE PERTH COUNTY SOIL SURVEY, THE SITE IS MAINLY HURON CLAY LOAM

 FIELD TILE SYSTEM DRAINS THE NORTHERN PORTION OF THE FEILDS AND FLOWS TO THE
OUTH. THE FLOW WAS ROUGHLY MEASURED DURING A SITE VISIT (OCT. 2, 2018) AND
AS ESTIMATED TO BE APPROXIMATELY 20L/S. THIS FLOW WAS ADDED TO CATCHMENT 103

ORTHERN PORTION OF THE FEILD FLOWS NORTH/WEST WHILE THE REMAINDER FLOWS TO THE
```

```
*PROPOSED OUTLET IN THE SOUTH-WEST CORNER OF THE SITE.
*
*STORM PARAMETERS ARE TAKEN FROM THE 'REFERENCE MANUAL FOR THE USE OF
*PRECIPITATION DESIGN EVENTS IN THE UPPER THAMES WATERSHED'. STORMS ARE MODELED
*WITH 3HR DURATIONS EXCEPT FOR THE 250YR EVENTS WHICH HAS A DURATION OF 24HRS.
*
*TIME TO PEAK RATIO IS ASSUMED TO BE 40% OF THE TIME OF CONCENTRATION
*TIME OF CONCENTRATION CALCULATED USING THE AIRPORT FORMULA USING A 'C' VALUE
*OF 0.2 FOR THE FIELDS
*===============================================================================
-------------------
| CHICAGO STORM    |    IDF curve parameters: A=1336.383
| Ptotal= 72.92 mm |                          B=  10.833
-------------------                           C=    .763
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  3.00 hrs
                        Storm time step    =  5.00 min
                        Time to peak ratio =   .33

          TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
           hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
           .08   7.446 |   .83  38.164 |  1.58  20.319 |  2.33   9.650
           .17   8.106 |   .92  76.872 |  1.67  17.997 |  2.42   9.148
           .25   8.913 |  1.00 162.429 |  1.75  16.172 |  2.50   8.700
           .33   9.921 |  1.08  93.105 |  1.83  14.699 |  2.58   8.298
           .42  11.221 |  1.17  59.119 |  1.92  13.487 |  2.67   7.935
           .50  12.962 |  1.25  42.875 |  2.00  12.471 |  2.75   7.606
           .58  15.416 |  1.33  33.535 |  2.08  11.607 |  2.83   7.305
           .67  19.134 |  1.42  27.529 |  2.17  10.864 |  2.92   7.030
           .75  25.416 |  1.50  23.365 |  2.25  10.218 |  3.00   6.778

---------------------------------------------------------------------------------
001:0003-------------------------------------------------------------------------
*===============================================================================
*CATCHMENT 101 -> CENTER PORTION OF THE FIELD
*              -> REPRESENTATIVE FLOW LENGTH = 220m
*              -> REPRESENTATIVE SLOPE = 3.9%
*===============================================================================
-----------------------
| CALIB NASHYD        |   Area     (ha)=   24.80   Curve Number   (CN)=82.00
| 01:101    DT= 5.00 |   Ia       (mm)=   7.000   # of Linear Res.(N)= 3.00
-----------------------   U.H. Tp(hrs)=      .180

    Unit Hyd Qpeak  (cms)=    5.262

    PEAK FLOW        (cms)=    2.736 (i)
    TIME TO PEAK     (hrs)=    1.250
    RUNOFF VOLUME     (mm)=   35.712
    TOTAL RAINFALL    (mm)=   72.918
    RUNOFF COEFFICIENT    =     .490

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---------------------------------------------------------------------------------
001:0004-------------------------------------------------------------------------
*===============================================================================
*CATCHMENT 102 -> WEST PORTION OF THE FIELD
*              -> REPRESENTATIVE FLOW LENGTH = 190m
*              -> REPRESENTATIVE SLOPE = 1.4%
*===============================================================================
-----------------------
| CALIB NASHYD        |   Area     (ha)=   11.50   Curve Number   (CN)=82.00
| 02:102    DT= 5.00 |   Ia       (mm)=   7.000   # of Linear Res.(N)= 3.00
-----------------------   U.H. Tp(hrs)=      .240

    Unit Hyd Qpeak  (cms)=    1.830

    PEAK FLOW        (cms)=    1.093 (i)
    TIME TO PEAK     (hrs)=    1.333
    RUNOFF VOLUME     (mm)=   35.712
    TOTAL RAINFALL    (mm)=   72.918
    RUNOFF COEFFICIENT    =     .490

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

```
        ACTUAL QPEAK: PEAK(   1.093) + QBASE(  .020) =   1.113  (cms)
----------------------------------------------------------------------------------
1:0005----------------------------------------------------------------------------
==============================================================================
ATCHMENT 103 -> EAST PORTION OF THE FIELD
             -> REPRESENTATIVE FLOW LENGTH = 120m
             -> REPRESENTATIVE SLOPE = 1.0%
==============================================================================
--------------------
CALIB NASHYD        |   Area    (ha)=    6.74   Curve Number   (CN)=82.00
03:103    DT= 5.00 |   Ia       (mm)=   7.000   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .210

   Unit Hyd Qpeak  (cms)=    1.226

   PEAK FLOW        (cms)=     .691 (i)
   TIME TO PEAK     (hrs)=    1.250
   RUNOFF VOLUME     (mm)=   35.711
   TOTAL RAINFALL    (mm)=   72.918
   RUNOFF COEFFICIENT    =     .490

   (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

        ACTUAL QPEAK: PEAK(    .691) + QBASE(  .020) =    .711  (cms)
----------------------------------------------------------------------------------
1:0006----------------------------------------------------------------------------
----------------------
ADD HYD (999        ) | ID: NHYD            AREA     QPEAK   TPEAK   R.V.    DWF
----------------------                      (ha)     (cms)   (hrs)   (mm)   (cms)
                   ID1 01:101              24.80     2.706    1.25  35.71    .000
                  +ID2 02:102              11.50     1.093    1.33  35.71    .020
                  +ID3 03:103               6.74      .691    1.25  35.71    .020
                   ===========================================================
                   SUM 04:999              43.04     4.478    1.25  35.71    .040

 NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
 ACTUAL TOTAL PEAK FLOW: PEAK (   4.478) + BASE (   .040) =    4.518  (cms).

----------------------------------------------------------------------------------
1:0007----------------------------------------------------------------------------
==============================================================================
ATCHMENT 111 -> NORTH PORTION OF THE FIELD
             -> REPRESENTATIVE FLOW LENGTH = 335m
             -> REPRESENTATIVE SLOPE = 0.8%
==============================================================================
--------------------
CALIB NASHYD        |   Area    (ha)=   16.85   Curve Number   (CN)=82.00
01:111    DT= 5.00 |   Ia       (mm)=   7.000   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .390

   Unit Hyd Qpeak  (cms)=    1.650

   PEAK FLOW        (cms)=    1.228 (i)
   TIME TO PEAK     (hrs)=    1.500
   RUNOFF VOLUME     (mm)=   35.712
   TOTAL RAINFALL    (mm)=   72.918
   RUNOFF COEFFICIENT    =     .490

   (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

----------------------------------------------------------------------------------
1:0008----------------------------------------------------------------------------
    FINISH
----------------------------------------------------------------------------------
**********************************************************************************
   WARNINGS / ERRORS / NOTES
   -------------------------
 Simulation ended on 2018-11-06    at 10:57:44
==================================================================================
```

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

 SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO         999    999    =========
 S      W W W  MM MM  H   H   Y Y   MM MM  O   O       9   9  9   9
 SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##   9   9  9   9   Ver  4.05
     S   W W   M   M  H   H    Y    M   M  O   O        9999   9999   Sept 2011
 SSSSS   W W   M   M  H   H    Y    M   M   OOO            9      9   =========
                                                       9   9  9   9   # 3057174
      StormWater Management HYdrologic Model            999    999    =========

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

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++++++++ Licensed user: MTE Consultants Inc.                         +++++++++
++++++++                  in any City           SERIAL#:3057174      +++++++++
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

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


********************  D E T A I L E D   O U T P U T  ********************
**********************************************************************
        DATE: 2018-11-06     TIME: 10:57:56     RUN COUNTER: 000084      *
**********************************************************************
 Input   filename: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\PRE\50YRSTM.dat   *
 Output  filename: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\PRE\50YRSTM.out   *
 Summary filename: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\PRE\50YRSTM.sum   *
 User comments:                                                          *
 1:______________________________________________________________________*
 2:______________________________________________________________________*
 3:______________________________________________________________________*
**********************************************************************

-------------------------------------------------------------------------------
·1:0001-----------------------------------------------------------------------
**********************************************************************
  Project Name: [THAMESCREST PH2]    Project Number: [35499-200]
  Date          : SEPTEMBER 2018
  Modeller      : [JJM]
  Company       : MTE CONSULTANTS Inc.
  License #     : 5826103
**********************************************************************
------------------
START             |  Project  dir.: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\PRE\
------------------   Rainfall dir.: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\PRE\
  TZERO =    .00 hrs on       0
  METOUT=    2 (output = METRIC)
  NRUN  = 001
  NSTORM=    0
-------------------------------------------------------------------------------
·1:0002-----------------------------------------------------------------------
==============================================================================
:ITE IS APPROXIMATELY 60HA OF AGRICULTURAL FIELD
'ER THE PERTH COUNTY SOIL SURVEY, THE SITE IS MAINLY HURON CLAY LOAM

, FIELD TILE SYSTEM DRAINS THE NORTHERN PORTION OF THE FEILDS AND FLOWS TO THE
:OUTH. THE FLOW WAS ROUGHLY MEASURED DURING A SITE VISIT (OCT. 2, 2018) AND
/AS ESTIMATED TO BE APPROXIMATELY 20L/S. THIS FLOW WAS ADDED TO CATCHMENT 103

IORTHERN PORTION OF THE FEILD FLOWS NORTH/WEST WHILE THE REMAINDER FLOWS TO THE
```

```
*PROPOSED OUTLET IN THE SOUTH-WEST CORNER OF THE SITE.
*
*STORM PARAMETERS ARE TAKEN FROM THE 'REFERENCE MANUAL FOR THE USE OF
*PRECIPITATION DESIGN EVENTS IN THE UPPER THAMES WATERSHED'. STORMS ARE MODELED
*WITH 3HR DURATIONS EXCEPT FOR THE 250YR EVENTS WHICH HAS A DURATION OF 24HRS.
*
*TIME TO PEAK RATIO IS ASSUMED TO BE 40% OF THE TIME OF CONCENTRATION
*TIME OF CONCENTRATION CALCULATED USING THE AIRPORT FORMULA USING A 'C' VALUE
*OF 0.2 FOR THE FIELDS
*=============================================================================
--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1546.625
| Ptotal= 82.70 mm |                          B=  11.945
--------------------                          C=    .766
                   used in:   INTENSITY =  A / (t + B)^C

                   Duration of storm  =  3.00 hrs
                   Storm time step    =  5.00 min
                   Time to peak ratio =   .33

           TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
            hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
            .08   8.496 |   .83  43.975 |  1.58  23.442 |  2.33  11.050
            .17   9.260 |   .92  86.170 |  1.67  20.748 |  2.42  10.467
            .25  10.194 |  1.00 176.986 |  1.75  18.627 |  2.50   9.948
            .33  11.364 |  1.08 104.803 |  1.83  16.915 |  2.58   9.482
            .42  12.873 |  1.17  67.625 |  1.92  15.505 |  2.67   9.062
            .50  14.896 |  1.25  49.351 |  2.00  14.325 |  2.75   8.681
            .58  17.748 |  1.33  38.693 |  2.08  13.321 |  2.83   8.333
            .67  22.067 |  1.42  31.785 |  2.17  12.458 |  2.92   8.016
            .75  29.343 |  1.50  26.973 |  2.25  11.708 |  3.00   7.723

-------------------------------------------------------------------------------
001:0003-----------------------------------------------------------------------
*=============================================================================
*CATCHMENT 101 -> CENTER PORTION OF THE FIELD
*              -> REPRESENTATIVE FLOW LENGTH = 220m
*              -> REPRESENTATIVE SLOPE = 3.9%
*=============================================================================
----------------------
| CALIB NASHYD        |   Area     (ha)=   24.80   Curve Number   (CN)=82.00
| 01:101    DT= 5.00  |   Ia       (mm)=   7.000   # of Linear Res.(N)= 3.00
----------------------    U.H. Tp(hrs)=     .180

    Unit Hyd Qpeak  (cms)=    5.262

    PEAK FLOW        (cms)=    3.332 (i)
    TIME TO PEAK     (hrs)=    1.250
    RUNOFF VOLUME     (mm)=   43.593
    TOTAL RAINFALL    (mm)=   82.701
    RUNOFF COEFFICIENT    =     .527

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
001:0004-----------------------------------------------------------------------
*=============================================================================
*CATCHMENT 102 -> WEST PORTION OF THE FIELD
*              -> REPRESENTATIVE FLOW LENGTH = 190m
*              -> REPRESENTATIVE SLOPE = 1.4%
*=============================================================================
----------------------
| CALIB NASHYD        |   Area     (ha)=   11.50   Curve Number   (CN)=82.00
| 02:102    DT= 5.00  |   Ia       (mm)=   7.000   # of Linear Res.(N)= 3.00
----------------------    U.H. Tp(hrs)=     .240

    Unit Hyd Qpeak  (cms)=    1.830

    PEAK FLOW        (cms)=    1.338 (i)
    TIME TO PEAK     (hrs)=    1.333
    RUNOFF VOLUME     (mm)=   43.593
    TOTAL RAINFALL    (mm)=   82.701
    RUNOFF COEFFICIENT    =     .527

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

```
        ACTUAL QPEAK: PEAK(   1.338) + QBASE(  .020) =   1.358  (cms)
-----------------------------------------------------------------------------------
1:0005-----------------------------------------------------------------------------
===============================================================================
ATCHMENT 103 -> EAST PORTION OF THE FIELD
             -> REPRESENTATIVE FLOW LENGTH = 120m
             -> REPRESENTATIVE SLOPE = 1.0%
===============================================================================
-------------------
CALIB NASHYD       |  Area     (ha)=    6.74  Curve Number    (CN)=82.00
03:103    DT= 5.00 |  Ia       (mm)=   7.000  # of Linear Res.(N)= 3.00
-------------------   U.H. Tp(hrs)=     .210

   Unit Hyd Qpeak  (cms)=     1.226

   PEAK FLOW        (cms)=      .845 (i)
   TIME TO PEAK     (hrs)=     1.250
   RUNOFF VOLUME     (mm)=    43.593
   TOTAL RAINFALL    (mm)=    82.701
   RUNOFF COEFFICIENT   =      .527

   (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

        ACTUAL QPEAK: PEAK(    .845) + QBASE(  .020) =    .865  (cms)
-----------------------------------------------------------------------------------
1:0006-----------------------------------------------------------------------------
----------------------
ADD HYD (999       ) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
----------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
                 ID1 01:101             24.80     3.302    1.25  43.59    .000
                +ID2 02:102             11.50     1.338    1.33  43.59    .020
                +ID3 03:103              6.74      .845    1.25  43.59    .020
                 ===========================================================
                 SUM 04:999             43.04     5.475    1.25  43.59    .040

 NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
 ACTUAL TOTAL PEAK FLOW: PEAK (   5.475) + BASE (   .040) =    5.515  (cms).

-----------------------------------------------------------------------------------
1:0007-----------------------------------------------------------------------------
===============================================================================
ATCHMENT 111 -> NORTH PORTION OF THE FIELD
             -> REPRESENTATIVE FLOW LENGTH = 335m
             -> REPRESENTATIVE SLOPE = 0.8%
===============================================================================
-------------------
CALIB NASHYD       |  Area     (ha)=   16.85  Curve Number    (CN)=82.00
01:111    DT= 5.00 |  Ia       (mm)=   7.000  # of Linear Res.(N)= 3.00
-------------------   U.H. Tp(hrs)=     .390

   Unit Hyd Qpeak  (cms)=     1.650

   PEAK FLOW        (cms)=     1.508 (i)
   TIME TO PEAK     (hrs)=     1.500
   RUNOFF VOLUME     (mm)=    43.593
   TOTAL RAINFALL    (mm)=    82.701
   RUNOFF COEFFICIENT   =      .527

   (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----------------------------------------------------------------------------------
1:0008-----------------------------------------------------------------------------
   FINISH
-----------------------------------------------------------------------------------
***********************************************************************************
   WARNINGS / ERRORS / NOTES
   -------------------------
 Simulation ended on 2018-11-06     at 10:57:57
===================================================================================
```

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

 SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999   999    =========
 S       W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9 9   9
 SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9 9   9  Ver  4.05
     S   W W   M   M  H   H    Y    M   M  O   O       9999  9999   Sept 2011
 SSSSS   W W   M   M  H   H    Y    M   M   OOO           9     9   =========
                                                       9   9 9   9  # 3057174
      StormWater Management HYdrologic Model            999   999   =========

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

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++++++++ Licensed user: MTE Consultants Inc.                         +++++++++
+++++++++               in any City             SERIAL#:3057174       +++++++++
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

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


********************   D E T A I L E D   O U T P U T   ********************
********************************************************************************
*       DATE: 2018-11-06     TIME: 10:57:03     RUN COUNTER: 000077            *
********************************************************************************
* Input   filename: Q:\35499\200(PH~1\PRELIM~1\SWM\SWMHYMO\PRE\100YRSTM.dat    *
* Output  filename: Q:\35499\200(PH~1\PRELIM~1\SWM\SWMHYMO\PRE\100YRSTM.out    *
* Summary filename: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\PRE\100YRSTM.sum    *
* User comments:                                                               *
* 1:__________________________________________________________________________*
* 2:__________________________________________________________________________*
* 3:__________________________________________________________________________*
********************************************************************************

-----------------------------------------------------------------------------------
1:0001-----------------------------------------------------------------------------
********************************************************************************
  Project Name: [THAMESCREST PH2]    Project Number: [35499-200]
  Date         : SEPTEMBER 2018
  Modeller     : [JJM]
  Company      : MTE CONSULTANTS Inc.
  License #    : 5826103
********************************************************************************
--------------------
START                | Project  dir.: Q:\35499\200(PH~1\PRELIM~1\SWM\SWMHYMO\PRE\
-------------------- Rainfall dir.: Q:\35499\200(PH-1\PRELIM~1\SWM\SWMHYMO\PRE\
  TZERO =    .00 hrs on        0
  METOUT=    2 (output = METRIC)
  NRUN  = 001
  NSTORM=    0
-----------------------------------------------------------------------------------
1:0002-----------------------------------------------------------------------------
================================================================================
ITE IS APPROXIMATELY 60HA OF AGRICULTURAL FIELD
ER THE PERTH COUNTY SOIL SURVEY, THE SITE IS MAINLY HURON CLAY LOAM

 FIELD TILE SYSTEM DRAINS THE NORTHERN PORTION OF THE FEILDS AND FLOWS TO THE
OUTH. THE FLOW WAS ROUGHLY MEASURED DURING A SITE VISIT (OCT. 2, 2018) AND
AS ESTIMATED TO BE APPROXIMATELY 20L/S. THIS FLOW WAS ADDED TO CATCHMENT 103

ORTHERN PORTION OF THE FEILD FLOWS NORTH/WEST WHILE THE REMAINDER FLOWS TO THE
```

```
*PROPOSED OUTLET IN THE SOUTH-WEST CORNER OF THE SITE.
*
*STORM PARAMETERS ARE TAKEN FROM THE 'REFERENCE MANUAL FOR THE USE OF
*PRECIPITATION DESIGN EVENTS IN THE UPPER THAMES WATERSHED'. STORMS ARE MODELED
*WITH 3HR DURATIONS EXCEPT FOR THE 250YR EVENTS WHICH HAS A DURATION OF 24HRS.
*
*TIME TO PEAK RATIO IS ASSUMED TO BE 40% OF THE TIME OF CONCENTRATION
*TIME OF CONCENTRATION CALCULATED USING THE AIRPORT FORMULA USING A 'C' VALUE
*OF 0.2 FOR THE FIELDS
*===============================================================================
---------------------
| CHICAGO STORM     |     IDF curve parameters: A=1717.698
| Ptotal= 92.63 mm  |                           B=  12.472
---------------------                           C=    .764
                          used in:   INTENSITY =  A / (t + B)^C

                          Duration of storm  =  3.00 hrs
                          Storm time step    =  5.00 min
                          Time to peak ratio =   .33

              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .08   9.645 |    .83  49.561 |   1.58  26.556 |   2.33  12.541
               .17  10.511 |    .92  95.358 |   1.67  23.516 |   2.42  11.881
               .25  11.571 |   1.00 193.107 |   1.75  21.120 |   2.50  11.292
               .33  12.898 |   1.08 116.261 |   1.83  19.185 |   2.58  10.763
               .42  14.608 |   1.17  75.751 |   1.92  17.590 |   2.67  10.287
               .50  16.899 |   1.25  55.551 |   2.00  16.253 |   2.75   9.854
               .58  20.126 |   1.33  43.675 |   2.08  15.116 |   2.83   9.460
               .67  25.004 |   1.42  35.939 |   2.17  14.138 |   2.92   9.100
               .75  33.195 |   1.50  30.532 |   2.25  13.288 |   3.00   8.768

-----------------------------------------------------------------------------------
001:0003---------------------------------------------------------------------------
*===============================================================================
*CATCHMENT 101 -> CENTER PORTION OF THE FIELD
*              -> REPRESENTATIVE FLOW LENGTH = 220m
*              -> REPRESENTATIVE SLOPE = 3.9%
*===============================================================================
-----------------------
| CALIB NASHYD        |   Area     (ha)=   24.30   Curve Number   (CN)=82.00
| 01:101    DT= 5.00  |   Ia       (mm)=   7.000   # of Linear Res.(N)= 3.00
-----------------------   U.H. Tp(hrs)=     .180

    Unit Hyd Qpeak  (cms)=    5.262

    PEAK FLOW         (cms)=    3.931 (i)
    TIME TO PEAK      (hrs)=    1.167
    RUNOFF VOLUME      (mm)=   51.857
    TOTAL RAINFALL     (mm)=   92.625
    RUNOFF COEFFICIENT   =      .560

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----------------------------------------------------------------------------------
001:0004---------------------------------------------------------------------------
*===============================================================================
*CATCHMENT 102 -> WEST PORTION OF THE FIELD
*              -> REPRESENTATIVE FLOW LENGTH = 190m
*              -> REPRESENTATIVE SLOPE = 1.4%
*===============================================================================
-----------------------
| CALIB NASHYD        |   Area     (ha)=   11.50   Curve Number   (CN)=82.00
| 02:102    DT= 5.00  |   Ia       (mm)=   7.000   # of Linear Res.(N)= 3.00
-----------------------   U.H. Tp(hrs)=     .240

    Unit Hyd Qpeak  (cms)=    1.830

    PEAK FLOW         (cms)=    1.591 (i)
    TIME TO PEAK      (hrs)=    1.333
    RUNOFF VOLUME      (mm)=   51.857
    TOTAL RAINFALL     (mm)=   92.625
    RUNOFF COEFFICIENT   =      .560

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

```
        ACTUAL QPEAK: PEAK(   1.591) + QBASE(  .020) =   1.611  (cms)
---------------------------------------------------------------------------------
1:0005---------------------------------------------------------------------------
=============================================================================
ATCHMENT 103 -> EAST PORTION OF THE FIELD
             -> REPRESENTATIVE FLOW LENGTH = 120m
             -> REPRESENTATIVE SLOPE = 1.0%
=============================================================================
 -------------------
 CALIB NASHYD       |   Area    (ha)=    6.74   Curve Number   (CN)=82.00
 03:103    DT= 5.00 |   Ia      (mm)=   7.000   # of Linear Res.(N)= 3.00
 -------------------    U.H. Tp(hrs)=    .210

    Unit Hyd Qpeak  (cms)=    1.226

    PEAK FLOW        (cms)=    1.007 (i)
    TIME TO PEAK     (hrs)=    1.250
    RUNOFF VOLUME     (mm)=   51.857
    TOTAL RAINFALL    (mm)=   92.625
    RUNOFF COEFFICIENT   =      .560

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

        ACTUAL QPEAK: PEAK(   1.007) + QBASE(  .020) =   1.027  (cms)
---------------------------------------------------------------------------------
1:0006---------------------------------------------------------------------------
 ----------------------
 ADD HYD (999        ) | ID: NHYD            AREA     QPEAK   TPEAK   R.V.    DWF
 ----------------------                      (ha)     (cms)   (hrs)   (mm)   (cms)
                   ID1 01:101               24.80     3.931    1.17  51.86    .000
                  +ID2 02:102               11.50     1.591    1.33  51.86    .020
                  +ID3 03:103                6.74     1.007    1.25  51.86    .020
                  ==================================================================
                   SUM 04:999               43.04     6.513    1.25  51.86    .040

 NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
 ACTUAL TOTAL PEAK FLOW: PEAK (   6.513) + BASE (   .040) =    6.553  (cms).

---------------------------------------------------------------------------------
1:0007---------------------------------------------------------------------------
=============================================================================
ATCHMENT 111 -> NORTH PORTION OF THE FIELD
             -> REPRESENTATIVE FLOW LENGTH = 335m
             -> REPRESENTATIVE SLOPE = 0.8%
=============================================================================
 -------------------
 CALIB NASHYD       |   Area    (ha)=   16.85   Curve Number   (CN)=82.00
 01:111    DT= 5.00 |   Ia      (mm)=   7.000   # of Linear Res.(N)= 3.00
 -------------------    U.H. Tp(hrs)=    .390

    Unit Hyd Qpeak  (cms)=    1.650

    PEAK FLOW        (cms)=    1.798 (i)
    TIME TO PEAK     (hrs)=    1.500
    RUNOFF VOLUME     (mm)=   51.857
    TOTAL RAINFALL    (mm)=   92.625
    RUNOFF COEFFICIENT   =      .560

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---------------------------------------------------------------------------------
1:0008---------------------------------------------------------------------------
   FINISH
---------------------------------------------------------------------------------
*********************************************************************************
   WARNINGS / ERRORS / NOTES
   -------------------------
 Simulation ended on 2018-11-06     at 10:57:03
=================================================================================
```

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

 SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO          999    999    =========
 S       W W W  MM MM  H   H   Y Y   MM MM  O   O        9   9  9   9
 SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##   9   9  9   9   Ver  4.05
     S   W W   M   M  H   H    Y    M   M  O   O        9999   9999   Sept 2011
 SSSSS   W W   M   M  H   H    Y    M   M   OOO            9      9   =========
                                                         9   9  9   9   # 3057174
      StormWater Management HYdrologic Model              999    999    =========

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

+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++++++++ Licensed user: MTE Consultants Inc.                        +++-+++++
++++++++                   in any City             SERIAL#:3057174   +++-+++++
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

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


********************  D E T A I L E D   O U T P U T  *********************
*******************************************************************************
*       DATE: 2018-11-06     TIME: 10:57:17     RUN COUNTER: 000079          *
*******************************************************************************
* Input   filename: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\PRE\250YRSTM.dat   *
* Output  filename: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\PRE\250YRSTM.out   *
* Summary filename: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\PRE\250YRSTM.sum   *
* User comments:                                                              *
* 1:__________________________________________________________________________*
* 2:__________________________________________________________________________*
* 3:__________________________________________________________________________*
*******************************************************************************

----------------------------------------------------------------------------------
1:0001----------------------------------------------------------------------------
*******************************************************************************
  Project Name: [THAMESCREST PH2]    Project Number: [35499-200]
  Date         : SEPTEMBER 2018
  Modeller     : [JJM]
  Company      : MTE CONSULTANTS Inc.
  License #    : 5826103
*******************************************************************************
 -----------------
 START              |  Project  dir.: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\PRE\
 -----------------     Rainfall dir.: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\PRE\
  TZERO =    .00 hrs on        0
  METOUT=    2 (output = METRIC)
  NRUN  = 001
  NSTORM=    0
----------------------------------------------------------------------------------
1:0002----------------------------------------------------------------------------
===============================================================================
ITE IS APPROXIMATELY 60HA OF AGRICULTURAL FIELD
ER THE PERTH COUNTY SOIL SURVEY, THE SITE IS MAINLY HURON CLAY LOAM

 FIELD TILE SYSTEM DRAINS THE NORTHERN PORTION OF THE FEILDS AND FLOWS TO THE
OUTH. THE FLOW WAS ROUGHLY MEASURED DURING A SITE VISIT (OCT. 2, 2018) AND
AS ESTIMATED TO BE APPROXIMATELY 20L/S. THIS FLOW WAS ADDED TO CATCHMENT 103

ORTHERN PORTION OF THE FEILD FLOWS NORTH/WEST WHILE THE REMAINDER FLOWS TO THE
```

```
*PROPOSED OUTLET IN THE SOUTH-WEST CORNER OF THE SITE.
*
*STORM PARAMETERS ARE TAKEN FROM THE 'REFERENCE MANUAL FOR THE USE OF
*PRECIPITATION DESIGN EVENTS IN THE UPPER THAMES WATERSHED'. STORMS ARE MODELED
*WITH 3HR DURATIONS EXCEPT FOR THE 250YR EVENTS WHICH HAS A DURATION OF 24HRS.
*
*TIME TO PEAK RATIO IS ASSUMED TO BE 40% OF THE TIME OF CONCENTRATION
*TIME OF CONCENTRATION CALCULATED USING THE AIRPORT FORMULA USING A 'C' VALUE
*OF 0.2 FOR THE FIELDS
*==============================================================================
 -------------------
| CHICAGO STORM     |    IDF curve parameters: A=2075.001
| Ptotal=182.83 mm  |                          B=  14.000
 -------------------                           C=    .770
                      used in:   INTENSITY =  A / (t + B)^C

                      Duration of storm  = 24.00 hrs
                      Storm time step    =  5.00 min
                      Time to peak ratio =   .33

              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .08   1.825 |   6.08   5.848 |  12.08   5.499 |  18.08   2.614
               .17   1.840 |   6.17   6.076 |  12.17   5.406 |  18.17   2.597
               .25   1.856 |   6.25   6.324 |  12.25   5.316 |  18.25   2.580
               .33   1.872 |   6.33   6.597 |  12.33   5.230 |  18.33   2.563
               .42   1.888 |   6.42   6.898 |  12.42   5.147 |  18.42   2.547
               .50   1.905 |   6.50   7.232 |  12.50   5.067 |  18.50   2.530
               .58   1.922 |   6.58   7.604 |  12.58   4.990 |  18.58   2.514
               .67   1.939 |   6.67   8.022 |  12.67   4.915 |  18.67   2.498
               .75   1.957 |   6.75   8.495 |  12.75   4.843 |  18.75   2.483
               .83   1.975 |   6.83   9.036 |  12.83   4.773 |  18.83   2.468
               .92   1.994 |   6.92   9.658 |  12.92   4.705 |  18.92   2.453
              1.00   2.013 |   7.00  10.385 |  13.00   4.640 |  19.00   2.438
              1.08   2.032 |   7.08  11.244 |  13.08   4.576 |  19.08   2.423
              1.17   2.052 |   7.17  12.276 |  13.17   4.515 |  19.17   2.408
              1.25   2.072 |   7.25  13.541 |  13.25   4.455 |  19.25   2.394
              1.33   2.093 |   7.33  15.126 |  13.33   4.397 |  19.33   2.380
              1.42   2.114 |   7.42  17.173 |  13.42   4.341 |  19.42   2.366
              1.50   2.136 |   7.50  19.918 |  13.50   4.287 |  19.50   2.352
              1.58   2.158 |   7.58  23.786 |  13.58   4.233 |  19.58   2.339
              1.67   2.181 |   7.67  29.628 |  13.67   4.182 |  19.67   2.325
              1.75   2.204 |   7.75  39.399 |  13.75   4.132 |  19.75   2.312
              1.83   2.228 |   7.83  58.696 |  13.83   4.083 |  19.83   2.299
              1.92   2.252 |   7.92 111.420 |  13.92   4.035 |  19.92   2.286
              2.00   2.277 |   8.00 214.970 |  14.00   3.989 |  20.00   2.274
              2.08   2.303 |   8.08 134.312 |  14.08   3.944 |  20.08   2.261
              2.17   2.329 |   8.17  88.936 |  14.17   3.900 |  20.17   2.248
              2.25   2.356 |   8.25  65.706 |  14.25   3.857 |  20.25   2.236
              2.33   2.384 |   8.33  51.808 |  14.33   3.815 |  20.33   2.224
              2.42   2.413 |   8.42  42.662 |  14.42   3.775 |  20.42   2.212
              2.50   2.442 |   8.50  36.232 |  14.50   3.735 |  20.50   2.200
              2.58   2.472 |   8.58  31.485 |  14.58   3.696 |  20.58   2.189
              2.67   2.503 |   8.67  27.848 |  14.67   3.658 |  20.67   2.177
              2.75   2.535 |   8.75  24.978 |  14.75   3.621 |  20.75   2.166
              2.83   2.568 |   8.83  22.658 |  14.83   3.585 |  20.83   2.155
              2.92   2.602 |   8.92  20.746 |  14.92   3.549 |  20.92   2.144
              3.00   2.637 |   9.00  19.143 |  15.00   3.515 |  21.00   2.133
              3.08   2.673 |   9.08  17.782 |  15.08   3.481 |  21.08   2.122
              3.17   2.711 |   9.17  16.610 |  15.17   3.448 |  21.17   2.111
              3.25   2.749 |   9.25  15.593 |  15.25   3.415 |  21.25   2.100
              3.33   2.789 |   9.33  14.700 |  15.33   3.384 |  21.33   2.090
              3.42   2.830 |   9.42  13.910 |  15.42   3.353 |  21.42   2.080
              3.50   2.872 |   9.50  13.207 |  15.50   3.322 |  21.50   2.070
              3.58   2.916 |   9.58  12.577 |  15.58   3.292 |  21.58   2.059
              3.67   2.962 |   9.67  12.008 |  15.67   3.263 |  21.67   2.049
              3.75   3.009 |   9.75  11.493 |  15.75   3.235 |  21.75   2.039
              3.83   3.058 |   9.83  11.024 |  15.83   3.207 |  21.83   2.030
              3.92   3.109 |   9.92  10.596 |  15.92   3.179 |  21.92   2.020
              4.00   3.162 |  10.00  10.202 |  16.00   3.152 |  22.00   2.010
              4.08   3.217 |  10.08   9.839 |  16.08   3.126 |  22.08   2.001
              4.17   3.274 |  10.17   9.503 |  16.17   3.100 |  22.17   1.992
              4.25   3.333 |  10.25   9.192 |  16.25   3.074 |  22.25   1.982
              4.33   3.395 |  10.33   8.903 |  16.33   3.049 |  22.33   1.973
              4.42   3.460 |  10.42   8.633 |  16.42   3.025 |  22.42   1.964
```

```
         4.50   3.528 |  10.50   8.380 |  16.50   3.001 |  22.50   1.955
         4.58   3.598 |  10.58   8.144 |  16.58   2.977 |  22.58   1.946
         4.67   3.672 |  10.67   7.922 |  16.67   2.954 |  22.67   1.937
         4.75   3.750 |  10.75   7.713 |  16.75   2.931 |  22.75   1.929
         4.83   3.832 |  10.83   7.515 |  16.83   2.909 |  22.83   1.920
         4.92   3.917 |  10.92   7.329 |  16.92   2.887 |  22.92   1.912
         5.00   4.007 |  11.00   7.153 |  17.00   2.865 |  23.00   1.903
         5.08   4.102 |  11.08   6.986 |  17.08   2.844 |  23.08   1.895
         5.17   4.202 |  11.17   6.828 |  17.17   2.823 |  23.17   1.887
         5.25   4.308 |  11.25   6.677 |  17.25   2.802 |  23.25   1.878
         5.33   4.421 |  11.33   6.534 |  17.33   2.782 |  23.33   1.870
         5.42   4.540 |  11.42   6.397 |  17.42   2.762 |  23.42   1.862
         5.50   4.667 |  11.50   6.267 |  17.50   2.743 |  23.50   1.854
         5.58   4.802 |  11.58   6.143 |  17.58   2.723 |  23.58   1.846
         5.67   4.946 |  11.67   6.024 |  17.67   2.705 |  23.67   1.839
         5.75   5.101 |  11.75   5.910 |  17.75   2.686 |  23.75   1.831
         5.83   5.267 |  11.83   5.801 |  17.83   2.667 |  23.83   1.823
         5.92   5.445 |  11.92   5.696 |  17.92   2.649 |  23.92   1.816
         6.00   5.639 |  12.00   5.595 |  18.00   2.632 |  24.00   1.808

-----------------------------------------------------------------------------------
1:0003-----------------------------------------------------------------------------
===============================================================================
ATCHMENT 101 -> CENTER PORTION OF THE FIELD
             -> REPRESENTATIVE FLOW LENGTH = 220m
             -> REPRESENTATIVE SLOPE = 3.9%
===============================================================================
--------------------
CALIB NASHYD        |  Area    (ha)=  24.80  Curve Number   (CN)=82.00
01:101    DT= 5.00  |  Ia      (mm)=  7.000  # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .180

   Unit Hyd Qpeak  (cms)=    5.262

   PEAK FLOW       (cms)=    6.367 (i)
   TIME TO PEAK    (hrs)=    8.167
   RUNOFF VOLUME    (mm)=  133.500
   TOTAL RAINFALL   (mm)=  182.833
   RUNOFF COEFFICIENT   =     .730

   (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----------------------------------------------------------------------------------
1:0004-----------------------------------------------------------------------------
===============================================================================
ATCHMENT 102 -> WEST PORTION OF THE FIELD
             -> REPRESENTATIVE FLOW LENGTH = 190m
             -> REPRESENTATIVE SLOPE = 1.4%
===============================================================================
--------------------
CALIB NASHYD        |  Area    (ha)=  11.50  Curve Number   (CN)=82.00
02:102    DT= 5.00  |  Ia      (mm)=  7.000  # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=    .240

   Unit Hyd Qpeak  (cms)=    1.830

   PEAK FLOW       (cms)=    2.574 (i)
   TIME TO PEAK    (hrs)=    8.250
   RUNOFF VOLUME    (mm)=  133.500
   TOTAL RAINFALL   (mm)=  182.833
   RUNOFF COEFFICIENT   =     .730

   (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

       ACTUAL QPEAK: PEAK(   2.574) + QBASE(  .020) =    2.594  (cms)
-----------------------------------------------------------------------------------
1:0005-----------------------------------------------------------------------------
===============================================================================
ATCHMENT 103 -> EAST PORTION OF THE FIELD
             -> REPRESENTATIVE FLOW LENGTH = 120m
             -> REPRESENTATIVE SLOPE = 1.0%
===============================================================================
--------------------
CALIB NASHYD        |  Area    (ha)=   6.74  Curve Number   (CN)=82.00
03:103    DT= 5.00  |  Ia      (mm)=  7.000  # of Linear Res.(N)= 3.00
```

```
----------------------  U.H. Tp(hrs)=    .210

    Unit Hyd Qpeak  (cms)=    1.226

    PEAK FLOW       (cms)=    1.590 (i)
    TIME TO PEAK    (hrs)=    8.250
    RUNOFF VOLUME    (mm)=  133.500
    TOTAL RAINFALL   (mm)=  182.833
    RUNOFF COEFFICIENT   =     .730

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

        ACTUAL QPEAK: PEAK(   1.590) + QBASE(  .020) =    1.610  (cms)
-----------------------------------------------------------------------------------
001:0006---------------------------------------------------------------------------
--------------------------
| ADD HYD (999         ) | ID: NHYD            AREA     QPEAK    TPEAK   R.V.     DWF
--------------------------                      (ha)     (cms)    (hrs)   (mm)    (cms)
                          ID1 01:101           24.80    6.367    8.17 133.50     .000
                         +ID2 02:102           11.50    2.574    8.25 133.50     .020
                         +ID3 03:103            6.74    1.590    8.25 133.50     .020
                         ==============================================================
                          SUM 04:999           43.04   10.398    8.17 133.50     .040

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
   ACTUAL TOTAL PEAK FLOW: PEAK (  10.398) + BASE (   .040) =   10.438  (cms).

-----------------------------------------------------------------------------------
001:0007---------------------------------------------------------------------------
*================================================================================
*CATCHMENT 111 -> NORTH PORTION OF THE FIELD
*              -> REPRESENTATIVE FLOW LENGTH = 335m
*              -> REPRESENTATIVE SLOPE = 0.8%
*================================================================================
----------------------
| CALIB NASHYD        |  Area    (ha)=  16.85  Curve Number   (CN)=82.00
| 01:111    DT= 5.00  |  Ia      (mm)=  7.000  # of Linear Res.(N)= 3.00
----------------------  U.H. Tp(hrs)=    .390

    Unit Hyd Qpeak  (cms)=    1.650

    PEAK FLOW       (cms)=    2.985 (i)
    TIME TO PEAK    (hrs)=    8.417
    RUNOFF VOLUME    (mm)=  133.500
    TOTAL RAINFALL   (mm)=  182.833
    RUNOFF COEFFICIENT   =     .730

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----------------------------------------------------------------------------------
001:0008---------------------------------------------------------------------------
    FINISH
-----------------------------------------------------------------------------------
***********************************************************************************
    WARNINGS / ERRORS / NOTES
    -------------------------
  Simulation ended on 2018-11-06    at 10:57:17
===================================================================================
```

POST-DEVELOPMENT

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

 SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
 S       W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
 SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
     S   W W   M   M  H   H    Y    M   M  O   O        9999   9999   Sept 2011
 SSSSS   W W   M   M  H   H    Y    M   M   OOO            9      9   =========
                                                     9   9  9   9    # 3057174
      StormWater Management HYdrologic Model              999    999    =========

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

+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++++++++ Licensed user: MTE Consultants Inc.                         +++++++++
+++++++++                in any City            SERIAL#:3057174       +++++++++
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

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


*********************  D E T A I L E D   O U T P U T  ***********************
*******************************************************************************
*       DATE: 2019-03-09     TIME: 19:32:53     RUN COUNTER: 000708          *
*******************************************************************************
* Input   filename: Q:\35499\200(PH~1\PRELIM~1\SWM\SWMHYMO\POST\MODEL.dat    *
* Output  filename: Q:\35499\200(PH~1\PRELIM~1\SWM\SWMHYMO\POST\MODEL.out    *
* Summary filename: Q:\35499\200(PH~1\PRELIM~1\SWM\SWMHYMO\POST\MODEL.sum    *
* User comments:                                                              *
* 1:_________________________________________________________________________*
* 2:_________________________________________________________________________*
* 3:_________________________________________________________________________*
*******************************************************************************

---------------------------------------------------------------------------------
*1:0001--------------------------------------------------------------------------
*******************************************************************************
   Project Name: [THAMESCREST PH2]    Project Number: [35499-200]
   Date          : SEPTEMBER 2018
   Modeller      : [JJM]
   Company       : J.F. Sabourin and Associates Inc.
   License #     : 5826103
*******************************************************************************
-------------------
START              |  Project  dir.: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\POST\
-------------------  Rainfall dir.: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\POST\
   TZERO =    .00 hrs on        0
   METOUT=    2 (output = METRIC)
   NRUN  = 001
   NSTORM=    0
---------------------------------------------------------------------------------
*1:0002--------------------------------------------------------------------------
-------------------
READ STORM         |    Filename: 25mm Chicago 4-hr duration
Ptotal=  25.23 mm|    Comments: 25mm Chicago 4-hr duration
-------------------
               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
                .02   1.380 |   1.03   3.419 |   2.05   6.735 |   3.07   2.151
                .03   1.392 |   1.05   3.513 |   2.07   6.489 |   3.08   2.129
                .05   1.405 |   1.07   3.614 |   2.08   6.261 |   3.10   2.107
```

```
                .07   1.418 |   1.08   3.720 |   2.10   6.049 |   3.12   2.086
                .08   1.431 |   1.10   3.834 |   2.12   5.851 |   3.13   2.066
                .10   1.445 |   1.12   3.955 |   2.13   5.666 |   3.15   2.046
                .12   1.459 |   1.13   4.084 |   2.15   5.493 |   3.17   2.026
                .13   1.473 |   1.15   4.224 |   2.17   5.330 |   3.18   2.007
                .15   1.488 |   1.17   4.373 |   2.18   5.178 |   3.20   1.988
                .17   1.503 |   1.18   4.535 |   2.20   5.034 |   3.22   1.969
                .18   1.518 |   1.20   4.709 |   2.22   4.899 |   3.23   1.951
                .20   1.533 |   1.22   4.899 |   2.23   4.771 |   3.25   1.934
                .22   1.549 |   1.23   5.105 |   2.25   4.649 |   3.27   1.916
                .23   1.566 |   1.25   5.330 |   2.27   4.535 |   3.28   1.899
                .25   1.582 |   1.27   5.578 |   2.28   4.426 |   3.30   1.882
                .27   1.599 |   1.28   5.851 |   2.30   4.322 |   3.32   1.866
                .28   1.617 |   1.30   6.153 |   2.32   4.224 |   3.33   1.850
                .30   1.635 |   1.32   6.489 |   2.33   4.130 |   3.35   1.834
                .32   1.653 |   1.33   6.866 |   2.35   4.040 |   3.37   1.819
                .33   1.672 |   1.35   7.291 |   2.37   3.955 |   3.38   1.804
                .35   1.691 |   1.37   7.773 |   2.38   3.873 |   3.40   1.789
                .37   1.711 |   1.38   8.326 |   2.40   3.795 |   3.42   1.774
                .38   1.732 |   1.40   8.964 |   2.42   3.720 |   3.43   1.760
                .40   1.753 |   1.42   9.710 |   2.43   3.648 |   3.45   1.746
                .42   1.774 |   1.43  10.590 |   2.45   3.579 |   3.47   1.732
                .43   1.796 |   1.45  11.645 |   2.47   3.513 |   3.48   1.718
                .45   1.819 |   1.47  12.929 |   2.48   3.450 |   3.50   1.705
                .47   1.842 |   1.48  14.523 |   2.50   3.389 |   3.52   1.691
                .48   1.866 |   1.50  16.546 |   2.52   3.330 |   3.53   1.679
                .50   1.891 |   1.52  19.187 |   2.53   3.273 |   3.55   1.666
                .52   1.916 |   1.53  22.758 |   2.55   3.219 |   3.57   1.653
                .53   1.942 |   1.55  27.806 |   2.57   3.166 |   3.58   1.641
                .55   1.969 |   1.57  35.379 |   2.58   3.115 |   3.60   1.629
                .57   1.997 |   1.58  47.716 |   2.60   3.066 |   3.62   1.617
                .58   2.026 |   1.60  70.433 |   2.62   3.019 |   3.63   1.605
                .50   2.056 |   1.62 121.612 |   2.63   2.973 |   3.65   1.594
                .62   2.086 |   1.63  82.615 |   2.65   2.928 |   3.67   1.582
                .63   2.118 |   1.65  61.359 |   2.67   2.886 |   3.68   1.571
                .65   2.151 |   1.67  47.716 |   2.68   2.844 |   3.70   1.560
                .67   2.185 |   1.68  38.790 |   2.70   2.804 |   3.72   1.549
                .68   2.220 |   1.70  32.473 |   2.72   2.764 |   3.73   1.539
                .70   2.256 |   1.72  27.806 |   2.73   2.727 |   3.75   1.528
                .72   2.294 |   1.73  24.239 |   2.75   2.690 |   3.77   1.518
                .73   2.333 |   1.75  21.437 |   2.77   2.654 |   3.78   1.508
                .75   2.374 |   1.77  19.187 |   2.78   2.619 |   3.80   1.498
                .77   2.416 |   1.78  17.346 |   2.80   2.586 |   3.82   1.488
                .78   2.460 |   1.80  15.814 |   2.82   2.553 |   3.83   1.478
                .80   2.505 |   1.82  14.523 |   2.83   2.521 |   3.85   1.469
                .82   2.553 |   1.83  13.421 |   2.85   2.490 |   3.87   1.459
                .83   2.602 |   1.85  12.471 |   2.87   2.460 |   3.88   1.450
                .85   2.654 |   1.87  11.645 |   2.88   2.430 |   3.90   1.441
                .87   2.708 |   1.88  10.920 |   2.90   2.401 |   3.92   1.431
                .88   2.764 |   1.90  10.279 |   2.92   2.374 |   3.93   1.423
                .90   2.824 |   1.92   9.710 |   2.93   2.346 |   3.95   1.414
                .92   2.886 |   1.93   9.200 |   2.95   2.320 |   3.97   1.405
                .93   2.951 |   1.95   8.741 |   2.97   2.294 |   3.98   1.396
                .95   3.019 |   1.97   8.326 |   2.98   2.269 |   4.00   1.388
                .97   3.091 |   1.98   7.949 |   3.00   2.244 |   4.02   1.380
                .98   3.166 |   2.00   7.606 |   3.02   2.220 |
               1.00   3.246 |   2.02   7.291 |   3.03   2.196 |
               1.02   3.330 |   2.03   7.002 |   3.05   2.173 |

---------------------------------------------------------------------------------
001:0003-------------------------------------------------------------------------
*=============================================================================
*FUTURE NORTH -> 22.7ha URBAN (Assumed Tributary Area to Future Pond)
*              -> FIELD TILE DRY WEATHER FLOW
*=============================================================================
-----------------------
| CALIB STANDHYD        |   Area     (ha)=   22.70
| 01:201     DT= 1.00 |   Total Imp(%)=   60.00   Dir. Conn.(%)=   60.00
-----------------------
                                    IMPERVIOUS    PERVIOUS (i)
     Surface Area        (ha)=        13.62          9.08
     Dep. Storage        (mm)=         1.00          5.00
     Average Slope       (%)=          2.50          2.50
     Length              (m)=         45.00         33.00
     Mannings n            =           .015          .050
```

```
    Max.eff.Inten.(mm/hr)=      121.61        12.45
               over (min)         1.00         6.00
    Storage Coeff.  (min)=        1.21 (ii)    6.36 (ii)
    Unit Hyd. Tpeak (min)=        1.00         6.00
    Unit Hyd. peak  (cms)=         .95          .18
                                                          *TOTALS*
    PEAK FLOW       (cms)=        3.53          .19        3.562 (iii)
    TIME TO PEAK    (hrs)=        1.62         1.75        1.617
    RUNOFF VOLUME    (mm)=       24.23         4.89       16.496
    TOTAL RAINFALL   (mm)=       25.23        25.23       25.234
    RUNOFF COEFFICIENT   =         .96          .19         .654

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
          CN* =  80.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
1:0004-------------------------------------------------------------------------
==========================================================================
OUTE FLOW THROUGH FUTURE POND
OND STAGE-STORAGE RELATIONSHIP HAS BEEN SET UP TO PROVIDE REASONABLE TARGET
LOW ESTIMATES FOR THE DETAILED DESIGN OF POND 1 AND THE FUTURE DESIGN OF
OND 3
==========================================================================
--------------------
ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
 IN>01:(201    )   |
OUT<02:(000301)    |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |   OUTFLOW    STORAGE
                         (cms)     (ha.m.)   |    (cms)     (ha.m.)
                          .000  .0000E+00    |      .680  .9200E+00
                          .140  .2800E+00    |      .730  .1070E+01
                          .285  .3750E+00    |      .790  .1230E+01
                          .485  .6000E+00    |     1.000  .1810E+01
                          .572  .7100E+00    |    10.000  .1000E+02

    ROUTING RESULTS              AREA     QPEAK     TPEAK       R.V.
    --------------------         (ha)     (cms)     (hrs)       (mm)
    INFLOW >01: (201    )       22.70     3.562     1.617     16.496
    OUTFLOW<02: (000301)        22.70      .138     2.700     16.496
   OVERFLOW<03: (       )         .00      .000      .000       .000

                TOTAL NUMBER OF SIMULATED OVERFLOWS  =           0
                CUMULATIVE TIME OF OVERFLOWS  (hours)=         .00
                PERCENTAGE OF TIME OVERFLOWING    (%)=         .00


                PEAK   FLOW   REDUCTION [Qout/Qin](%)=     3.870
                TIME SHIFT OF PEAK FLOW          (min)=    65.00
                MAXIMUM  STORAGE   USED         (ha.m.)=.2757E+00

------------------------------------------------------------------------------
1:0005-------------------------------------------------------------------------
==========================================================================
EST CATCHMENT -> 22.86ha URBAN (i.e. Phase 2&3 Area Tributary to Pond 1)
==========================================================================
--------------------
CALIB STANDHYD      |   Area    (ha)=   22.86
01:201    DT= 1.00  |   Total Imp(%)=   60.00   Dir. Conn.(%)=   60.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=     13.72         9.14
    Dep. Storage     (mm)=      1.00         5.00
    Average Slope     (%)=      2.50         2.50
    Length            (m)=     45.00        33.00
    Mannings n           =      .015         .050

    Max.eff.Inten.(mm/hr)=    121.61        12.45
               over (min)       1.00         6.00
    Storage Coeff.  (min)=      1.21 (ii)    6.36 (ii)
    Unit Hyd. Tpeak (min)=      1.00         6.00
    Unit Hyd. peak  (cms)=       .95          .18
```

```
                                                          *TOTALS*
    PEAK FLOW       (cms)=        3.56          .19        3.587 (iii)
    TIME TO PEAK    (hrs)=        1.62         1.75        1.617
    RUNOFF VOLUME    (mm)=       24.23         4.89       16.496
    TOTAL RAINFALL   (mm)=       25.23        25.23       25.234
    RUNOFF COEFFICIENT   =         .96          .19         .654

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
          CN* =  80.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
001:0006-----------------------------------------------------------------------
*=========================================================================
*ADD RUNOFF FROM WEST CATCHMENT TO OUTFLOW FROM FUTURE POND 3
*=========================================================================
--------------------
| ADD HYD (         5) | ID: NHYD          AREA    QPEAK   TPEAK   R.V.    DWF
--------------------                       (ha)    (cms)   (hrs)   (mm)   (cms)
                         ID1 01:201       22.86    3.587    1.62  16.50    .000
                        +ID2 02:     301  22.70     .138    2.70  16.50    .000
                        +ID3 03:            .00     .000     .00    .00    .000  **DRY**
                        ======================================================
                         SUM 04:       5  45.56    3.641    1.62  16.50    .000

  NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
001:0007-----------------------------------------------------------------------
*=========================================================================
*ROUTE HYDROGRAPH THROUGH POND 1
*=========================================================================
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>04:(000005)   |
| OUT<01:(000401)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------     OUTFLOW    STORAGE   |   OUTFLOW    STORAGE
                          (cms)     (ha.m.)   |    (cms)     (ha.m.)
                           .000  .0000E+00    |     1.351  .9228E+00
                           .022  .5970E-01    |     1.499  .1093E+01
                           .036  .1213E+00    |     1.632  .1270E+01
                           .046  .1848E+00    |     1.695  .1362E+01
                           .155  .2501E+00    |     1.756  .1456E+01
                           .347  .3173E+00    |     1.815  .1551E+01
                           .593  .3865E+00    |     1.871  .1648E+01
                           .751  .4574E+00    |     1.926  .1747E+01
                           .993  .6050E+00    |     1.980  .1849E+01
                          1.186  .7601E+00    |      .000  .0000E+00

    ROUTING RESULTS              AREA     QPEAK     TPEAK       R.V.
    --------------------         (ha)     (cms)     (hrs)       (mm)
    INFLOW >04: (000005)        45.56     3.641     1.617     16.496
    OUTFLOW<01: (000401)        45.56      .285     2.650     16.496
   OVERFLOW<02: (000001)          .00      .000      .000       .000

                TOTAL NUMBER OF SIMULATED OVERFLOWS  =           0
                CUMULATIVE TIME OF OVERFLOWS  (hours)=         .00
                PERCENTAGE OF TIME OVERFLOWING    (%)=         .00


                PEAK   FLOW   REDUCTION [Qout/Qin](%)=     7.816
   `            TIME SHIFT OF PEAK FLOW          (min)=    62.00
                MAXIMUM  STORAGE   USED         (ha.m.)=.2954E+00

------------------------------------------------------------------------------
001:0008-----------------------------------------------------------------------
*=========================================================================
*EAST CATCHMENT -> 8.93ha Proposed URBAN + Assumed Future 3.59ha Park/Yard Area
*=========================================================================
--------------------
| CALIB STANDHYD    |   Area    (ha)=    8.93
| 03:2021   DT= 1.00 |  Total Imp(%)=   60.00   Dir. Conn.(%)=   60.00
--------------------
```

```
                             IMPERVIOUS    PERVIOUS (i)
 Surface Area      (ha)=        5.36          3.57
 Dep. Storage      (mm)=        1.00          5.00
 Average Slope      (%)=        2.50          2.50
 Length             (m)=       45.00         33.00
 Mannings n            =        .015          .050

 Max.eff.Inten.(mm/hr)=       121.61         12.45
            over (min)          1.00          6.00
 Storage Coeff.  (min)=         1.21 (ii)     6.36 (ii)
 Unit Hyd. Tpeak (min)=         1.00          6.00
 Unit Hyd. peak  (cms)=          .95           .18
                                                          *TOTALS*
 PEAK FLOW       (cms)=         1.39           .08          1.401 (iii)
 TIME TO PEAK    (hrs)=         1.62          1.75          1.617
 RUNOFF VOLUME    (mm)=        24.23          4.89         16.496
 TOTAL RAINFALL   (mm)=        25.23         25.23         25.234
 RUNOFF COEFFICIENT   =          .96           .19           .654

   (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
       CN* =  80.0    Ia = Dep. Storage  (Above)
  (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
       THAN THE STORAGE COEFFICIENT.
 (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
1:0009--------------------------------------------------------------------------
---------------------
CALIB NASHYD        |  Area     (ha)=    3.59  Curve Number   (CN)=80.00
04:2022   DT= 1.00  |  Ia       (mm)=   5.000  # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=     .200

 Unit Hyd Qpeak  (cms)=     .686

 PEAK FLOW       (cms)=     .055 (i)
 TIME TO PEAK    (hrs)=    1.917
 RUNOFF VOLUME    (mm)=    4.889
 TOTAL RAINFALL   (mm)=   25.234
 RUNOFF COEFFICIENT   =     .194

 (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
1:0010--------------------------------------------------------------------------
----------------------
ADD HYD (          9) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.     DWF
----------------------                    (ha)     (cms)   (hrs)   (mm)    (cms)
                 ID1 03:2021              8.93     1.401    1.62  16.50     .000
                +ID2 04:2022              3.59      .055    1.92   4.89     .000
                ===============================================================
                 SUM 05:            9    12.52     1.404    1.62  13.17     .000

 NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
1:0011--------------------------------------------------------------------------
============================================================================
OUTE FLOW THROUGH WETLAND 2
============================================================================
---------------------
ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
 IN>05:(000009)    |
OUT<06:(000402)    |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW     STORAGE   | OUTFLOW    STORAGE
                         (cms)      (ha.m.)   |  (cms)     (ha.m.)
                          .000   .0000E+00    |   .585   .3940E+00
                          .007   .4050E-01    |   .647   .4544E+00
                          .014   .8360E-01    |   .705   .5174E+00
                          .074   .1291E+00    |   .758   .5828E+00
                          .180   .1771E+00    |   .807   .6507E+00
                          .316   .2276E+00    |   .853   .7210E+00
                          .432   .2806E+00    |   .898   .7939E+00
                          .514   .3360E+00    |   .000   .0000E+00

   ROUTING RESULTS            AREA     QPEAK     TPEAK        R.V.
```

```
     --------------------         (ha)      (cms)      (hrs)       (mm)
     INFLOW >05: (000009)        12.52      1.404      1.617     13.168
     OUTFLOW<06: (000402)        12.52       .065      2.767     13.168
   OVERFLOW<07: (000002)           .00       .000       .000       .000

                 TOTAL NUMBER OF SIMULATED OVERFLOWS  =           0
                 CUMULATIVE TIME OF OVERFLOWS  (hours)=         .00
                 PERCENTAGE OF TIME OVERFLOWING    (%)=         .00


                 PEAK   FLOW   REDUCTION [Qout/Qin](%)=     4.661
                 TIME SHIFT OF PEAK FLOW         (min)=     69.00
                 MAXIMUM  STORAGE   USED        (ha.m.)=.1226E+00

--------------------------------------------------------------------------------
001:0012------------------------------------------------------------------------
*============================================================================
*ADD OUTFLOW FROM POND1 TO OUTFLOW FROM POND 2
*============================================================================
----------------------
| ADD HYD (          9) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.     DWF
----------------------                      (ha)     (cms)   (hrs)   (mm)    (cms)
                  ID1 01:          401     45.56      .285    2.65  16.50     .000
                 +ID2 02:            1       .00      .000     .00    .00     .000  **DRY**
                 +ID3 06:          402     12.52      .065    2.77  13.17     .000
                 +ID4 07:            2       .00      .000     .00    .00     .000  **DRY**
                 ===============================================================
                  SUM 08:            9     58.08      .350    2.67  15.78     .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
001:0013------------------------------------------------------------------------
     FINISH
--------------------------------------------------------------------------------
********************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2019-03-09     at 19:32:54
================================================================================
```

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

 SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
 S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
 SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
     S   W W   M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
 SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9   =========
                                                      9   9  9   9   # 3057174
      StormWater Management HYdrologic Model           999    999    =========

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

+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++++++++ Licensed user: MTE Consultants Inc.                        +++++++++
+++++++++                in any City            SERIAL#:3057174      +++++++++
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

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


********************  D E T A I L E D   O U T P U T  ************************
*****************************************************************************
        DATE: 2019-03-09      TIME: 19:33:30      RUN COUNTER: 000709      *
*****************************************************************************
 Input   filename: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\POST\MODEL.dat    *
 Output  filename: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\POST\MODEL.out    *
 Summary filename: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\POST\MODEL.sum    *
 User comments:                                                              *
 1:__________________________________________________________________________*
 2:__________________________________________________________________________*
 3:__________________________________________________________________________*
*****************************************************************************

------------------------------------------------------------------------------
1:0001------------------------------------------------------------------------
*****************************************************************************
  Project Name: [THAMESCREST PH2]    Project Number: [35499-200]
  Date          : SEPTEMBER 2018
  Modeller      : [JJM]
  Company       : J.F. Sabourin and Associates Inc.
  License #     : 5826103
*****************************************************************************
------------------
START              |  Project  dir.: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\POST\
------------------    Rainfall dir.: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\POST\
  TZERO =    .00 hrs on        0
  METOUT=   2 (output = METRIC)
  NRUN  = 001
  NSTORM=   0
------------------------------------------------------------------------------
1:0002------------------------------------------------------------------------
------------------
READ STORM         |     Filename: 2yr Chicago 3-hr duration
Ptotal=  33.13 mm|     Comments: 2yr Chicago 3-hr duration
------------------
                TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
                 hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
                 .02   2.775 |    .78   6.609 |   1.55  12.108 |   2.32   4.188
                 .03   2.807 |    .80   6.843 |   1.57  11.574 |   2.33   4.135
                 .05   2.840 |    .82   7.096 |   1.58  11.088 |   2.35   4.083
```

```
                 .07   2.874 |    .83   7.370 |   1.60  10.644 |   2.37   4.033
                 .08   2.909 |    .85   7.669 |   1.62  10.237 |   2.38   3.984
                 .10   2.945 |    .87   7.997 |   1.63   9.861 |   2.40   3.937
                 .12   2.982 |    .88   8.356 |   1.65   9.514 |   2.42   3.890
                 .13   3.020 |    .90   8.753 |   1.67   9.193 |   2.43   3.846
                 .15   3.059 |    .92   9.193 |   1.68   8.894 |   2.45   3.802
                 .17   3.099 |    .93   9.684 |   1.70   8.616 |   2.47   3.759
                 .18   3.140 |    .95  10.237 |   1.72   8.356 |   2.48   3.717
                 .20   3.183 |    .97  10.861 |   1.73   8.113 |   2.50   3.677
                 .22   3.227 |    .98  11.574 |   1.75   7.884 |   2.52   3.637
                 .23   3.272 |   1.00  12.395 |   1.77   7.669 |   2.53   3.598
                 .25   3.319 |   1.02  13.350 |   1.78   7.467 |   2.55   3.560
                 .27   3.368 |   1.03  14.475 |   1.80   7.276 |   2.57   3.523
                 .28   3.418 |   1.05  15.820 |   1.82   7.096 |   2.58   3.487
                 .30   3.470 |   1.07  17.453 |   1.83   6.925 |   2.60   3.452
                 .32   3.523 |   1.08  19.476 |   1.85   6.763 |   2.62   3.418
                 .33   3.579 |   1.10  22.046 |   1.87   6.609 |   2.63   3.384
                 .35   3.637 |   1.12  25.406 |   1.88   6.463 |   2.65   3.351
                 .37   3.697 |   1.13  29.970 |   1.90   6.323 |   2.67   3.319
                 .38   3.759 |   1.15  36.482 |   1.92   6.191 |   2.68   3.288
                 .40   3.823 |   1.17  46.415 |   1.93   6.064 |   2.70   3.257
                 .42   3.890 |   1.18  63.087 |   1.95   5.943 |   2.72   3.227
                 .43   3.960 |   1.20  95.555 |   1.97   5.827 |   2.73   3.197
                 .45   4.033 |   1.22 177.843 |   1.98   5.716 |   2.75   3.168
                 .47   4.109 |   1.23 113.965 |   2.00   5.610 |   2.77   3.140
                 .48   4.188 |   1.25  81.869 |   2.02   5.508 |   2.78   3.112
                 .50   4.271 |   1.27  63.087 |   2.03   5.410 |   2.80   3.085
                 .52   4.357 |   1.28  50.961 |   2.05   5.316 |   2.82   3.059
                 .53   4.448 |   1.30  42.579 |   2.07   5.225 |   2.83   3.032
                 .55   4.543 |   1.32  36.482 |   2.08   5.138 |   2.85   3.007
                 .57   4.642 |   1.33  31.873 |   2.10   5.054 |   2.87   2.982
                 .58   4.747 |   1.35  28.279 |   2.12   4.973 |   2.88   2.957
                 .60   4.857 |   1.37  25.406 |   2.13   4.895 |   2.90   2.933
                 .62   4.973 |   1.38  23.062 |   2.15   4.820 |   2.92   2.909
                 .63   5.096 |   1.40  21.116 |   2.17   4.747 |   2.93   2.886
                 .65   5.225 |   1.42  19.476 |   2.18   4.677 |   2.95   2.863
                 .67   5.362 |   1.43  18.078 |   2.20   4.609 |   2.97   2.840
                 .68   5.508 |   1.45  16.871 |   2.22   4.543 |   2.98   2.818
                 .70   5.662 |   1.47  15.820 |   2.23   4.479 |   3.00   2.796
                 .72   5.827 |   1.48  14.896 |   2.25   4.417 |   3.02   2.775
                 .73   6.003 |   1.50  14.079 |   2.27   4.357 |
                 .75   6.191 |   1.52  13.350 |   2.28   4.299 |
                 .77   6.392 |   1.53  12.697 |   2.30   4.243 |

------------------------------------------------------------------------------
001:0003----------------------------------------------------------------------
*=========================================================================
*FUTURE NORTH -> 22.7ha URBAN (Assumed Tributary Area to Future Pond)
*             -> FIELD TILE DRY WEATHER FLOW
*=========================================================================
---------------------
| CALIB STANDHYD      |   Area    (ha)=   22.70
| 01:201    DT= 1.00 |   Total Imp(%)=   60.00   Dir. Conn.(%)=   60.00
---------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area      (ha)=     13.62          9.08
     Dep. Storage      (mm)=      1.00          5.00
     Average Slope      (%)=      2.50          2.50
     Length             (m)=     45.00         33.00
     Mannings n            =      .015          .050

     Max.eff.Inten.(mm/hr)=    177.84         26.28
                over (min)       1.00          5.00
     Storage Coeff.  (min)=      1.04 (ii)     4.86 (ii)
     Unit Hyd. Tpeak (min)=      1.00          5.00
     Unit Hyd. peak  (cms)=      1.05           .23
                                                             *TOTALS*
     PEAK FLOW       (cms)=      5.31           .43           5.418 (iii)
     TIME TO PEAK    (hrs)=      1.22          1.32           1.217
     RUNOFF VOLUME    (mm)=     32.13          8.64          22.733
     TOTAL RAINFALL   (mm)=     33.13         33.13          33.130
     RUNOFF COEFFICIENT   =       .97           .26            .686

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0     Ia = Dep. Storage  (Above)
```

```
   (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
        THAN THE STORAGE COEFFICIENT.
  (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---------------------------------------------------------------------------------
1:0004---------------------------------------------------------------------------
===============================================================================
OUTE FLOW THROUGH FUTURE POND
OND STAGE-STORAGE RELATIONSHIP HAS BEEN SET UP TO PROVIDE REASONABLE TARGET
LOW ESTIMATES FOR THE DETAILED DESIGN OF POND 1 AND THE FUTURE DESIGN OF
OND 3
===============================================================================
-------------------
ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
 IN>01:(201    )   |
OUT<02:(000301)    |    =========  OUTLFOW STORAGE TABLE  =========
-------------------     OUTFLOW    STORAGE   |  OUTFLOW   STORAGE
                         (cms)     (ha.m.)   |   (cms)    (ha.m.)
                          .000  .0000E+00    |     .680  .9200E+00
                          .140  .2800E+00    |     .730  .1070E+01
                          .285  .3750E+00    |     .790  .1230E+01
                          .485  .6000E+00    |    1.000  .1810E+01
                          .572  .7100E+00    |   10.000  .1000E+02

   ROUTING RESULTS             AREA     QPEAK     TPEAK      R.V.
   -------------------         (ha)     (cms)     (hrs)      (mm)
   INFLOW >01: (201    )      22.70     5.418     1.217    22.733
   OUTFLOW<02: (000301)       22.70      .280     2.033    22.732
  OVERFLOW<03: (       )        .00      .000      .000      .000

            TOTAL NUMBER OF SIMULATED OVERFLOWS  =          0
            CUMULATIVE TIME OF OVERFLOWS  (hours)=        .00
            PERCENTAGE OF TIME OVERFLOWING    (%)=        .00


            PEAK   FLOW   REDUCTION [Qout/Qin](%)=    5.170
            TIME SHIFT OF PEAK FLOW         (min)=    49.00
            MAXIMUM  STORAGE   USED       (ha.m.)=.3718E+00

---------------------------------------------------------------------------------
1:0005---------------------------------------------------------------------------
===============================================================================
EST CATCHMENT -> 22.86ha URBAN (i.e. Phase 2&3 Area Tributary to Pond 1)
===============================================================================
-------------------
CALIB STANDHYD    |   Area    (ha)=   22.86
01:201   DT= 1.00 |   Total Imp(%)=   60.00   Dir. Conn.(%)=   60.00
-------------------
                            IMPERVIOUS    PERVIOUS (i)
   Surface Area     (ha)=     13.72          9.14
   Dep. Storage     (mm)=      1.00          5.00
   Average Slope     (%)=      2.50          2.50
   Length            (m)=     45.00         33.00
   Mannings n           =      .015          .050

   Max.eff.Inten.(mm/hr)=    177.84         26.28
              over (min)      1.00          5.00
   Storage Coeff.  (min)=     1.04 (ii)     4.86 (ii)
   Unit Hyd. Tpeak (min)=     1.00          5.00
   Unit Hyd. peak  (cms)=     1.05           .23
                                                        *TOTALS*
   PEAK FLOW       (cms)=     5.35           .44         5.456 (iii)
   TIME TO PEAK    (hrs)=     1.22          1.32         1.217
   RUNOFF VOLUME    (mm)=    32.13          8.64        22.733
   TOTAL RAINFALL   (mm)=    33.13         33.13        33.130
   RUNOFF COEFFICIENT   =      .97           .26          .686

   (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
       CN* =  80.0    Ia = Dep. Storage  (Above)
  (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
       THAN THE STORAGE COEFFICIENT.
 (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---------------------------------------------------------------------------------
1:0006---------------------------------------------------------------------------
```

```
*==============================================================================
*ADD RUNOFF FROM WEST CATCHMENT TO OUTFLOW FROM FUTURE POND 3
*==============================================================================
-------------------------
| ADD HYD (          5) | ID: NHYD        AREA     QPEAK    TPEAK    R.V.     DWF
-------------------------                 (ha)     (cms)    (hrs)    (mm)    (cms)
                   ID1 01:201             22.86    5.456     1.22   22.73    .000
                  +ID2 02:       301      22.70     .280     2.03   22.73    .000
                  +ID3 03:                  .00     .000      .00     .00    .000  **DRY**
                  ==================================================================
                   SUM 04:         5      45.56    5.530     1.22   22.73    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

---------------------------------------------------------------------------------
001:0007-------------------------------------------------------------------------
*==============================================================================
*ROUTE HYDROGRAPH THROUGH POND 1
*==============================================================================
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>04:(000005)   |
| OUT<01:(000401)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------     OUTFLOW    STORAGE   |  OUTFLOW   STORAGE
                          (cms)     (ha.m.)   |   (cms)    (ha.m.)
                           .000  .0000E+00    |   1.351  .9228E+00
                           .022  .5970E-01    |   1.499  .1093E+01
                           .036  .1213E+00    |   1.632  .1270E+01
                           .046  .1848E+00    |   1.695  .1362E+01
                           .155  .2501E+00    |   1.756  .1456E+01
                           .347  .3173E+00    |   1.815  .1551E+01
                           .593  .3865E+00    |   1.871  .1648E+01
                           .751  .4574E+00    |   1.926  .1747E+01
                           .993  .6050E+00    |   1.980  .1849E+01
                          1.186  .7601E+00    |    .000  .0000E+00

    ROUTING RESULTS             AREA     QPEAK     TPEAK      R.V.
    --------------------        (ha)     (cms)     (hrs)      (mm)
    INFLOW >04: (000005)       45.56     5.530     1.217    22.732
    OUTFLOW<01: (000401)       45.56      .577     1.983    22.732
   OVERFLOW<02: (000001)         .00      .000      .000      .000

             TOTAL NUMBER OF SIMULATED OVERFLOWS  =          0
             CUMULATIVE TIME OF OVERFLOWS  (hours)=        .00
             PERCENTAGE OF TIME OVERFLOWING    (%)=        .00


             PEAK   FLOW   REDUCTION [Qout/Qin](%)=   10.442
             TIME SHIFT OF PEAK FLOW         (min)=    46.00
             MAXIMUM  STORAGE   USED       (ha.m.)=.3821E+00

---------------------------------------------------------------------------------
001:0008-------------------------------------------------------------------------
*==============================================================================
*EAST CATCHMENT -> 8.93ha Proposed URBAN + Assumed Future 3.59ha Park/Yard Area
*==============================================================================
--------------------
| CALIB STANDHYD    |   Area    (ha)=    8.93
| 03:2021  DT= 1.00 |   Total Imp(%)=   60.00   Dir. Conn.(%)=   60.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=      5.36          3.57
    Dep. Storage     (mm)=      1.00          5.00
    Average Slope     (%)=      2.50          2.50
    Length            (m)=     45.00         33.00
    Mannings n           =      .015          .050

    Max.eff.Inten.(mm/hr)=    177.84         26.28
               over (min)      1.00          5.00
    Storage Coeff.  (min)=     1.04 (ii)     4.86 (ii)
    Unit Hyd. Tpeak (min)=     1.00          5.00
    Unit Hyd. peak  (cms)=     1.05           .23
                                                         *TOTALS*
    PEAK FLOW       (cms)=     2.09           .17         2.131 (iii)
    TIME TO PEAK    (hrs)=     1.22          1.32         1.217
```

```
    RUNOFF VOLUME     (mm)=       32.13         8.64          22.733
    TOTAL RAINFALL    (mm)=       33.13        33.13          33.130
    RUNOFF COEFFICIENT   =          .97          .26            .686

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
          CN* =  80.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---------------------------------------------------------------------------------
1:0009---------------------------------------------------------------------------
---------------------
CALIB NASHYD        |   Area    (ha)=    3.59   Curve Number   (CN)=80.00
04:2022   DT= 1.00 |   Ia      (mm)=   5.000   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .200

    Unit Hyd Qpeak  (cms)=     .686

    PEAK FLOW       (cms)=     .105 (i)
    TIME TO PEAK    (hrs)=    1.500
    RUNOFF VOLUME    (mm)=    8.636
    TOTAL RAINFALL   (mm)=   33.130
    RUNOFF COEFFICIENT   =     .261

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---------------------------------------------------------------------------------
1:0010---------------------------------------------------------------------------
-----------------------
ADD HYD (          9) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
-----------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
                  ID1 03:2021              8.93    2.131    1.22  22.73    .000
                 +ID2 04:2022              3.59     .105    1.50   8.64    .000
                  ===========================================================
                  SUM 05:          9      12.52    2.139    1.22  18.69    .000

  NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

---------------------------------------------------------------------------------
1:0011---------------------------------------------------------------------------
============================================================================
OUTE FLOW THROUGH WETLAND 2
============================================================================
--------------------
ROUTE RESERVOIR     |    Requested routing time step =  1.0 min.
 IN>05:(000009)     |
OUT<06:(000402)     |    =========  OUTLFOW STORAGE TABLE  =========
--------------------     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .000  .0000E+00   |     .585  .3940E+00
                           .007  .4050E-01   |     .647  .4544E+00
                           .014  .8360E-01   |     .705  .5174E+00
                           .074  .1291E+00   |     .758  .5828E+00
                           .180  .1771E+00   |     .807  .6507E+00
                           .316  .2276E+00   |     .853  .7210E+00
                           .432  .2806E+00   |     .898  .7939E+00
                           .514  .3360E+00   |     .000  .0000E-00

    ROUTING RESULTS             AREA      QPEAK      TPEAK        R.V.
    -------------------         (ha)      (cms)      (hrs)        (mm)
    INFLOW >05: (000009)       12.52      2.139      1.217      18.690
    OUTFLOW<06: (000402)       12.52       .149      2.050      18.690
   OVERFLOW<07: (000002)         .00       .000       .000        .000

                TOTAL NUMBER OF SIMULATED OVERFLOWS  =          0
                CUMULATIVE TIME OF OVERFLOWS  (hours)=        .00
                PERCENTAGE OF TIME OVERFLOWING     (%)=       .00


                PEAK   FLOW   REDUCTION [Qout/Qin](%)=    6.967
                TIME SHIFT OF PEAK FLOW          (min)=   53.00
                MAXIMUM  STORAGE   USED       (ha.m.)=.1631E+00

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

```
001:0012-------------------------------------------------------------------------
*============================================================================
*ADD OUTFLOW FROM POND1 TO OUTFLOW FROM POND 2
*============================================================================
------------------------
| ADD HYD (          9) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
                    ID1 01:        401     45.56     .577    1.98  22.73    .000
                   +ID2 02:          1       .00     .000     .00    .00    .000  **DRY**
                   +ID3 06:        402     12.52     .149    2.05  18.69    .000
                   +ID4 07:          2       .00     .000     .00    .00    .000  **DRY**
                    =============================================================
                    SUM 08:          9     58.08     .726    2.00  21.86    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

---------------------------------------------------------------------------------
001:0013-------------------------------------------------------------------------
      FINISH
---------------------------------------------------------------------------------
*********************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2019-03-09     at 19:33:31
=================================================================================
```

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

 SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO         999    999    =========
 S      W W W  MM MM  H   H   Y Y   MM MM  O   O       9   9  9   9
 SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
     S   W W   M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
 SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9   =========
                                                       9   9  9   9  # 3057174
      StormWater Management HYdrologic Model            999    999   =========

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

+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++++++++ Licensed user: MTE Consultants Inc.                         +++++++++
++++++++                in any City            SERIAL#:3057174       +++++++++
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

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


********************  D E T A I L E D   O U T P U T  ********************
*******************************************************************************
        DATE: 2019-03-09     TIME: 19:33:53     RUN COUNTER: 000710          *
*******************************************************************************
 Input   filename: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\POST\MODEL.dat     *
 Output  filename: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\POST\MODEL.out     *
 Summary filename: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\POST\MODEL.sum     *
 User comments:                                                              *
 1:__________________________________________________________________________*
 2:__________________________________________________________________________*
 3:__________________________________________________________________________*
*******************************************************************************

----------------------------------------------------------------------------------
1:0001----------------------------------------------------------------------------
*******************************************************************************
  Project Name: [THAMESCREST PH2]    Project Number: [35499-200]
  Date         : SEPTEMBER 2018
  Modeller     : [JJM]
  Company      : J.F. Sabourin and Associates Inc.
  License #    : 5826103
*******************************************************************************
-----------------
START              |  Project  dir.: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\POST\
-------------------   Rainfall dir.: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\POST\
  TZERO =    .00 hrs on        0
  METOUT=   2 (output = METRIC)
  NRUN  = 001
  NSTORM=   0
----------------------------------------------------------------------------------
1:0002----------------------------------------------------------------------------
-----------------
READ STORM        |     Filename: 5YR Chicago 3-hr duration
Ptotal=  48.92 mm|     Comments: 5YR Chicago 3-hr duration
-----------------
            TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
             hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
             .02   4.391 |    .78  10.623 |   1.55  19.549 |   2.32   6.674
             .03   4.442 |    .80  11.005 |   1.57  18.691 |   2.33   6.588
             .05   4.495 |    .82  11.419 |   1.58  17.909 |   2.35   6.504
```

```
             .07   4.550 |    .83  11.867 |   1.60  17.192 |   2.37   6.423
             .08   4.606 |    .85  12.356 |   1.62  16.532 |   2.38   6.343
             .10   4.663 |    .87  12.890 |   1.63  15.924 |   2.40   6.266
             .12   4.723 |    .88  13.476 |   1.65  15.361 |   2.42   6.191
             .13   4.784 |    .90  14.123 |   1.67  14.839 |   2.43   6.118
             .15   4.847 |    .92  14.839 |   1.68  14.353 |   2.45   6.047
             .17   4.911 |    .93  15.637 |   1.70  13.900 |   2.47   5.978
             .18   4.978 |    .95  16.532 |   1.72  13.476 |   2.48   5.910
             .20   5.047 |    .97  17.543 |   1.73  13.079 |   2.50   5.845
             .22   5.118 |    .98  18.691 |   1.75  12.706 |   2.52   5.780
             .23   5.191 |   1.00  20.009 |   1.77  12.356 |   2.53   5.718
             .25   5.267 |   1.02  21.534 |   1.78  12.025 |   2.55   5.657
             .27   5.345 |   1.03  23.319 |   1.80  11.714 |   2.57   5.597
             .28   5.426 |   1.05  25.435 |   1.82  11.419 |   2.58   5.539
             .30   5.510 |   1.07  27.980 |   1.83  11.139 |   2.60   5.482
             .32   5.597 |   1.08  31.093 |   1.85  10.875 |   2.62   5.426
             .33   5.687 |   1.10  34.979 |   1.87  10.623 |   2.63   5.372
             .35   5.780 |   1.12  39.952 |   1.88  10.384 |   2.65   5.319
             .37   5.877 |   1.13  46.510 |   1.90  10.156 |   2.67   5.267
             .38   5.978 |   1.15  55.497 |   1.92   9.939 |   2.68   5.216
             .40   6.082 |   1.17  68.440 |   1.93   9.732 |   2.70   5.167
             .42   6.191 |   1.18  88.380 |   1.95   9.535 |   2.72   5.118
             .43   6.305 |   1.20 122.193 |   1.97   9.345 |   2.73   5.070
             .45   6.423 |   1.22 188.707 |   1.98   9.164 |   2.75   5.024
             .47   6.546 |   1.23 139.086 |   2.00   8.991 |   2.77   4.978
             .48   6.674 |   1.25 108.640 |   2.02   8.824 |   2.78   4.933
             .50   6.809 |   1.27  88.380 |   2.03   8.664 |   2.80   4.890
             .52   6.949 |   1.28  74.086 |   2.05   8.510 |   2.82   4.847
             .53   7.096 |   1.30  63.545 |   2.07   8.363 |   2.83   4.805
             .55   7.251 |   1.32  55.497 |   2.08   8.221 |   2.85   4.763
             .57   7.413 |   1.33  49.179 |   2.10   8.084 |   2.87   4.723
             .58   7.583 |   1.35  44.105 |   2.12   7.952 |   2.88   4.683
             .60   7.763 |   1.37  39.952 |   2.13   7.825 |   2.90   4.644
             .62   7.952 |   1.38  36.496 |   2.15   7.702 |   2.92   4.606
             .63   8.152 |   1.40  33.581 |   2.17   7.583 |   2.93   4.568
             .65   8.363 |   1.42  31.093 |   2.18   7.469 |   2.95   4.532
             .67   8.587 |   1.43  28.946 |   2.20   7.358 |   2.97   4.495
             .68   8.824 |   1.45  27.077 |   2.22   7.251 |   2.98   4.460
             .70   9.076 |   1.47  25.435 |   2.23   7.147 |   3.00   4.425
             .72   9.345 |   1.48  23.984 |   2.25   7.047 |   3.02   4.391
             .73   9.632 |   1.50  22.692 |   2.27   6.949 |
             .75   9.939 |   1.52  21.534 |   2.28   6.855 |
             .77  10.269 |   1.53  20.492 |   2.30   6.763 |

----------------------------------------------------------------------------------
001:0003--------------------------------------------------------------------------
*=============================================================================
*FUTURE NORTH -> 22.7ha URBAN (Assumed Tributary Area to Future Pond)
*            -> FIELD TILE DRY WEATHER FLOW
*=============================================================================
---------------------
| CALIB STANDHYD     |   Area    (ha)=   22.70
| 01:201    DT= 1.00 |   Total Imp(%)=   60.00   Dir. Conn.(%)=   60.00
---------------------
                               IMPERVIOUS    PERVIOUS (i)
    Surface Area      (ha)=       13.62         9.08
    Dep. Storage      (mm)=        1.00         5.00
    Average Slope      (%)=        2.50         2.50
    Length             (m)=       45.00        33.00
    Mannings n            =        .015         .050

    Max.eff.Inten.(mm/hr)=      188.71        50.17
               over (min)        1.00         4.00
    Storage Coeff.  (min)=        1.02 (ii)    3.97 (ii)
    Unit Hyd. Tpeak (min)=        1.00         4.00
    Unit Hyd. peak  (cms)=        1.06          .28
                                                          *TOTALS*
    PEAK FLOW        (cms)=        5.97          .90         6.348 (iii)
    TIME TO PEAK     (hrs)=        1.22         1.30         1.217
    RUNOFF VOLUME     (mm)=       47.92        17.96        35.934
    TOTAL RAINFALL    (mm)=       48.92        48.92        48.919
    RUNOFF COEFFICIENT    =         .98          .37          .735

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
          CN* =  80.0     Ia = Dep. Storage  (Above)
```

```
    (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
         THAN THE STORAGE COEFFICIENT.
   (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
1:0004-------------------------------------------------------------------------
================================================================================
OUTE FLOW THROUGH FUTURE POND
OND STAGE-STORAGE RELATIONSHIP HAS BEEN SET UP TO PROVIDE REASONABLE TARGET
LOW ESTIMATES FOR THE DETAILED DESIGN OF POND 1 AND THE FUTURE DESIGN OF
OND 3
================================================================================
--------------------
ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
 IN>01:(201    )   |
OUT<02:(000301)    |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE    |  OUTFLOW    STORAGE
                         (cms)     (ha.m.)    |   (cms)     (ha.m.)
                          .000  .0000E+00     |     .680  .9200E+00
                          .140  .2800E+00     |     .730  .1070E+01
                          .285  .3750E+00     |     .790  .1230E+01
                          .485  .6000E+00     |    1.000  .1810E+01
                          .572  .7100E+00     |   10.000  .1000E+02

  ROUTING RESULTS              AREA      QPEAK      TPEAK        R.V.
  --------------------         (ha)      (cms)      (hrs)        (mm)
  INFLOW >01: (201    )       22.70      6.348      1.217      35.934
  OUTFLOW<02: (000301)        22.70       .457      2.083      35.933
 OVERFLOW<03: (       )         .00       .000       .000        .000

            TOTAL NUMBER OF SIMULATED OVERFLOWS  =         0
            CUMULATIVE TIME OF OVERFLOWS  (hours)=       .00
            PERCENTAGE OF TIME OVERFLOWING    (%)=       .00


            PEAK   FLOW   REDUCTION [Qout/Qin](%)=     7.201
            TIME SHIFT OF PEAK FLOW          (min)=    52.00
            MAXIMUM  STORAGE   USED       (ha.m.)=.5687E+00

-------------------------------------------------------------------------------
1:0005-------------------------------------------------------------------------
================================================================================
EST CATCHMENT -> 22.86ha URBAN (i.e. Phase 2&3 Area Tributary to Pond 1)
================================================================================
--------------------
CALIB STANDHYD     |   Area    (ha)=   22.86
01:201    DT= 1.00 |   Total Imp(%)=   60.00   Dir. Conn.(%)=   60.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
  Surface Area     (ha)=      13.72          9.14
  Dep. Storage     (mm)=       1.00          5.00
  Average Slope     (%)=       2.50          2.50
  Length            (m)=      45.00         33.00
  Mannings n          =        .015          .050

  Max.eff.Inten.(mm/hr)=     188.71         50.17
             over (min)       1.00          4.00
  Storage Coeff.  (min)=       1.02 (ii)     3.97 (ii)
  Unit Hyd. Tpeak (min)=       1.00          4.00
  Unit Hyd. peak  (cms)=       1.06           .28
                                                          *TOTALS*
  PEAK FLOW       (cms)=       6.01           .91          6.393 (iii)
  TIME TO PEAK    (hrs)=       1.22          1.30          1.217
  RUNOFF VOLUME    (mm)=      47.92         17.96         35.934
  TOTAL RAINFALL   (mm)=      48.92         48.92         48.919
  RUNOFF COEFFICIENT  =        .98           .37           .735

    (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
        CN* =  80.0     Ia = Dep. Storage  (Above)
   (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
        THAN THE STORAGE COEFFICIENT.
  (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
1:0006-------------------------------------------------------------------------
```

```
*================================================================================
*ADD RUNOFF FROM WEST CATCHMENT TO OUTFLOW FROM FUTURE POND 3
*================================================================================
----------------------
| ADD HYD |         5) | ID: NHYD          AREA     QPEAK    TPEAK   R.V.     DWF
----------------------                     (ha)     (cms)    (hrs)   (mm)    (cms)
                   ID1 01:201             22.86     6.393     1.22  35.93     .000
                  +ID2 02:         301    22.70      .457     2.08  35.93     .000
                  +ID3 03:                  .00      .000      .00    .00     .000  **DRY**
                  ==============================================================
                   SUM 04:           5    45.56     6.510     1.22  35.93     .000

  NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
001:0007-----------------------------------------------------------------------
*================================================================================
*ROUTE HYDROGRAPH THROUGH POND 1
*================================================================================
---------------------
| ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
|  IN>04:(000005)    |
| OUT<01:(000401)    |    =========  OUTLFOW STORAGE TABLE  =========
---------------------     OUTFLOW    STORAGE    |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)    |   (cms)     (ha.m.)
                            .000  .0000E+00     |    1.351  .9228E+00
                            .022  .5970E-01     |    1.499  .1093E+01
                            .036  .1213E+00     |    1.632  .1270E+01
                            .046  .1848E+00     |    1.695  .1362E+01
                            .155  .2501E+00     |    1.756  .1456E+01
                            .347  .3173E+00     |    1.815  .1551E+01
                            .593  .3865E+00     |    1.871  .1648E+01
                            .751  .4574E+00     |    1.926  .1747E+01
                            .993  .6250E+00     |    1.980  .1849E+01
                           1.186  .7601E+00     |     .000  .0000E+00

    ROUTING RESULTS              AREA      QPEAK      TPEAK        R.V.
    --------------------         (ha)      (cms)      (hrs)        (mm)
    INFLOW >04: (000005)        45.56      6.510      1.217      35.933
    OUTFLOW<01: (000401)        45.56       .945      2.017      35.933
   OVERFLOW<02: (000001)          .00       .000       .000        .000

              TOTAL NUMBER OF SIMULATED OVERFLOWS  =         0
              CUMULATIVE TIME OF OVERFLOWS  (hours)=       .00
              PERCENTAGE OF TIME OVERFLOWING    (%)=       .00


              PEAK   FLOW   REDUCTION [Qout/Qin](%)=    14.509
              TIME SHIFT OF PEAK FLOW          (min)=    48.00
              MAXIMUM  STORAGE   USED       (ha.m.)=.5754E+00

-------------------------------------------------------------------------------
001:0008-----------------------------------------------------------------------
*================================================================================
*EAST CATCHMENT -> 8.93ha Proposed URBAN + Assumed Future 3.59ha Park/Yard Area
*================================================================================
---------------------
| CALIB STANDHYD     |   Area    (ha)=    8.93
| 03:2021   DT= 1.00 |   Total Imp(%)=   60.00   Dir. Conn.(%)=   60.00
---------------------
                            IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=       5.36          3.57
    Dep. Storage     (mm)=       1.00          5.00
    Average Slope     (%)=       2.50          2.50
    Length            (m)=      45.00         33.00
    Mannings n          =        .015          .050

    Max.eff.Inten.(mm/hr)=     188.71         50.17
               over (min)       1.00          4.00
    Storage Coeff.  (min)=       1.02 (ii)     3.97 (ii)
    Unit Hyd. Tpeak (min)=       1.00          4.00
    Unit Hyd. peak  (cms)=       1.06           .28
                                                            *TOTALS*
    PEAK FLOW       (cms)=       2.35           .36          2.497 (iii)
    TIME TO PEAK    (hrs)=       1.22          1.30          1.217
```

```
    RUNOFF VOLUME     (mm)=       47.92          17.96          35.934
    TOTAL RAINFALL    (mm)=       48.92          48.92          48.919
    RUNOFF COEFFICIENT    =         .98            .37            .735

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
          CN* =  80.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----------------------------------------------------------------------------
1:0009-----------------------------------------------------------------------
---------------------
CALIB NASHYD         |   Area    (ha)=    3.59   Curve Number   (CN)=80.00
04:2022   DT= 1.00 |   Ia      (mm)=   5.000   # of Linear Res.(N)= 3.00
---------------------    U.H. Tp(hrs)=    .200

    Unit Hyd Qpeak  (cms)=      .686

    PEAK FLOW       (cms)=      .214 (i)
    TIME TO PEAK    (hrs)=     1.500
    RUNOFF VOLUME    (mm)=    17.956
    TOTAL RAINFALL   (mm)=    48.919
    RUNOFF COEFFICIENT   =      .367

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----------------------------------------------------------------------------
1:0010-----------------------------------------------------------------------
----------------------
ADD HYD (          9) | ID: NHYD           AREA      QPEAK    TPEAK   R.V.    DWF
----------------------                      (ha)      (cms)    (hrs)   (mm)   (cms)
                  ID1 03:2021              8.93     2.497     1.22  35.93    .000
                 +ID2 04:2022              3.59      .214     1.50  17.96    .000
                  ==========================================================
                  SUM 05:          9      12.52     2.528     1.22  30.78    .000

  NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-----------------------------------------------------------------------------
1:0011-----------------------------------------------------------------------
========================================================================
OUTE FLOW THROUGH WETLAND 2
========================================================================
--------------------
ROUTE RESERVOIR     |    Requested routing time step =  1.0 min.
 IN>05:(000009)     |
OUT<06:(000402)     |    =========  OUTLFOW STORAGE TABLE  =========
--------------------     OUTFLOW     STORAGE   |  OUTFLOW     STORAGE
                          (cms)     (ha.m.)    |   (cms)      (ha.m.)
                           .000  .0000E+00     |     .585  .3940E+00
                           .007  .4050E-01     |     .647  .4544E+00
                           .014  .8360E-01     |     .705  .5174E+00
                           .074  .1291E+00     |     .758  .5828E+00
                           .180  .1771E+00     |     .807  .6507E+00
                           .316  .2276E+00     |     .853  .7210E+00
                           .432  .2806E+00     |     .898  .7939E+00
                           .514  .3360E+00     |     .000  .0000E+00

   ROUTING RESULTS               AREA      QPEAK      TPEAK          R.V.
   --------------------          (ha)      (cms)      (hrs)          (mm)
   INFLOW >05: (000009)         12.52      2.528      1.217        30.779
   OUTFLOW<06: (000402)         12.52       .338      1.883        30.778
  OVERFLOW<07: (000002)           .00       .000       .000          .000

               TOTAL NUMBER OF SIMULATED OVERFLOWS  =          0
               CUMULATIVE TIME OF OVERFLOWS  (hours)=        .00
               PERCENTAGE OF TIME OVERFLOWING    (%)=        .00


               PEAK   FLOW   REDUCTION [Qout/Qin](%)=   13.364
               TIME SHIFT OF PEAK FLOW          (min)=   40.00
               MAXIMUM  STORAGE   USED       (ha.m.)=.2376E+00

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

```
001:0012---------------------------------------------------------------------
*========================================================================
*ADD OUTFLOW FROM POND1 TO OUTFLOW FROM POND 2
*========================================================================
-----------------------
| ADD HYD (          9) | ID: NHYD           AREA      QPEAK    TPEAK   R.V.     DWF
-----------------------                      (ha)      (cms)    (hrs)   (mm)    (cms)
                  ID1 01:         401     45.56      .945     2.02  35.93    .000
                 +ID2 02:           1       .00      .000      .00    .00    .000  **DRY**
                 +ID3 06:         402     12.52      .338     1.88  30.78    .000
                 +ID4 07:           2       .00      .000      .00    .00    .000  **DRY**
                  ==============================================================
                  SUM 08:           9     58.08     1.281     1.95  34.82    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-----------------------------------------------------------------------------
001:0013---------------------------------------------------------------------
      FINISH
-----------------------------------------------------------------------------
*****************************************************************************
    WARNINGS / ERRORS / NOTES
    -------------------------
   Simulation ended on 2019-03-09     at 19:33:53
=============================================================================
```

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

 SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO          999    999    =========
 S       W W W  MM MM  H   H   Y Y   MM MM  O   O        9   9  9   9
 SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##   9   9  9   9   Ver  4.05
     S   W W   M   M  H   H    Y    M   M  O   O         9999   9999   Sept 2011
 SSSSS   W W   M   M  H   H    Y    M   M   OOO             9      9   =========
                                                         9   9  9   9   # 3057174
      StormWater Management HYdrologic Model              999    999    =========

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

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++++++++ Licensed user: MTE Consultants Inc.                           +-+++++++
++++++++                in any City             SERIAL#:3057174        +-+++++++
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

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


*********************   D E T A I L E D   O U T P U T   *********************
**********************************************************************************
        DATE: 2019-03-09      TIME: 19:34:17      RUN COUNTER: 300711           *
**********************************************************************************
 Input   filename: Q:\35499\200(PH~1\PRELIM~1\SWM\SWMHYMO\POST\MODEL.dat        *
 Output  filename: Q:\35499\200(PH~1\PRELIM~1\SWM\SWMHYMO\POST\MODEL.out        *
 Summary filename: Q:\35499\200(PH~1\PRELIM~1\SWM\SWMHYMO\POST\MODEL.sum        *
 User comments:                                                                 *
 1:_____________________________________________________________________________*
 2:_____________________________________________________________________________*
 3:_____________________________________________________________________________*
**********************************************************************************

-------------------------------------------------------------------------------------
1:0001-------------------------------------------------------------------------------
**********************************************************************************
  Project Name: [THAMESCREST PH2]    Project Number: [35499-200]
  Date         : SEPTEMBER 2018
  Modeller     : [JJM]
  Company      : J.F. Sabourin and Associates Inc.
  License #    : 5826103
**********************************************************************************
-------------------
START              |  Project  dir.: Q:\35499\200(PH~1\PRELIM~1\SWM\SWMHYMO\POST\
-------------------   Rainfall dir.: Q:\35499\200(PH~1\PRELIM~1\SWM\SWMHYMO\POST\
  TZERO =    .00 hrs on        0
  METOUT=    2 (output = METRIC)
  NRUN  = 001
  NSTORM=    0
-------------------------------------------------------------------------------------
1:0002-------------------------------------------------------------------------------
-------------------
READ STORM         |    Filename: 10YR Chicago 3-hr duration
Ptotal=  59.52 mm|    Comments: 10YR Chicago 3-hr duration
-------------------
           TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
            hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
            .02   5.450 |    .78  13.373 |   1.55  24.695 |   2.32   8.341
            .03   5.515 |    .80  13.860 |   1.57  23.615 |   2.33   8.232
            .05   5.582 |    .82  14.387 |   1.58  22.628 |   2.35   8.125
```

```
            .07   5.650 |    .83  14.958 |   1.60  21.722 |   2.37   8.022
            .08   5.721 |    .85  15.581 |   1.62  20.887 |   2.38   7.921
            .10   5.794 |    .87  16.261 |   1.63  20.117 |   2.40   7.823
            .12   5.869 |    .88  17.007 |   1.65  19.403 |   2.42   7.728
            .13   5.946 |    .90  17.829 |   1.67  18.740 |   2.43   7.635
            .15   6.025 |    .92  18.740 |   1.68  18.122 |   2.45   7.545
            .17   6.107 |    .93  19.753 |   1.70  17.546 |   2.47   7.457
            .18   6.191 |    .95  20.887 |   1.72  17.007 |   2.48   7.372
            .20   6.278 |    .97  22.165 |   1.73  16.502 |   2.50   7.288
            .22   6.368 |    .98  23.615 |   1.75  16.027 |   2.52   7.207
            .23   6.461 |   1.00  25.274 |   1.77  15.581 |   2.53   7.128
            .25   6.557 |   1.02  27.188 |   1.78  15.160 |   2.55   7.050
            .27   6.656 |   1.03  29.420 |   1.80  14.763 |   2.57   6.975
            .28   6.758 |   1.05  32.052 |   1.82  14.387 |   2.58   6.901
            .30   6.865 |   1.07  35.199 |   1.83  14.031 |   2.60   6.829
            .32   6.975 |   1.08  39.020 |   1.85  13.693 |   2.62   6.758
            .33   7.089 |   1.10  43.746 |   1.87  13.373 |   2.63   6.689
            .35   7.207 |   1.12  49.722 |   1.88  13.068 |   2.65   6.622
            .37   7.330 |   1.13  57.481 |   1.90  12.778 |   2.67   6.557
            .38   7.457 |   1.15  67.899 |   1.92  12.501 |   2.68   6.492
            .40   7.590 |   1.17  82.490 |   1.93  12.237 |   2.70   6.430
            .42   7.728 |   1.18 104.096 |   1.95  11.984 |   2.72   6.368
            .43   7.872 |   1.20 138.640 |   1.97  11.743 |   2.73   6.308
            .45   8.022 |   1.22 200.417 |   1.98  11.512 |   2.75   6.249
            .47   8.178 |   1.23 155.038 |   2.00  11.291 |   2.77   6.191
            .48   8.341 |   1.25 125.085 |   2.02  11.078 |   2.78   6.135
            .50   8.512 |   1.27 104.096 |   2.03  10.875 |   2.80   6.079
            .52   8.691 |   1.28  88.710 |   2.05  10.679 |   2.82   6.025
            .53   8.878 |   1.30  77.026 |   2.07  10.491 |   2.83   5.972
            .55   9.075 |   1.32  67.899 |   2.08  10.310 |   2.85   5.920
            .57   9.281 |   1.33  60.601 |   2.10  10.135 |   2.87   5.869
            .58   9.498 |   1.35  54.652 |   2.12   9.967 |   2.88   5.818
            .60   9.726 |   1.37  49.722 |   2.13   9.805 |   2.90   5.769
            .62   9.967 |   1.38  45.578 |   2.15   9.649 |   2.92   5.721
            .63  10.222 |   1.40  42.052 |   2.17   9.498 |   2.93   5.674
            .65  10.491 |   1.42  39.020 |   2.18   9.352 |   2.95   5.627
            .67  10.776 |   1.43  36.388 |   2.20   9.211 |   2.97   5.582
            .68  11.078 |   1.45  34.084 |   2.22   9.075 |   2.98   5.537
            .70  11.400 |   1.47  32.052 |   2.23   8.943 |   3.00   5.493
            .72  11.743 |   1.48  30.248 |   2.25   8.815 |   3.02   5.450
            .73  12.109 |   1.50  28.636 |   2.27   8.691 |
            .75  12.501 |   1.52  27.188 |   2.28   8.571 |
            .77  12.921 |   1.53  25.881 |   2.30   8.454 |

-------------------------------------------------------------------------------------
001:0003-----------------------------------------------------------------------------
*================================================================================
*FUTURE NORTH -> 22.7ha URBAN (Assumed Tributary Area to Future Pond)
*             -> FIELD TILE DRY WEATHER FLOW
*================================================================================
---------------------
| CALIB STANDHYD      |   Area    (ha)=   22.70
| 01:201    DT= 1.00 |   Total Imp(%)=   60.00   Dir. Conn.(%)=   60.00
---------------------
                              IMPERVIOUS     PERVIOUS (i)
    Surface Area      (ha)=      13.62          9.08
    Dep. Storage      (mm)=       1.00          5.00
    Average Slope     (%)=        2.50          2.50
    Length            (m)=       45.00         33.00
    Mannings n           =        .015          .050

    Max.eff.Inten.(mm/hr)=      200.42         65.38
              over (min)         1.00          4.00
    Storage Coeff.  (min)=        .99 (ii)     3.65 (ii)
    Unit Hyd. Tpeak (min)=       1.00          4.00
    Unit Hyd. peak  (cms)=       1.08           .30
                                                            *TOTALS*
    PEAK FLOW       (cms)=       6.50          1.25           7.095 (iii)
    TIME TO PEAK    (hrs)=       1.22          1.30           1.217
    RUNOFF VOLUME   (mm)=       58.52         25.18          45.185
    TOTAL RAINFALL  (mm)=       59.52         59.52          59.518
    RUNOFF COEFFICIENT   =        .98           .42            .759

      (i) CN PROCEDURE SELECTED FOR PERVICUS LOSSES:
          CN* =  80.0     Ia = Dep. Storage  (Above)
```

```
    (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
         THAN THE STORAGE COEFFICIENT.
   (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----------------------------------------------------------------------------
1:0004-----------------------------------------------------------------------
=========================================================================
:OUTE FLOW THROUGH FUTURE POND
'OND STAGE-STORAGE RELATIONSHIP HAS BEEN SET UP TO PROVIDE REASONABLE TARGET
'LOW ESTIMATES FOR THE DETAILED DESIGN OF POND 1 AND THE FUTURE DESIGN OF
'OND 3
=========================================================================
--------------------
ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
 IN>01:(201    )   |
OUT<02:(000301)    |    =========  OUTLFOW STORAGE TABLE  =========
-------------------     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                         (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .000  .0000E+00    |     .680  .9200E+00
                          .140  .2800E+00    |     .730  .1070E+01
                          .285  .3750E+00    |     .790  .1230E+01
                          .485  .6000E+00    |    1.000  .1810E+01
                          .572  .7100E+00    |   10.000  .1000E+02

   ROUTING RESULTS              AREA     QPEAK      TPEAK        R.V.
   --------------------         (ha)     (cms)      (hrs)        (mm)
   INFLOW >01: (201    )       22.70     7.095      1.217      45.185
   OUTFLOW<02: (000301)        22.70      .572      2.100      45.184
  OVERFLOW<03: (       )         .00      .000       .000        .000

               TOTAL NUMBER OF SIMULATED OVERFLOWS  =              0
               CUMULATIVE TIME OF OVERFLOWS  (hours)=            .00
               PERCENTAGE OF TIME OVERFLOWING    (%)=            .00


               PEAK   FLOW   REDUCTION [Qout/Qin](%)=          8.069
               TIME SHIFT OF PEAK FLOW          (min)=         53.00
               MAXIMUM  STORAGE   USED        (ha.m.)=.7109E+00

-----------------------------------------------------------------------------
1:0005-----------------------------------------------------------------------
=========================================================================
EST CATCHMENT -> 22.86ha URBAN (i.e. Phase 2&3 Area Tributary to Pond 1)
=========================================================================
--------------------
CALIB STANDHYD      |   Area    (ha)=   22.86
01:201    DT= 1.00  |   Total Imp(%)=   60.00   Dir. Conn.(%)=   60.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
   Surface Area      (ha)=     13.72          9.14
   Dep. Storage      (mm)=      1.00          5.00
   Average Slope      (%)=      2.50          2.50
   Length             (m)=     45.00         33.00
   Mannings n            =      .015          .050

   Max.eff.Inten.(mm/hr)=    200.42         65.38
              over (min)      1.00          4.00
   Storage Coeff.  (min)=       .99 (ii)     3.65 (ii)
   Unit Hyd. Tpeak (min)=      1.00          4.00
   Unit Hyd. peak  (cms)=      1.08           .30
                                                         *TOTALS*
   PEAK FLOW       (cms)=      6.55          1.25          7.145 (iii)
   TIME TO PEAK    (hrs)=      1.22          1.30          1.217
   RUNOFF VOLUME    (mm)=     58.52         25.18         45.185
   TOTAL RAINFALL   (mm)=     59.52         59.52         59.518
   RUNOFF COEFFICIENT   =       .98           .42           .759

     (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
         CN* =  80.0     Ia = Dep. Storage  (Above)
    (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
         THAN THE STORAGE COEFFICIENT.
   (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----------------------------------------------------------------------------
1:0006-----------------------------------------------------------------------
```

```
*========================================================================
*ADD RUNOFF FROM WEST CATCHMENT TO OUTFLOW FROM FUTURE POND 3
*========================================================================
----------------------
| ADD HYD (        5) | ID: NHYD         AREA     QPEAK    TPEAK   R.V.     DWF
----------------------                   (ha)     (cms)    (hrs)   (mm)    (cms)
                  ID1 01:201            22.86     7.145     1.22  45.18     .000
                 +ID2 02:        301    22.70      .572     2.10  45.18     .000
                 +ID3 03:                 .00      .000      .00    .00     .000  **DRY**
                 ==================================================================
                  SUM 04:          5    45.56     7.307     1.22  45.18     .000

  NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-----------------------------------------------------------------------------
001:0007---------------------------------------------------------------------
*========================================================================
*ROUTE HYDROGRAPH THROUGH POND 1
*========================================================================
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>04:(000005)   |
| OUT<01:(000401)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .000  .0000E+00    |    1.351  .9228E+00
                           .022  .5970E-01    |    1.499  .1093E+01
                           .036  .1213E+00    |    1.632  .1270E+01
                           .046  .1848E+00    |    1.695  .1362E+01
                           .155  .2501E+00    |    1.756  .1456E+01
                           .347  .3173E+00    |    1.815  .1551E+01
                           .593  .3865E+00    |    1.871  .1648E+01
                           .751  .4574E+00    |    1.926  .1747E+01
                           .993  .6050E+00    |    1.980  .1849E+01
                          1.186  .7601E+00    |     .000  .0000E+00

    ROUTING RESULTS              AREA     QPEAK      TPEAK        R.V.
    --------------------         (ha)     (cms)      (hrs)        (mm)
    INFLOW >04: (000005)        45.56     7.307      1.217      45.184
    OUTFLOW<01: (000401)        45.56     1.145      2.117      45.184
   OVERFLOW<02: (000001)          .00      .000       .000        .000

                TOTAL NUMBER OF SIMULATED OVERFLOWS  =              0
                CUMULATIVE TIME OF OVERFLOWS  (hours)=            .00
                PERCENTAGE OF TIME OVERFLOWING    (%)=            .00


                PEAK   FLOW   REDUCTION [Qout/Qin](%)=         15.665
                TIME SHIFT OF PEAK FLOW          (min)=         54.00
                MAXIMUM  STORAGE   USED        (ha.m.)=.7269E+00

-----------------------------------------------------------------------------
001:0008---------------------------------------------------------------------
*========================================================================
*EAST CATCHMENT -> 8.93ha Proposed URBAN + Assumed Future 3.59ha Park/Yard Area
*========================================================================
--------------------
| CALIB STANDHYD     |   Area    (ha)=    8.93
| 03:2021   DT= 1.00 |   Total Imp(%)=   60.00   Dir. Conn.(%)=   60.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
    Surface Area      (ha)=      5.36          3.57
    Dep. Storage      (mm)=      1.00          5.00
    Average Slope      (%)=      2.50          2.50
    Length             (m)=     45.00         33.00
    Mannings n            =      .015          .050

    Max.eff.Inten.(mm/hr)=    200.42         65.38
               over (min)      1.00          4.00
    Storage Coeff.  (min)=       .99 (ii)     3.65 (ii)
    Unit Hyd. Tpeak (min)=      1.00          4.00
    Unit Hyd. peak  (cms)=      1.08           .30
                                                          *TOTALS*
    PEAK FLOW       (cms)=      2.56           .49          2.791 (iii)
    TIME TO PEAK    (hrs)=      1.22          1.30          1.217
```

```
    RUNOFF VOLUME    (mm)=      58.52         25.18          45.185
    TOTAL RAINFALL   (mm)=      59.52         59.52          59.518
    RUNOFF COEFFICIENT   =        .98           .42            .759

     (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
         CN* =  80.0    Ia = Dep. Storage  (Above)
    (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
         THAN THE STORAGE COEFFICIENT.
   (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 ------------------------------------------------------------------------------
 1:0009------------------------------------------------------------------------
 --------------------
 CALIB NASHYD       |   Area    (ha)=    3.59   Curve Number   (CN)=80.00
 04:2022   DT= 1.00 |   Ia      (mm)=   5.000   # of Linear Res.(N)= 3.00
 --------------------   U.H. Tp(hrs)=    .200

    Unit Hyd Qpeak  (cms)=     .686

    PEAK FLOW       (cms)=     .296 (i)
    TIME TO PEAK    (hrs)=    1.500
    RUNOFF VOLUME    (mm)=   25.184
    TOTAL RAINFALL   (mm)=   59.518
    RUNOFF COEFFICIENT   =     .423

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 ------------------------------------------------------------------------------
 1:0010------------------------------------------------------------------------
 ----------------------
 ADD HYD (          9) | ID: NHYD          AREA    QPEAK   TPEAK  R.V.    DWF
 ----------------------                    (ha)    (cms)   (hrs)  (mm)   (cms)
                     ID1 03:2021           8.93    2.791    1.22 45.18    .000
                    +ID2 04:2022           3.59     .296    1.50 25.18    .000
                     ==========================================================
                     SUM 05:          9   12.52    2.844    1.22 39.45    .000

  NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 ------------------------------------------------------------------------------
 1:0011------------------------------------------------------------------------
 ==========================================================================
 OUTE FLOW THROUGH WETLAND 2
 ==========================================================================
 --------------------
 ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
  IN>05:(000009)    |
 OUT<06:(000402)    |    =========  OUTLFOW STORAGE TABLE  =========
 --------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .000  .0000E+00    |     .585  .3940E+00
                           .007  .4050E-01    |     .647  .4544E+00
                           .014  .8360E-01    |     .705  .5174E+00
                           .074  .1291E+00    |     .758  .5828E+00
                           .180  .1771E+00    |     .807  .6507E+00
                           .316  .2276E+00    |     .853  .7210E+00
                           .432  .2806E+00    |     .898  .7939E+00
                           .514  .3360E+00    |     .000  .0000E+00

    ROUTING RESULTS               AREA      QPEAK     TPEAK        R.V.
    --------------------          (ha)      (cms)     (hrs)        (mm)
    INFLOW >05: (000009)         12.52      2.844     1.217      39.450
    OUTFLOW<06: (000402)         12.52       .451     1.883      39.449
   OVERFLOW<07: (000002)           .00       .000      .000        .000

                TOTAL NUMBER OF SIMULATED OVERFLOWS  =           0
                CUMULATIVE TIME OF OVERFLOWS  (hours)=         .00
                PERCENTAGE OF TIME OVERFLOWING    (%)=         .00

                PEAK   FLOW   REDUCTION [Qout/Qin](%)=   15.855
                TIME SHIFT OF PEAK FLOW          (min)=    40.00
                MAXIMUM  STORAGE   USED        (ha.m.)=.2934E+00

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

```
001:0012-----------------------------------------------------------------------
*=========================================================================
*ADD OUTFLOW FROM POND1 TO OUTFLOW FROM POND 2
*=========================================================================
-----------------------
| ADD HYD (          9) | ID: NHYD          AREA    QPEAK   TPEAK  R.V.    DWF
-----------------------                     (ha)    (cms)   (hrs)  (mm)   (cms)
                    ID1 01:         401    45.56    1.145    2.12 45.18    .000
                   +ID2 02:           1      .00     .000     .00   .00    .000  **DRY**
                   +ID3 06:         402    12.52     .451    1.88 39.45    .000
                   +ID4 07:           2      .00     .000     .00   .00    .000  **DRY**
                    ==========================================================
                    SUM 08:           9    58.08    1.591    2.00 43.95    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
001:0013-----------------------------------------------------------------------
     FINISH
-------------------------------------------------------------------------------
*******************************************************************************
    WARNINGS / ERRORS / NOTES
    -------------------------
  Simulation ended on 2019-03-09     at 19:34:18
===============================================================================
```

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

 SSSSS  W    W  M    M  H    H  Y    Y  M    M   OOO          999    999    =========
 S       W W W  MM MM   H    H   Y Y    MM MM   O    O        9   9  9    9
 SSSSS  W W W   M M M   HHHHH     Y     M M M   O    O   ##   9   9  9    9  Ver  4.05
     S   W W    M    M  H    H    Y     M    M  O    O         9999   9999  Sept 2011
-SSSSS   W W    M    M  H    H    Y     M    M   OOO              9      9   =========
                                                              9   9  9    9  # 3057174
      StormWater Management HYdrologic Model                   999    999   =========

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

+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++++++++ Licensed user: MTE Consultants Inc.                        +++++++++
+++++++++                in any City            SERIAL#:3057174      +++++++++
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

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


*********************    D E T A I L E D   O U T P U T   *********************
*******************************************************************************
         DATE: 2019-03-09      TIME: 19:34:39     RUN COUNTER: 000712        *
*******************************************************************************
 Input   filename: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\POST\MODEL.dat    *
 Output  filename: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\POST\MODEL.out    *
 Summary filename: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\POST\MODEL.sum    *
 User comments:                                                              *
 1:_________________________________________________________________________*
 2:_________________________________________________________________________*
 3:_________________________________________________________________________*
*******************************************************************************

---------------------------------------------------------------------------------
1:0001---------------------------------------------------------------------------
*******************************************************************************
  Project Name: [THAMESCREST PH2]    Project Number: [35499-200]
  Date         : SEPTEMBER 2018
  Modeller     : [JJM]
  Company      : J.F. Sabourin and Associates Inc.
  License #    : 5826103
*******************************************************************************
 -------------------
 START               |  Project  dir.: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\POST\
 -------------------   Rainfall dir.: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\POST\
  TZERO =    .00 hrs on        0
  METOUT=   2 (output = METRIC)
  NRUN  = 001
  NSTORM=   0
---------------------------------------------------------------------------------
1:0002---------------------------------------------------------------------------
 -------------------
 READ STORM          |    Filename: 25YR Chicago 3-hr duration
 Ptotal=  73.22 mm|    Comments: 25YR Chicago 3-hr duration
 -------------------
              TIME     RAIN |   TIME     RAIN |   TIME     RAIN |   TIME     RAIN
               hrs    mm/hr |    hrs    mm/hr |    hrs    mm/hr |    hrs    mm/hr
               .02    6.814 |    .78   17.009 |   1.55   31.495 |   2.32   10.522
               .03    6.898 |    .80   17.637 |   1.57   30.126 |   2.33   10.381
               .05    6.983 |    .82   18.316 |   1.58   28.872 |   2.35   10.244
```

```
               .07    7.071 |    .83   19.052 |   1.60   27.718 |   2.37   10.111
               .08    7.161 |    .85   19.853 |   1.62   26.654 |   2.38    9.981
               .10    7.254 |    .87   20.728 |   1.63   25.670 |   2.40    9.856
               .12    7.349 |    .88   21.687 |   1.65   24.758 |   2.42    9.733
               .13    7.448 |    .90   22.742 |   1.67   23.909 |   2.43    9.614
               .15    7.549 |    .92   23.909 |   1.68   23.118 |   2.45    9.498
               .17    7.654 |    .93   25.206 |   1.70   22.379 |   2.47    9.385
               .18    7.762 |    .95   26.654 |   1.72   21.687 |   2.48    9.275
               .20    7.873 |    .97   28.283 |   1.73   21.038 |   2.50    9.168
               .22    7.988 |    .98   30.126 |   1.75   20.428 |   2.52    9.064
               .23    8.107 |   1.00   32.227 |   1.77   19.853 |   2.53    8.962
               .25    8.230 |   1.02   34.643 |   1.78   19.312 |   2.55    8.863
               .27    8.357 |   1.03   37.446 |   1.80   18.800 |   2.57    8.766
               .28    8.488 |   1.05   40.734 |   1.82   18.316 |   2.58    8.671
               .30    8.625 |   1.07   44.637 |   1.83   17.857 |   2.60    8.579
               .32    8.766 |   1.08   49.336 |   1.85   17.422 |   2.62    8.488
               .33    8.912 |   1.10   55.089 |   1.87   17.009 |   2.63    8.400
               .35    9.064 |   1.12   62.268 |   1.88   16.616 |   2.65    8.314
               .37    9.221 |   1.13   71.439 |   1.90   16.241 |   2.67    8.230
               .38    9.385 |   1.15   83.492 |   1.92   15.884 |   2.68    8.148
               .40    9.556 |   1.17   99.504 |   1.93   15.544 |   2.70    8.067
               .42    9.733 |   1.18  123.291 |   1.95   15.218 |   2.72    7.988
               .43    9.918 |   1.20  158.693 |   1.97   14.907 |   2.73    7.911
               .45   10.111 |   1.22  216.979 |   1.98   14.609 |   2.75    7.836
               .47   10.312 |   1.23  174.744 |   2.00   14.323 |   2.77    7.762
               .48   10.522 |   1.25  145.072 |   2.02   14.050 |   2.78    7.689
               .50   10.742 |   1.27  123.291 |   2.03   13.787 |   2.80    7.619
               .52   10.972 |   1.28  106.745 |   2.05   13.534 |   2.82    7.549
               .53   11.213 |   1.30   93.820 |   2.07   13.292 |   2.83    7.481
               .55   11.466 |   1.32   83.492 |   2.08   13.058 |   2.85    7.415
               .57   11.732 |   1.33   75.079 |   2.10   12.833 |   2.87    7.349
               .58   12.011 |   1.35   68.115 |   2.12   12.616 |   2.88    7.285
               .60   12.306 |   1.37   62.268 |   2.13   12.408 |   2.90    7.222
               .62   12.616 |   1.38   57.301 |   2.15   12.206 |   2.92    7.161
               .63   12.944 |   1.40   53.035 |   2.17   12.011 |   2.93    7.100
               .65   13.292 |   1.42   49.336 |   2.18   11.823 |   2.95    7.041
               .67   13.659 |   1.43   46.104 |   2.20   11.642 |   2.97    6.983
               .68   14.050 |   1.45   43.257 |   2.22   11.466 |   2.98    6.926
               .70   14.465 |   1.47   40.734 |   2.23   11.296 |   3.00    6.870
               .72   14.907 |   1.48   38.482 |   2.25   11.131 |   3.02    6.814
               .73   15.379 |   1.50   36.463 |   2.27   10.972 |
               .75   15.884 |   1.52   34.643 |   2.28   10.817 |
               .77   16.426 |   1.53   32.994 |   2.30   10.667 |

---------------------------------------------------------------------------------
001:0003-------------------------------------------------------------------------
*==============================================================================
*FUTURE NORTH -> 22.7ha URBAN (Assumed Tributary Area to Future Pond)
*             -> FIELD TILE DRY WEATHER FLOW
*==============================================================================
 ---------------------
 | CALIB STANDHYD      |   Area     (ha)=   22.70
 | 01:201    DT= 1.00 |   Total Imp(%)=   60.00   Dir. Conn.(%)=   60.00
 ---------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area      (ha)=     13.62         9.08
     Dep. Storage      (mm)=      1.00         5.00
     Average Slope      (%)=      2.50         2.50
     Length             (m)=     45.00        33.00
     Mannings n            =      .015         .050

     Max.eff.Inten.(mm/hr)=    216.98        90.62
               over (min)       1.00         3.00
     Storage Coeff.  (min)=       .96 (ii)     3.29 (ii)
     Unit Hyd. Tpeak (min)=      1.00         3.00
     Unit Hyd. peak  (cms)=      1.10          .35
                                                          *TOTALS*
     PEAK FLOW       (cms)=      7.21         1.73          8.257 (iii)
     TIME TO PEAK    (hrs)=      1.22         1.28          1.217
     RUNOFF VOLUME    (mm)=     72.22        35.33         57.465
     TOTAL RAINFALL   (mm)=     73.22        73.22         73.220
     RUNOFF COEFFICIENT    =       .99          .48           .785

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =   80.0    Ia = Dep. Storage  (Above)
```

```
    (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
         THAN THE STORAGE COEFFICIENT.
   (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
1:0004--------------------------------------------------------------------------
===============================================================================
OUTE FLOW THROUGH FUTURE POND
OND STAGE-STORAGE RELATIONSHIP HAS BEEN SET UP TO PROVIDE REASONABLE TARGET
LOW ESTIMATES FOR THE DETAILED DESIGN OF POND 1 AND THE FUTURE DESIGN OF
OND 3
===============================================================================
-------------------
ROUTE RESERVOIR   |     Requested routing time step =  1.0 min.
 IN>01:(201    )  |
OUT<02:(000301)   |     =========  OUTLFOW STORAGE TABLE  =========
-------------------     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                         (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .000  .0000E+00    |     .680  .9200E+00
                          .140  .2800E+00    |     .730  .1070E+01
                          .285  .3750E+00    |     .790  .1230E+01
                          .485  .6000E+00    |    1.000  .1810E+01
                          .572  .7100E+00    |   10.000  .1000E+02

   ROUTING RESULTS              AREA     QPEAK     TPEAK        R.V.
   -------------------          (ha)     (cms)     (hrs)        (mm)
   INFLOW >01: (201    )       22.70     8.257     1.217      57.465
   OUTFLOW<02: (000301)        22.70      .676     2.200      57.465
  OVERFLOW<03: (       )         .00      .000      .000        .000

              TOTAL NUMBER OF SIMULATED OVERFLOWS  =          0
              CUMULATIVE TIME OF OVERFLOWS  (hours)=        .00
              PERCENTAGE OF TIME OVERFLOWING    (%)=        .00


              PEAK   FLOW   REDUCTION [Qout/Qin](%)=    8.191
              TIME SHIFT OF PEAK FLOW         (min)=    59.00
              MAXIMUM  STORAGE   USED        (ha.m.)=.9128E+00

--------------------------------------------------------------------------------
1:0005--------------------------------------------------------------------------
===============================================================================
EST CATCHMENT -> 22.86ha URBAN (i.e. Phase 2&3 Area Tributary to Pond 1)
===============================================================================
--------------------
CALIB STANDHYD      |   Area    (ha)=   22.86
01:201    DT= 1.00  |   Total Imp(%)=   60.00   Dir. Conn.(%)=   60.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
   Surface Area      (ha)=       13.72          9.14
   Dep. Storage      (mm)=        1.00          5.00
   Average Slope      (%)=        2.50          2.50
   Length             (m)=       45.00         33.00
   Mannings n            =        .015          .050

   Max.eff.Inten.(mm/hr)=       216.98         90.62
              over (min)          1.00          3.00
   Storage Coeff.  (min)=          .96 (ii)     3.29 (ii)
   Unit Hyd. Tpeak (min)=         1.00          3.00
   Unit Hyd. peak  (cms)=         1.10           .35
                                                              *TOTALS*
   PEAK FLOW       (cms)=         7.26          1.75            8.315 (iii)
   TIME TO PEAK    (hrs)=         1.22          1.28            1.217
   RUNOFF VOLUME    (mm)=        72.22         35.33           57.465
   TOTAL RAINFALL   (mm)=        73.22         73.22           73.220
   RUNOFF COEFFICIENT   =          .99           .48             .785

     (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
         CN* =  80.0     Ia = Dep. Storage  (Above)
    (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
         THAN THE STORAGE COEFFICIENT.
   (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
1:0006--------------------------------------------------------------------------
```

```
*===============================================================================
*ADD RUNOFF FROM WEST CATCHMENT TO OUTFLOW FROM FUTURE POND 3
*===============================================================================
------------------------
| ADD HYD (          5) | ID: NHYD          AREA     QPEAK    TPEAK   R.V.     DWF
------------------------                    (ha)     (cms)    (hrs)   (mm)    (cms)
                         ID1 01:201         22.86    8.315     1.22  57.47     .000
                        +ID2 02:       301  22.70     .676     2.20  57.46     .000
                        +ID3 03:              .00     .000      .00    .00     .000  **DRY**
                        ==========================================================
                         SUM 04:         5  45.56    8.604     1.22  57.46     .000

  NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
001:0007------------------------------------------------------------------------
*===============================================================================
*ROUTE HYDROGRAPH THROUGH POND 1
*===============================================================================
--------------------
| ROUTE RESERVOIR   |     Requested routing time step =  1.0 min.
|  IN>04:(000005)   |
| OUT<01:(000401)   |     =========  OUTLFOW STORAGE TABLE  =========
--------------------      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)   |   (cms)     (ha.m.)
                            .000  .0000E+00    |    1.351  .9228E+00
                            .022  .5970E-01    |    1.499  .1093E+01
                            .036  .1213E+00    |    1.632  .1270E+01
                            .046  .1848E+00    |    1.695  .1362E+01
                            .155  .2501E+00    |    1.756  .1456E+01
                            .347  .3173E+00    |    1.815  .1551E+01
                            .593  .3865E+00    |    1.871  .1648E+01
                            .751  .4574E+00    |    1.926  .1747E+01
                            .993  .6050E+00    |    1.980  .1849E+01
                           1.186  .7601E+00    |     .000  .0000E+00

   ROUTING RESULTS              AREA     QPEAK     TPEAK        R.V.
   -------------------          (ha)     (cms)     (hrs)        (mm)
   INFLOW >04: (000005)        45.56     8.604     1.217      57.465
   OUTFLOW<01: (000401)        45.56     1.359     2.200      57.465
  OVERFLOW<02: (000001)          .00      .000      .000        .000

              TOTAL NUMBER OF SIMULATED OVERFLOWS  =          0
              CUMULATIVE TIME OF OVERFLOWS  (hours)=        .00
              PERCENTAGE OF TIME OVERFLOWING    (%)=        .00


              PEAK   FLOW   REDUCTION [Qout/Qin](%)=   15.801
              TIME SHIFT OF PEAK FLOW         (min)=    59.00
              MAXIMUM  STORAGE   USED        (ha.m.)=.9325E+00

--------------------------------------------------------------------------------
001:0008------------------------------------------------------------------------
*===============================================================================
*EAST CATCHMENT -> 8.93ha Proposed URBAN + Assumed Future 3.59ha Park/Yard Area
*===============================================================================
--------------------
| CALIB STANDHYD    |   Area    (ha)=    8.93
| 03:2021   DT= 1.00 |  Total Imp(%)=   60.00   Dir. Conn.(%)=   60.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
   Surface Area      (ha)=        5.36          3.57
   Dep. Storage      (mm)=        1.00          5.00
   Average Slope      (%)=        2.50          2.50
   Length             (m)=       45.00         33.00
   Mannings n            =        .015          .050

   Max.eff.Inten.(mm/hr)=       216.98         90.62
              over (min)          1.00          3.00
   Storage Coeff.  (min)=          .96 (ii)     3.29 (ii)
   Unit Hyd. Tpeak (min)=         1.00          3.00
   Unit Hyd. peak  (cms)=         1.10           .35
                                                              *TOTALS*
   PEAK FLOW       (cms)=         2.84           .68            3.248 (iii)
   TIME TO PEAK    (hrs)=         1.22          1.28            1.217
```

```
   RUNOFF VOLUME    (mm)=      72.22         35.33          57.465
   TOTAL RAINFALL   (mm)=      73.22         73.22          73.220
   RUNOFF COEFFICIENT   =        .99           .48            .785

     (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
         CN* =  80.0    Ia = Dep. Storage  (Above)
    (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
         THAN THE STORAGE COEFFICIENT.
   (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
1:0009--------------------------------------------------------------------------
--------------------
CALIB NASHYD        |   Area     (ha)=    3.59   Curve Number   (CN)=80.00
04:2022   DT= 1.00 |   Ia       (mm)=   5.000   # of Linear Res.(N)= 3.00
--------------------    U.H. Tp(hrs)=    .200

   Unit Hyd Qpeak  (cms)=      .686

   PEAK FLOW       (cms)=      .410 (i)
   TIME TO PEAK    (hrs)=     1.500
   RUNOFF VOLUME    (mm)=    35.333
   TOTAL RAINFALL   (mm)=    73.220
   RUNOFF COEFFICIENT   =      .483

   (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
1:0010--------------------------------------------------------------------------
----------------------
ADD HYD (          9) | ID: NHYD         AREA     QPEAK    TPEAK   R.V.    DWF
----------------------                    (ha)     (cms)    (hrs)   (mm)   (cms)
                  ID1 03:2021              8.93    3.248    1.22  57.47    .000
                 +ID2 04:2022              3.59     .410    1.50  35.33    .000
                  ==========================================================
                  SUM 05:          9      12.52    3.337    1.22  51.12    .000

 NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
1:0011--------------------------------------------------------------------------
==============================================================================
OUTE FLOW THROUGH WETLAND 2
==============================================================================
--------------------
ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
 IN>05:(000009)    |
OUT<06:(000402)    |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                         (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .000  .0000E+00    |     .585  .3940E+00
                          .007  .4050E-01    |     .647  .4544E+00
                          .014  .8360E-01    |     .705  .5174E+00
                          .074  .1291E+00    |     .758  .5828E+00
                          .180  .1771E+00    |     .807  .6507E+00
                          .316  .2276E+00    |     .853  .7210E+00
                          .432  .2806E+00    |     .898  .7939E+00
                          .514  .3360E+00    |     .000  .0000E+00

   ROUTING RESULTS             AREA      QPEAK      TPEAK        R.V.
   ---------------------       (ha)      (cms)      (hrs)        (mm)
   INFLOW >05: (000009)       12.52      3.337      1.217      51.119
   OUTFLOW<06: (000402)       12.52       .563      1.917      51.118
  OVERFLOW<07: (000002)         .00       .000       .000        .000

               TOTAL NUMBER OF SIMULATED OVERFLOWS  =          0
               CUMULATIVE TIME OF OVERFLOWS  (hours)=        .00
               PERCENTAGE OF TIME OVERFLOWING    (%)=        .00


               PEAK   FLOW   REDUCTION [Qout/Qin](%)=   16.868
               TIME SHIFT OF PEAK FLOW         (min)=    42.00
               MAXIMUM  STORAGE   USED       (ha.m.)=.3760E+00

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

```
001:0012------------------------------------------------------------------------
*=============================================================================
*ADD OUTFLOW FROM POND1 TO OUTFLOW FROM POND 2
*=============================================================================
------------------------
| ADD HYD (          9) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
                    ID1 01:        401     45.56    1.359    2.20  57.46   .000
                   +ID2 02:          1       .00     .000     .00    .00   .000  **DRY**
                   +ID3 06:        402     12.52     .563    1.92  51.12   .000
                   +ID4 07:          2       .00     .000     .00    .00   .000  **DRY**
                    ============================================================
                    SUM 08:          9     58.08    1.917    2.03  56.10   .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
001:0013------------------------------------------------------------------------
     FINISH
--------------------------------------------------------------------------------
********************************************************************************
    WARNINGS / ERRORS / NOTES
    -------------------------
  Simulation ended on 2019-03-09     at 19:34:39
================================================================================
```

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

 SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO          999    999    =========
 S      W W W  MM MM  H   H   Y Y   MM MM  O   O        9   9  9   9
 SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##    9   9  9   9   Ver  4.05
     S   W W   M   M  H   H    Y    M   M  O   O         9999   9999   Sept 2011
 SSSSS   W W   M   M  H   H    Y    M   M   OOO             9      9   =========
                                                        9   9  9   9   # 3057174
      StormWater Management HYdrologic Model              999    999   =========

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

+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++++++++ Licensed user: MTE Consultants Inc.                          +++++++++
+++++++++                in any City           SERIAL#:3057174         +++++++++
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

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


*********************   D E T A I L E D   O U T P U T   *********************
*******************************************************************************
        DATE: 2019-03-09      TIME: 19:35:01      RUN COUNTER: 000713         *
*******************************************************************************
 Input   filename: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\POST\MODEL.dat      *
 Output  filename: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\POST\MODEL.out      *
 Summary filename: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\POST\MODEL.sum      *
 User comments:                                                               *
 1:___________________________________________________________________________*
 2:___________________________________________________________________________*
 3:___________________________________________________________________________*
*******************************************************************************

--------------------------------------------------------------------------------
-1:0001-------------------------------------------------------------------------
*******************************************************************************
  Project Name: [THAMESCREST PH2]    Project Number: [35499-200]
  Date          : SEPTEMBER 2018
  Modeller      : [JJM]
  Company       : J.F. Sabourin and Associates Inc.
  License #     : 5826103
*******************************************************************************
-------------------
START              |  Project  dir.: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\POST\
-------------------   Rainfall dir.: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\POST\
  TZERO =    .00 hrs on         0
  METOUT=    2 (output = METRIC)
  NRUN  = 001
  NSTORM=    0
--------------------------------------------------------------------------------
-1:0002-------------------------------------------------------------------------
-------------------
READ STORM         |    Filename: 50YR Chicago 3-hr duration
Ptotal=  83.02 mm|    Comments: 50YR Chicago 3-hr duration
-------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .02   7.766 |    .78  19.599 |   1.55  36.353 |   2.32  12.061
               .03   7.862 |    .80  20.329 |   1.57  34.778 |   2.33  11.897
               .05   7.961 |    .82  21.118 |   1.58  33.334 |   2.35  11.738
```

```
               .07   8.062 |    .83  21.973 |   1.60  32.004 |   2.37  11.584
               .08   8.166 |    .85  22.902 |   1.62  30.776 |   2.38  11.434
               .10   8.274 |    .87  23.917 |   1.63  29.640 |   2.40  11.288
               .12   8.384 |    .88  25.029 |   1.65  28.584 |   2.42  11.146
               .13   8.498 |    .90  26.252 |   1.67  27.603 |   2.43  11.007
               .15   8.616 |    .92  27.603 |   1.68  26.687 |   2.45  10.873
               .17   8.737 |    .93  29.102 |   1.70  25.831 |   2.47  10.742
               .18   8.861 |    .95  30.776 |   1.72  25.029 |   2.48  10.615
               .20   8.990 |    .97  32.655 |   1.73  24.276 |   2.50  10.490
               .22   9.123 |    .98  34.778 |   1.75  23.569 |   2.52  10.369
               .23   9.261 |   1.00  37.194 |   1.77  22.902 |   2.53  10.251
               .25   9.403 |   1.02  39.965 |   1.78  22.274 |   2.55  10.136
               .27   9.550 |   1.03  43.173 |   1.80  21.680 |   2.57  10.024
               .28   9.703 |   1.05  46.922 |   1.82  21.118 |   2.58   9.914
               .30   9.860 |   1.07  51.357 |   1.83  20.585 |   2.60   9.807
               .32  10.024 |   1.08  56.672 |   1.85  20.080 |   2.62   9.703
               .33  10.193 |   1.10  63.141 |   1.87  19.599 |   2.63   9.600
               .35  10.369 |   1.12  71.159 |   1.88  19.142 |   2.65   9.501
               .37  10.552 |   1.13  81.312 |   1.90  18.707 |   2.67   9.403
               .38  10.742 |   1.15  94.508 |   1.92  18.293 |   2.68   9.308
               .40  10.940 |   1.17 112.220 |   1.93  17.897 |   2.70   9.215
               .42  11.146 |   1.18 136.983 |   1.95  17.518 |   2.72   9.123
               .43  11.360 |   1.20 173.490 |   1.97  17.156 |   2.73   9.034
               .45  11.584 |   1.22 231.345 |   1.98  16.810 |   2.75   8.947
               .47  11.817 |   1.23 189.687 |   2.00  16.478 |   2.77   8.861
               .48  12.061 |   1.25 159.575 |   2.02  16.160 |   2.78   8.778
               .50  12.316 |   1.27 136.983 |   2.03  15.854 |   2.80   8.696
               .52  12.583 |   1.28 119.519 |   2.05  15.561 |   2.82   8.616
               .53  12.863 |   1.30 105.688 |   2.07  15.279 |   2.83   8.537
               .55  13.157 |   1.32  94.508 |   2.08  15.007 |   2.85   8.460
               .57  13.466 |   1.33  85.314 |   2.10  14.746 |   2.87   8.384
               .58  13.791 |   1.35  77.643 |   2.12  14.494 |   2.88   8.310
               .60  14.133 |   1.37  71.159 |   2.13  14.251 |   2.90   8.238
               .62  14.494 |   1.38  65.618 |   2.15  14.017 |   2.92   8.166
               .63  14.875 |   1.40  60.836 |   2.17  13.791 |   2.93   8.097
               .65  15.279 |   1.42  56.672 |   2.18  13.573 |   2.95   8.028
               .67  15.706 |   1.43  53.019 |   2.20  13.361 |   2.97   7.961
               .68  16.160 |   1.45  49.792 |   2.22  13.157 |   2.98   7.895
               .70  16.642 |   1.47  46.922 |   2.23  12.960 |   3.00   7.830
               .72  17.156 |   1.48  44.356 |   2.25  12.769 |   3.02   7.766
               .73  17.705 |   1.50  42.049 |   2.27  12.583 |
               .75  18.293 |   1.52  39.965 |   2.28  12.404 |
               .77  18.922 |   1.53  38.275 |   2.30  12.230 |

--------------------------------------------------------------------------------
001:0003------------------------------------------------------------------------
*=============================================================================
*FUTURE NORTH -> 22.7ha URBAN (Assumed Tributary Area to Future Pond)
*              -> FIELD TILE DRY WEATHER FLOW
*=============================================================================
-----------------------
| CALIB STANDHYD      |   Area     (ha)=   22.70
| 01:201    DT= 1.00  |   Total Imp(%)=   60.00   Dir. Conn.(%)=   60.00
-----------------------
                             IMPERVIOUS    PERVIOUS (i)
    Surface Area      (ha)=     13.62         9.08
    Dep. Storage      (mm)=      1.00         5.00
    Average Slope      (%)=      2.50         2.50
    Length             (m)=     45.00        33.00
    Mannings n            =      .015         .250

    Max.eff.Inten.(mm/hr)=     231.35       106.22
               over (min)       1.00         3.00
    Storage Coeff.  (min)=       .94 (ii)     3.12 (ii)
    Unit Hyd. Tpeak (min)=      1.00         3.00
    Unit Hyd. peak  (cms)=      1.12          .37
                                                        *TOTALS*
    PEAK FLOW        (cms)=      7.79         2.09        9.105 (iii)
    TIME TO PEAK     (hrs)=      1.22         1.28        1.217
    RUNOFF VOLUME     (mm)=     82.02        43.01       66.414
    TOTAL RAINFALL    (mm)=     83.02        83.02       83.017
    RUNOFF COEFFICIENT    =       .99          .52         .800

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
          CN* =   80.0    Ia = Dep. Storage  (Above)
```

```
    (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
         THAN THE STORAGE COEFFICIENT.
   (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
1:0004-------------------------------------------------------------------------
===========================================================================
OUTE FLOW THROUGH FUTURE POND
OND STAGE-STORAGE RELATIONSHIP HAS BEEN SET UP TO PROVIDE REASONABLE TARGET
LOW ESTIMATES FOR THE DETAILED DESIGN OF POND 1 AND THE FUTURE DESIGN OF
OND 3
===========================================================================
-------------------
ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
 IN>01:(201    )   |
OUT<02:(000301)    |    =========  OUTLFOW STORAGE TABLE  =========
-------------------     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                         (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .000  .0000E+00    |     .680  .9200E+00
                          .140  .2800E+00    |     .730  .1370E+01
                          .285  .3750E+00    |     .790  .1230E+01
                          .485  .6000E+00    |    1.000  .1810E+01
                          .572  .7100E+00    |   10.000  .1000E+02

  ROUTING RESULTS                AREA     QPEAK     TPEAK        R.V.
  --------------------           (ha)     (cms)     (hrs)        (mm)
  INFLOW >01: (201    )         22.70     9.105     1.217      66.414
  OUTFLOW<02: (000301)          22.70      .729     2.283      66.413
 OVERFLOW<03: (       )           .00      .000      .000        .000

                TOTAL NUMBER OF SIMULATED OVERFLOWS  =           0
                CUMULATIVE TIME OF OVERFLOWS  (hours)=         .00
                PERCENTAGE OF TIME OVERFLOWING    (%)=         .00


                PEAK   FLOW   REDUCTION [Qout/Qin](%)=     8.010
                TIME SHIFT OF PEAK FLOW          (min)=    64.00
                MAXIMUM  STORAGE   USED        (ha.m.)=.1068E+01

-------------------------------------------------------------------------------
1:0005-------------------------------------------------------------------------
===========================================================================
EST CATCHMENT -> 22.86ha URBAN (i.e. Phase 2&3 Area Tributary to Pond 1)
===========================================================================
--------------------
CALIB STANDHYD      |   Area    (ha)=   22.86
01:201    DT= 1.00  |   Total Imp(%)=   60.00   Dir. Conn.(%)=   60.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
  Surface Area      (ha)=      13.72          9.14
  Dep. Storage      (mm)=       1.00          5.00
  Average Slope      (%)=       2.50          2.50
  Length             (m)=      45.00         33.00
  Mannings n            =       .015          .050

  Max.eff.Inten.(mm/hr)=      231.35        106.22
             over (min)        1.00          3.00
  Storage Coeff.  (min)=        .94 (ii)     3.12 (ii)
  Unit Hyd. Tpeak (min)=       1.00          3.00
  Unit Hyd. peak  (cms)=       1.12           .37
                                                          *TOTALS*
  PEAK FLOW       (cms)=       7.84          2.11           9.169 (iii)
  TIME TO PEAK    (hrs)=       1.22          1.28           1.217
  RUNOFF VOLUME    (mm)=      82.02         43.01          66.414
  TOTAL RAINFALL   (mm)=      83.02         83.02          83.017
  RUNOFF COEFFICIENT   =        .99           .52            .800

    (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
        CN* =  80.0    Ia = Dep. Storage  (Above)
   (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
        THAN THE STORAGE COEFFICIENT.
  (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
1:0006-------------------------------------------------------------------------
```

```
*===========================================================================
*ADD RUNOFF FROM WEST CATCHMENT TO OUTFLOW FROM FUTURE POND 3
*===========================================================================
----------------------
| ADD HYD (        5) | ID: NHYD          AREA     QPEAK    TPEAK   R.V.     DWF
----------------------                    (ha)     (cms)    (hrs)   (mm)    (cms)
                    ID1 01:201           22.86     9.169     1.22  66.41     .000
                   +ID2 02:       301    22.70      .729     2.28  66.41     .000
                   +ID3 03:                .00      .000      .00    .00     .000  **DRY**
                   ==================================================================
                    SUM 04:         5    45.56     9.511     1.22  66.41     .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
001:0007-----------------------------------------------------------------------
*===========================================================================
*ROUTE HYDROGRAPH THROUGH POND 1
*===========================================================================
--------------------
| ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
|  IN>04:(000005)    |
| OUT<01:(000401)    |    =========  OUTLFOW STORAGE TABLE  =========
--------------------      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)   |   (cms)     (ha.m.)
                            .000  .0000E+00    |    1.351  .9228E+00
                            .022  .5970E-01    |    1.499  .1093E+01
                            .036  .1213E+00    |    1.632  .1270E+01
                            .046  .1848E+00    |    1.695  .1362E+01
                            .155  .2501E+00    |    1.756  .1456E+01
                            .347  .3173E+00    |    1.815  .1551E+01
                            .593  .3865E+00    |    1.871  .1648E+01
                            .751  .4574E+00    |    1.926  .1747E+01
                            .993  .6050E+00    |    1.980  .1849E+01
                           1.186  .7601E+00    |     .000  .0000E+00

    ROUTING RESULTS               AREA     QPEAK     TPEAK        R.V.
    --------------------          (ha)     (cms)     (hrs)        (mm)
    INFLOW >04: (000005)         45.56     9.511     1.217      66.413
    OUTFLOW<01: (000401)         45.56     1.491     2.250      66.413
   OVERFLOW<02: (000001)           .00      .000      .000        .000

                  TOTAL NUMBER OF SIMULATED OVERFLOWS  =           0
                  CUMULATIVE TIME OF OVERFLOWS  (hours)=         .00
                  PERCENTAGE OF TIME OVERFLOWING    (%)=         .00


                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=    15.682
                  TIME SHIFT OF PEAK FLOW          (min)=    62.00
                  MAXIMUM  STORAGE   USED        (ha.m.)=.1084E+01

-------------------------------------------------------------------------------
001:0008-----------------------------------------------------------------------
*===========================================================================
*EAST CATCHMENT -> 8.93ha Proposed URBAN + Assumed Future 3.59ha Park/Yard Area
*===========================================================================
--------------------
| CALIB STANDHYD      |   Area    (ha)=    8.93
| 03:2021   DT= 1.00  |   Total Imp(%)=   60.00   Dir. Conn.(%)=   60.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
    Surface Area      (ha)=       5.36          3.57
    Dep. Storage      (mm)=       1.00          5.00
    Average Slope      (%)=       2.50          2.50
    Length             (m)=      45.00         33.00
    Mannings n            =       .015          .050

    Max.eff.Inten.(mm/hr)=      231.35        106.22
               over (min)        1.00          3.00
    Storage Coeff.  (min)=        .94 (ii)     3.12 (ii)
    Unit Hyd. Tpeak (min)=       1.00          3.00
    Unit Hyd. peak  (cms)=       1.12           .37
                                                            *TOTALS*
    PEAK FLOW       (cms)=       3.06           .82           3.582 (iii)
    TIME TO PEAK    (hrs)=       1.22          1.28           1.217
```

```
   RUNOFF VOLUME    (mm)=       82.02          43.01          66.414
   TOTAL RAINFALL   (mm)=       83.02          83.02          83.017
   RUNOFF COEFFICIENT   =         .99            .52            .800

     (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
         CN* =  80.0     Ia = Dep. Storage  (Above)
    (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
         THAN THE STORAGE COEFFICIENT.
   (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
1:0009-------------------------------------------------------------------------
--------------------
CALIB NASHYD        |   Area    (ha)=    3.59   Curve Number    (CN)=80.00
04:2022   DT= 1.00 |   Ia      (mm)=   5.000   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .200

   Unit Hyd Qpeak  (cms)=     .686

   PEAK FLOW       (cms)=     .496 (i)
   TIME TO PEAK    (hrs)=    1.500
   RUNOFF VOLUME    (mm)=   43.010
   TOTAL RAINFALL   (mm)=   83.017
   RUNOFF COEFFICIENT   =     .518

   (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
1:0010-------------------------------------------------------------------------
----------------------
ADD HYD (          9) | ID: NHYD         AREA     QPEAK    TPEAK   R.V.     DWF
----------------------                    (ha)     (cms)    (hrs)   (mm)   (cms)
                   ID1 03:2021              8.93     3.582     1.22  66.41    .000
                  +ID2 04:2022              3.59      .496     1.50  43.01    .000
                  ===============================================================
                   SUM 05:          9     12.52     3.700     1.23  59.70    .000

 NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
1:0011-------------------------------------------------------------------------
==============================================================================
OUTE FLOW THROUGH WETLAND 2
==============================================================================
--------------------
ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
 IN>05:(000009)   |
OUT<06:(000402)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------   OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                        (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         .000  .0000E+00    |     .585  .3940E+00
                         .007  .4050E-01    |     .647  .4544E+00
                         .014  .8360E-01    |     .705  .5174E+00
                         .074  .1291E+00    |     .758  .5828E+00
                         .180  .1771E+00    |     .807  .6507E+00
                         .316  .2276E+00    |     .853  .7210E+00
                         .432  .2806E+00    |     .898  .7939E+00
                         .514  .3360E+00    |     .000  .0000E+00

   ROUTING RESULTS              AREA      QPEAK      TPEAK         R.V.
   --------------------          (ha)     (cms)      (hrs)         (mm)
   INFLOW >05: (000009)         12.52     3.700      1.233       59.703
   OUTFLOW<06: (000402)         12.52      .633      1.950       59.701
  OVERFLOW<07: (000002)           .00      .000       .000         .000

                 TOTAL NUMBER OF SIMULATED OVERFLOWS  =           0
                 CUMULATIVE TIME OF OVERFLOWS  (hours)=         .00
                 PERCENTAGE OF TIME OVERFLOWING    (%)=         .00


                 PEAK   FLOW   REDUCTION [Qout/Qin](%)=    17.099
                 TIME SHIFT OF PEAK FLOW          (min)=     43.00
                 MAXIMUM  STORAGE   USED         (ha.m.)=.4405E+00

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

```
001:0012-----------------------------------------------------------------------
*==============================================================================
*ADD OUTFLOW FROM POND1 TO OUTFLOW FROM POND 2
*==============================================================================
----------------------
| ADD HYD (          9) | ID: NHYD         AREA     QPEAK    TPEAK   R.V.     DWF
----------------------                    (ha)     (cms)    (hrs)   (mm)   (cms)
                   ID1 01:        401     45.56     1.491     2.25  66.41    .000
                  +ID2 02:          1       .00      .000      .00    .00    .000  **DRY**
                  +ID3 06:        402     12.52      .633     1.95  59.70    .000
                  +ID4 07:          2       .00      .000      .00    .00    .000  **DRY**
                  ===============================================================
                   SUM 08:          9     58.08     2.119     2.08  64.97    .000

  NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
001:0013-----------------------------------------------------------------------
    FINISH
-------------------------------------------------------------------------------
*******************************************************************************
    WARNINGS / ERRORS / NOTES
    -------------------------
  Simulation ended on 2019-03-09     at 19:35:01
===============================================================================
```

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

 SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999   999    =========
 S       W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9 9   9
 SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9 9   9   Ver  4.05
     S   W W   M   M  H   H    Y    M   M  O   O       9999  9999   Sept 2011
 SSSSS   W W   M   M  H   H    Y    M   M   OOO           9     9   =========
                                                      9   9 9   9   # 3057174
      StormWater Management HYdrologic Model           999   999    =========

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

+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++++++++ Licensed user: MTE Consultants Inc.                           +++++++++
++++++++                in any City              SERIAL#:3057174       +++++++++
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

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


********************  D E T A I L E D   O U T P U T  *****************************
**********************************************************************************
       DATE: 2019-03-09      TIME: 19:35:21      RUN COUNTER: 002714            *
**********************************************************************************
 Input    filename: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\POST\MODEL.dat     *
 Output   filename: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\POST\MODEL.out     *
 Summary  filename: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\POST\MODEL.sum     *
 User comments:                                                                *
 1:_____________________________________________________________________________*
 2:_____________________________________________________________________________*
 3:_____________________________________________________________________________*
**********************************************************************************

-------------------------------------------------------------------------------------
1:0001-------------------------------------------------------------------------------
**********************************************************************************
  Project Name: [THAMESCREST PH2]    Project Number: [35499-203]
  Date         : SEPTEMBER 2018
  Modeller     : [JJM]
  Company      : J.F. Sabourin and Associates Inc.
  License #    : 5826103
**********************************************************************************
------------------
START              |  Project  dir.: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\POST\
------------------   Rainfall dir.: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\POST\
  TZERO =    .00 hrs on        0
  METOUT=    2 (output = METRIC)
  NRUN   = 001
  NSTORM=    0
-------------------------------------------------------------------------------------
1:0002-------------------------------------------------------------------------------
------------------
READ STORM         |    Filename: 100YR Chicago 3-hr duration
Ptotal=  92.97 mm|     Comments: 100YR Chicago 3-hr duration
------------------
            TIME     RAIN |   TIME     RAIN |    TIME     RAIN |    TIME     RAIN
             hrs    mm/hr |    hrs    mm/hr |     hrs    mm/hr |     hrs    mm/hr
             .02    8.817 |    .78   22.219 |    1.55   41.060 |    2.32   13.688
             .03    8.925 |    .80   23.043 |    1.57   39.296 |    2.33   13.502
             .05    9.037 |    .82   23.934 |    1.58   37.677 |    2.35   13.322
```

```
             .07    9.152 |    .83   24.899 |    1.60   36.186 |    2.37   13.147
             .08    9.271 |    .85   25.948 |    1.62   34.808 |    2.38   12.977
             .10    9.393 |    .87   27.091 |    1.63   33.531 |    2.40   12.811
             .12    9.518 |    .88   28.344 |    1.65   32.345 |    2.42   12.650
             .13    9.647 |    .90   29.721 |    1.67   31.241 |    2.43   12.493
             .15    9.780 |    .92   31.241 |    1.68   30.211 |    2.45   12.341
             .17    9.918 |    .93   32.929 |    1.70   29.247 |    2.47   12.193
             .18   10.059 |    .95   34.808 |    1.72   28.344 |    2.48   12.048
             .20   10.206 |    .97   36.917 |    1.73   27.496 |    2.50   11.907
             .22   10.356 |    .98   39.296 |    1.75   26.699 |    2.52   11.770
             .23   10.513 |   1.00   42.001 |    1.77   25.948 |    2.53   11.636
             .25   10.674 |   1.02   45.099 |    1.78   25.238 |    2.55   11.505
             .27   10.841 |   1.03   48.678 |    1.80   24.568 |    2.57   11.378
             .28   11.014 |   1.05   52.855 |    1.82   23.934 |    2.58   11.253
             .30   11.192 |   1.07   57.784 |    1.83   23.332 |    2.60   11.132
             .32   11.378 |   1.08   63.675 |    1.85   22.762 |    2.62   11.014
             .33   11.570 |   1.10   70.824 |    1.87   22.219 |    2.63   10.898
             .35   11.770 |   1.12   79.651 |    1.88   21.703 |    2.65   10.785
             .37   11.977 |   1.13   90.778 |    1.90   21.211 |    2.67   10.674
             .38   12.193 |   1.15  105.160 |    1.92   20.743 |    2.68   10.566
             .40   12.417 |   1.17  124.329 |    1.93   20.295 |    2.70   10.460
             .42   12.650 |   1.18  150.887 |    1.95   19.867 |    2.72   10.356
             .43   12.893 |   1.20  189.567 |    1.97   19.458 |    2.73   10.255
             .45   13.147 |   1.22  249.834 |    1.98   19.066 |    2.75   10.156
             .47   13.411 |   1.23  206.561 |    2.00   18.691 |    2.77   10.059
             .48   13.688 |   1.25  174.887 |    2.02   18.330 |    2.78    9.964
             .50   13.977 |   1.27  150.887 |    2.03   17.985 |    2.80    9.871
             .52   14.280 |   1.28  132.186 |    2.05   17.652 |    2.82    9.780
             .53   14.597 |   1.30  117.277 |    2.07   17.333 |    2.83    9.691
             .55   14.931 |   1.32  105.160 |    2.08   17.026 |    2.85    9.604
             .57   15.280 |   1.33   95.150 |    2.10   16.730 |    2.87    9.518
             .58   15.648 |   1.35   86.763 |    2.12   16.445 |    2.88    9.434
             .60   16.036 |   1.37   79.651 |    2.13   16.170 |    2.90    9.352
             .62   16.445 |   1.38   73.554 |    2.15   15.904 |    2.92    9.271
             .63   16.876 |   1.40   68.279 |    2.17   15.648 |    2.93    9.191
             .65   17.333 |   1.42   63.675 |    2.18   15.401 |    2.95    9.114
             .67   17.817 |   1.43   59.628 |    2.20   15.162 |    2.97    9.037
             .68   18.330 |   1.45   56.046 |    2.22   14.931 |    2.98    8.962
             .70   18.876 |   1.47   52.855 |    2.23   14.707 |    3.00    8.889
             .72   19.458 |   1.48   49.997 |    2.25   14.490 |    3.02    8.817
             .73   20.079 |   1.50   47.425 |    2.27   14.280 |
             .75   20.743 |   1.52   45.099 |    2.28   14.077 |
             .77   21.454 |   1.53   42.986 |    2.30   13.879 |

-------------------------------------------------------------------------------------
001:0003-----------------------------------------------------------------------------
*================================================================================
*FUTURE NORTH -> 22.7ha URBAN (Assumed Tributary Area to Future Pond)
*              -> FIELD TILE DRY WEATHER FLOW
*================================================================================
---------------------
| CALIB STANDHYD     |   Area    (ha)=   22.70
| 01:201    DT= 1.00 |   Total Imp(%)=   60.00   Dir. Conn.(%)=   60.00
---------------------
                                IMPERVIOUS    PERVIOUS (i)
    Surface Area      (ha)=       13.62          9.08
    Dep. Storage      (mm)=        1.00          5.00
    Average Slope      (%)=        2.50          2.50
    Length             (m)=       45.00         33.00
    Mannings n            =        .015          .050

    Max.eff.Inten.(mm/hr)=      249.83        123.46
               over (min)        1.00          3.00
    Storage Coeff.   (min)=         .91 (ii)     2.97 (ii)
    Unit Hyd. Tpeak  (min)=        1.00          3.00
    Unit Hyd. peak   (cms)=        1.13           .38
                                                           *TOTALS*
    PEAK FLOW        (cms)=        8.48          2.48        10.099 (iii)
    TIME TO PEAK     (hrs)=        1.22          1.28         1.217
    RUNOFF VOLUME     (mm)=       91.97         51.09        75.614
    TOTAL RAINFALL    (mm)=       92.97         92.97        92.966
    RUNOFF COEFFICIENT    =         .99           .55          .813

     (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
         CN* =   80.0     Ia = Dep. Storage  (Above)
```

```
    (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
         THAN THE STORAGE COEFFICIENT.
   (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
1:0004--------------------------------------------------------------------------
================================================================================
OUTE FLOW THROUGH FUTURE POND
OND STAGE-STORAGE RELATIONSHIP HAS BEEN SET UP TO PROVIDE REASONABLE TARGET
LOW ESTIMATES FOR THE DETAILED DESIGN OF POND 1 AND THE FUTURE DESIGN OF
OND 3
================================================================================
--------------------
ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
 IN>01:(201    )   |
OUT<02:(000301)    |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                         (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .000  .0000E+00    |     .680  .9200E+00
                          .140  .2800E+00    |     .730  .1070E+01
                          .285  .3750E+00    |     .790  .1230E+01
                          .485  .6000E+00    |    1.000  .1810E+01
                          .572  .7100E+00    |   10.000  .1000E+02

  ROUTING RESULTS              AREA     QPEAK     TPEAK       R.V.
  --------------------         (ha)     (cms)     (hrs)       (mm)
  INFLOW >01: (201    )       22.70    10.099     1.217     75.614
  OUTFLOW<02: (000301)        22.70      .790     2.350     75.613
 OVERFLOW<03: (       )         .00      .000      .000       .000

             TOTAL NUMBER OF SIMULATED OVERFLOWS  =           0
             CUMULATIVE TIME OF OVERFLOWS  (hours)=         .00
             PERCENTAGE OF TIME OVERFLOWING    (%)=         .00


             PEAK   FLOW   REDUCTION [Qout/Qin](%)=     7.819
             TIME SHIFT OF PEAK FLOW         (min)=     68.00
             MAXIMUM  STORAGE   USED       (ha.m.)=.1229E+01

--------------------------------------------------------------------------------
1:0005--------------------------------------------------------------------------
================================================================================
EST CATCHMENT -> 22.86ha URBAN (i.e. Phase 2&3 Area Tributary to Pond 1)
================================================================================
--------------------
CALIB STANDHYD     |  Area    (ha)=   22.86
01:201    DT= 1.00 |  Total Imp(%)=   60.00   Dir. Conn.(%)=   60.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
   Surface Area     (ha)=    13.72          9.14
   Dep. Storage     (mm)=     1.00          5.00
   Average Slope     (%)=     2.50          2.50
   Length            (m)=    45.00         33.00
   Mannings n           =     .015          .050

   Max.eff.Inten.(mm/hr)=   249.83        123.46
             over (min)      1.00          3.00
   Storage Coeff.  (min)=      .91 (ii)     2.97 (ii)
   Unit Hyd. Tpeak (min)=     1.00          3.00
   Unit Hyd. peak  (cms)=     1.13           .38
                                                      *TOTALS*
   PEAK FLOW       (cms)=     8.54          2.49       10.170 (iii)
   TIME TO PEAK    (hrs)=     1.22          1.28        1.217
   RUNOFF VOLUME    (mm)=    91.97         51.09       75.614
   TOTAL RAINFALL   (mm)=    92.97         92.97       92.966
   RUNOFF COEFFICIENT   =      .99           .55         .813

   (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
       CN* =  80.0    Ia = Dep. Storage  (Above)
  (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
       THAN THE STORAGE COEFFICIENT.
 (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
1:0006--------------------------------------------------------------------------
```

```
*================================================================================
*ADD RUNOFF FROM WEST CATCHMENT TO OUTFLOW FROM FUTURE POND 3
*================================================================================
-------------------------
| ADD HYD (         5) | ID: NHYD         AREA     QPEAK    TPEAK   R.V.    DWF
-------------------------                 (ha)     (cms)    (hrs)   (mm)   (cms)
                 ID1 01:201              22.86    10.170     1.22  75.61    .000
                +ID2 02:         301     22.70      .790     2.35  75.61    .000
                +ID3 03:                   .00      .000      .00    .00    .000 **DRY**
                ==================================================================
                 SUM 04:           5     45.56    10.568     1.23  75.61    .000

  NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
001:0007------------------------------------------------------------------------
*================================================================================
*ROUTE HYDROGRAPH THROUGH POND 1
*================================================================================
----------------------
| ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
|  IN>04:(000005)    |
| OUT<01:(000401)    |    =========  OUTLFOW STORAGE TABLE  =========
----------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)   |   (cms)     (ha.m.)
                            .000  .0000E+00    |    1.351  .9228E+00
                            .022  .5970E-01    |    1.499  .1093E+01
                            .036  .1213E+00    |    1.632  .1270E+01
                            .046  .1848E+00    |    1.695  .1362E+01
                            .155  .2501E+00    |    1.756  .1456E+01
                            .347  .3173E+00    |    1.815  .1551E+01
                            .593  .3865E+00    |    1.871  .1648E+01
                            .751  .4574E+00    |    1.926  .1747E+01
                            .993  .6050E+00    |    1.980  .1849E+01
                           1.186  .7601E+00    |     .000  .0000E+00

   ROUTING RESULTS              AREA     QPEAK     TPEAK       R.V.
   --------------------         (ha)     (cms)     (hrs)       (mm)
   INFLOW >04: (000005)        45.56    10.568     1.233     75.613
   OUTFLOW<01: (000401)        45.56     1.612     2.317     75.613
  OVERFLOW<02: (000001)          .00      .000      .000       .000

              TOTAL NUMBER OF SIMULATED OVERFLOWS  =           0
              CUMULATIVE TIME OF OVERFLOWS  (hours)=         .00
              PERCENTAGE OF TIME OVERFLOWING    (%)=         .00


              PEAK   FLOW   REDUCTION [Qout/Qin](%)=    15.251
              TIME SHIFT OF PEAK FLOW         (min)=     65.00
              MAXIMUM  STORAGE   USED       (ha.m.)=.1243E+01

--------------------------------------------------------------------------------
001:0008------------------------------------------------------------------------
*================================================================================
*EAST CATCHMENT -> 8.93ha Proposed URBAN + Assumed Future 3.59ha Park/Yard Area
*================================================================================
----------------------
| CALIB STANDHYD     |  Area    (ha)=    8.93
| 03:2021   DT= 1.00 |  Total Imp(%)=   60.00   Dir. Conn.(%)=   60.00
----------------------
                            IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=     5.36          3.57
    Dep. Storage     (mm)=     1.00          5.00
    Average Slope     (%)=     2.50          2.50
    Length            (m)=    45.00         33.00
    Mannings n           =     .015          .050

    Max.eff.Inten.(mm/hr)=   249.83        123.46
              over (min)      1.00          3.00
    Storage Coeff.  (min)=      .91 (ii)     2.97 (ii)
    Unit Hyd. Tpeak (min)=     1.00          3.00
    Unit Hyd. peak  (cms)=     1.13           .38
                                                       *TOTALS*
    PEAK FLOW       (cms)=     3.34           .97        3.973 (iii)
    TIME TO PEAK    (hrs)=     1.22          1.28        1.217
```

```
   RUNOFF VOLUME     (mm)=       91.97         51.09         75.614
   TOTAL RAINFALL    (mm)=       92.97         92.97         92.966
   RUNOFF COEFFICIENT    =         .99           .55           .813

     (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
         CN* =  80.0     Ia = Dep. Storage  (Above)
    (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
         THAN THE STORAGE COEFFICIENT.
   (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
1:0009--------------------------------------------------------------------------
--------------------
CALIB NASHYD       |  Area    (ha)=    3.59  Curve Number   (CX)=80.00
04:2022   DT= 1.00 |  Ia      (mm)=   5.000  # of Linear Res.(N)= 3.00
-------------------- U.H. Tp(hrs)=    .200

   Unit Hyd Qpeak  (cms)=     .686

   PEAK FLOW       (cms)=     .586 (i)
   TIME TO PEAK    (hrs)=    1.500
   RUNOFF VOLUME    (mm)=   51.087
   TOTAL RAINFALL   (mm)=   92.966
   RUNOFF COEFFICIENT   =     .550

   (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
1:0010--------------------------------------------------------------------------
----------------------
ADD HYD (          9) | ID: NHYD           AREA     QPEAK    TPEAK   R.V.     DWF
----------------------                     (ha)     (cms)    (hrs)   (mm)    (cms)
                    ID1 03:2021             8.93    3.973     1.22  75.61     .000
                   +ID2 04:2022             3.59     .586     1.50  51.09     .000
                   ==============================================================
                    SUM 05:          9     12.52    4.130     1.23  68.58     .000

 NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
1:0011--------------------------------------------------------------------------
============================================================================
OUTE FLOW THROUGH WETLAND 2
============================================================================
--------------------
ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
 IN>05:(000009)   |
OUT<06:(000402)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------   OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                        (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         .000  .0000E+00    |     .585  .3940E+00
                         .007  .4050E-01    |     .647  .4544E+00
                         .014  .8360E-01    |     .705  .5174E+00
                         .074  .1291E+00    |     .758  .5828E+00
                         .180  .1771E+00    |     .807  .6507E+00
                         .316  .2276E+00    |     .853  .7210E+00
                         .432  .2806E+00    |     .898  .7939E+00
                         .514  .3360E+00    |     .000  .0000E+00

   ROUTING RESULTS              AREA      QPEAK      TPEAK        R.V.
   --------------------         (ha)      (cms)      (hrs)        (mm)
   INFLOW >05: (000009)        12.52      4.130      1.233      68.581
   OUTFLOW<06: (000402)        12.52       .697      1.983      68.579
  OVERFLOW<07: (000002)          .00       .000       .000        .000

               TOTAL NUMBER OF SIMULATED OVERFLOWS  =         0
               CUMULATIVE TIME OF OVERFLOWS  (hours)=       .00
               PERCENTAGE OF TIME OVERFLOWING    (%)=       .00


               PEAK   FLOW   REDUCTION [Qout/Qin](%)=   16.880
               TIME SHIFT OF PEAK FLOW          (min)=   45.00
               MAXIMUM  STORAGE   USED        (ha.m.)=.5089E+00

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

```
001:0012------------------------------------------------------------------------
*===========================================================================
*ADD OUTFLOW FROM POND1 TO OUTFLOW FROM POND 2
*===========================================================================
------------------------
| ADD HYD (          9) | ID: NHYD           AREA     QPEAK    TPEAK   R.V.     DWF
------------------------                     (ha)     (cms)    (hrs)   (mm)    (cms)
                      ID1 01:          401   45.56    1.612     2.32  75.61     .000
                     +ID2 02:            1     .00     .000      .00    .00     .000  **DRY**
                     +ID3 06:          402   12.52     .697     1.98  68.58     .000
                     +ID4 07:            2     .00     .000      .00    .00     .000  **DRY**
                     ============================================================
                      SUM 08:            9   58.08    2.302     2.13  74.10     .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
001:0013------------------------------------------------------------------------
     FINISH
--------------------------------------------------------------------------------
********************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2019-03-09     at 19:35:21
================================================================================
```

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

  SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO          999    999    =========
  S       W W W  MM MM  H   H   Y Y   MM MM  O   O        9   9  9   9
  SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##    9   9  9   9   Ver  4.05
      S   W W   M   M  H   H    Y    M   M  O   O         9999   9999   Sept 2011
  SSSSS   W W   M   M  H   H    Y    M   M   OOO              9      9   =========
                                                          9   9  9   9  # 3057174
       StormWater Management HYdrologic Model              999    999    =========

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

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 ++++++++ Licensed user: MTE Consultants Inc.                          +++++++++
 ++++++++                in any City           SERIAL#:3057174         +++++++++
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

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


 ********************  D E T A I L E D   O U T P U T  *********************
 *******************************************************************************
        DATE: 2019-03-09     TIME: 19:35:48     RUN COUNTER: 000715          *
 *******************************************************************************
  Input   filename: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\POST\MODEL.dat    *
  Output  filename: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\POST\MODEL.out    *
  Summary filename: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\POST\MODEL.sum    *
  User comments:                                                             *
  1:_________________________________________________________________________*
  2:_________________________________________________________________________*
  3:_________________________________________________________________________*
 *******************************************************************************

---------------------------------------------------------------------------------
1:0001---------------------------------------------------------------------------
 *******************************************************************************
   Project Name: [THAMESCREST PH2]    Project Number: [35499-200]
   Date          : SEPTEMBER 2018
   Modeller      : [JJM]
   Company       : J.F. Sabourin and Associates Inc.
   License #     : 5826103
 *******************************************************************************
 -------------------
 START              |  Project  dir.: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\POST\
 -------------------   Rainfall dir.: Q:\35499\200(PH-1\PRELIM-1\SWM\SWMHYMO\POST\
   TZERO =    .00 hrs on        0
   METOUT=    2 (output = METRIC)
   NRUN   = 001
   NSTORM=    0
---------------------------------------------------------------------------------
1:0002---------------------------------------------------------------------------
 -------------------
 READ STORM         |    Filename: 250YR Chicago 24-hr duration
 Ptotal= 183.04 mm|    Comments: 250YR Chicago 24-hr duration
 -------------------
               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
                .02   1.809 |   6.03   4.010 |  12.05   7.858 |  18.07   2.771
                .03   1.811 |   6.05   4.026 |  12.07   7.812 |  18.08   2.767
                .05   1.814 |   6.07   4.041 |  12.08   7.766 |  18.10   2.762
```

```
                .07   1.816 |   6.08   4.057 |  12.10   7.720 |  18.12   2.758
                .08   1.819 |   6.10   4.073 |  12.12   7.675 |  18.13   2.753
                .10   1.821 |   6.12   4.089 |  12.13   7.631 |  18.15   2.749
                .12   1.824 |   6.13   4.105 |  12.15   7.587 |  18.17   2.745
                .13   1.826 |   6.15   4.122 |  12.17   7.544 |  18.18   2.740
                .15   1.829 |   6.17   4.138 |  12.18   7.501 |  18.20   2.736
                .17   1.831 |   6.18   4.155 |  12.20   7.459 |  18.22   2.732
                .18   1.834 |   6.20   4.172 |  12.22   7.418 |  18.23   2.728
                .20   1.837 |   6.22   4.189 |  12.23   7.376 |  18.25   2.723
                .22   1.839 |   6.23   4.206 |  12.25   7.336 |  18.27   2.719
                .23   1.842 |   6.25   4.223 |  12.27   7.296 |  18.28   2.715
                .25   1.844 |   6.27   4.240 |  12.28   7.256 |  18.30   2.711
                .27   1.847 |   6.28   4.258 |  12.30   7.217 |  18.32   2.707
                .28   1.849 |   6.30   4.276 |  12.32   7.178 |  18.33   2.702
                .30   1.852 |   6.32   4.294 |  12.33   7.140 |  18.35   2.698
                .32   1.855 |   6.33   4.312 |  12.35   7.102 |  18.37   2.694
                .33   1.857 |   6.35   4.330 |  12.37   7.065 |  18.38   2.690
                .35   1.860 |   6.37   4.348 |  12.38   7.028 |  18.40   2.686
                .37   1.863 |   6.38   4.367 |  12.40   6.992 |  18.42   2.682
                .38   1.865 |   6.40   4.386 |  12.42   6.956 |  18.43   2.678
                .40   1.868 |   6.42   4.405 |  12.43   6.920 |  18.45   2.674
                .42   1.871 |   6.43   4.424 |  12.45   6.885 |  18.47   2.670
                .43   1.874 |   6.45   4.444 |  12.47   6.851 |  18.48   2.665
                .45   1.876 |   6.47   4.463 |  12.48   6.816 |  18.50   2.661
                .47   1.879 |   6.48   4.483 |  12.50   6.782 |  18.52   2.657
                .48   1.882 |   6.50   4.503 |  12.52   6.749 |  18.53   2.653
                .50   1.884 |   6.52   4.523 |  12.53   6.715 |  18.55   2.649
                .52   1.887 |   6.53   4.543 |  12.55   6.682 |  18.57   2.645
                .53   1.890 |   6.55   4.564 |  12.57   6.650 |  18.58   2.641
                .55   1.893 |   6.57   4.585 |  12.58   6.618 |  18.60   2.638
                .57   1.895 |   6.58   4.606 |  12.60   6.586 |  18.62   2.634
                .58   1.898 |   6.60   4.627 |  12.62   6.554 |  18.63   2.630
                .60   1.901 |   6.62   4.649 |  12.63   6.523 |  18.65   2.626
                .62   1.904 |   6.63   4.670 |  12.65   6.492 |  18.67   2.622
                .63   1.907 |   6.65   4.692 |  12.67   6.462 |  18.68   2.618
                .65   1.909 |   6.67   4.714 |  12.68   6.432 |  18.70   2.614
                .67   1.912 |   6.68   4.737 |  12.70   6.402 |  18.72   2.610
                .68   1.915 |   6.70   4.759 |  12.72   6.372 |  18.73   2.606
                .70   1.918 |   6.72   4.782 |  12.73   6.343 |  18.75   2.602
                .72   1.921 |   6.73   4.806 |  12.75   6.314 |  18.77   2.599
                .73   1.924 |   6.75   4.829 |  12.77   6.286 |  18.78   2.595
                .75   1.926 |   6.77   4.852 |  12.78   6.257 |  18.80   2.591
                .77   1.929 |   6.78   4.876 |  12.80   6.229 |  18.82   2.587
                .78   1.932 |   6.80   4.901 |  12.82   6.201 |  18.83   2.583
                .80   1.935 |   6.82   4.925 |  12.83   6.174 |  18.85   2.580
                .82   1.938 |   6.83   4.950 |  12.85   6.147 |  18.87   2.576
                .83   1.941 |   6.85   4.975 |  12.87   6.120 |  18.88   2.572
                .85   1.944 |   6.87   5.000 |  12.88   6.093 |  18.90   2.569
                .87   1.947 |   6.88   5.026 |  12.90   6.067 |  18.92   2.565
                .88   1.950 |   6.90   5.052 |  12.92   6.041 |  18.93   2.561
                .90   1.953 |   6.92   5.078 |  12.93   6.015 |  18.95   2.557
                .92   1.956 |   6.93   5.104 |  12.95   5.989 |  18.97   2.554
                .93   1.959 |   6.95   5.131 |  12.97   5.963 |  18.98   2.550
                .95   1.962 |   6.97   5.159 |  12.98   5.938 |  19.00   2.546
                .97   1.965 |   6.98   5.186 |  13.00   5.913 |  19.02   2.543
                .98   1.968 |   7.00   5.214 |  13.02   5.889 |  19.03   2.539
               1.00   1.971 |   7.02   5.242 |  13.03   5.864 |  19.05   2.536
               1.02   1.974 |   7.03   5.271 |  13.05   5.840 |  19.07   2.532
               1.03   1.977 |   7.05   5.299 |  13.07   5.816 |  19.08   2.528
               1.05   1.980 |   7.07   5.329 |  13.08   5.792 |  19.10   2.525
               1.07   1.983 |   7.08   5.358 |  13.10   5.768 |  19.12   2.521
               1.08   1.986 |   7.10   5.388 |  13.12   5.745 |  19.13   2.518
               1.10   1.989 |   7.12   5.419 |  13.13   5.722 |  19.15   2.514
               1.12   1.992 |   7.13   5.449 |  13.15   5.699 |  19.17   2.511
               1.13   1.995 |   7.15   5.481 |  13.17   5.676 |  19.18   2.507
               1.15   1.999 |   7.17   5.512 |  13.18   5.654 |  19.20   2.504
               1.17   2.002 |   7.18   5.544 |  13.20   5.631 |  19.22   2.500
               1.18   2.005 |   7.20   5.576 |  13.22   5.609 |  19.23   2.497
               1.20   2.008 |   7.22   5.609 |  13.23   5.587 |  19.25   2.493
               1.22   2.011 |   7.23   5.643 |  13.25   5.566 |  19.27   2.490
               1.23   2.014 |   7.25   5.676 |  13.27   5.544 |  19.28   2.486
               1.25   2.018 |   7.27   5.710 |  13.28   5.523 |  19.30   2.483
               1.27   2.021 |   7.28   5.745 |  13.30   5.502 |  19.32   2.479
               1.28   2.024 |   7.30   5.780 |  13.32   5.481 |  19.33   2.476
               1.30   2.027 |   7.32   5.816 |  13.33   5.460 |  19.35   2.473
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 1.32   2.030 |   7.33   5.852 |  13.35   5.439 |  19.37   2.469
 1.33   2.034 |   7.35   5.889 |  13.37   5.419 |  19.38   2.466
 1.35   2.037 |   7.37   5.926 |  13.38   5.398 |  19.40   2.462
 1.37   2.040 |   7.38   5.963 |  13.40   5.378 |  19.42   2.459
 1.38   2.044 |   7.40   6.002 |  13.42   5.358 |  19.43   2.456
 1.40   2.047 |   7.42   6.041 |  13.43   5.339 |  19.45   2.452
 1.42   2.050 |   7.43   6.080 |  13.45   5.319 |  19.47   2.449
 1.43   2.053 |   7.45   6.120 |  13.47   5.299 |  19.48   2.446
 1.45   2.057 |   7.47   6.160 |  13.48   5.280 |  19.50   2.442
 1.47   2.060 |   7.48   6.201 |  13.50   5.261 |  19.52   2.439
 1.48   2.064 |   7.50   6.243 |  13.52   5.242 |  19.53   2.436
 1.50   2.067 |   7.52   6.286 |  13.53   5.223 |  19.55   2.432
 1.52   2.070 |   7.53   6.329 |  13.55   5.205 |  19.57   2.429
 1.53   2.074 |   7.55   6.372 |  13.57   5.186 |  19.58   2.426
 1.55   2.077 |   7.57   6.417 |  13.58   5.168 |  19.60   2.423
 1.57   2.081 |   7.58   6.462 |  13.60   5.149 |  19.62   2.420
 1.58   2.084 |   7.60   6.508 |  13.62   5.131 |  19.63   2.416
 1.60   2.088 |   7.62   6.554 |  13.63   5.113 |  19.65   2.413
 1.62   2.091 |   7.63   6.602 |  13.65   5.096 |  19.67   2.410
 1.63   2.095 |   7.65   6.650 |  13.67   5.078 |  19.68   2.407
 1.65   2.098 |   7.67   6.699 |  13.68   5.061 |  19.70   2.403
 1.67   2.102 |   7.68   6.749 |  13.70   5.043 |  19.72   2.400
 1.68   2.105 |   7.70   6.799 |  13.72   5.026 |  19.73   2.397
 1.70   2.109 |   7.72   6.851 |  13.73   5.009 |  19.75   2.394
 1.72   2.112 |   7.73   6.903 |  13.75   4.992 |  19.77   2.391
 1.73   2.116 |   7.75   6.956 |  13.77   4.975 |  19.78   2.388
 1.75   2.119 |   7.77   7.010 |  13.78   4.958 |  19.80   2.384
 1.77   2.123 |   7.78   7.065 |  13.80   4.942 |  19.82   2.381
 1.78   2.126 |   7.80   7.121 |  13.82   4.925 |  19.83   2.378
 1.80   2.130 |   7.82   7.178 |  13.83   4.909 |  19.85   2.375
 1.82   2.134 |   7.83   7.237 |  13.85   4.892 |  19.87   2.372
 1.83   2.137 |   7.85   7.296 |  13.87   4.876 |  19.88   2.369
 1.85   2.141 |   7.87   7.356 |  13.88   4.860 |  19.90   2.366
 1.87   2.145 |   7.88   7.418 |  13.90   4.845 |  19.92   2.363
 1.88   2.148 |   7.90   7.480 |  13.92   4.829 |  19.93   2.360
 1.90   2.152 |   7.92   7.544 |  13.93   4.813 |  19.95   2.357
 1.92   2.156 |   7.93   7.609 |  13.95   4.798 |  19.97   2.354
 1.93   2.159 |   7.95   7.675 |  13.97   4.782 |  19.98   2.351
 1.95   2.163 |   7.97   7.743 |  13.98   4.767 |  20.00   2.348
 1.97   2.167 |   7.98   7.812 |  14.00   4.752 |  20.02   2.345
 1.98   2.171 |   8.00   7.882 |  14.02   4.737 |  20.03   2.342
 2.00   2.175 |   8.02   7.954 |  14.03   4.722 |  20.05   2.339
 2.02   2.178 |   8.03   8.027 |  14.05   4.707 |  20.07   2.336
 2.03   2.182 |   8.05   8.102 |  14.07   4.692 |  20.08   2.332
 2.05   2.186 |   8.07   8.178 |  14.08   4.678 |  20.10   2.330
 2.07   2.190 |   8.08   8.256 |  14.10   4.663 |  20.12   2.327
 2.08   2.194 |   8.10   8.335 |  14.12   4.649 |  20.13   2.324
 2.10   2.198 |   8.12   8.417 |  14.13   4.634 |  20.15   2.321
 2.12   2.202 |   8.13   8.500 |  14.15   4.620 |  20.17   2.318
 2.13   2.205 |   8.15   8.585 |  14.17   4.606 |  20.18   2.315
 2.15   2.209 |   8.17   8.672 |  14.18   4.592 |  20.20   2.312
 2.17   2.213 |   8.18   8.761 |  14.20   4.578 |  20.22   2.309
 2.18   2.217 |   8.20   8.852 |  14.22   4.564 |  20.23   2.306
 2.20   2.221 |   8.22   8.945 |  14.23   4.550 |  20.25   2.303
 2.22   2.225 |   8.23   9.040 |  14.25   4.537 |  20.27   2.300
 2.23   2.229 |   8.25   9.137 |  14.27   4.523 |  20.28   2.297
 2.25   2.233 |   8.27   9.237 |  14.28   4.510 |  20.30   2.295
 2.27   2.237 |   8.28   9.340 |  14.30   4.496 |  20.32   2.292
 2.28   2.241 |   8.30   9.445 |  14.32   4.483 |  20.33   2.289
 2.30   2.246 |   8.32   9.552 |  14.33   4.470 |  20.35   2.286
 2.32   2.250 |   8.33   9.663 |  14.35   4.457 |  20.37   2.283
 2.33   2.254 |   8.35   9.776 |  14.37   4.444 |  20.38   2.280
 2.35   2.258 |   8.37   9.892 |  14.38   4.431 |  20.40   2.277
 2.37   2.262 |   8.38  10.011 |  14.40   4.418 |  20.42   2.275
 2.38   2.266 |   8.40  10.134 |  14.42   4.405 |  20.43   2.272
 2.40   2.270 |   8.42  10.259 |  14.43   4.392 |  20.45   2.269
 2.42   2.275 |   8.43  10.389 |  14.45   4.380 |  20.47   2.266
 2.43   2.279 |   8.45  10.522 |  14.47   4.367 |  20.48   2.263
 2.45   2.283 |   8.47  10.658 |  14.48   4.355 |  20.50   2.261
 2.47   2.287 |   8.48  10.799 |  14.50   4.342 |  20.52   2.258
 2.48   2.292 |   8.50  10.944 |  14.52   4.330 |  20.53   2.255
 2.50   2.296 |   8.52  11.093 |  14.53   4.318 |  20.55   2.253
 2.52   2.300 |   8.53  11.247 |  14.55   4.306 |  20.57   2.250
 2.53   2.305 |   8.55  11.405 |  14.57   4.294 |  20.58   2.247
 2.55   2.309 |   8.57  11.569 |  14.58   4.282 |  20.60   2.244
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 2.57   2.313 |   8.58  11.738 |  14.60   4.270 |  20.62   2.241
 2.58   2.318 |   8.60  11.912 |  14.62   4.258 |  20.63   2.239
 2.60   2.322 |   8.62  12.092 |  14.63   4.246 |  20.65   2.236
 2.62   2.327 |   8.63  12.278 |  14.65   4.235 |  20.67   2.233
 2.63   2.331 |   8.65  12.470 |  14.67   4.223 |  20.68   2.231
 2.65   2.336 |   8.67  12.669 |  14.68   4.211 |  20.70   2.228
 2.67   2.340 |   8.68  12.875 |  14.70   4.200 |  20.72   2.225
 2.68   2.345 |   8.70  13.089 |  14.72   4.189 |  20.73   2.223
 2.70   2.349 |   8.72  13.310 |  14.73   4.177 |  20.75   2.220
 2.72   2.354 |   8.73  13.540 |  14.75   4.166 |  20.77   2.217
 2.73   2.358 |   8.75  13.778 |  14.77   4.155 |  20.78   2.215
 2.75   2.363 |   8.77  14.026 |  14.78   4.144 |  20.80   2.212
 2.77   2.367 |   8.78  14.283 |  14.80   4.133 |  20.82   2.209
 2.78   2.372 |   8.80  14.551 |  14.82   4.122 |  20.83   2.207
 2.80   2.377 |   8.82  14.830 |  14.83   4.111 |  20.85   2.204
 2.82   2.381 |   8.83  15.121 |  14.85   4.100 |  20.87   2.202
 2.83   2.386 |   8.85  15.424 |  14.87   4.089 |  20.88   2.199
 2.85   2.391 |   8.87  15.740 |  14.88   4.078 |  20.90   2.196
 2.87   2.395 |   8.88  16.071 |  14.90   4.068 |  20.92   2.194
 2.88   2.400 |   8.90  16.418 |  14.92   4.057 |  20.93   2.191
 2.90   2.405 |   8.92  16.780 |  14.93   4.047 |  20.95   2.189
 2.92   2.410 |   8.93  17.160 |  14.95   4.036 |  20.97   2.186
 2.93   2.415 |   8.95  17.559 |  14.97   4.026 |  20.98   2.184
 2.95   2.420 |   8.97  17.978 |  14.98   4.016 |  21.00   2.181
 2.97   2.424 |   8.98  18.419 |  15.00   4.005 |  21.02   2.178
 2.98   2.429 |   9.00  18.883 |  15.02   3.995 |  21.03   2.176
 3.00   2.434 |   9.02  19.373 |  15.03   3.985 |  21.05   2.173
 3.02   2.439 |   9.03  19.890 |  15.05   3.975 |  21.07   2.171
 3.03   2.444 |   9.05  20.438 |  15.07   3.965 |  21.08   2.168
 3.05   2.449 |   9.07  21.018 |  15.08   3.955 |  21.10   2.166
 3.07   2.454 |   9.08  21.633 |  15.10   3.945 |  21.12   2.163
 3.08   2.459 |   9.10  22.288 |  15.12   3.935 |  21.13   2.161
 3.10   2.464 |   9.12  22.985 |  15.13   3.925 |  21.15   2.158
 3.12   2.469 |   9.13  23.729 |  15.15   3.915 |  21.17   2.156
 3.13   2.474 |   9.15  24.525 |  15.17   3.906 |  21.18   2.153
 3.15   2.479 |   9.17  25.378 |  15.18   3.896 |  21.20   2.151
 3.17   2.485 |   9.18  26.295 |  15.20   3.886 |  21.22   2.148
 3.18   2.490 |   9.20  27.282 |  15.22   3.877 |  21.23   2.146
 3.20   2.495 |   9.22  28.348 |  15.23   3.867 |  21.25   2.143
 3.22   2.500 |   9.23  29.503 |  15.25   3.858 |  21.27   2.141
 3.23   2.505 |   9.25  30.758 |  15.27   3.849 |  21.28   2.138
 3.25   2.511 |   9.27  32.125 |  15.28   3.839 |  21.30   2.136
 3.27   2.516 |   9.28  33.622 |  15.30   3.830 |  21.32   2.134
 3.28   2.521 |   9.30  35.265 |  15.32   3.821 |  21.33   2.131
 3.30   2.527 |   9.32  37.077 |  15.33   3.811 |  21.35   2.129
 3.32   2.532 |   9.33  39.085 |  15.35   3.802 |  21.37   2.126
 3.33   2.537 |   9.35  41.321 |  15.37   3.793 |  21.38   2.124
 3.35   2.543 |   9.37  43.824 |  15.38   3.784 |  21.40   2.122
 3.37   2.548 |   9.38  46.642 |  15.40   3.775 |  21.42   2.119
 3.38   2.554 |   9.40  49.838 |  15.42   3.766 |  21.43   2.117
 3.40   2.559 |   9.42  53.488 |  15.43   3.757 |  21.45   2.114
 3.42   2.565 |   9.43  57.690 |  15.45   3.749 |  21.47   2.112
 3.43   2.570 |   9.45  62.575 |  15.47   3.740 |  21.48   2.110
 3.45   2.576 |   9.47  68.312 |  15.48   3.731 |  21.50   2.107
 3.47   2.582 |   9.48  75.130 |  15.50   3.722 |  21.52   2.105
 3.48   2.587 |   9.50  83.346 |  15.52   3.714 |  21.53   2.103
 3.50   2.593 |   9.52  93.405 |  15.53   3.705 |  21.55   2.100
 3.52   2.599 |   9.53 105.954 |  15.55   3.697 |  21.57   2.098
 3.53   2.604 |   9.55 121.964 |  15.57   3.688 |  21.58   2.096
 3.55   2.610 |   9.57 142.953 |  15.58   3.679 |  21.60   2.093
 3.57   2.616 |   9.58 171.410 |  15.60   3.671 |  21.62   2.091
 3.58   2.622 |   9.60 211.680 |  15.62   3.663 |  21.63   2.089
 3.60   2.628 |   9.62 271.957 |  15.63   3.654 |  21.65   2.086
 3.62   2.634 |   9.63 228.965 |  15.65   3.646 |  21.67   2.084
 3.63   2.639 |   9.65 196.553 |  15.67   3.638 |  21.68   2.082
 3.65   2.645 |   9.67 171.410 |  15.68   3.630 |  21.70   2.079
 3.67   2.651 |   9.68 151.445 |  15.70   3.621 |  21.72   2.077
 3.68   2.657 |   9.70 135.277 |  15.72   3.613 |  21.73   2.075
 3.70   2.663 |   9.72 121.964 |  15.73   3.605 |  21.75   2.073
 3.72   2.670 |   9.73 110.845 |  15.75   3.597 |  21.77   2.070
 3.73   2.676 |   9.75 101.443 |  15.77   3.589 |  21.78   2.068
 3.75   2.682 |   9.77  93.405 |  15.78   3.581 |  21.80   2.066
 3.77   2.688 |   9.78  86.467 |  15.80   3.573 |  21.82   2.064
 3.78   2.694 |   9.80  80.428 |  15.82   3.565 |  21.83   2.061
 3.80   2.700 |   9.82  75.130 |  15.83   3.558 |  21.85   2.059
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    3.82   2.707 |   9.83  70.451 |  15.85   3.550 |  21.87   2.057
    3.83   2.713 |   9.85  66.292 |  15.87   3.542 |  21.88   2.055
    3.85   2.719 |   9.87  62.575 |  15.88   3.534 |  21.90   2.052
    3.87   2.726 |   9.88  59.236 |  15.90   3.527 |  21.92   2.050
    3.88   2.732 |   9.90  56.221 |  15.92   3.519 |  21.93   2.048
    3.90   2.738 |   9.92  53.488 |  15.93   3.511 |  21.95   2.046
    3.92   2.745 |   9.93  51.000 |  15.95   3.504 |  21.97   2.044
    3.93   2.751 |   9.95  48.726 |  15.97   3.496 |  21.98   2.041
    3.95   2.758 |   9.97  46.642 |  15.98   3.489 |  22.00   2.039
    3.97   2.764 |   9.98  44.725 |  16.00   3.481 |  22.02   2.037
    3.98   2.771 |  10.00  42.957 |  16.02   3.474 |  22.03   2.035
    4.00   2.778 |  10.02  41.321 |  16.03   3.467 |  22.05   2.033
    4.02   2.784 |  10.03  39.803 |  16.05   3.459 |  22.07   2.030
    4.03   2.791 |  10.05  38.392 |  16.07   3.452 |  22.08   2.028
    4.05   2.798 |  10.07  37.077 |  16.08   3.444 |  22.10   2.026
    4.07   2.805 |  10.08  35.849 |  16.10   3.437 |  22.12   2.024
    4.08   2.812 |  10.10  34.700 |  16.12   3.430 |  22.13   2.022
    4.10   2.818 |  10.12  33.622 |  16.13   3.423 |  22.15   2.020
    4.12   2.825 |  10.13  32.609 |  16.15   3.416 |  22.17   2.018
    4.13   2.832 |  10.15  31.656 |  16.17   3.409 |  22.18   2.016
    4.15   2.839 |  10.17  30.758 |  16.18   3.402 |  22.20   2.013
    4.17   2.846 |  10.18  29.909 |  16.20   3.395 |  22.22   2.011
    4.18   2.853 |  10.20  29.107 |  16.22   3.388 |  22.23   2.009
    4.20   2.860 |  10.22  28.348 |  16.23   3.381 |  22.25   2.007
    4.22   2.868 |  10.23  27.628 |  16.25   3.374 |  22.27   2.005
    4.23   2.875 |  10.25  26.944 |  16.27   3.367 |  22.28   2.003
    4.25   2.882 |  10.27  26.295 |  16.28   3.360 |  22.30   2.001
    4.27   2.889 |  10.28  25.676 |  16.30   3.353 |  22.32   1.999
    4.28   2.897 |  10.30  25.087 |  16.32   3.346 |  22.33   1.997
    4.30   2.904 |  10.32  24.525 |  16.33   3.339 |  22.35   1.994
    4.32   2.911 |  10.33  23.989 |  16.35   3.332 |  22.37   1.992
    4.33   2.919 |  10.35  23.476 |  16.37   3.326 |  22.38   1.990
    4.35   2.926 |  10.37  22.985 |  16.38   3.319 |  22.40   1.988
    4.37   2.934 |  10.38  22.515 |  16.40   3.313 |  22.42   1.986
    4.38   2.941 |  10.40  22.065 |  16.42   3.306 |  22.43   1.984
    4.40   2.949 |  10.42  21.633 |  16.43   3.299 |  22.45   1.982
    4.42   2.957 |  10.43  21.219 |  16.45   3.293 |  22.47   1.980
    4.43   2.964 |  10.45  20.821 |  16.47   3.286 |  22.48   1.978
    4.45   2.972 |  10.47  20.438 |  16.48   3.280 |  22.50   1.976
    4.47   2.980 |  10.48  20.069 |  16.50   3.273 |  22.52   1.974
    4.48   2.988 |  10.50  19.715 |  16.52   3.267 |  22.53   1.972
    4.50   2.996 |  10.52  19.373 |  16.53   3.260 |  22.55   1.970
    4.52   3.004 |  10.53  19.044 |  16.55   3.254 |  22.57   1.968
    4.53   3.012 |  10.55  18.726 |  16.57   3.247 |  22.58   1.966
    4.55   3.020 |  10.57  18.419 |  16.58   3.241 |  22.60   1.964
    4.57   3.028 |  10.58  18.122 |  16.60   3.235 |  22.62   1.962
    4.58   3.036 |  10.60  17.836 |  16.62   3.229 |  22.63   1.960
    4.60   3.044 |  10.62  17.559 |  16.63   3.222 |  22.65   1.958
    4.62   3.052 |  10.63  17.291 |  16.65   3.216 |  22.67   1.956
    4.63   3.061 |  10.65  17.031 |  16.67   3.210 |  22.68   1.954
    4.65   3.069 |  10.67  16.780 |  16.68   3.204 |  22.70   1.952
    4.67   3.077 |  10.68  16.537 |  16.70   3.198 |  22.72   1.950
    4.68   3.086 |  10.70  16.301 |  16.72   3.191 |  22.73   1.948
    4.70   3.094 |  10.72  16.071 |  16.73   3.185 |  22.75   1.946
    4.72   3.103 |  10.73  15.849 |  16.75   3.179 |  22.77   1.944
    4.73   3.111 |  10.75  15.633 |  16.77   3.173 |  22.78   1.942
    4.75   3.120 |  10.77  15.424 |  16.78   3.167 |  22.80   1.940
    4.77   3.129 |  10.78  15.220 |  16.80   3.161 |  22.82   1.938
    4.78   3.138 |  10.80  15.022 |  16.82   3.155 |  22.83   1.936
    4.80   3.146 |  10.82  14.830 |  16.83   3.149 |  22.85   1.934
    4.82   3.155 |  10.83  14.643 |  16.85   3.144 |  22.87   1.932
    4.83   3.164 |  10.85  14.460 |  16.87   3.138 |  22.88   1.930
    4.85   3.173 |  10.87  14.283 |  16.88   3.132 |  22.90   1.928
    4.87   3.182 |  10.88  14.110 |  16.90   3.126 |  22.92   1.926
    4.88   3.191 |  10.90  13.942 |  16.92   3.120 |  22.93   1.925
    4.90   3.201 |  10.92  13.778 |  16.93   3.114 |  22.95   1.923
    4.92   3.210 |  10.93  13.618 |  16.95   3.109 |  22.97   1.921
    4.93   3.219 |  10.95  13.462 |  16.97   3.103 |  22.98   1.919
    4.95   3.229 |  10.97  13.310 |  16.98   3.097 |  23.00   1.917
    4.97   3.238 |  10.98  13.161 |  17.00   3.091 |  23.02   1.915
    4.98   3.247 |  11.00  13.017 |  17.02   3.086 |  23.03   1.913
    5.00   3.257 |  11.02  12.875 |  17.03   3.080 |  23.05   1.911
    5.02   3.267 |  11.03  12.737 |  17.05   3.075 |  23.07   1.909
    5.03   3.276 |  11.05  12.602 |  17.07   3.069 |  23.08   1.908
    5.05   3.286 |  11.07  12.470 |  17.08   3.063 |  23.10   1.906
```

```
    5.07   3.296 |  11.08  12.341 |  17.10   3.058 |  23.12   1.904
    5.08   3.306 |  11.10  12.215 |  17.12   3.052 |  23.13   1.902
    5.10   3.316 |  11.12  12.092 |  17.13   3.047 |  23.15   1.900
    5.12   3.326 |  11.13  11.971 |  17.15   3.041 |  23.17   1.898
    5.13   3.336 |  11.15  11.853 |  17.17   3.036 |  23.18   1.896
    5.15   3.346 |  11.17  11.738 |  17.18   3.030 |  23.20   1.895
    5.17   3.356 |  11.18  11.625 |  17.20   3.025 |  23.22   1.893
    5.18   3.367 |  11.20  11.514 |  17.22   3.020 |  23.23   1.891
    5.20   3.377 |  11.22  11.405 |  17.23   3.014 |  23.25   1.889
    5.22   3.388 |  11.23  11.299 |  17.25   3.009 |  23.27   1.887
    5.23   3.398 |  11.25  11.195 |  17.27   3.004 |  23.28   1.885
    5.25   3.409 |  11.27  11.093 |  17.28   2.998 |  23.30   1.883
    5.27   3.419 |  11.28  10.993 |  17.30   2.993 |  23.32   1.882
    5.28   3.430 |  11.30  10.895 |  17.32   2.988 |  23.33   1.880
    5.30   3.441 |  11.32  10.799 |  17.33   2.983 |  23.35   1.878
    5.32   3.452 |  11.33  10.705 |  17.35   2.977 |  23.37   1.876
    5.33   3.463 |  11.35  10.612 |  17.37   2.972 |  23.38   1.874
    5.35   3.474 |  11.37  10.522 |  17.38   2.967 |  23.40   1.873
    5.37   3.485 |  11.38  10.432 |  17.40   2.962 |  23.42   1.871
    5.38   3.496 |  11.40  10.345 |  17.42   2.957 |  23.43   1.869
    5.40   3.508 |  11.42  10.259 |  17.43   2.951 |  23.45   1.867
    5.42   3.519 |  11.43  10.175 |  17.45   2.946 |  23.47   1.865
    5.43   3.530 |  11.45  10.092 |  17.47   2.941 |  23.48   1.864
    5.45   3.542 |  11.47  10.011 |  17.48   2.936 |  23.50   1.862
    5.47   3.554 |  11.48   9.931 |  17.50   2.931 |  23.52   1.860
    5.48   3.565 |  11.50   9.853 |  17.52   2.926 |  23.53   1.858
    5.50   3.577 |  11.52   9.776 |  17.53   2.921 |  23.55   1.857
    5.52   3.589 |  11.53   9.700 |  17.55   2.916 |  23.57   1.855
    5.53   3.601 |  11.55   9.625 |  17.57   2.911 |  23.58   1.853
    5.55   3.613 |  11.57   9.552 |  17.58   2.906 |  23.60   1.851
    5.57   3.626 |  11.58   9.480 |  17.60   2.901 |  23.62   1.849
    5.58   3.638 |  11.60   9.409 |  17.62   2.897 |  23.63   1.848
    5.60   3.650 |  11.62   9.340 |  17.63   2.892 |  23.65   1.846
    5.62   3.663 |  11.63   9.271 |  17.65   2.887 |  23.67   1.844
    5.63   3.675 |  11.65   9.204 |  17.67   2.882 |  23.68   1.843
    5.65   3.688 |  11.67   9.137 |  17.68   2.877 |  23.70   1.841
    5.67   3.701 |  11.68   9.072 |  17.70   2.872 |  23.72   1.839
    5.68   3.714 |  11.70   9.008 |  17.72   2.868 |  23.73   1.837
    5.70   3.727 |  11.72   8.945 |  17.73   2.863 |  23.75   1.836
    5.72   3.740 |  11.73   8.882 |  17.75   2.858 |  23.77   1.834
    5.73   3.753 |  11.75   8.821 |  17.77   2.853 |  23.78   1.832
    5.75   3.766 |  11.77   8.761 |  17.78   2.849 |  23.80   1.831
    5.77   3.780 |  11.78   8.701 |  17.80   2.844 |  23.82   1.829
    5.78   3.793 |  11.80   8.643 |  17.82   2.839 |  23.83   1.827
    5.80   3.807 |  11.82   8.585 |  17.83   2.835 |  23.85   1.825
    5.82   3.821 |  11.83   8.528 |  17.85   2.830 |  23.87   1.824
    5.83   3.835 |  11.85   8.472 |  17.87   2.825 |  23.88   1.822
    5.85   3.849 |  11.87   8.417 |  17.88   2.821 |  23.90   1.820
    5.87   3.863 |  11.88   8.362 |  17.90   2.816 |  23.92   1.819
    5.88   3.877 |  11.90   8.309 |  17.92   2.812 |  23.93   1.817
    5.90   3.891 |  11.92   8.256 |  17.93   2.807 |  23.95   1.815
    5.92   3.906 |  11.93   8.204 |  17.95   2.802 |  23.97   1.814
    5.93   3.920 |  11.95   8.152 |  17.97   2.798 |  23.98   1.812
    5.95   3.935 |  11.97   8.102 |  17.98   2.793 |  24.00   1.810
    5.97   3.950 |  11.98   8.052 |  18.00   2.789 |  24.02   1.809
    5.98   3.965 |  12.00   8.002 |  18.02   2.784 |
    6.00   3.980 |  12.02   7.954 |  18.03   2.780 |
    6.02   3.995 |  12.03   7.906 |  18.05   2.776 |

--------------------------------------------------------------------------------
001:0003------------------------------------------------------------------------
*==============================================================================
*FUTURE NORTH -> 22.7ha URBAN (Assumed Tributary Area to Future Pond)
*            -> FIELD TILE DRY WEATHER FLOW
*==============================================================================
-----------------------
| CALIB STANDHYD      |   Area    (ha)=   22.70
| 01:201    DT= 1.00  |   Total Imp(%)=   60.00   Dir. Conn.(%)=   60.00
-----------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area    (ha)=     13.62        9.08
     Dep. Storage    (mm)=      1.00        5.00
     Average Slope   (%)=       2.50        2.50
     Length          (m)=      45.00       33.00
     Mannings n         =       .015        .250
```

```
    Max.eff.Inten.(mm/hr)=     271.96        182.37
              over (min)         1.00          3.00
    Storage Coeff.  (min)=        .88 (ii)     2.64 (ii)
    Unit Hyd. Tpeak (min)=       1.00          3.00
    Unit Hyd. peak  (cms)=       1.16           .41
                                                           *TOTALS*
    PEAK FLOW       (cms)=       9.36          3.89        12.295 (iii)
    TIME TO PEAK    (hrs)=       9.62          9.67         9.633
    RUNOFF VOLUME    (mm)=     182.03        131.22       161.713
    TOTAL RAINFALL   (mm)=     183.04        183.04       183.036
    RUNOFF COEFFICIENT   =        .99           .72          .884

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
          CN* =  80.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
1:0004-------------------------------------------------------------------------
==============================================================================
OUTE FLOW THROUGH FUTURE POND
OND STAGE-STORAGE RELATIONSHIP HAS BEEN SET UP TO PROVIDE REASONABLE TARGET
LOW ESTIMATES FOR THE DETAILED DESIGN OF POND 1 AND THE FUTURE DESIGN OF
OND 3
==============================================================================
 -------------------
 ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
  IN>01:(201    )  |
 OUT<02:(000301)   |    =========  OUTLFOW STORAGE TABLE  =========
 -------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |     .680  .9200E+00
                           .140  .2800E+00   |     .730  .1070E+01
                           .285  .3750E+00   |     .790  .1230E+01
                           .485  .6000E+00   |    1.000  .1810E+01
                           .572  .7100E+00   |   10.000  .1000E+02

    ROUTING RESULTS               AREA     QPEAK     TPEAK       R.V.
    --------------------          (ha)     (cms)     (hrs)       (mm)
    INFLOW >01: (201    )        22.70    12.295     9.633    161.713
    OUTFLOW<02: (000301)         22.70     1.000    10.700    161.712
   OVERFLOW<03: (       )          .00      .000      .000       .000

                 TOTAL NUMBER OF SIMULATED OVERFLOWS  =          0
                 CUMULATIVE TIME OF OVERFLOWS  (hours)=        .00
                 PERCENTAGE OF TIME OVERFLOWING    (%)=        .00


                 PEAK   FLOW   REDUCTION [Qout/Qin](%)=     8.132
                 TIME SHIFT OF PEAK FLOW         (min)=     64.00
                 MAXIMUM  STORAGE   USED       (ha.m.)=.1809E+01

-------------------------------------------------------------------------------
1:0005-------------------------------------------------------------------------
==============================================================================
EST CATCHMENT -> 22.86ha URBAN (i.e. Phase 2&3 Area Tributary to Pond 1)
==============================================================================
 --------------------
 CALIB STANDHYD     |   Area    (ha)=   22.86
 01:201    DT= 1.00 |   Total Imp(%)=   60.00   Dir. Conn.(%)=   60.00
 --------------------
                              IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=      13.72          9.14
    Dep. Storage     (mm)=       1.00          5.00
    Average Slope     (%)=       2.50          2.50
    Length            (m)=      45.00         33.00
    Mannings n           =       .015          .050

    Max.eff.Inten.(mm/hr)=     271.96        182.37
              over (min)         1.00          3.00
    Storage Coeff.  (min)=        .88 (ii)     2.64 (ii)
    Unit Hyd. Tpeak (min)=       1.00          3.00
    Unit Hyd. peak  (cms)=       1.16           .41
```

```
                                                           *TOTALS*
    PEAK FLOW       (cms)=       9.42          3.91        12.382 (iii)
    TIME TO PEAK    (hrs)=       9.62          9.67         9.633
    RUNOFF VOLUME    (mm)=     182.03        131.22       161.713
    TOTAL RAINFALL   (mm)=     183.04        183.04       183.036
    RUNOFF COEFFICIENT   =        .99           .72          .884

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
          CN* =  80.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
001:0006-----------------------------------------------------------------------
*==============================================================================
*ADD RUNOFF FROM WEST CATCHMENT TO OUTFLOW FROM FUTURE POND 3
*==============================================================================
 ----------------------
| ADD HYD (         5) | ID: NHYD         AREA    QPEAK    TPEAK   R.V.     DWF
 ----------------------                   (ha)    (cms)    (hrs)   (mm)   (cms)
                    ID1 01:201           22.86   12.382    9.63 161.71    .000
                   +ID2 02:        301   22.70    1.000   10.70 161.71    .000
                   +ID3 03:                .00     .000     .00    .00    .000  **DRY**
                   ============================================================
                    SUM 04:          5   45.56   13.085    9.63 161.71    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
001:0007-----------------------------------------------------------------------
*==============================================================================
*ROUTE HYDROGRAPH THROUGH POND 1
*==============================================================================
 ---------------------
| ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
|  IN>04:(000005)    |
| OUT<01:(000401)    |    =========  OUTLFOW STORAGE TABLE  =========
 ---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                            (cms)    (ha.m.)   |    (cms)    (ha.m.)
                             .000  .0000E+00   |    1.351  .9228E+00
                             .022  .5970E-01   |    1.499  .1093E+01
                             .036  .1213E+00   |    1.632  .1270E+01
                             .046  .1848E+00   |    1.695  .1362E+01
                             .155  .2501E+00   |    1.756  .1456E+01
                             .347  .3173E+00   |    1.815  .1551E+01
                             .593  .3865E+00   |    1.871  .1648E+01
                             .751  .4574E+00   |    1.926  .1747E+01
                             .993  .6050E+00   |    1.980  .1849E+01
                            1.186  .7601E+00   |     .000  .0000E+00

      ROUTING RESULTS               AREA     QPEAK     TPEAK       R.V.
      --------------------          (ha)     (cms)     (hrs)       (mm)
      INFLOW >04: (000005)         45.56    13.085     9.633    161.712
      OUTFLOW<01: (000401)         45.56     1.975    10.733    161.711
     OVERFLOW<02: (000001)           .00      .000      .000       .000

                   TOTAL NUMBER OF SIMULATED OVERFLOWS  =          0
                   CUMULATIVE TIME OF OVERFLOWS  (hours)=        .00
                   PERCENTAGE OF TIME OVERFLOWING    (%)=        .00


                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=    15.097
                   TIME SHIFT OF PEAK FLOW         (min)=     66.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.1841E+01

-------------------------------------------------------------------------------
001:0008-----------------------------------------------------------------------
*==============================================================================
*EAST CATCHMENT -> 8.93ha Proposed URBAN + Assumed Future 3.59ha Park/Yard Area
*==============================================================================
 ---------------------
| CALIB STANDHYD     |   Area    (ha)=    8.93
| 03:2021   DT= 1.00 |   Total Imp(%)=   60.00   Dir. Conn.(%)=   60.00
 ---------------------
```

```
                               IMPERVIOUS    PERVIOUS (i)
   Surface Area       (ha)=       5.36         3.57
   Dep. Storage       (mm)=       1.00         5.00
   Average Slope       (%)=       2.50         2.50
   Length              (m)=      45.00        33.00
   Mannings n             =       .015         .050

   Max.eff.Inten.(mm/hr)=       271.96       182.37
              over (min)          1.00         3.00
   Storage Coeff.  (min)=          .88 (ii)    2.64 (ii)
   Unit Hyd. Tpeak (min)=         1.00         3.00
   Unit Hyd. peak  (cms)=         1.16          .41
                                                          *TOTALS*
   PEAK FLOW       (cms)=         3.68         1.53         4.837 (iii)
   TIME TO PEAK    (hrs)=         9.62         9.67         9.633
   RUNOFF VOLUME    (mm)=       182.03       131.22       161.713
   TOTAL RAINFALL   (mm)=       183.04       183.04       183.036
   RUNOFF COEFFICIENT   =          .99          .72          .884

     (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
         CN* =  80.0     Ia = Dep. Storage  (Above)
    (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
         THAN THE STORAGE COEFFICIENT.
   (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
1:0009--------------------------------------------------------------------------
---------------------
CALIB NASHYD         |   Area    (ha)=     3.59   Curve Number    (CN)=80.00
04:2022   DT= 1.00   |   Ia      (mm)=    5.000   # of Linear Res.(N)= 3.00
---------------------    U.H. Tp(hrs)=     .200

   Unit Hyd Qpeak  (cms)=      .686

   PEAK FLOW       (cms)=      .912 (i)
   TIME TO PEAK    (hrs)=     9.867
   RUNOFF VOLUME    (mm)=   131.230
   TOTAL RAINFALL   (mm)=   183.036
   RUNOFF COEFFICIENT   =      .717

   (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
1:0010--------------------------------------------------------------------------
----------------------
ADD HYD (          9) | ID: NHYD          AREA     QPEAK    TPEAK    R.V.    DWF
----------------------                    (ha)     (cms)    (hrs)    (mm)   (cms)
                   ID1 03:2021            8.93     4.837     9.63  161.71    .000
                  +ID2 04:2022            3.59      .912     9.87  131.23    .000
                  ==============================================================
                   SUM 05:          9    12.52     5.240     9.63  152.97    .000

 NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
1:0011--------------------------------------------------------------------------
===========================================================================
OUTE FLOW THROUGH WETLAND 2
===========================================================================
--------------------
ROUTE RESERVOIR    |     Requested routing time step =  1.0 min.
 IN>05:(000009)    |
OUT<06:(000402)    |     =========  OUTLFOW STORAGE TABLE  =========
--------------------     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .000   .0000E+00   |     .585   .3940E+00
                           .007   .4050E-01   |     .647   .4544E+00
                           .014   .8360E-01   |     .705   .5174E+00
                           .074   .1291E+00   |     .758   .5828E+00
                           .180   .1771E+00   |     .807   .6507E+00
                           .316   .2276E+00   |     .853   .7210E+00
                           .432   .2806E+00   |     .898   .7939E+00
                           .514   .3360E+00   |     .000   .0000E+00

   ROUTING RESULTS             AREA       QPEAK       TPEAK        R.V.
```

```
     ------------------        (ha)      (cms)      (hrs)       (mm)
     INFLOW >05: (000009)      12.52     5.240      9.633    152.973
     OUTFLOW<06: (000402)      12.52      .891     10.383    152.968
    OVERFLOW<07: (000002)        .00      .000       .000       .000

                  TOTAL NUMBER OF SIMULATED OVERFLOWS  =          0
                  CUMULATIVE TIME OF OVERFLOWS  (hours)=        .00
                  PERCENTAGE OF TIME OVERFLOWING    (%)=        .00


                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     17.003
                  TIME SHIFT OF PEAK FLOW          (min)=     45.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.7825E+00

--------------------------------------------------------------------------------
001:0012------------------------------------------------------------------------
*===========================================================================
*ADD OUTFLOW FROM POND1 TO OUTFLOW FROM POND 2
*===========================================================================
----------------------
| ADD HYD (          9) | ID: NHYD           AREA     QPEAK    TPEAK    R.V.    DWF
----------------------                     (ha)     (cms)    (hrs)    (mm)   (cms)
                   ID1 01:          401     45.56     1.975    10.73  161.71   .000
                  +ID2 02:            1       .00      .000      .00     .00   .000  **DRY**
                  +ID3 06:          402     12.52      .891    10.38  152.97   .000
                  +ID4 07:            2       .00      .000      .00     .00   .000  **DRY**
                  ================================================================
                   SUM 08:            9     58.08     2.860    10.53  159.83   .000

  NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
001:0013------------------------------------------------------------------------
    FINISH
--------------------------------------------------------------------------------
********************************************************************************
    WARNINGS / ERRORS / NOTES
    ------------------------
  Simulation ended on 2019-03-09     at 19:35:49
================================================================================
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MTE

APPENDIX E

SWM FACILITY DESIGN INFORMATION

THAMES CREST PHASE 2

STORMWATER MANAGEMENT FACILITY 1

St. Marys, Ontario

Project Number:	35499-200
Date:	March 11, 2019
Design By:	JJM
File:	Q:\35499\200 (Phase 2)\Preliminary\SWM\35499-200 Pond 1 (West) Master SWM Facility Design Sheet.xlsx

HYDROLOGIC PARAMETERS

Pre-Development Conditions

Sub-Catchment Number	Area (ha)	Overland Slope (%)	Overland Length (m)	SCS Curve Number			Percent Impervious (%)	Land Use	Comment
				Pervious (AMC II)	Pervious (AMC III)	Impervious			
101	24.8	3.9	220	82	91	98	0	Agriculture	Field
102	11.5	1.4	190	82	91	98	0	Agriculture	Field
103	6.74	1	120	82	91	98	0	Agriculture	Field
111	16.85	0.8	335	82	91	98	0	Agriculture	Field
Total	59.89						0.00		

Post-Development Conditions

Sub-Catchment Number	Area (ha)	Overland Slope (%)	Overland Length (Perv./Imp.) (m)	SCS Curve Number			Percent Impervious (%)	Land Use	Comment
				Pervious (AMC II)	Pervious (AMC III)	Impervious			
201A & 201B	22.9	2.5	33/45	80	90	98	60	Residential / SWM / Park	To Pond 1
202A	8.9	2.5	33/45	80	90	98	60	Residential / SWM	To Pond 2
202B	3.6	TC = 0.3 Hrs		80	90	98	5	Park	To Pond 2
203	22.7	2.5	33/45	80	90	98	60	Residential / SWM / Park	To Future Pond 3
Total	58.1						56.59		

IDF PARAMETERS

Upper Thames River Conservation Authority

Frequency (Years)	a	b	c	Comment
25mm	509.000	6.000	0.799	
2	595.248	4.841	0.766	
5	860.463	7.382	0.759	
10	1060.397	8.954	0.760	
25	1336.383	10.833	0.763	
50	1546.625	11.945	0.766	
100	1717.698	12.472	0.764	
250 (24 hr)	2075.001	14.000	0.770	

THAMES CREST PHASE 2
STORMWATER MANAGEMENT FACILITY 1
St. Marys, Ontario

Project Number:	35499-200
Date:	March 11, 2019
Design By:	JJM
File:	Q:\35499\200 (Phase 2)\Preliminary\SWM\35499-200 Pond 1 (West) Master SWM Facility Design Sheet.xlsx

Step 1: Choose Level of Water Quality Control
Enhanced 80% long-term S.S. removal

Step 2: Choose Type of Facility
Wet Pond

Step 3: Define Catchment area and Imperviousness

Catchment Area (ha) 22.9

Imperviousness (%) 60.00

***Interpolated Storage Volume Requirement (m^3/ha)**
241.67

Permanent Pool Required (m^3)
4618.17

Extended Detention Volume Required (m^3)
1832.00

Table 3.2 Water Quality Storage Requirements based on Receiving Waters (from MOE Stormwater Management Planning and Design Manual, March 2003)

Protection Level	SWMP Type	Storage Volume (m^3/ha) for Impervious Level			
		35	55	70	85
Enhanced 80% long-term S.S. removal	*Wetlands*	80	105	120	140
	Hybrid Wet Pond/Wetland	110	150	175	195
	Wet Pond	140	190	225	250
Normal 70% long-term S.S. Removal	*Wetlands*	60	70	80	90
	Hybrid Wet Pond/Wetland	75	90	105	120
	Wet Pond	90	110	130	150
Basic 60% long-term S.S. Removal	*Wetlands*	60	60	60	60
	Hybrid Wet Pond/Wetland	60	70	75	80
	Wet Pond	60	75	85	95
	Dry Pond (Continuous Flow)	90	150	200	240

**An additional 40m^3/ha of extended detention volume has been accounted for as Pond 1 will be downstream of future SWM Facility 3*

THAMES CREST PHASE 2
STORMWATER MANAGEMENT FACILITY 1
St. Marys, Ontario

Project Number:	35499-200
Date:	March 11, 2019
Design By:	JJM
File:	Q:\35499\200 (Phase 2)\Preliminary\SWM\35499-200 Pond 1 (West) Master SWM Facility Design Sheet.xlsx

STAGE-STORAGE RELATIONSHIP

Stage	Active Depth	Forebay			Main Pond			Total Pond Volume	Active Storage Volume	Volume Summary	Ponding Elevation	Comments	Stage
		Area	Volume	Cumulative Volume	Area	Volume	Cumulative Volume						
m	m	m^2	m^3	m^3	m^2	m^3	m^3	m^3	m^3	m^3	m		m
313.40		523	0	0	2555	0	0	0					313.40
313.50		573	55	55	2692	262	262	317					313.50
313.60		623	60	115	2829	276	538	653					313.60
313.70		673	65	179	2965	290	828	1007					313.70
313.80		723	70	249	3102	303	1131	1380					313.80
313.90		773	75	324	3238	317	1448	1772					313.90
314.00		823	80	404	3375	331	1779	2183					314.00
314.10		873	85	488	3512	344	2123	2612					314.10
314.20		923	90	578	3648	358	2481	3060					314.20
314.30		973	95	673	3785	372	2853	3526					314.30
314.40		1023	100	773	3922	385	3238	4011					314.40
314.50		1073	105	877	4058	399	3637	4515					314.50
314.60		1123	110	987	4195	413	4050	5037					314.60
314.70		1173	115	1102	4332	426	4476	5578					314.70
314.80		1223	120	1222	4468	440	4916	6138					314.80
314.90		1273	125	1346	4605	454	5370	6716				Permanent Pool	314.90
314.90	0.00				5878	0	5370	6716	0				314.90
315.00	0.10				6065	597	5967	7314	597				315.00
315.10	0.20				6253	616	6583	7930	1213				315.10
315.20	0.30				6441	635	7218	8564	1848				315.20
315.30	0.40				6629	653	7871	9218	2501				315.30
315.40	0.50				6816	672	8544	9890	3173	2954	315.37	25mm Event	315.40
315.50	0.60				7004	691	9235	10581	3865	3821	315.50	1:2 Year Event	315.50
315.60	0.70				7192	710	9944	11291	4574				315.60
315.70	0.80				7380	729	10673	12019	5303				315.70
315.80	0.90				7568	747	11420	12767	6050	5754	315.77	1:5 Year Event	315.80
315.90	1.00				7755	766	12187	13533	6816				315.90
316.00	1.10				7943	785	12972	14318	7601	7269	315.96	1:10 Year Event	316.00
316.10	1.20				8131	804	13775	15122	8405				316.10
316.20	1.30				8319	822	14598	15944	9228				316.20
316.30	1.40				8507	841	15439	16785	10069	9325	316.22	1:25 Year Event	316.30
316.40	1.50				8694	860	16299	17645	10929	10840	316.39	1:50 Year Event	316.40
316.50	1.60				8882	879	17178	18524	11808				316.50
316.60	1.70				9070	898	18075	19422	12705	12430	316.57	1:100 Year Event	316.60
316.70	1.80				9258	916	18992	20338	13622				316.70
316.80	1.90				9445	935	19927	21273	14557				316.80
316.90	2.00				9633	954	20881	22227	15511				316.90
317.00	2.10				9821	973	21854	23200	16484				317.00
317.10	2.20				10009	991	22845	24192	17475				317.10
317.20	2.30				10384	1020	23865	25211	18495	18410	317.20	1:250 Year Event	317.20

THAMES CREST PHASE 2
STORMWATER MANAGEMENT FACILITY 1
St. Marys, Ontario

Project Number:	35499-200
Date:	March 11, 2019
Design By:	JJM
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Orifice Calculations

$Q_o=C_d*A_o*(2*g*H_o)^{\wedge}0.5$

	Orifice 1	Orifice 2
C_d	0.63	0.63
Invert (m)	314.90	315.20
Width (m)	0.215	0.540
Diameter/Height (m)	0.075	0.300
Type (H/V)	V	V
# of orifices	2	3

C_d	Description
0.63	Orifice Plate
0.80	Orifice Tube

STAGE-DISCHARGE RELATIONSHIP

		Outlet Controls											Extended Detention
		Orifice 1			Orifice 2								
Stage	Active Volume	Area	H_o	Flow	Area	H_o	Flow	Total Flow		Average Discharge	Increment Volume	Increment Dewatering Time	Cumulative Dewatering Time
m	m^3	m^2	m	m^3/s	m^2	m	m^3/s	m^3/s		m^3/s	m^3	hours	hours
314.90	0	0	0	0	0	0	0	0.0000		0.0112	597	14.75	24.85
315.00	597	0.02	0.06	0.0225	0	0	0	0.0225		0.0294	616	5.82	10.10
315.10	1213	0.02	0.16	0.0363	0	0	0	0.0363		0.0412	635	4.28	4.28
315.20	1848	0.02	0.26	0.0461	0	0	0	0.0461		0.1007	653	1.80	1.80
315.30	2501	0.02	0.36	0.0542	0.05	0.05	0.1011	0.1553		0.2512	672	0.74	
315.40	3173	0.02	0.46	0.0612	0.11	0.10	0.2859	0.3471	25mm	0.4699	691	0.41	
315.50	3865	0.02	0.56	0.0675	0.16	0.15	0.5253	0.5928	2	0.6721	710	0.29	
315.60	4574	0.02	0.66	0.0733	0.16	0.25	0.6781	0.7514		0.8161	729	0.25	
315.70	5303	0.02	0.76	0.0786	0.16	0.35	0.8023	0.8809		0.9371	747	0.22	
315.80	6050	0.02	0.86	0.0836	0.16	0.45	0.9098	0.9934	5	1.0437	766	0.20	
315.90	6816	0.02	0.96	0.0883	0.16	0.55	1.0058	1.0941		1.1401	785	0.19	
316.00	7601	0.02	1.06	0.0928	0.16	0.65	1.0934	1.1862	10	1.2289	804	0.18	
316.10	8405	0.02	1.16	0.0970	0.16	0.75	1.1745	1.2715	25	1.3115	822	0.17	
316.20	9228	0.02	1.26	0.1011	0.16	0.85	1.2504	1.3515	50	1.3892	841	0.17	
316.30	10069	0.02	1.36	0.1050	0.16	0.95	1.3219	1.4269	100	1.4627	860	0.16	
316.40	10929	0.02	1.46	0.1088	0.16	1.05	1.3897	1.4985		1.5327	879	0.16	
316.50	11808	0.02	1.56	0.1125	0.16	1.15	1.4544	1.5669		1.5996	898	0.16	
316.60	12705	0.02	1.66	0.1160	0.16	1.25	1.5163	1.6323		1.6638	916	0.15	
316.70	13622	0.02	1.76	0.1195	0.16	1.35	1.5758	1.6952		1.7256	935	0.15	
316.80	14557	0.02	1.86	0.1228	0.16	1.45	1.6331	1.7559		1.7852	954	0.15	
316.90	15511	0.02	1.96	0.1261	0.16	1.55	1.6885	1.8145		1.8429	973	0.15	
317.00	16484	0.02	2.06	0.1292	0.16	1.65	1.7421	1.8713		1.8989	991	0.15	
317.10	17475	0.02	2.16	0.1323	0.16	1.75	1.7941	1.9264		1.9532	1020	0.15	
317.20	18495	0.02	2.26	0.1354	0.16	1.85	1.8446	1.9800	250				

THAMES CREST PHASE 2
STORMWATER MANAGEMENT FACILITY 1
St. Marys, Ontario

Project Number: 35499-200
Date: March 11, 2019
Design By: JJM
File: Q:\35499\200 (Phase 2)\Preliminary\SWM\35499-200 Pond 1 (West) Master SWM Facility Design Sheet.xlsx

FOREBAY DESIGN CALCULATIONS
MOE SWM Planning and Design Manual, 2003

Forebay Design Flows

Flow into forebay during the 1:5-year return period event 2.712 m^3/s
Flow into forebay during the 25 mm - 4 hour design storm event 1.658 m^3/s
Peak flow from main pond outlet for the 25mm design storm (from MIDUSS) 0.200 m^3/s

Forebay Characteristics

b = 8.0 *m* bottom width
y = 1.5 *m* depth
z = 3 :1 side slope
w = 12.5 *m* average width
R = 1.07 *m* hydraulic radius
A = 18.8 m^2 cross-sectional area

1. Length Calculation Based on Settling Velocity

L = forebay flow length *(m)*
r = length-to-width ratio
Q_p = peak flow rate through forebay *(m^3/s)*
v_s = settling velocity *(m/s)*

Equation 4.5: Forebay Settling Length

a) Required Settling Length (assuming Q_p = forebay through-flow & v_s = 0.0055 m/s)

Q_p = 1.66 m^3/s peak flow rate through forebay
v_s = 0.0055 *m/s* settling velocity
r = 1.93 length-to-width ratio
L = 24.1 m required settling length
L = *24.1 m* *trial length*

b) Required Settling Length (assuming Q_p = pond discharge & v_s = 0.0003 m/s)

Q_p = 0.200 m^3/s peak flow rate through forebay
v_s = 0.0003 *m/s* settling velocity
r = 4.27 length-to-width ratio
L = 53.4 m required settling length
L = *53.4 m* *trial length*

Table 1: Average settling velocities

	Mass Removed	Particle Size Range	Average Settling Velocity
	%	*μm*	*m/s*
	80 - 100	x ≤ 20	0.00000254
Enhanced:	70 - 80	20 < x ≤ 40	0.00001300
Normal:	60 - 70	40 < x ≤ 60	0.00002540
Basic:	40 - 60	60 < x ≤ 130	0.00012700
Medium Sand:	20 - 40	130 < x ≤ 400	0.00059267
Gross Grit:	0 - 20	400 < x ≤ 4000	0.00550333

2. Length Calculation Based on Flow Dispersion Length

Q = 2.71 m^3/s inlet flow rate
d = 1.5 *m* depth of permanent pool in forebay
V_f = 0.50 *m/s* desired velocity in forebay (typical value ≤ 0.50 *m/s*)
L = 28.9 m required length of dispersion

Equation 4.6: Dispersion Length

3. Required Forebay Length

L = 53.4 *m* design length
r = 4.27 design length-to-width ratio (typical minimum of 2.0)

4. Scour Velocity

v_s = 0.15 *m/s* scour velocity (typical value = 0.15 *m/s*)
v = 0.145 *m/s* actual velocity

OK The actual velocity through the forebay is less than the scour velocity.

5. Weir Flow From Forebay

L = 11 *m* length of crest of weir
α = 1.65 coefficient
H = 0.3 *m* head
Q = 2.98 m^3/s discharge

Equation 4.4: Weir Flow

OK The weir flow from the forebay exceeds the flow entering the forebay

6. Estimated Cleanout Frequencies

a) Forebay

Forebay volume 1346 m^3
Estimated TSS removal efficiency 80%
Impervious level 60%
Estimated annual sediment loading 2.2 m^3/ha
Contributing area 20.50 *ha*
Annual sediment volume 36 m^3/yr
Cleanout frequency for 33% volume reduction 12.3 *years*

Table 2: Annual sediment loading

Impervious Level	Annual Loading
%	m^3/ha
35%	0.6
55%	1.9
70%	2.8
85%	3.8

b) Stormwater Management Pond

Wetpond volume (excluding forebay) 5370 m^3
Estimated TSS removal efficiency 30%
Impervious level 60%
Estimated annual sediment loading 2.2 m^3/ha
Contributing area 20.50 *ha*
Annual sediment volume 14 m^3/yr
Cleanout frequency for 33% volume reduction 131.0 *years*

THAMES CREST PH2
STORMWATER MANAGEMENT FACILITY 2
St. Marys, Ontario

MTE

Project Number: 35499-200
Date: March 11, 2019
Design By: JJM
File: Q:\35499\200 (Phase 2)\Preliminary\SWM\35499-200 Pond 2 (East) Master SWM Facility Design Sheet.xlsx

Step 1: Choose Level of Water Quality Control
Enhanced 80% long-term S.S. removal

Step 2: Choose Type of Facility
Wetlands

Step 3: Define Catchment area and Imperviousness

Catchment Area (ha) 12.5

Imperviousness (%) 44.30

Interpolated Storage Volume Requirement (m^3/ha)
91.63

Permanent Pool Required (m^3)
645.31

Extended Detention Volume Required (m^3)
500.00

Table 3.2 Water Quality Storage Requirements based on Receiving Waters (from MOE Stormwater Management Planning and Design Manual, March 2003)

Protection Level	**SWMP Type**	**Storage Volume (m^3/ha) for Impervious Level**			
		35	**55**	**70**	**85**
Enhanced 80% long-term S.S. removal	*Wetlands*	80	105	120	140
	Hybrid Wet Pond/Wetland	110	150	175	195
	Wet Pond	140	190	225	250
Normal 70% long-term S.S. Removal	*Wetlands*	60	70	80	90
	Hybrid Wet Pond/Wetland	75	90	105	120
	Wet Pond	90	110	130	150
Basic 60% long-term S.S. Removal	*Wetlands*	60	60	60	60
	Hybrid Wet Pond/Wetland	60	70	75	80
	Wet Pond	60	75	85	95
	Dry Pond (Continuous Flow)	90	150	200	240

THAMES CREST PH2
STORMWATER MANAGEMENT FACILITY 2
St. Marys, Ontario

MTE

Project Number: 35499-200
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STAGE-STORAGE RELATIONSHIP

Stage	Active Depth	Forebay			Main Pond			Total Pond Volume	Active Storage Volume	Volume Summary	Ponding Elevation	Comments	Stage
		Area	Volume	Cumulative Volume	Area	Volume	Cumulative Volume						
m	m	m^2	m^3	m^3	m^2	m^3	m^3	m^3	m^3	m^3	m		m
													0.00
													0.00
320.00		122	0	0				0					320.00
320.10		150	14	14				14					320.10
320.20		178	16	30				30					320.20
320.30		206	19	49				49					320.30
320.40		234	22	71				71					320.40
320.50		262	25	96				96					320.50
320.60		290	28	124				124					320.60
320.70		318	30	154				154					320.70
320.80		346	33	187				187					320.80
320.90		374	36	223				223					320.90
321.00		402	39	262	3026	0	0	262					321.00
321.10		430	42	303	3054	304	304	607					321.10
321.20		458	44	348	3082	307	611	958					321.20
321.30		485	47	395	3445	326	937	1332		1332		Permanent Pool	321.30
321.30	0.00				3930	0	937	1332	0				321.30
321.40	0.10				4179	405	1343	1737	405				321.40
321.50	0.20				4428	430	1773	2168	836				321.50
321.60	0.30				4676	455	2228	2623	1291	1226	321.59	25mm Event	321.60
321.70	0.40				4925	480	2708	3103	1771	1631	321.68	1:2 Year Event	321.70
321.80	0.50				5174	505	3213	3608	2276				321.80
321.90	0.60				5422	530	3743	4138	2806	2376	321.82	1:5 Year Event	321.90
322.00	0.70				5671	555	4298	4692	3360	2934	321.93	1:10 Year Event	322.00
322.10	0.80				5919	580	4877	5272	3940	3760	322.07	1:25 Year Event	322.10
322.20	0.90				6168	604	5481	5876	4544	4405	322.18	1:50 Year Event	322.20
322.30	1.00				6417	629	6111	6506	5174	5089	322.29	1:100 Year Event	322.30
322.40	1.10				6665	654	6765	7160	5828				322.40
322.50	1.20				6914	679	7444	7839	6507				322.50
322.60	1.30				7163	704	8148	8542	7210				322.60
322.70	1.40				7411	729	8876	9271	7939	7825	322.69	1:250 Year Event	322.70

THAMES CREST PH2
STORMWATER MANAGEMENT FACILITY 2
St. Marys, Ontario

Project Number:	35499-200
Date:	March 11, 2019
Design By:	JJM
File:	Q:\35499\200 (Phase 2)\Preliminary\SWM\35499-200 Pond 2 (East) Master SWM Facility Design Sheet.xlsx

Orifice Calculations

$Q_o=C_d*A_o*(2*g*H_o)^0.5$

	Orifice 1	Orifice 2	Orifice 3
C_d	0.63	0.63	0.63
Invert (m)	321.30	321.50	321.50
Width (m)		0.450	0.450
Diameter/Height (m)	0.130	0.350	0.320
Type (H/V)	V	V	V

C_d	Description
0.63	Orifice Plate
0.80	Orifice Tube

STAGE-DISCHARGE RELATIONSHIP

Stage	Active Volume	Emily Street Sewer Outlet Controls									Total Flow		Average Discharge	Increment Volume	Increment Dewatering Time	Extended Detention
		Orifice 1			Orifice 2			Orifice 3								Cumulative Dewatering Time
		Area	H_o	Flow	Area	H_o	Flow	Area	H_o	Flow						
m	m^3	m^2	m	m^3/s	m^2	m	m^3/s	m^2	m	m^3/s	m^3/s		m^3/s	m^3	hours	hours
321.30	0	0	0	0	0	0	0	0	0	0	0.0000		0.0034	405	32.95	44.64
321.40	405	0.01	0.05	0.0068	0	0	0	0	0	0	0.0068		0.0102	430	11.69	11.69
321.50	836	0.01	0.14	0.0136	0	0	0	0	0	0	0.0136		0.0439	455	2.88	
321.60	1291	0.01	0.24	0.0180	0.05	0.05	0.0281	0.05	0.05	0.0281	0.0741		0.1272	480	1.05	
321.70	1771	0.01	0.34	0.0214	0.09	0.10	0.0794	0.09	0.10	0.0794	0.1803	25mm	0.2483	505	0.56	
321.80	2276	0.01	0.44	0.0244	0.14	0.15	0.1459	0.14	0.15	0.1459	0.3162	2	0.3743	530	0.39	
321.90	2806	0.01	0.54	0.0271	0.16	0.23	0.2085	0.14	0.24	0.1969	0.4324	5	0.4734	555	0.33	
322.00	3360	0.01	0.64	0.0295	0.16	0.33	0.2506	0.14	0.34	0.2343	0.5144	10	0.5496	580	0.29	
322.10	3940	0.01	0.74	0.0318	0.16	0.43	0.2865	0.14	0.44	0.2666	0.5848		0.6162	604	0.27	
322.20	4544	0.01	0.84	0.0338	0.16	0.53	0.3185	0.14	0.54	0.2953	0.6476	25	0.6762	629	0.26	
322.30	5174	0.01	0.94	0.0358	0.16	0.63	0.3475	0.14	0.64	0.3215	0.7048	50	0.7312	654	0.25	
322.40	5828	0.01	1.04	0.0377	0.16	0.73	0.3742	0.14	0.74	0.3457	0.7576	100	0.7823	679	0.24	
322.50	6507	0.01	1.14	0.0395	0.16	0.83	0.3992	0.14	0.84	0.3683	0.8070		0.8302	704	0.24	
322.60	7210	0.01	1.24	0.0412	0.16	0.93	0.4227	0.14	0.94	0.3896	0.8535		0.8755	729	0.23	
322.70	7939	0.01	1.34	0.0428	0.16	1.03	0.4450	0.14	1.04	0.4098	0.8976	250				

THAMES CREST PH2
STORMWATER MANAGEMENT FACILITY 2
St. Marys, Ontario

Project Number:	35499-200
Date:	March 11, 2019
Design By:	JJM
File:	Q:\35499\200 (Phase 2)\Preliminary\SWM\35499-200 Pond 2 (East) Master SWM Facility Design Sheet.xlsx

FOREBAY DESIGN CALCULATIONS
MOE SWM Planning and Design Manual, 2003

Forebay Design Flows

Flow into forebay during the 1:5-year return period event	1.200 m^3/s
Flow into forebay during the 25 mm - 3 hour design storm event	0.700 m^3/s
Peak flow from main pond outlet for the 25mm design storm (from MIDUSS)	0.054 m^3/s

Forebay Characteristics

b =	5.3 *m*	bottom width
y =	1 *m*	depth
z =	3 :1	side slope
w =	8.3 *m*	average width
R =	0.71 *m*	hydraulic radius
A =	8.3 m^2	cross-sectional area

1. Length Calculation Based on Settling Velocity

L = forebay flow length *(m)*
r = length-to-width ratio
Q_p = peak flow rate through forebay *(m^3/s)*
v_s = settling velocity *(m/s)*

Equation 4.5: Forebay Settling Length

a) Required Settling Length (assuming Q_p = forebay through-flow & v_s = 0.0055 m/s)

Q_p =	0.70 m^3/s	peak flow rate through forebay
v_s =	0.0055 *m/s*	settling velocity
r =	1.84	length-to-width ratio
L =	15.3 *m*	required settling length
L =	*15.3 m*	*trial length*

b) Required Settling Length (assuming Q_p = pond discharge & v_s = 0.0003 m/s)

Q_p =	0.054 m^3/s	peak flow rate through forebay
v_s =	0.0003 *m/s*	settling velocity
r =	2.60	length-to-width ratio
L =	21.6 *m*	required settling length
L =	*21.6 m*	*trial length*

Table 1: Average settling velocities

	Mass Removed	Particle Size Range	Average Settling Velocity
	%	*μm*	*m/s*
	80 - 100	x ≤ 20	0.00000254
Enhanced:	70 - 80	20 < x ≤ 40	0.00001300
Normal:	60 - 70	40 < x ≤ 60	0.00002540
Basic:	40 - 60	60 < x ≤ 130	0.00012700
Medium Sand:	20 - 40	130 < x ≤ 400	0.00059267
Gross Grit:	0 - 20	400 < x ≤ 4000	0.00550333

2. Length Calculation Based on Flow Dispersion Length

Q =	1.20 m^3/s	inlet flow rate
d =	1 *m*	depth of permanent pool in forebay
V_f =	0.50 *m/s*	desired velocity in forebay (typical value ≤ 0.50 *m/s*)
L =	19.2 m	required length of dispersion

Equation 4.6: Dispersion Length

3. Required Forebay Length

L =	**21.6 *m***	**design length**
r =	2.61	design length-to-width ratio (typical minimum of 2.0)

4. Scour Velocity

v_s =	0.15 *m/s*	scour velocity (typical value = 0.15 *m/s*)
v =	**0.145 *m/s***	**actual velocity**

OK The actual velocity through the forebay is less than the scour velocity.

5. Weir Flow From Forebay

L =	5 *m*	length of crest of weir
α =	1.65	coefficient
H =	0.3 *m*	head
Q =	**1.36 m^3/s**	**discharge**

Equation 4.4: Weir Flow

OK The weir flow from the forebay exceeds the flow entering the forebay

6. Estimated Cleanout Frequencies

a) Forebay

Forebay volume	350 m^3
Estimated TSS removal efficiency	80%
Impervious level	60%
Estimated annual sediment loading	2.2 m^3/ha
Contributing area	12.00 *ha*
Annual sediment volume	21 m^3/yr
Cleanout frequency for 33% volume reduction	**5.5 *years***

b) Stormwater Management Pond

Wetpond volume (excluding forebay)	1257 m^3
Estimated TSS removal efficiency	30%
Impervious level	60%
Estimated annual sediment loading	2.2 m^3/ha
Contributing area	12.00 *ha*
Annual sediment volume	8 m^3/yr
Cleanout frequency for 33% volume reduction	**52.4 *years***

Table 2: Annual sediment loading

Impervious Level	Annual Loading
%	m^3/ha
35%	0.6
55%	1.9
70%	2.8
85%	3.8

APPENDIX F

GEOTECHNICAL REPORT

THAMES CREST FARM SUBDIVISION PHASES 2A & 2B

Preliminary Geotechnical Investigation

Project Location:
Glass Street
St. Marys, ON

Prepared for:
Thames Crest Development Corporation
301-100 Wellington Street
London, ON

Prepared by:
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Stratford, ON N5A 2A5

December 14, 2018

MTE File No.: 35499-200

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APPENDICES

1.0 INTRODUCTION

MTE Consultants Inc. (MTE) was retained by Thames Crest Development Corporation to conduct a preliminary geotechnical investigation for a proposed residential subdivision (Phases 2A and 2B) along Glass Street between James Street North and Emily Street in St. Marys, Ontario, as shown on **Figure 1 in Appendix A**. The site is currently agricultural fields north and south of Glass Street and comprises approximately 61.7 hectares. There is a possible farm structure at the southwest corner of the site.

It is understood that the Phase 2A and 2B development will include approximately 179 residential lots, each with municipal services. Two Stormwater Management (SWM) blocks and a park block are proposed along the south side of the site and two medium density blocks are also proposed within the development. Wellington Street North and Glass Street are projected to extend into the subdivision and multiple new roadways are also proposed within the development. It is noted Glass Street was developed as a temporary road for use during the last phase of construction along Emily Street. The proposed development layout is referenced to MTE's Draft Plan Sketch, File No. 35499-200, dated November 2018.

The property is bordered to the north by agricultural fields and farm structures; to the east by James Street North and residential buildings; to the south by the Grand Trunk Trail, residential buildings and a park; and to the west by Emily Street and residential buildings. The ground surface slopes down from northeast to southwest at the site approximately 7 to 8 m between borehole locations.

The purpose of this preliminary geotechnical investigation is to determine the soil and groundwater conditions in the area of the proposed development and provide geotechnical engineering recommendations for site grading, site servicing, foundations, basements, floor slabs, pavement design, subdrainage requirements, and stormwater infiltration.

2.0 FIELD AND LABORATORY PROGRAM

The fieldwork for this investigation was carried out on December 6th and 7th, 2018 and involved the drilling of eight boreholes (Boreholes BH101-18 to BH104-18, MW105-18, MW106-18, BH107-18 and MW108-18) to depths ranging from 4.7 to 6.7 m. The locations of the boreholes are shown on the Site Plan, **Figure 2 in Appendix A**.

Private and public utility companies were contacted prior to the start of drilling activities in order to isolate underground utilities near the boring locations.

The boreholes were advanced with a D50T track mounted drill rig equipped with continuous flight hollow stem augers, supplied and operated by London Soil Test Ltd.

Representative soil samples were recovered throughout the depths explored. Standard Penetration Tests (SPT) were carried out during sampling operations in the boreholes using conventional split spoon equipment. The SPT N-values recorded are plotted on the borehole logs in **Appendix B.**

Cohesive soil samples were tested using a pocket penetrometer to determine approximate shear strengths. The results of the penetrometer testing are plotted on the appended borehole logs.

Three 50 mm diameter monitoring wells were installed in Boreholes MW105-18, MW106-18 and MW108-18 to allow measurement of stabilized groundwater levels and groundwater sampling and testing. The installation comprised 1.5 m filtered screens and bentonite seals above and below the screens. Details of the installation and groundwater observations and measurements are provided on the appended borehole logs.

The monitoring wells were installed in accordance to Ontario Regulation 468/10. A licensed well technician must properly decommission all wells before construction. The construction, maintenance and abandonment of the wells are regulated under the province's Water Resources Act.

Upon completion of drilling, the remaining boreholes were backfilled with soil cuttings and bentonite in accordance with Ontario Regulation 468/10 (formerly O. Reg. 903) under the provinces Water Resources Act.

The fieldwork was monitored throughout by a member of our geotechnical engineering staff, who directed the drilling procedures; conducted SPT and pocket penetrometer tests; documented the soil stratigraphies; monitored the groundwater conditions; observed the monitoring well installation; and transported the recovered soil samples back to our office for further classification.

The geodetic ground surface elevations at the borehole locations were surveyed by MTE OLS Ltd.

All of the soil samples collected were submitted for moisture content testing and three soil samples were submitted for particle size distribution analyses. The results of the laboratory tests are provided in **Appendix C**. The remaining soil samples will be stored for a period of 1 month and will be discarded of at that time without prior request from the client to extend storage time.

3.0 SOIL CONDITIONS

Reference is provided to the appended borehole logs for soil stratigraphy details, SPT N-values, results of pocket penetrometer testing, moisture content profiles, and groundwater observations and measurements. Soil conditions encountered at the site typically include topsoil overlying glacial till deposits.

3.1 Topsoil

Topsoil was encountered surficially in all of the boreholes and was 0.4 to 1.1 m thick (average thickness = 520 mm). The topsoil typically comprises dark brown/black sandy silt and was frozen at the time of the fieldwork.

3.2 Glacial Till

Glacial till was encountered beneath the topsoil in all of the boreholes and extends to the termination depth of each borehole. The till typically ranges in composition from brown clayey silt with some sand and trace gravel to grey gravelly silt with some sand and trace clay. Occasional cobbles were encountered within the till in Boreholes BH102-18 to BH104-18 and BH107-18. The results of three particle size distribution analyses conducted on the till are provided in **Appendix C** and summarized in the following table;

TABLE 1 - RESULTS OF SILT TILL PARTICLE SIZE DISTRIBUTION ANALYSES

Borehole Number	Sample Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
BH101-18	1.52 - 2.13	7	12	47	34
MW106-18	3.05 - 3.66	8	22	44	26
MW108-18	2.29 - 2.90	19	22	36	23

SPT N-values measured in the till typically increase with depth and range from 3 to above 50 blows per 300 mm penetration of the split spoon sampler indicating very loose to very dense conditions. Shear strengths measured with a pocket penetrometer range from 75 to above 200 kPa.

Insitu moisture contents in the till range from 6 to 26% indicating very moist to saturated conditions. Cohesive deposits of the till were at drier than the plastic limit conditions. It is noted that the upper portion of glacial till was frozen in Boreholes BH103-18, BH104-18 and MW108-18.

4.0 GROUNDWATER CONDITIONS

Groundwater observations and measurements were carried out in the open boreholes at the time of drilling and are summarized on the borehole logs. Perched groundwater was noted within the gravelly and sandy silt till in Boreholes BH101-18, BH103-18, BH104-18, MW105-18, MW106-18, BH107-18 and MW108-18 at depths ranging from 0.4 to 3.0 m (Elevation 317.5 to 324.5 m).

Upon completion of drilling activities, free groundwater was measured in Borehole BH104-18 at a depth of 2.3 m below the ground surface (Elevation 323.0 m). The stabilized groundwater level measurements completed in the three monitoring wells are summarized in the following table;

TABLE 2 - GROUNDWATER LEVEL MEASUREMENTS

Borehole Number	Borehole Elevation (masl)	Water Level Measured December 13, 2018 (mbgs)	Groundwater Level Elevation December 13, 2018 (masl)
MW105-18	322.47	3.79	318.68
MW106-18	320.53	Dry	Dry
MW108-18	323.59	1.22	322.37

It should be noted that the groundwater levels can vary and are subject to seasonal fluctuations and local variations.

5.0 DISCUSSION AND RECOMMENDATIONS

5.1 General

The project involves the design of a proposed residential development that will include approximately 179 residential lots in Phases 2A and 2B located along Glass Street between James Street North and Emily Street in St. Marys, Ontario. It is understood that the residential lots will be provided with full municipal services. Wellington Street North is projected to extend into the subdivision and multiple new roadways are also proposed within the development.

The subsurface stratigraphy at the site generally comprises topsoil overlying glacial till deposits. Perched groundwater was encountered within the gravelly and sandy silt till and the stabilized groundwater level was measured between Elevation 318.7 to 322.4 m.

Based on the results of this preliminary geotechnical investigation, the site is suitable for the proposed development; however, the groundwater table and loose native soils will affect design and construction. The following subsections of this report contain preliminary geotechnical recommendations pertaining to development of the property; including, site grading, site servicing, foundations, basements, floor slabs, pavement design, subdrainage requirements, and stormwater infiltration.

5.2 Site Preparation

The first construction activity that will be required for the proposed development will be grading. There is a farm structure located at the southwest corner of the site and should be removed (including old foundations and slabs).

Prior to carrying out any cutting and engineering fill operations, the surficial topsoil must be removed and stockpiled. The average topsoil thickness measured in the boreholes was 520 mm. It is recommended that the average topsoil thickness across the site be increased by 50 mm for removal/stripping calculations to account for variations at the site. The upper loose glacial till ranging from depths of 0.8 to 2.3 m is also not suitable to remain below the residential buildings and must be removed. The topsoil and upper loose glacial till could be used in landscaping areas.

The majority of the inorganic native soils above the groundwater table are suitable for reuse as engineered fill if sufficient drying time is allotted. All fill should be placed in maximum 300 mm thick lifts and compacted to the following percentages;

TABLE 3 - ENGINEERED FILL REQUIREMENTS

Fill Use	Minimum Compaction Required
Structural fill to support buildings	100% SPMDD
Subgrade fill beneath pavements or services	95% SPMDD
Bulk fill in landscape areas	90% SPMDD

The subgrade soils are **extremely susceptible** to disturbance due to the silt content, and it is recommended that construction traffic on the subgrade be minimized.

Structural fill used for raising grades beneath the residential buildings should comprise granular material. Subgrade fill material beneath the proposed pavement areas and services should meet the requirements of OPSS Select Subgrade Material. Any imported fill should be tested and verified by a geotechnical engineer prior to placement.

Structural fill pads should extend a minimum 0.3 m beyond the edge of the footing envelope of any building and down to subgrade at an angle of 45 degrees to the horizontal. Full time testing by geotechnical personnel is recommended during fill placement and compaction to monitor material quality, lift thickness, and verify the compaction by insitu density testing.

In order to minimize the effects of weather and groundwater, fill operations onsite should be carried out in the dry summer months.

5.3 Site Servicing

5.3.1 Excavations and Dewatering

The development will be serviced to provide the individual lots with full municipal services. It is anticipated that the invert levels for the watermain and sewers will be at conventional depths.

Temporary excavations to conventional depths for installation of underground pipes at this site must comply with the Ontario Occupational Health and Safety Act and Regulations for Construction Projects. The topsoil and upper loose glacial till soils encountered in the boreholes would be classified as Type 3 soils (O. Reg. 213/91, s. 226 (4)). Temporary side slopes must be cut at an inclination of 1.0 horizontal to 1.0 vertical or less from the base of the excavation for open cut pipe installation. The lower compact glacial till deposits would be classified as Type 2 soils and temporary side slopes must be cut near vertical at 1.2 m above the base of excavation and at an inclination of 1 horizontal to 1 vertical or less above this level, exclusive of groundwater effects.

Trench side slopes must be continuously inspected especially after periods of heavy rainfall or snow melt to identify areas of instability. Surface water should be directed away from entering the trench.

Minor to moderate groundwater inflow should be expected where the excavations extend into the perched groundwater, encountered within the gravelly and sandy silt till, and into the groundwater table, encountered along the south side of the site between Elevation 318.7 to 322.4 m. A dewatering system with properly constructed sumps and perimeter interceptor ditches and pumps may be needed for the groundwater encountered in Boreholes BH104-18 and MW108-18. It will be necessary to flatten the excavation side slopes where groundwater seepage is occurring to ensure stability. Every excavation that a worker may be required to enter shall be kept reasonably free of water (O. Reg. 213/91, s. 230).

It should be noted that an Environmental Activity and Sector Registry (EASR) or Permit to Take Water (PTTW), issued by the Ministry of Environment, Conservation and Parks, will be required if the dewatering system/sumps result in a water taking of more than 50,000 L/day to 400,000 L/day, respectively. The design of the dewatering system should be left to the contractor's discretion to control groundwater at least 0.5 m below the invert level in order to provide stable excavation base. The contractor should notify the prime consultant in the event that he feels that a PTTW will be needed.

5.3.2 Pipe Bedding

It is anticipated invert elevation of the pipes will be at conventional 2 to 3 m depths below ground surface. No bearing problems are anticipated for pipes set on native inorganic subsoil or imported structural fill. The bedding material may need to be thickened if sub-excavation encounters soft or spongy soil from the base of the service trench.

Pipe bedding for water and sewer services should be conventional Class 'B' pipe bedding comprising a minimum 150 mm thick layer of OPSS Granular 'A' aggregate below the pipe invert. Granular 'A' type aggregate should be provided around the pipe to at least 300 mm above the pipe and the bedding aggregate should be compacted to a minimum 95% Standard Proctor Maximum Dry Density (SPMDD), as per the Town of St. Marys Engineering Design Guidelines and Supplemental Specifications for Municipal Services Manual, dated May 3, 2017.

A well-graded clear stone such as Coarse Aggregate for HL4 Asphaltic Concrete (OPSS 1003) could be used in the sewer trenches as bedding below the spring line of the pipe to facilitate sump pump dewatering, if necessary. The clear stone should be compacted with a plate tamper.

5.3.3 Groundwater Cutoffs

The proposed alignment of the sewers could create a hydraulic connection between groundwater regimes that are not currently connected. To prevent the movement of water along the pipe bedding, it is recommended that concrete or clay cutoff collars be installed. The cutoffs should be 1 m long and in place of regular bedding material.

5.3.4 Trench Backfilling

The trenches above the specified pipe bedding should be backfilled with inorganic onsite soils placed in 300 mm thick lifts and compacted to at least 95% SPMDD. Due to the high moisture content of the inorganic onsite soils, sufficient drying time must be made for the soils to be suitable for trench backfill. Wet or saturated native mineral soils are not considered suitable for reuse as trench backfill. Any additional material required at the site should comprise imported granular soils such as OPSS Select Subgrade Material.

To minimize potential problems, backfilling operations should follow closely after excavation so that only a minimal length of trench is exposed. Care should be taken to protect side slopes of excavations by diverting surface run-off away from the excavations. If construction extends into the winter, then additional steps should be taken to minimize frost and ensure that frozen material is not used as backfill.

5.3.5 Manholes

Precast concrete manholes shall be backfilled with compacted Type 1 Granular 'B' material on all sides for ease of compaction and to minimize post-construction settlement. The backfill should be placed in maximum 500 mm thick lifts and brought up evenly on all sides in order to provide uniform lateral support and earth pressure. All precast manhole bases shall be set on a pad of drainage stone or Granular 'A' with a minimum thickness of 150 mm.

5.4 Pavements

It is understood pavements will be constructed for the proposed roadways and the extension of Wellington Street North at the site. It is anticipated Glass Street will be reconstructed to an urban cross-section. The pavement subgrade soils will comprise native inorganic soils or imported structural fill.

The pavement component thicknesses in the following table are recommended based on the proposed pavement usage, the frost-susceptibility and strength of the subgrade soils, and the Town of St. Marys Engineering Design Guidelines and Supplemental Specifications for Municipal Services Manual, dated May 3, 2017;

TABLE 4 - PAVEMENT DESIGN

Pavement Component	Local Residential Streets
Asphalt Hot Mix	90 mm
OPSS 1010 Granular 'A' Base	150 mm
OPSS 1010 Granular 'B' Subbase	350 mm

Samples of aggregates should be checked for conformance to OPSS 1010 prior to utilization on site and during construction. The Granular 'B' subbase and Granular 'A' base courses must be compacted to 100% SPMDD, as verified by insitu density testing.

The asphaltic concrete paving materials should conform to the requirements of OPSS 1150. The asphalt should be placed and compacted in accordance with OPSS 310. The Performance Graded Asphalt Cement designation for the asphaltic concrete is 58-28.

The asphaltic concrete should comprise 40 mm of HL3 surface over 50 mm of HL4 binder for local residential streets, as per the Town of St. Marys Engineering Design Guidelines and Supplemental Specifications for Municipal Services Manual, dated May 3, 2017.

The pavement design is based on the assumption that construction will be carried out during the drier time of the year and that the subgrade soil is stable as determined by proof-rolling inspected by a geotechnical engineer. If the subgrade is wet and unstable, additional granular subbase will be required.

All materials and construction services required for the work should be in accordance with the relevant sections of the Ontario Provincial Standard Specifications.

It is **strongly recommended** to install subdrains beneath the low areas of pavement and connected to catchbasins. The purpose of the subdrains is to remove excess subsurface water in order to improve overall pavement serviceability and increase the pavement life. Consideration should be given to providing continuous subdrains along the perimeter edges of the new roadways to promote drainage of the granular materials.

The work of subdrain installation shall be in accordance with OPSS 405 and OPSD 216.021. The subdrain shall be 100 or 150 mm diameter perforated pipe conforming to OPSS 1801 or 1840, and wrapped with geotextile conforming to OPSS 1860.

5.5 Curbs and Gutter and Sidewalks

The concrete for curbs, gutters and sidewalks should be proportioned, mixed, placed and cured in accordance with the requirements of OPSS 353, and OPSS 1350 and shall meet the following specific requirements (OPSS 353.05.01), as per the Town of St. Marys Engineering Design Guidelines and Supplemental Specifications for Municipal Services Manual, dated May 3, 2017:

- Minimum compressive strength = 30 MPa at 28 days
- Coarse aggregate = 19.0 mm nominal max. size
- Maximum slump = 60 mm for curb and gutter, 70 mm for sidewalks
- Air entrainment = 7.0 ± 1.5%

During cold weather any freshly placed concrete must be covered with insulating blankets to protect against freezing as per OPSS 904. Three cylinders from each days pour should be taken for compressive strength testing. Air entrainment, temperature and slump tests should be conducted on the same batch of concrete from the test cylinders made.

5.6 Residential Foundation Design

It is understood that the proposed house designs may be constructed with slab-on-grade floors or with full basements. In general, the undisturbed compact native soils or approved structural fill is considered suitable to support house foundations. The upper 0.8 to 2.3 m of loose glacial till soils encountered in the boreholes are not suitable to support foundations due to low internal strength.

Residential building footings constructed on the undisturbed compact native glacial till soils or approved structural fill may be designed for a factored geotechnical bearing resistance at Ultimate Limit States (ULS) of 225 kPa, and soil bearing resistance for 25 mm of settlement at Serviceability Limit States (SLS) of 150 kPa.

The founding materials are **extremely susceptible** to disturbance by construction activity, especially during wet weather and care should be taken to preserve the integrity of the material as bearing strata.

The soil in trenches beneath footings for sewer and watermain services shall be compacted by tamping up to the level of the footing base, or shall be filled with concrete having a strength not less than 10 MPa, to support the footing.

The footing areas must be inspected by a geotechnical engineer to ensure that the soil conditions encountered at the time of construction are suitable to support the design resistances prior to pouring concrete. Any loose, disturbed, organic and deleterious material identified during the inspection should be removed from the footing areas and replaced with structural fill or concrete.

It should be noted that the till is a non-sorted sediment and therefore may contain cobbles and boulders. Provisions are recommended in the excavation contract for the removal of possible boulders in the till.

All exterior floor slabs and footings in unheated areas must be provided with a minimum 1.2 m of earth cover after final grading in order to minimize the potential of damage due to frost action, as per Ontario Provincial Standard Drawing, OPSD 3090.101, dated November 2010. If construction is undertaken during the winter, the subgrade soil and concrete should be protected from freezing.

A modulus of subgrade reaction of 25 MPa/m should be used in the design of the floor slab.

A minimum 150 mm thick layer of Granular 'A' material uniformly compacted to 100% SPMDD should be provided directly beneath the floor slab for leveling and support purposes.

Where spread footings are constructed at different elevations, the difference in elevation in the individual footing should not be greater than one half of the clear distance between the footings. The lower footing should be constructed first so that if it is necessary to construct the lower footings at a greater depth than anticipated, the elevation of the upper footings can be adjusted accordingly. Stepped strip footings should be constructed in accordance with OBC Section 9.15.3.8.

A Site Classification 'D' should be used for earthquake load and effects in accordance with Table 4.1.8.4.A. of the 2012 Ontario Building Code.

All excavations at the site should be carried out in conformance with the Ontario Occupational Health and Safety Act and Regulations for Construction Projects. The topsoil and upper loose glacial till encountered in the boreholes would be classified as Type 3 soils, and temporary side slopes through this material must be cut at an inclination of 1.0 horizontal to 1.0 vertical or less from the base of the excavation. The compact glacial till deposits encountered at the site are classified as Type 2 soils and temporary side slopes must be cut near vertical at 1.2 m above the base of excavation and at an inclination of 1 horizontal to 1 vertical or less above this level, exclusive of groundwater effects.

5.6.1 Basements

It is understood that basements may be installed for the residential buildings at the site. The house basement excavations will encounter perched groundwater conditions and the stabilized groundwater level along the south side of the site was measured between Elevation 318.7 to 322.4 m. We recommend the basement floor levels be designed a minimum 0.5 m above the seasonal high groundwater elevations.

Basements at this site must be provided with perimeter weeping tile systems as per the Ontario Building Code (Section 9.14). The drain tile or pipe should be laid on undisturbed or well-compacted soil so that the top of the tile or pipe (minimum 100 mm diameter) is below the bottom of the basement floor slab. The top and sides of the drain tile or pipe shall be surrounded with not less than 150 mm of crushed stone or other clean coarse granular material containing no more than 10% of material that will pass the 4 mm sieve. The crushed stone should be wrapped with filter cloth. The weeping tile must drain to a suitable frost-free outlet or sump equipped with an automatic pump that will discharge water into a storm sewer service or other frost free outlet.

The portion of the exterior basement wall and floor slab below finished ground level must be waterproofed as per the Ontario Building Code (Subsection 9.13.3). Free-draining sand materials should be used for basement wall backfill. The basement wall backfill should be graded to allow drainage away from the foundation.

The basement walls should be designed to resist the lateral earth pressure. For calculating the lateral earth pressure, the coefficient of earth pressure (K) may be assumed as 0.50 for cohesionless sandy soils and 1.0 for silt and clay (Section 24.12.3.3 Canadian Foundation Engineering Manual). The bulk unit weight of the retained backfill may be taken as 21 kN/m^3 for well-compacted soil. An appropriate factor of safety should be employed.

The subgrade for the basement floor slabs should comprise undisturbed compact native soil or well-compacted fill. A minimum 100 mm thick layer of coarse clean granular material containing not more than 10% material that will pass a 4 mm sieve shall be placed beneath slabs in houses as per Subsection 9.16.2 of the Ontario Building Code. If the subgrade soil is wet, we strongly recommend that subfloor weeping tiles be placed and connected to the sump pit.

If a moisture-sensitive floor finish is to be applied to the slab, then we recommend that a 15 mil polyethylene moisture vapour barrier be installed directly beneath the slab as per Article 9.13.2.7 of the Ontario Building Code. The purpose of the vapour barrier is to reduce moisture transfer by diffusion as per Article 5.5.1.2 of the Ontario Building Code. Joints in the vapour barrier should be lapped not less than 100 mm.

Concrete testing should be performed onsite to determine the slump, temperature, and air entrainment; and concrete cylinders should be cast for compressive strength testing.

5.7 Stormwater Management Blocks

It is understood that two Stormwater Management (SWM) blocks are proposed for the development along the south side of the site. Boreholes MW105-18, MW106-18, BH107-18 and MW108-18 were advanced in the vicinity of the proposed SWM blocks.

SWM inlet/outlet structures footing constructed on the compact undisturbed native glacial till soils encountered at depths of 0.8 to 2.3 m (Elevation 319.0 to 321.7 m) may be designed for a factored geotechnical bearing resistance at Ultimate Limit States (ULS) of 225 kPa, and soil bearing resistance for 25 mm of settlement at Serviceability Limit States (SLS) of 150 kPa.

The footing areas must be inspected by a geotechnical engineer to ensure that the soil conditions encountered at the time of construction are suitable to support the design resistances prior to pouring concrete. Any loose, disturbed, organic and deleterious material identified during the inspection should be removed from the footing areas and replaced with structural fill or concrete.

Embankments for the SWM blocks should be at an inclination of 3.0 horizontal to 1.0 vertical or less from the base of the excavation and can be constructed with onsite native soils. The native soils should be placed in 300 mm thick lifts and compacted to at least 95% SPMDD. The embankment surfaces should be topsoiled and sodded to prevent surface erosion.

5.8 Stormwater Infiltration

It is understood that at-source infiltration of stormwater runoff from the development may also be considered for this site. Soak-away pits generally require soils with a minimum percolation rate of 15 mm/hr and a minimum separation between the bottom of the pit and the seasonally high water table of 1 m (MOE, 2003). Three particle size distribution analyses were carried out on the glacial till deposits encountered at the site. They are plotted on **Table 1 in Appendix C**.

The geometric mean vertical hydraulic conductivity (k) is derived from an empirical formulae by Kaubisch. The estimated design infiltration rate is based on recommendations found in the *Low Impact Development Stormwater Management Planning and Design Guide, Appendix C*, Version 1.0, 2011, published by the Toronto and Region (TRCA) and the Credit Valley (CVC) Conservation Authority, and the approximate relationship between hydraulic conductivity and infiltration rate. A Factor of Safety of 2.5 has been applied to the calculated infiltration rates.

TABLE 5 - INFILTRATION RATES FOR NATIVE SOILS

Borehole Number	Sample Depth (m)	Borehole Elevation (m)	Soil Type	Geometric Mean K-Value (m/sec)	Infiltration Rate (mm/hr)
BH101-18	1.52 - 2.13	322.69	Silt Till	4.7E-10	2
MW106-18	3.05 - 3.66	320.53	Silt Till	1.8E-09	3
MW108-18	2.29 - 2.90	323.59	Silt Till	9.7E-09	5

Due to the low permeability of the native soils, it is our opinion that at-source infiltration of stormwater runoff is not feasible for this development.

5.9 Construction Inspection and Testing

MTE recommends that geotechnical inspection and testing procedures be conducted throughout the various phases of the project.

Engineer site visits should be conducted to confirm geotechnical bearing resistances for footings. Soil compaction testing should be carried out on structural fill beneath the residential buildings, foundation wall backfill, subslab granular fill, and trench backfill. Laboratory and field testing of the pavement structure components (granulars and asphaltic concrete) should be conducted, as well as concrete testing for foundations, curbs and sidewalks.

MTE offers soil compaction, concrete, and asphalt testing as well as soil inspection services through our Stratford office.

6.0 LIMITATIONS OF REPORT

Services performed by **MTE Consultants Inc.** (MTE) were conducted in a manner consistent with the level of care and skill ordinarily exercised by members of the Geotechnical Engineering & Consulting profession practicing under similar conditions in the same geographic area were the services are provided. No other warranty or representation expressed or implied as to the accuracy of the information, conclusions or recommendations is included or intended in this report.

This report was completed for the sole use of the Client. This report is not intended to be exhaustive in scope or to imply a risk-free site. As such, this report may not deal with <u>all</u> issues potentially applicable to the site and may omit aspects which are or may be of interest to the reader.

In addition, it should be recognized that a soil sample result represents one distinct portion of a site at the time it is collected, and that the findings of this report are based on conditions as they existed during the time period of the investigation. The material in the report reflects our best judgment using the information available at the time the report was written. The soil and groundwater conditions between and beyond the test holes may differ from those encountered in the test holes. Should subsurface conditions arise that are different from those in the test holes MTE should be notified to determine whether or not changes should be made as a result of these conditions.

It should be recognized that the passage of time may affect the views, conclusions and recommendations (if any) provided in this report because groundwater conditions of a property can change, along with regulatory requirements. All design details were not known at the time of submission of this report and it is recommended MTE should be retained to review the final design documents prior to construction to confirm they are consistent with our report recommendations. Should additional or new information become available, MTE recommends that it be brought to our attention in order that we may determine whether it affects the contents of this report.

Any use which another party makes of this report, or any reliance on, or decisions to be made based upon it, are the responsibility of such parties. MTE accepts no responsibility for liabilities incurred by or damages, if any, suffered by another party as a result of decisions made or actions taken, based upon this report. Others with interest in the site should undertake their own investigations and studies to determine how or if the condition affects them or their plans. The contractors bidding on this project or undertaking the construction should make their own interpretation of the factual information and draw their own conclusions as to how subsurface conditions may affect their work.

The benchmark and elevations provided in this report are primarily established to identify differences between the test hole locations and should not be used for other purposes such as, planning, development, grading, and excavation.

Respectfully submitted,

MTE CONSULTANTS INC.

LICENSED PROFESSIONAL ENGINEER
M. E. WILSON
100130472
2018.12.14
PROVINCE OF ONTARIO

Ben Heinbuch, EIT
Senior Geotechnical Technician

Montana Wilson, M.Eng. P.Eng. PMP
Civil and Geotechnical Division Manager

MXW:dld

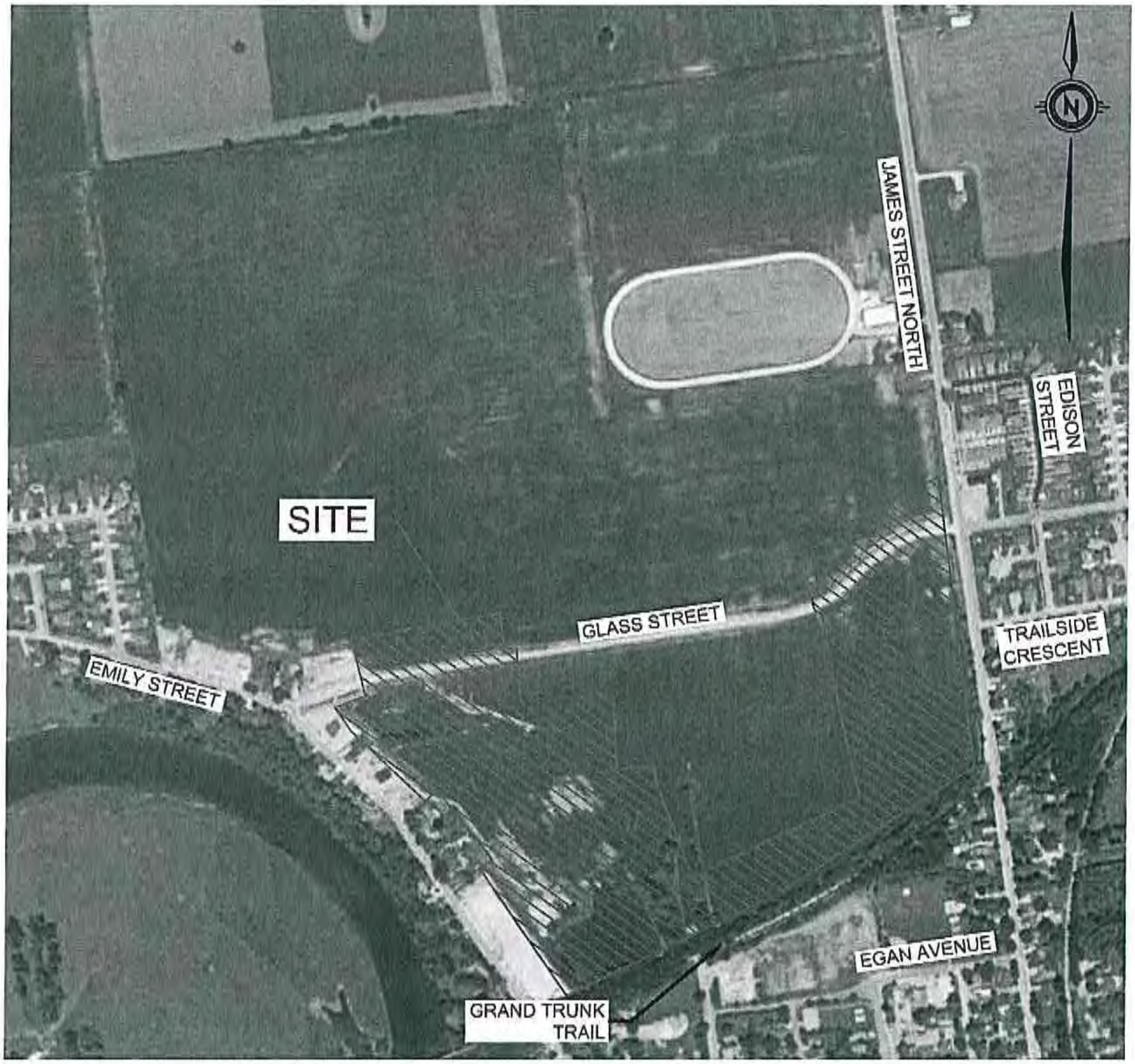
MTE

APPENDIX A

FIGURES

Figure 1- Location Plan
Figure 2 - Site Plan

December 14, 2018 - 3:19 p.m. - Plotted By: cschaerer FIGURE 1 Project: 35499-800 CAD: P:\P\35499\200-PHASE 2\35499-200-BHFIGURES.DWG



AERIAL IMAGE FROM GOOGLE EARTH

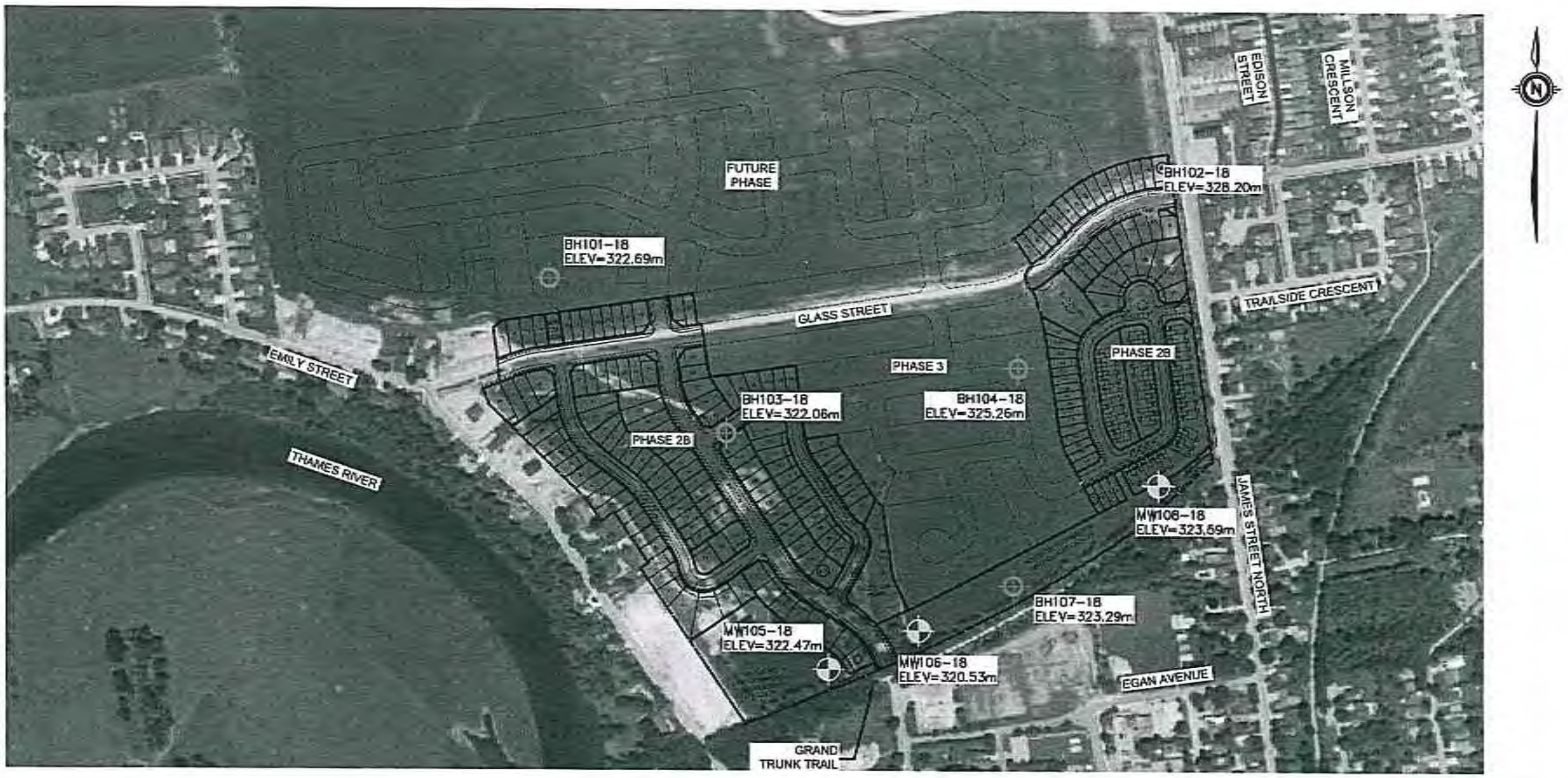
LOCATION PLAN

MTE
Engineers | Scientists | Surveyors

Project Name
THAMES CREST FARM SUBDIVISION GEOTECHNICAL INVESTIGATION

Site	Client
GLASS STREET, ST. MARYS, ONTARIO	THAMES CREST DEVELOPMENT CORPORATION

Scale. (8.5x11)	MTE Project No.	Date	Figure No.
N.T.S	35499-200	DEC.11.2018	**1**



LEGEND

BH101–18
⌖ MTE BOREHOLE

MW105–18
⊕ MTE MONITORING WELL

REFERENCES:

- BASE PLAN REFERENCED FROM MTE CONSULTANTS INC. DWG # 35499-200-PHASING, DATED NOVEMBER 2018.
- AERIAL IMAGE FROM GOOGLE EARTH
- BOREHOLE ELEVATIONS SURVEYED BY MTE OLS LTD.

MTE
Engineers | Scientists | Surveyors

SITE PLAN

Project Name THAMES CREST FARM SUBDIVISION GEOTECHNICAL INVESTIGATION			
Site GLASS STREET, ST. MARYS, ONTARIO		Client THAMES CREST DEVELOPMENT CORPORATION	
Scale (11x17) 1:5000	MTE Project No. 35499-200	Date DEC.11.2018	Figure No. 2

December 14, 2018 – 3:17 p.m. – Plotted By: eschoerer FIGURE 2 Project: 35499-800 CAD: P:\P\35499\200-PHASE 2\35499-200-BHFIGURES.DWG

MTE

APPENDIX B

BOREHOLE LOGS

Boreholes BH101-18 to BH104-18, MW105-18, MW106-18, BH107-18 & MW108-18

ID Number: BH101-18

Project: Thames Crest Farm Subdivision

Project No: 35499-200

Client: Thames Crest Development Corp.

Site Location: Glass Street, St. Mary's, ON

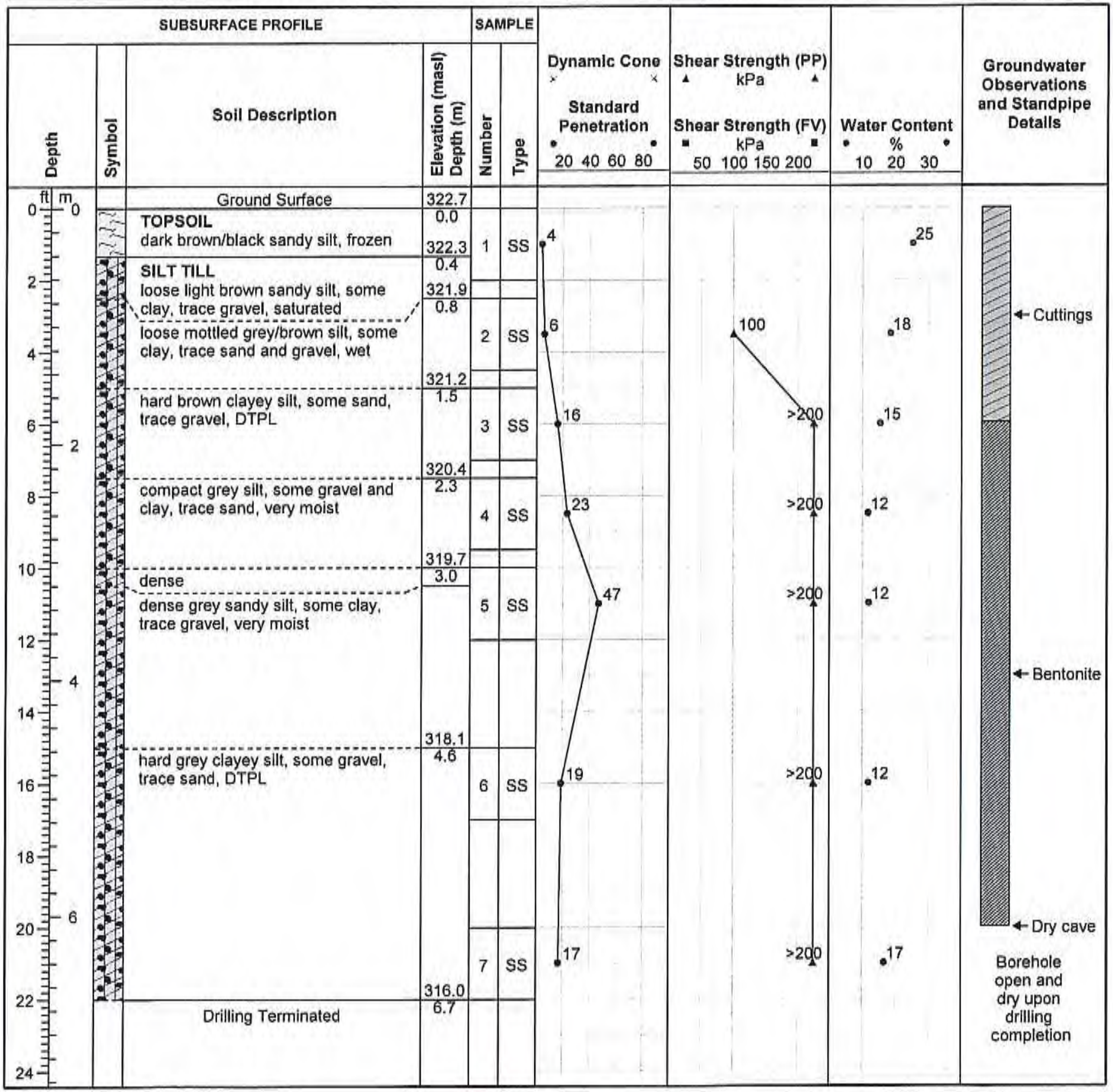
Drill Date: 12/6/2018

Drilling Contractor: London Soil Test Ltd.

Drill Rig: D50T Track

Drill Method: Hollow Stem Auger

Protective Cover: N/A



Soil Description	Elevation (masl) Depth (m)	Number	Type	Standard Penetration	Shear Strength (PP) kPa	Water Content %	Groundwater Observations and Standpipe Details
Ground Surface	322.7 0.0						
TOPSOIL dark brown/black sandy silt, frozen		1	SS	4		25	Cuttings
SILT TILL loose light brown sandy silt, some clay, trace gravel, saturated	322.3 0.4						
loose mottled grey/brown silt, some clay, trace sand and gravel, wet	321.9 0.8	2	SS	6	100	18	
hard brown clayey silt, some sand, trace gravel, DTPL	321.2 1.5	3	SS	16	>200	15	
compact grey silt, some gravel and clay, trace sand, very moist	320.4 2.3	4	SS	23	>200	12	
dense dense grey sandy silt, some clay, trace gravel, very moist	319.7 3.0	5	SS	47	>200	12	Bentonite
hard grey clayey silt, some gravel, trace sand, DTPL	318.1 4.6	6	SS	19	>200	12	
		7	SS	17	>200	17	Dry cave Borehole open and dry upon drilling completion
Drilling Terminated	316.0 6.7						

Field Technician: M. Dalgliesh

Drafted by: K. Jenkinson

Reviewed by: M. Wilson

MTE

Sheet: 1 of 1

ID Number: BH102-18

Project: Thames Crest Farm Subdivision

Project No: 35499-200

Client: Thames Crest Development Corp.

Site Location: Glass Street, St. Mary's, ON

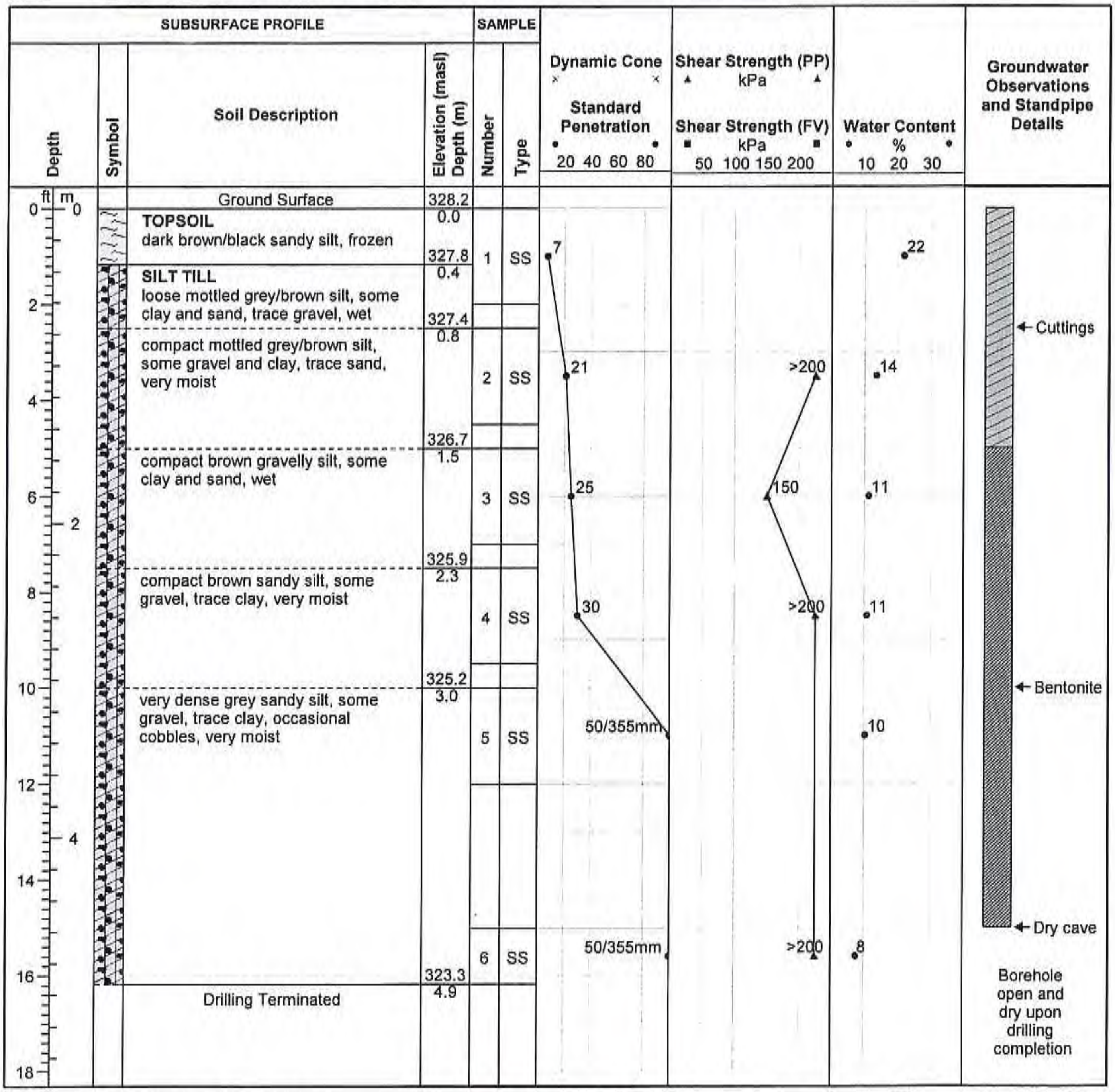
Drill Date: 12/7/2018

Drilling Contractor: London Soil Test Ltd.

Drill Rig: D50T Track

Drill Method: Hollow Stem Auger

Protective Cover: N/A



Elevation (masl) Depth (m)	Soil Description	Number	Type	Standard Penetration	Shear Strength (PP) kPa	Water Content %
328.2	Ground Surface					
0.0	**TOPSOIL** dark brown/black sandy silt, frozen	1	SS	7		22
327.8 0.4	**SILT TILL** loose mottled grey/brown silt, some clay and sand, trace gravel, wet					
327.4 0.8	compact mottled grey/brown silt, some gravel and clay, trace sand, very moist	2	SS	21	>200	14
326.7 1.5	compact brown gravelly silt, some clay and sand, wet	3	SS	25	150	11
325.9 2.3	compact brown sandy silt, some gravel, trace clay, very moist	4	SS	30	>200	11
325.2 3.0	very dense grey sandy silt, some gravel, trace clay, occasional cobbles, very moist	5	SS	50/355mm		10
		6	SS	50/355mm	>200	8
323.3 4.9	Drilling Terminated					

Borehole open and dry upon drilling completion

Field Technician: M. Dalgliesh

Drafted by: K. Jenkinson

Reviewed by: M. Wilson

MTE

Sheet: 1 of 1

ID Number: BH103-18

Project: Thames Crest Farm Subdivision

Project No: 35499-200

Client: Thames Crest Development Corp.

Site Location: Glass Street, St. Mary's, ON

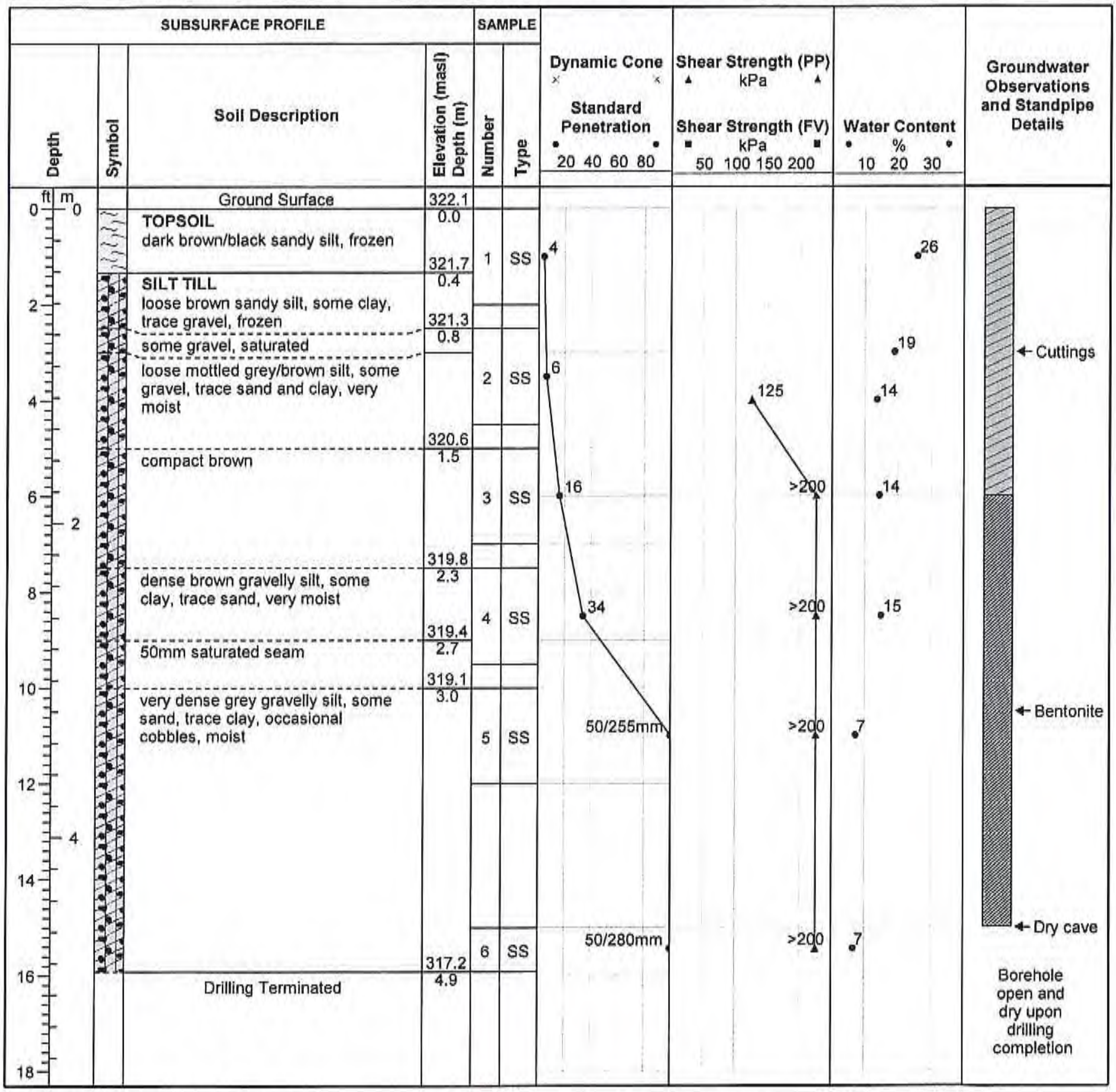
Drill Date: 12/7/2018

Drilling Contractor: London Soil Test Ltd.

Drill Rig: D50T Track

Drill Method: Hollow Stem Auger

Protective Cover: N/A



Elevation (masl) Depth (m)	Soil Description	Number	Type	Standard Penetration	Shear Strength (PP) kPa	Water Content %
322.1	Ground Surface					
0.0	**TOPSOIL** dark brown/black sandy silt, frozen	1	SS	4		26
321.7 0.4	**SILT TILL** loose brown sandy silt, some clay, trace gravel, frozen					
321.3 0.8	some gravel, saturated					19
	loose mottled grey/brown silt, some gravel, trace sand and clay, very moist	2	SS	6	125	14
320.6 1.5	compact brown	3	SS	16	>200	14
319.8 2.3	dense brown gravelly silt, some clay, trace sand, very moist	4	SS	34	>200	15
319.4 2.7	50mm saturated seam					
319.1 3.0	very dense grey gravelly silt, some sand, trace clay, occasional cobbles, moist	5	SS	50/255mm	>200	7
		6	SS	50/280mm	>200	7
317.2 4.9	Drilling Terminated					

Borehole open and dry upon drilling completion

Field Technician: M. Dalgliesh

Drafted by: K. Jenkinson

Reviewed by: M. Wilson

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Sheet: 1 of 1

ID Number: BH104-18

Project: Thames Crest Farm Subdivision

Project No: 35499-200

Client: Thames Crest Development Corp.

Site Location: Glass Street, St. Mary's, ON

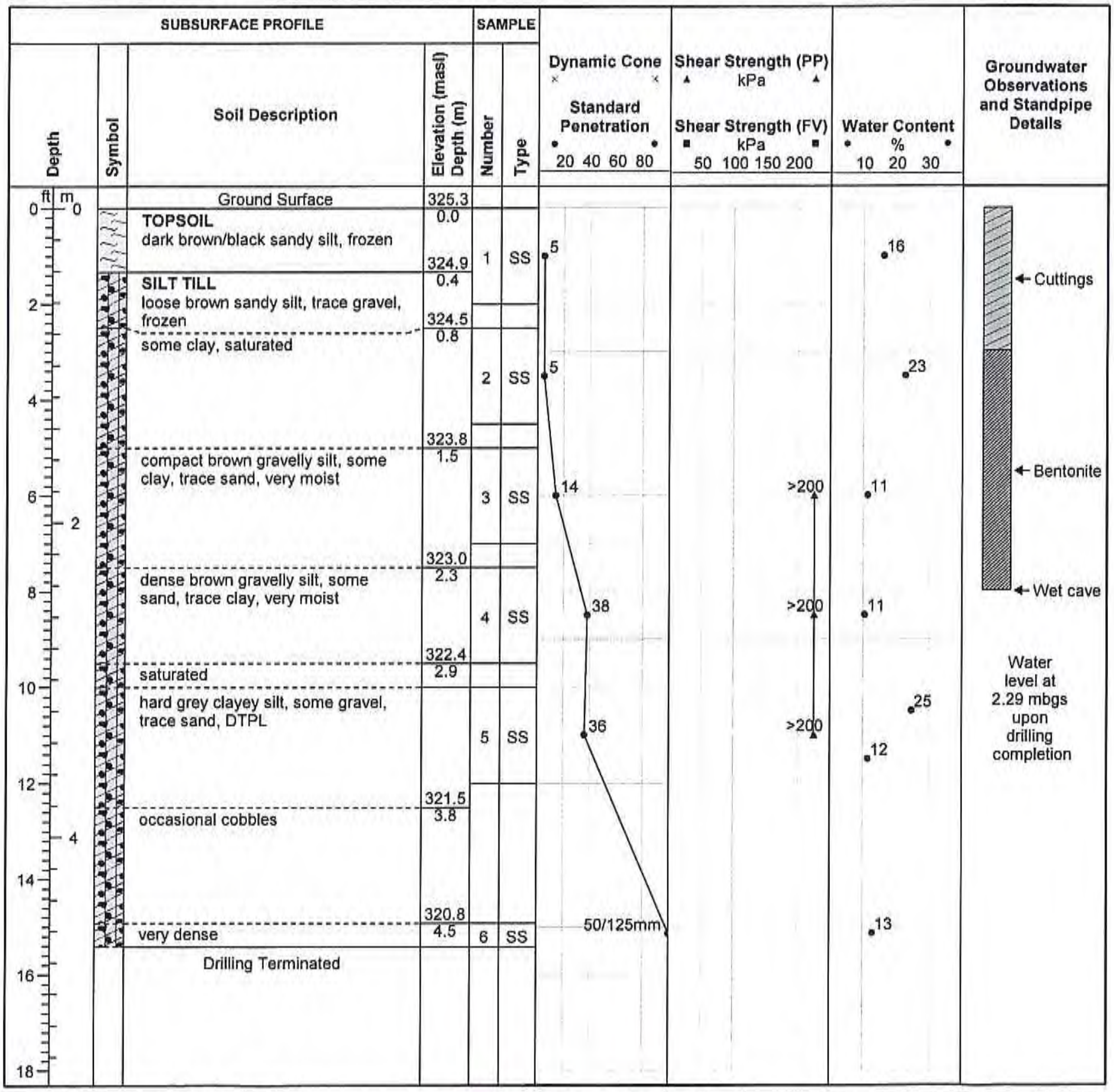
Drill Date: 12/7/2018

Drilling Contractor: London Soil Test Ltd.

Drill Rig: D50T Track

Drill Method: Hollow Stem Auger

Protective Cover: N/A



Soil Description	Elevation (masl) Depth (m)	Number	Type	Standard Penetration	Shear Strength	Water Content %
Ground Surface	325.3					
TOPSOIL dark brown/black sandy silt, frozen	0.0	1	SS	5		16
SILT TILL loose brown sandy silt, trace gravel, frozen	324.9 0.4					
some clay, saturated	324.5 0.8	2	SS	5		23
compact brown gravelly silt, some clay, trace sand, very moist	323.8 1.5	3	SS	14	>200	11
dense brown gravelly silt, some sand, trace clay, very moist	323.0 2.3	4	SS	38	>200	11
saturated	322.4 2.9					25
hard grey clayey silt, some gravel, trace sand, DTPL		5	SS	36	>200	12
occasional cobbles	321.5 3.8					
very dense	320.8 4.5	6	SS	50/125mm		13
Drilling Terminated						

Water level at 2.29 mbgs upon drilling completion

Field Technician: M. Dalgliesh

Drafted by: K. Jenkinson

Reviewed by: M. Wilson

MTE

Sheet: 1 of 1

ID Number: MW105-18

Project: Thames Crest Farm Subdivision

Project No: 35499-200

Client: Thames Crest Development Corp.

Site Location: Glass Street, St. Mary's, ON

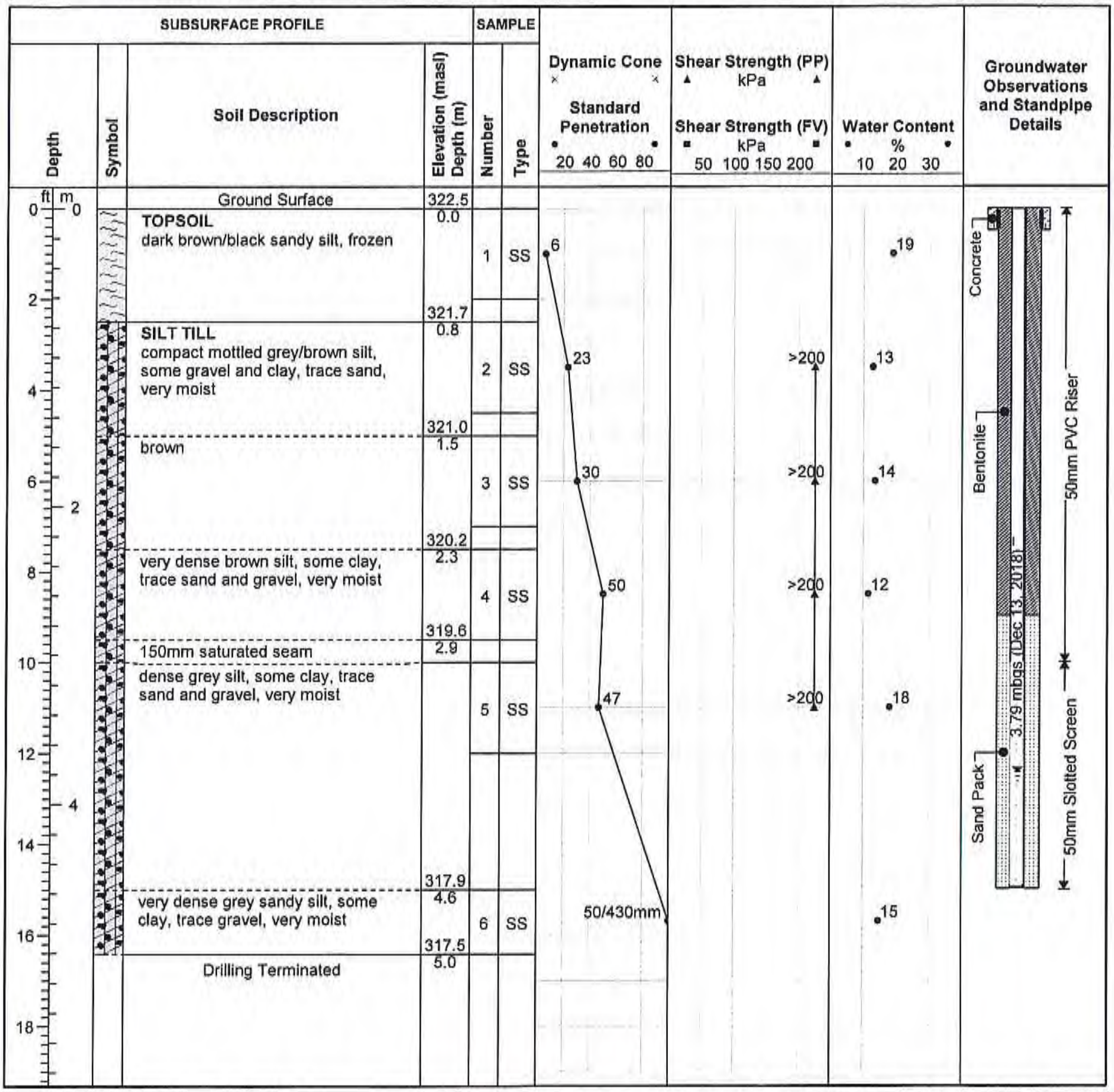
Drill Date: 12/6/2018

Drilling Contractor: London Soil Test Ltd.

Drill Rig: D50T Track

Drill Method: Hollow Stem Auger

Protective Cover: Monument Casing



Soil Description	Elevation (masl) Depth (m)	Number	Type	Standard Penetration	Shear Strength (PP) kPa	Water Content %
Ground Surface	322.5 0.0					
TOPSOIL dark brown/black sandy silt, frozen		1	SS	6		19
SILT TILL compact mottled grey/brown silt, some gravel and clay, trace sand, very moist	321.7 0.8	2	SS	23	>200	13
brown	321.0 1.5	3	SS	30	>200	14
very dense brown silt, some clay, trace sand and gravel, very moist	320.2 2.3	4	SS	50	>200	12
150mm saturated seam dense grey silt, some clay, trace sand and gravel, very moist	319.6 2.9	5	SS	47	>200	18
very dense grey sandy silt, some clay, trace gravel, very moist	317.9 4.6	6	SS	50/430mm		15
Drilling Terminated	317.5 5.0					

Field Technician: M. Dalgliesh

Drafted by: K. Jenkinson

Reviewed by: M. Wilson

Stabilized groundwater level measured at 3.79 mbgs on December 13, 2018

Sheet: 1 of 1

ID Number: MW106-18

Project: Thames Crest Farm Subdivision

Project No: 35499-200

Client: Thames Crest Development Corp.

Site Location: Glass Street, St. Mary's, ON

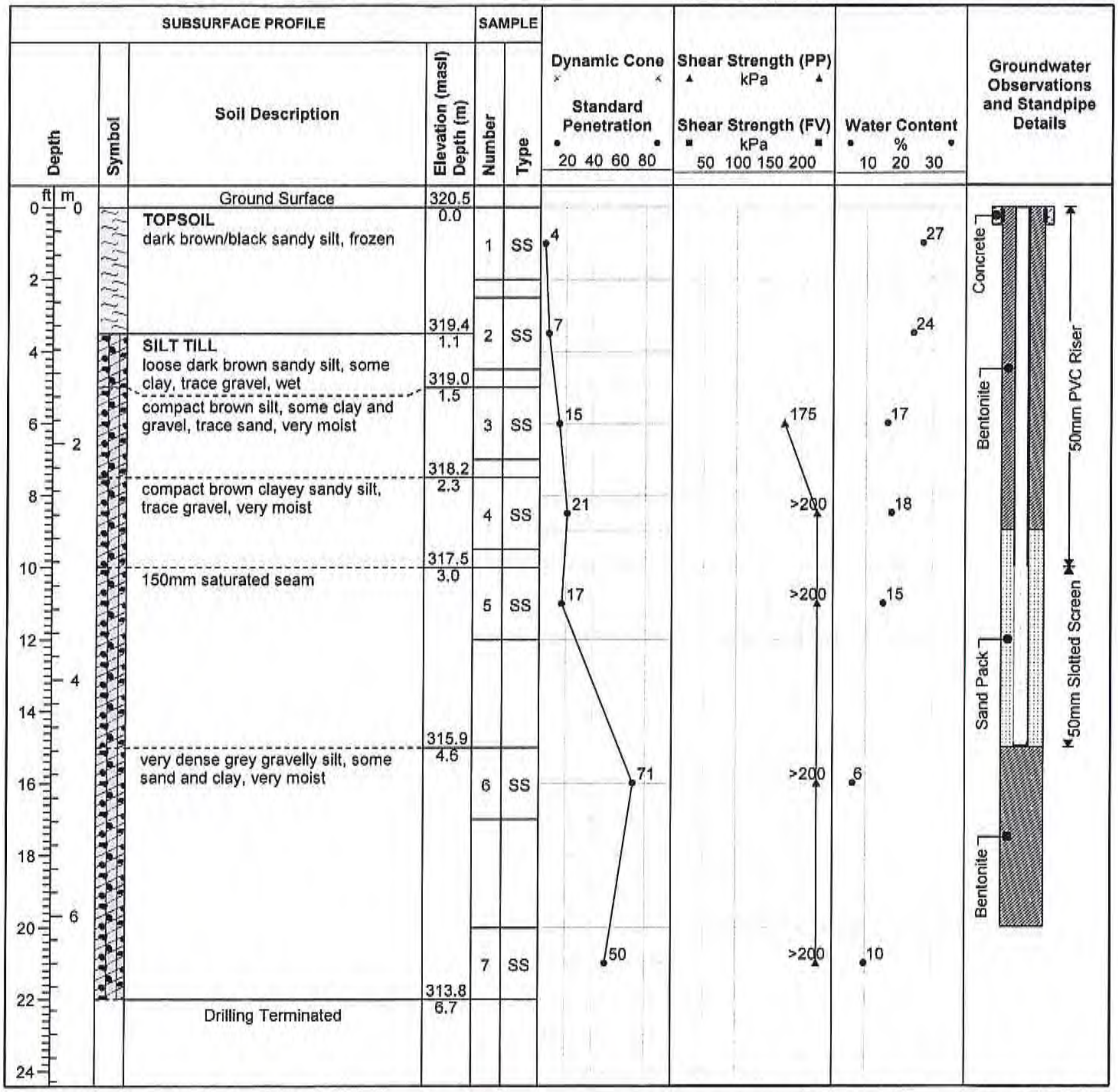
Drill Date: 12/6/2018

Drilling Contractor: London Soil Test Ltd.

Drill Rig: D50T Track

Drill Method: Hollow Stem Auger

Protective Cover: Monument Casing



Elevation (masl) Depth (m)	Soil Description	Number	Type	Standard Penetration	Shear Strength (PP) kPa	Water Content %
320.5	Ground Surface					
0.0	**TOPSOIL** dark brown/black sandy silt, frozen	1	SS	4		27
319.4 1.1	**SILT TILL** loose dark brown sandy silt, some clay, trace gravel, wet	2	SS	7		24
319.0 1.5	compact brown silt, some clay and gravel, trace sand, very moist	3	SS	15	175	17
318.2 2.3	compact brown clayey sandy silt, trace gravel, very moist	4	SS	21	>200	18
317.5 3.0	150mm saturated seam	5	SS	17	>200	15
315.9 4.6	very dense grey gravelly silt, some sand and clay, very moist	6	SS	71	>200	6
		7	SS	50	>200	10
313.8 6.7	Drilling Terminated					

Field Technician: M. Dalgliesh

Drafted by: K. Jenkinson

Reviewed by: M. Wilson

Monitoring well dry on December 13, 2018

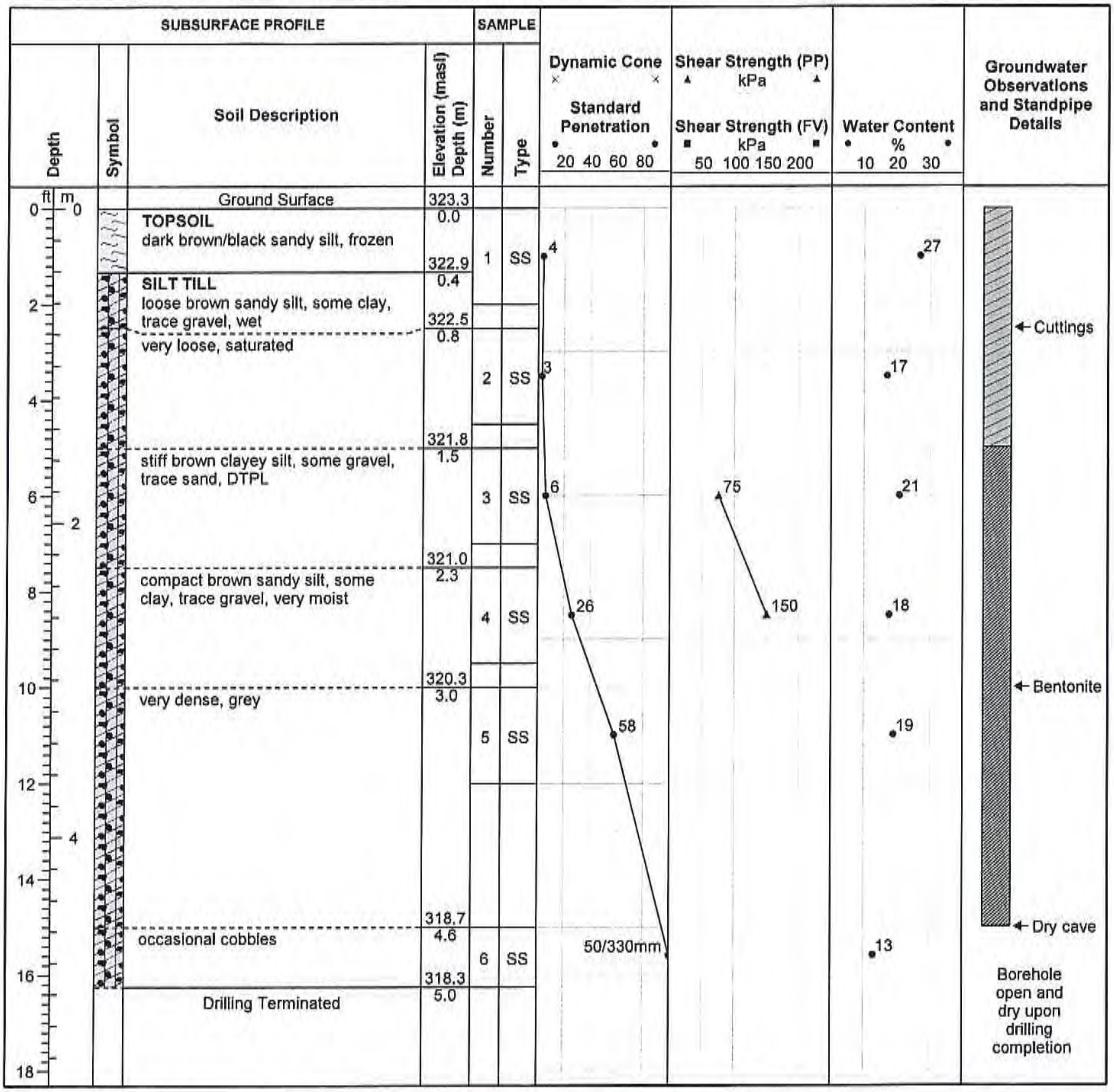
MTE

Sheet: 1 of 1

ID Number: BH107-18

Project: Thames Crest Farm Subdivision
Project No: 35499-200
Client: Thames Crest Development Corp.
Site Location: Glass Street, St. Mary's, ON

Drill Date: 12/6/2018
Drilling Contractor: London Soil Test Ltd.
Drill Rig: D50T Track
Drill Method: Hollow Stem Auger
Protective Cover: N/A



Soil Description	Elevation (masl) Depth (m)	Number	Type	Standard Penetration	Shear Strength (PP) kPa	Water Content %
Ground Surface	323.3					
TOPSOIL dark brown/black sandy silt, frozen	0.0	1	SS	4		27
SILT TILL loose brown sandy silt, some clay, trace gravel, wet	322.9 0.4					
very loose, saturated	322.5 0.8	2	SS	3		17
stiff brown clayey silt, some gravel, trace sand, DTPL	321.8 1.5	3	SS	6	75	21
compact brown sandy silt, some clay, trace gravel, very moist	321.0 2.3	4	SS	26	150	18
very dense, grey	320.3 3.0	5	SS	58		19
occasional cobbles	318.7 4.6	6	SS	50/330mm		13
Drilling Terminated	318.3 5.0					

Borehole open and dry upon drilling completion

Field Technician: M. Dalgliesh
Drafted by: K. Jenkinson
Reviewed by: M. Wilson

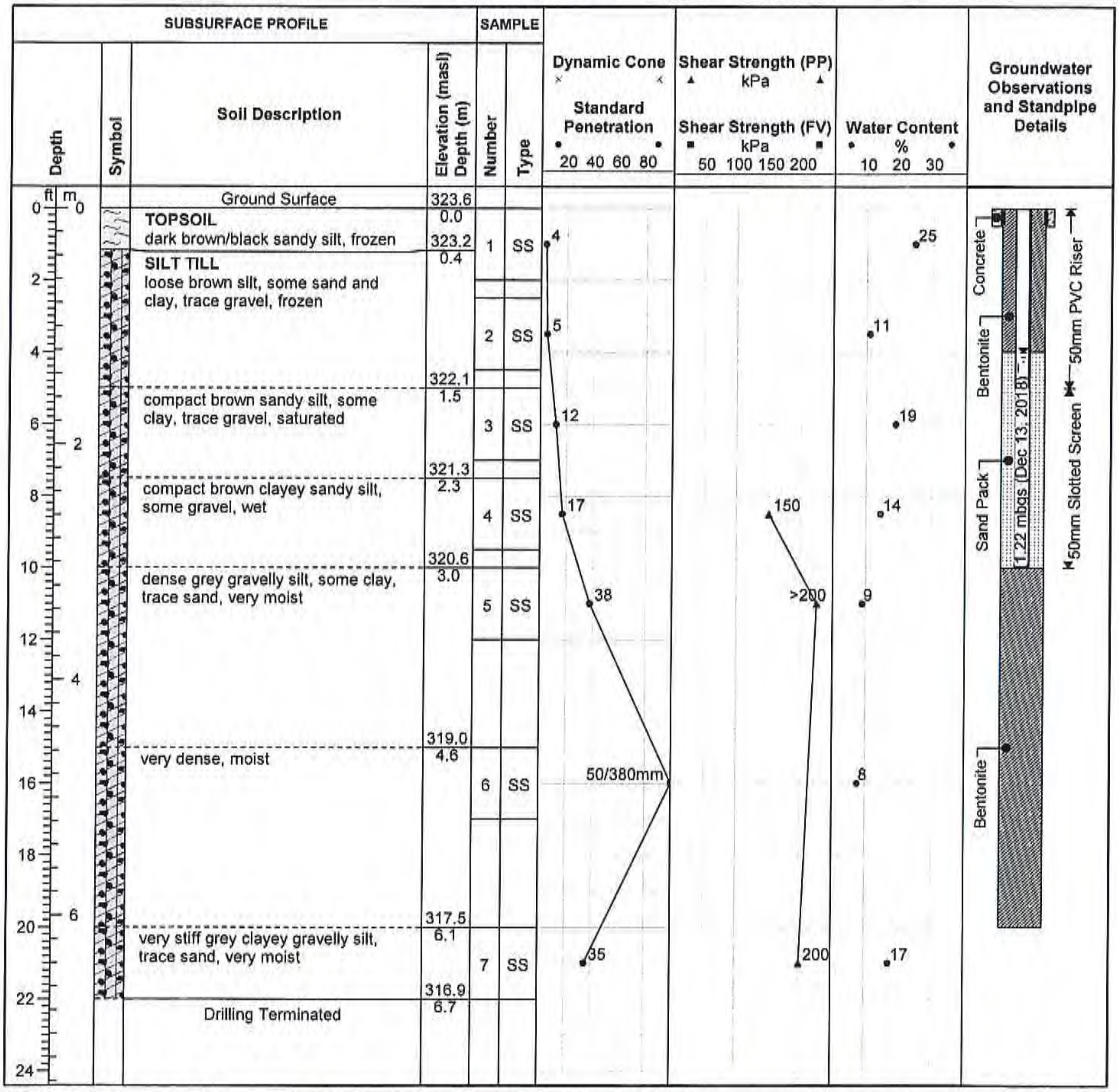
MTE

Sheet: 1 of 1

ID Number: MW108-18

Project: Thames Crest Farm Subdivision
Project No: 35499-200
Client: Thames Crest Development Corp.
Site Location: Glass Street, St. Mary's, ON

Drill Date: 12/6/2018
Drilling Contractor: London Soil Test Ltd.
Drill Rig: D50T Track
Drill Method: Hollow Stem Auger
Protective Cover: Monument Casing



SUBSURFACE PROFILE

Elevation (masl) Depth (m)	Soil Description
323.6	Ground Surface
0.0	**TOPSOIL** dark brown/black sandy silt, frozen
323.2 0.4	**SILT TILL** loose brown silt, some sand and clay, trace gravel, frozen
322.1 1.5	compact brown sandy silt, some clay, trace gravel, saturated
321.3 2.3	compact brown clayey sandy silt, some gravel, wet
320.6 3.0	dense grey gravelly silt, some clay, trace sand, very moist
319.0 4.6	very dense, moist
317.5 6.1	very stiff grey clayey gravelly silt, trace sand, very moist
316.9 6.7	Drilling Terminated

SAMPLE

Number	Type	Standard Penetration	Shear Strength (PP) kPa	Water Content %
1	SS	4		25
2	SS	5		11
3	SS	12		19
4	SS	17	150	14
5	SS	38	>200	9
6	SS	50/380mm		8
7	SS	35	200	17

Field Technician: M. Dalgliesh

Drafted by: K. Jenkinson

Reviewed by: M. Wilson

Stabilized groundwater level measured at 1.22 mbgs on December 13, 2018

Sheet: 1 of 1

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APPENDIX C

LABORATORY TEST RESULTS

Table 1

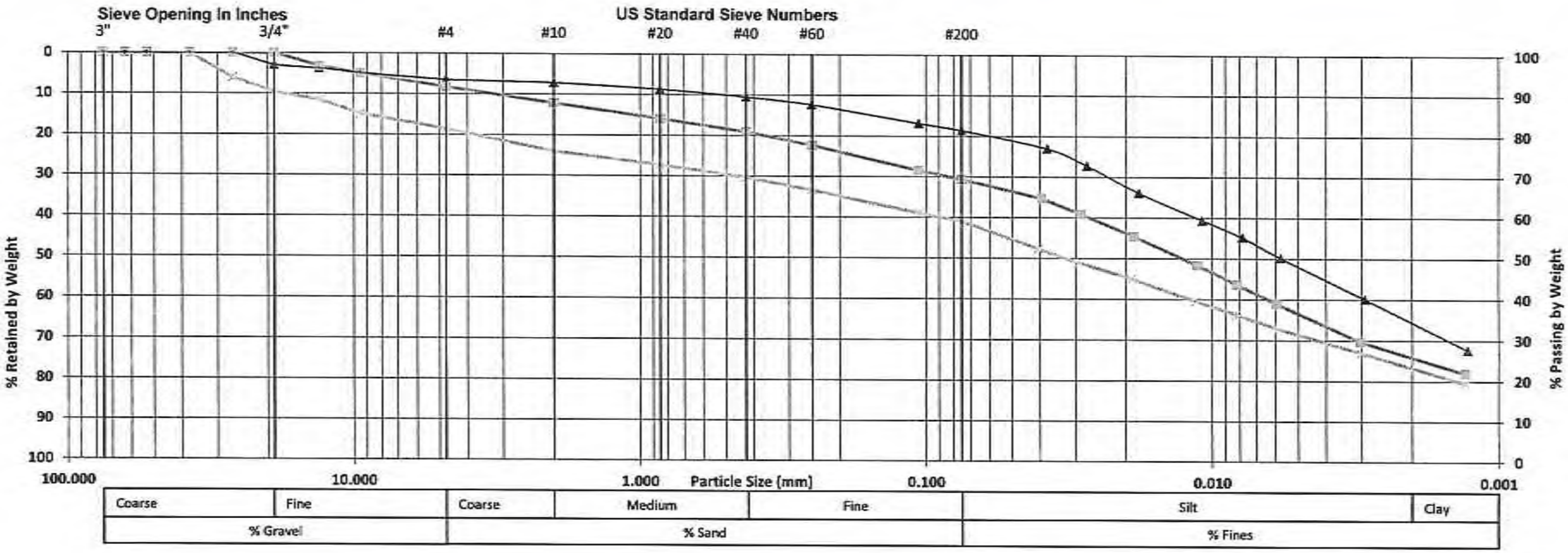
Particle Size Distribution Analysis Test Results

PROJECT NAME: Thames Crest Farm Subdivision
CLIENT: Thames Crest Development Corp.

DATE SAMPLED: Dec. 6-7, 2018
DATE TESTED: Dec. 10-12, 2018

FILE No.: 35499-200
TABLE #: 1

Unified Soil Classification



Symbol	Borehole ID	Sample #	*Sample Depth*	Description
—▲—	BH101-18	SS-3	1.52-2.13 mbgs	Clayey SILT TILL, some Sand, trace Gravel
—■—	MW106-18	SS-5	3.05-3.66 mbgs	Clayey Sandy SILT TILL, trace Gravel
------	MW108-18	SS-4	2.29-2.90 mbgs	Clayey Sandy SILT TILL, some Gravel

CERTIFIED BY CCIL
Canadian Council of Independent Laboratories
For specific tests as listed on www.ccil.com

NOTES:

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Stratford, Ontario N5A 2A5
Phone: 519-271-7952
Fax: 519-271-3545

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Phone: 905-639-2552
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520 Bingemans Centre Drive
Kitchener, Ontario N2B 3X9
Phone: 519-743-6500
Fax: 519-743-6513

560 Wellington Street, Fourth Floor
London, Ontario N6A 3R4
Phone. 519-204-6510
Fax: 519-204-6511

365 Home Street
Stratford, Ontario N5A 2A5
Phone: 519-271-7952
Fax: 519-271-3545

EXISTING SERVICES	DRAWING #, SOURCE	DATE	CONSTRUCTED SERVICES	COMPLETION	DETAILS		No.	REVISIONS	DATE	CONSULTANT
					DESIGN	JJM				
					DRAWN BY	JAC				
					CHECKED	RC				
					APPROVED	JJM				
					DATE	MAR. 2019				

CONSULTANT OR DIVISION

MTE

Engineers |Scientists |Surveyors

ENGINEER'S STAMP

ONTARIO CANADA
ST. MARYS

SCALE

HORIZONTAL
SCALE – 1 : 300
3m 0 6m

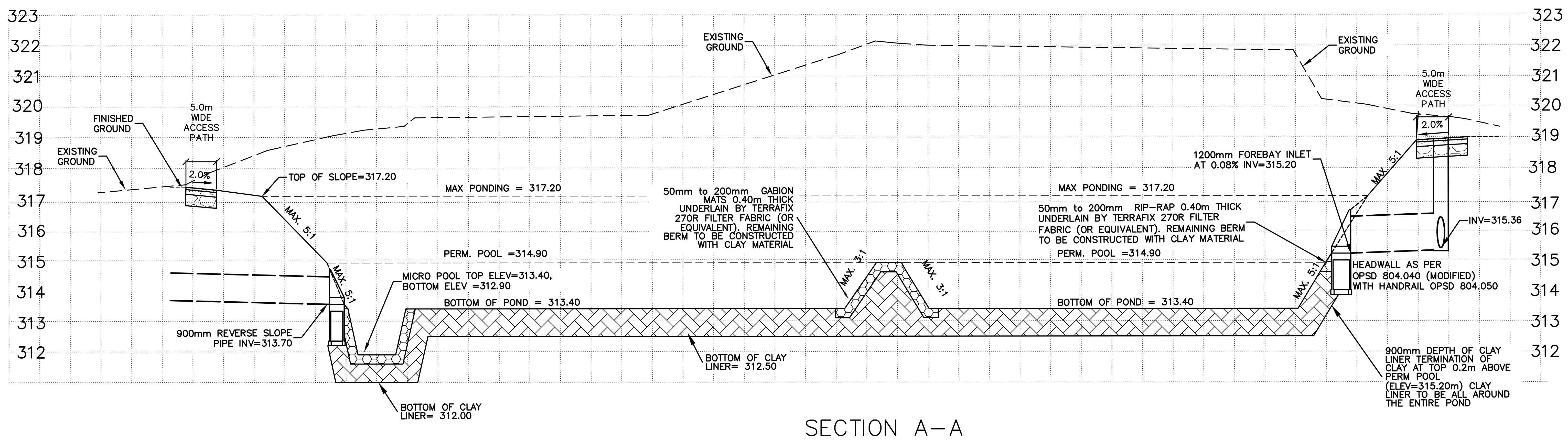
THAMES CREST SUBDIVISION – PHASE 2
THAMES CREST FARMS LIMITED

STORM MANAGEMENT POND 1

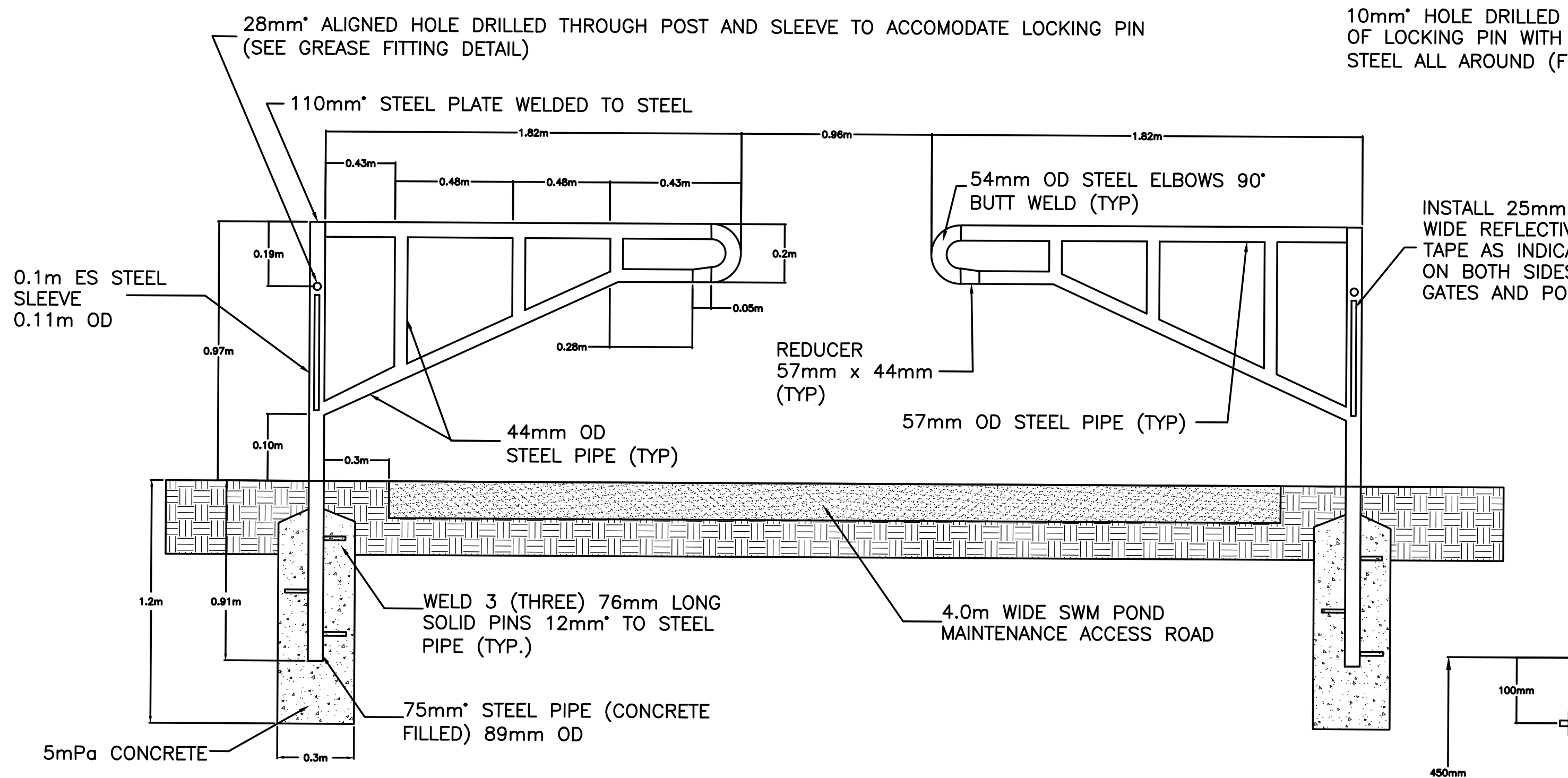
PROJECT No.
35499–200

SHEET No.
SW1.1

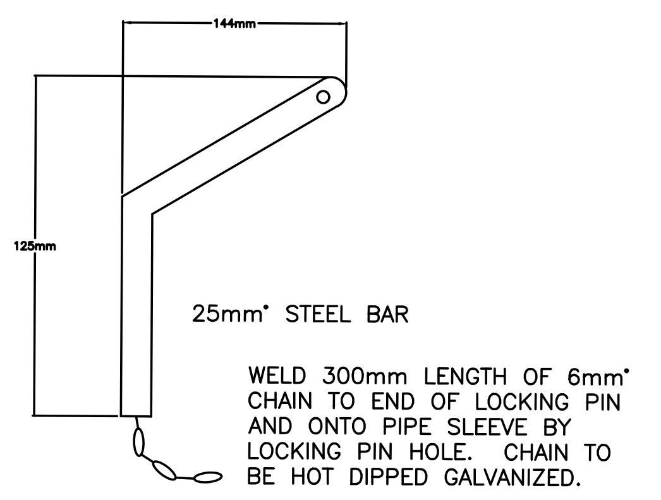
PLAN FILE No.



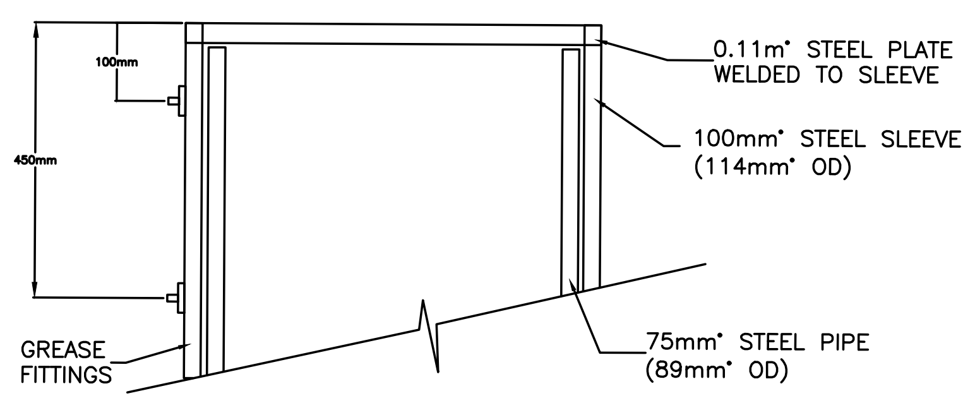
SECTION A–A
SWM POND INLET & OUTLET
SCALE: HORIZ=1:500
VERT=1:100



10mm° HOLE DRILLED IN CENTRE OF LOCKING PIN WITH 6mm° OF STEEL ALL AROUND (FOR LOCK)



LOCKING PIN
N.T.S



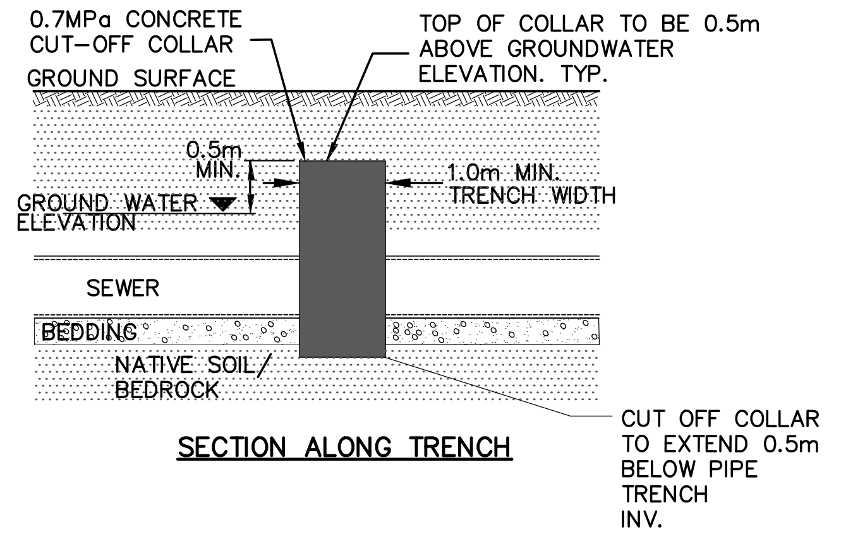
GREASE FITTINGS
N.T.S

1. ALL CONNECTIONS TO BE WELDED WITH COMPLETE SOLID WELD.
2. GRIND WELDS SMOOTH – NO SHARP EDGES.
3. GATES TO BE HOT DIPPED GALVANIZED AFTER FABRICATIONS.
4. GATES TO BE HOT DIPPED GALVANIZED LEVEL PLUMB, AND TRUE.
5. GREASE PIPE SLEEVE THOROUGHLY AFTER INSTALLATION.
6. GATE TO BE INSTALLED ALONG PROPERTY LINE AND PERPENDICULAR TO WALKWAY.

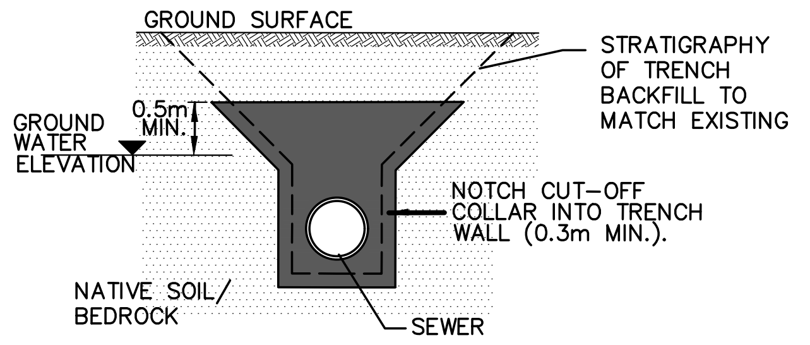
MAINTENANCE ACCESS GATE
N.T.S

POND CONSTRUCTION NOTES:

1. BERMS TO BE CONSTRUCTED ON APPROVED SUBGRADE (APPROVED BY THE GEOTECHNICAL ENGINEER) WITH ON SITE LOW PERMEABILITY TILL PLACED IN 300mm LIFTS COMPACTED TO 95% SPMMD. BERM MATERIAL AND CONSTRUCTION TO BE APPROVED AND SUPERVISED BY THE GEOTECHNICAL ENGINEER.
2. SEEPAGE CUT–OFF COLLARS REQUIRED ON INLET AND OUTLET PIPES. COLLARS TO BE 1.0m THICK AND TO EXTEND 1.0m BEYOND LIMIT OF CONSTRUCTION TRENCH (REFER TO DETAIL & THIS DRAWING). CAREFUL HAND COMPACTION OF LOW PERMEABILITY FILL AROUND THE SEEPAGE COLLARS IS REQUIRED TO ENSURE INTIMATE CONTACT BETWEEN SOIL AND PIPE TO BE INSTALLED AS DIRECTED BY THE GEOTECHNICAL ENGINEER.
3. BACKFILL OF PIPE TRENCHES IN THE VICINITY OF THE PROPOSED INLET AND OUTLET STRUCTURES TO CONSIST OF NATIVE LOW PERMEABILITY SILT TILL PLACED IN MAXIMUM 200mm THICK LIFTS COMPACTED TO 95% SPMMD AS DIRECTED BY THE GEOTECHNICAL ENGINEER. BACKFILL IS TO BE IN INTIMATE CONTACT WITH THE COMPLETE CIRCUMFERENCE OF THE PIPE. WHERE COMPACTION WILL BE DIFFICULT TO ACHIEVE, LEAN CONCRETE BACKFILL IS TO BE USED.
4. GROUNDWATER SEEPAGE MAY BE ENCOUNTERED ALONG THE BANKS OF THIS PROPOSED STORMWATER MANAGEMENT FACILITY. AS REQUIRED AND AS DIRECTED BY THE GEOTECHNICAL ENGINEER, SLOPE DRAINS ARE TO BE INSTALLED. SEE TYPICAL DETAIL ON THIS DRAWING.
5. POND TO MAINTAIN A MINIMUM TOPSOIL THICKNESS OF 100mm.
6. FINISHED SLOPES AND BASE OF POND TO BE TOP–SOILED AND VEGETATED AS SOON AS POSSIBLE FOLLOWING CONSTRUCTION.
7. SUPPORT FOR HEADWALL TO BE DERIVED FROM NATIVE SILT TILL. ALLOWABLE BEARING PRESSURE OF 150 kPa TO BE CONFIRMED BY THE GEOTECHNICAL ENGINEER. TO BE INSPECTED BY THE GEOTECHNICAL ENGINEER AT THE TIME OF CONSTRUCTION. HEADWALL TO BE BACKFILLED USING FREE–DRAINING GRANULAR MATERIAL (GRANULAR 'B') AND DESIGNED USING AN ACTIVE EARTH PRESSURE COEFFICIENT OF 0.35 AND A UNIT WEIGHT OF 21 kN/m3. ANY FOOTINGS MUST BE PROTECTED WITH A MINIMUM 1.2m EARTH COVERING OR EQUIVALENT INSULATION. STAMPED SHOP DRAWINGS TO BE PROVIDED BY CONTRACTOR PRIOR TO CONSTRUCTION.



SECTION ALONG TRENCH

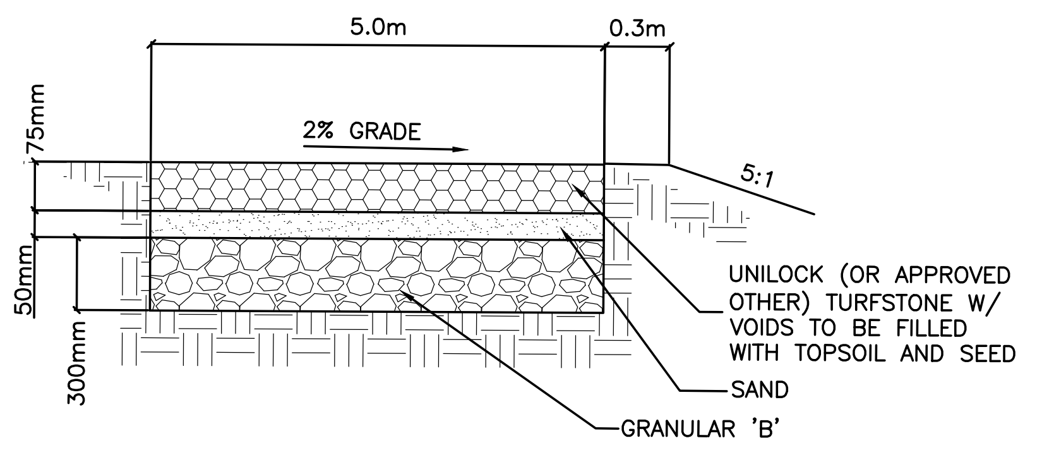


SECTION THROUGH TRENCH

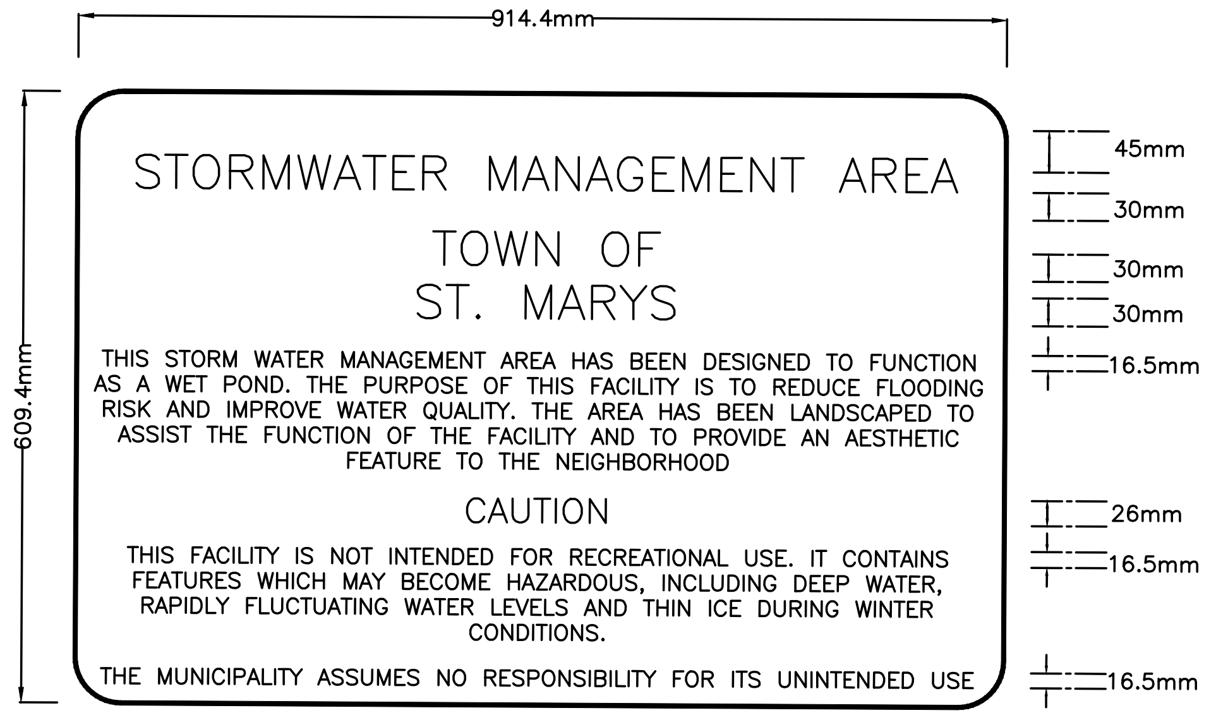
NOTES:
1. TOP WIDTH TO BE 1.0m.
2. COLLARS TO BE PLACED AS SHOWN.
3. TOP ELEVATION OF CUT–OFF COLLARS TO BE DETERMINED ON SITE BY GEOTECHNICAL ENGINEER, GENERALLY 0.5m MIN. ABOVE GROUND WATER ELEVATION.
4. CONCRETE TO BE MINIMUM 0.7 MPa PLACED/POURED AGAINST UNDISTURBED NATIVE TRENCH WALLS.
5. REFER TO OPSS 1359.

CONCRETE CUT–OFF COLLAR DETAIL
N.T.S.

NOTE:
LOCATION AND DEPTH OF CUT–OFF COLLARS TO BE DETERMINED BASED ON GROUNDWATER ELEVATIONS AT TIME OF CONSTRUCTION AND APPROVED BY THE PROJECT SITE ENGINEER.



5m TURFSTONE ACCESS PATH



STORMWATER MANAGEMENT AREA

TOWN OF
ST. MARYS

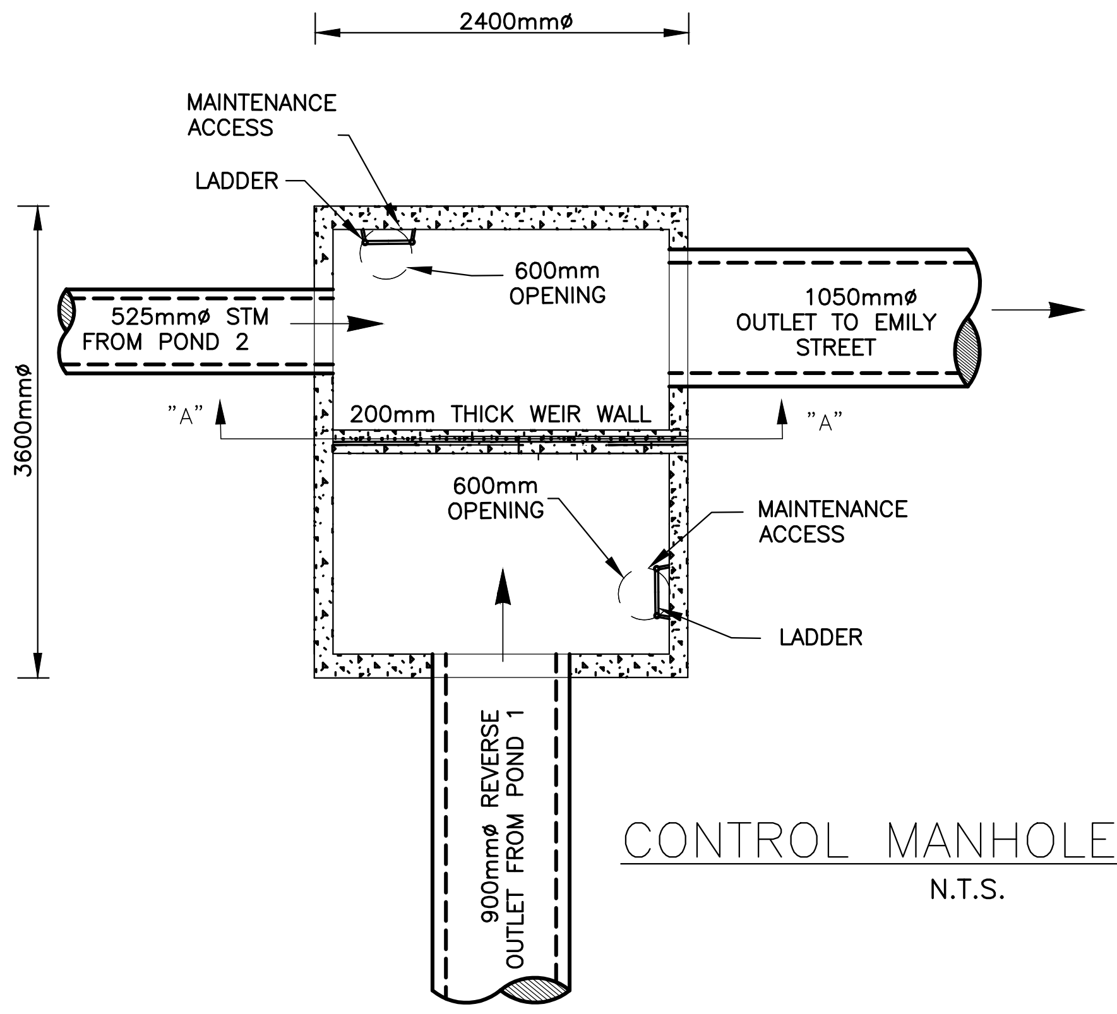
THIS STORM WATER MANAGEMENT AREA HAS BEEN DESIGNED TO FUNCTION AS A WET POND. THE PURPOSE OF THIS FACILITY IS TO REDUCE FLOODING RISK AND IMPROVE WATER QUALITY. THE AREA HAS BEEN LANDSCAPED TO ASSIST THE FUNCTION OF THE FACILITY AND TO PROVIDE AN AESTHETIC FEATURE TO THE NEIGHBORHOOD

CAUTION

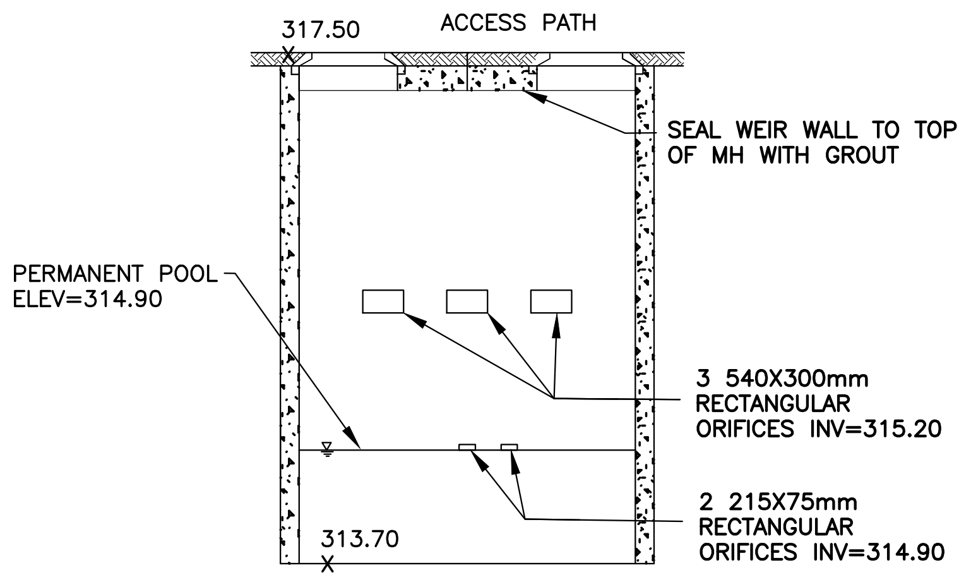
THIS FACILITY IS NOT INTENDED FOR RECREATIONAL USE. IT CONTAINS FEATURES WHICH MAY BECOME HAZARDOUS, INCLUDING DEEP WATER, RAPIDLY FLUCTUATING WATER LEVELS AND THIN ICE DURING WINTER CONDITIONS.

THE MUNICIPALITY ASSUMES NO RESPONSIBILITY FOR ITS UNINTENDED USE

NOTES:
1. SIGN TO BE SUPPLIED AND MOUNTED BY CONTRACTOR
2. SIGN TO BE MOUNTED ON TWO 100mmx100mm PRESSURE TREATED WOOD POSTS WITH SUITABLE FRAMING. POSTS TO BE SUPPLIED AND INSTALLED BY THE CONTRACTOR.
3. SIGN TO BE CONSTRUCTED OF ALUMINUM



CONTROL MANHOLE DETAIL
N.T.S.



SECTION A–A
N.T.S.

EXISTING SERVICES	DRAWING #, SOURCE	DATE	CONSTRUCTED SERVICES	COMPLETION	DETAILS		No.	REVISIONS	DATE	CONSULTANT
					DESIGN	JJM				
					DRAWN BY	JAC				
					CHECKED	RC				
					APPROVED	JJM				
					DATE	MAR.2018				

CONSULTANT OR DIVISION
MTE
Engineers |Scientists |Surveyors

ENGINEER'S STAMP

ONTARIO CANADA
ST. MARYS

SCALE
HORIZONTAL SCALE – 1 : 500
5m 0 10m
VERTICAL SCALE – 1 : 100
1m 0 2m

THAMES CREST SUBDIVISION – PHASE 2
THAMES CREST FARMS LIMITED

STORM MANAGEMENT POND 1
DETAILS

PROJECT No.
41988–144
SHEET No.
SW1.2
PLAN FILE No.

EXISTING SERVICES	DRAWING #. SOURCE	DATE	CONSTRUCTED SERVICES	COMPLETION

DETAILS	
DESIGN	JJM
DRAWN BY	JAC
CHECKED	RC
APPROVED	JJM
DATE	MAR. 2018

No.	REVISIONS	DATE	CONSULTANT

CONSULTANT OR DIVISION

MTE
Engineers |Scientists |Surveyors

ENGINEER'S STAMP

ONTARIO CANADA
ST. MARYS

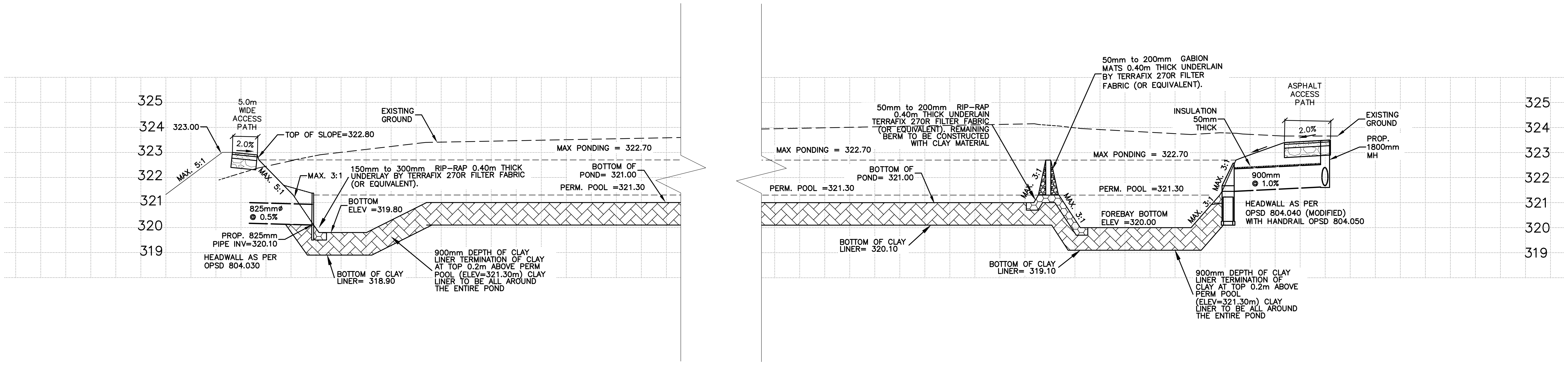
SCALE
HORIZONTAL SCALE – 1 : 300
3m 0 6m

THAMES CREST SUBDIVISION – PHASE 2
THAMES CREST FARMS LIMITED

STORM MANAGEMENT POND 2

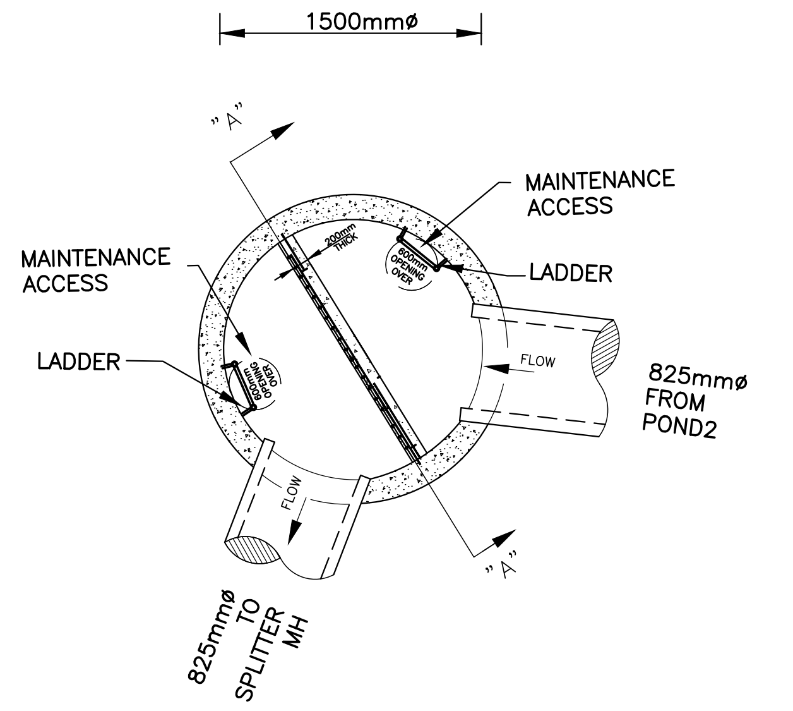
PROJECT No. 35499-200
SHEET No. SW2.1
PLAN FILE No.

P:\P\35499\200–PHASE 2\TEMP\JAC\35499–200–POND.DWG



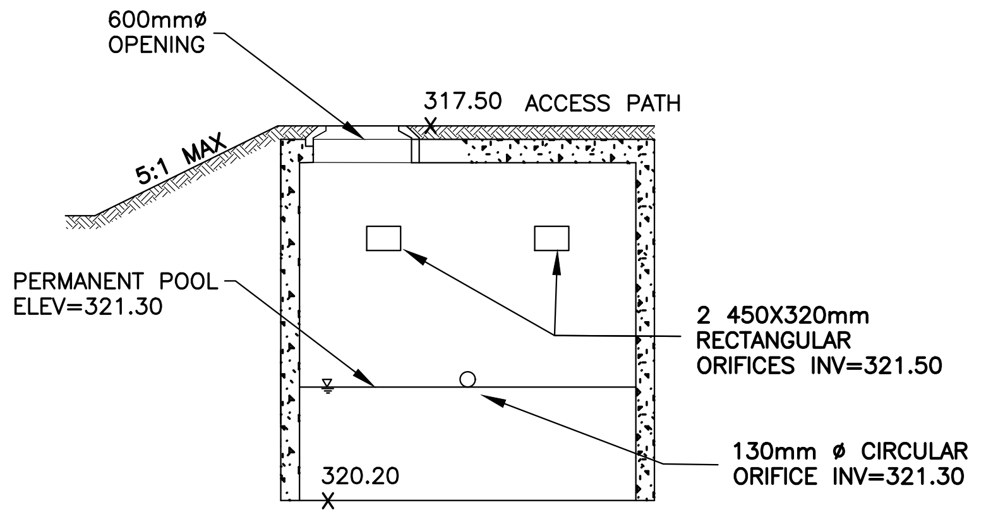
SECTION B–B
SWM POND INLET & OUTLET

SCALE: HORIZ=1:500
VERT=1:100



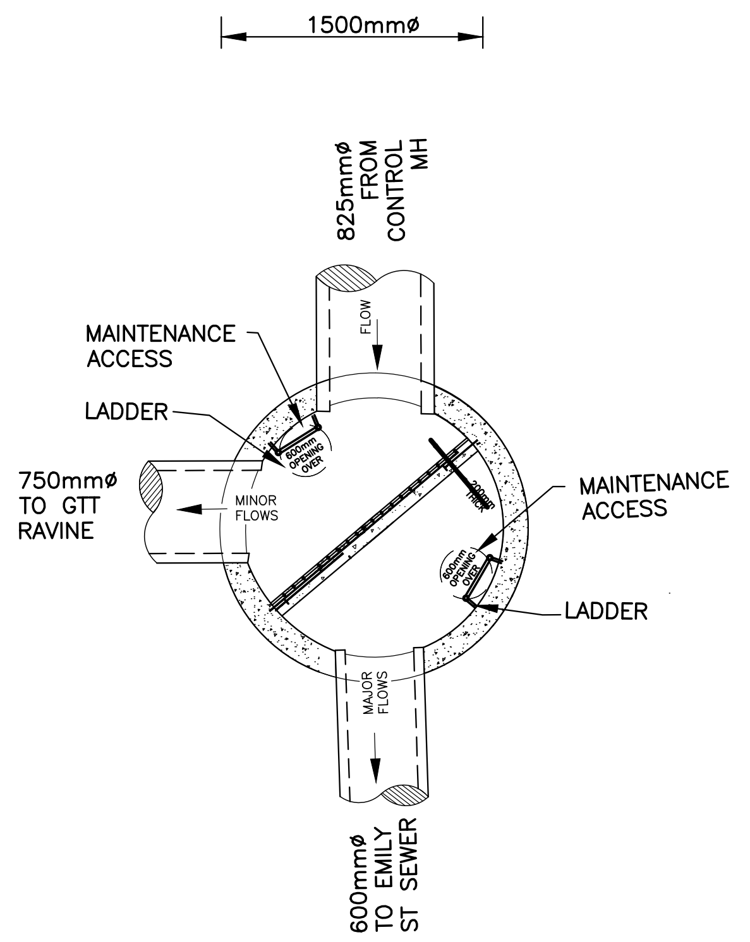
CONTROL MH DETAIL

SCALE N.T.S.



SECTION A–A

SCALE N.T.S.



SPLITTER MH DETAIL

SCALE N.T.S.

EXISTING SERVICES	DRAWING #, SOURCE	DATE	CONSTRUCTED SERVICES	COMPLETION	DETAILS		No.	REVISIONS	DATE	CONSULTANT
					DESIGN	JJM				
					DRAWN BY	JAC				
					CHECKED	RC				
					APPROVED	JJM				
					DATE	MAR. 2018				

CONSULTANT OR DIVISION

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Engineers |Scientists |Surveyors

ENGINEER'S STAMP

ONTARIO CANADA
ST. MARYS

SCALE
HORIZONTAL
SCALE – 1 : 500
5m 0 10m
VERTICAL
SCALE – 1 : 100
1m 0 2m

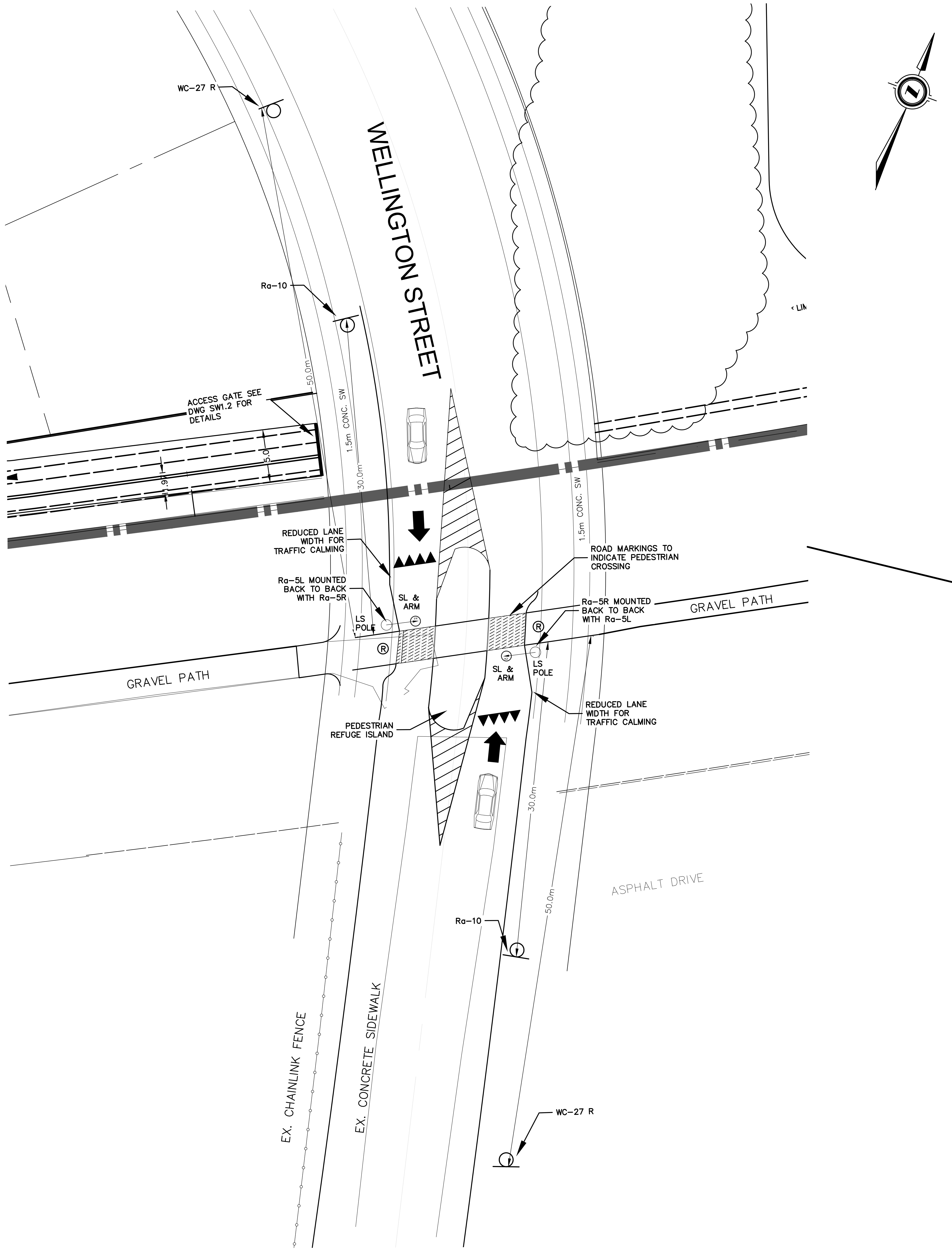
THAMES CREST SUBDIVISION – PHASE 2
THAMES CREST FARMS LIMITED

STORM MANAGEMENT POND 2
DETAILS

PROJECT No.
35499–200

SHEET No.
SW2.2

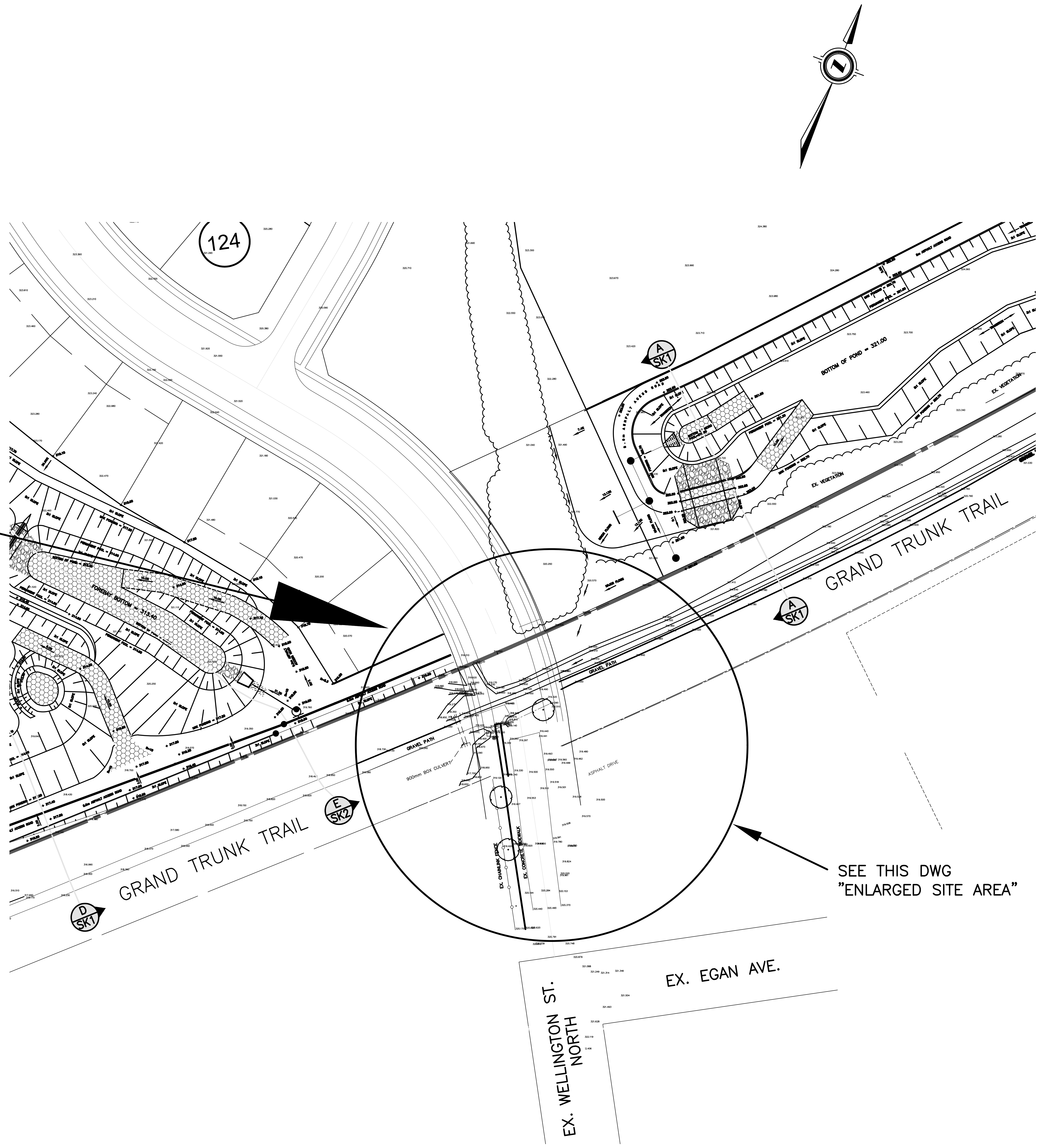
PLAN FILE No.



ENLARGED SITE AREA N.T.S

LEGEND

- ⊖—⊖ STREET LIGHT & LIGHT POLE
- ➡ DENOTES DIRECTION OF TRAFFIC
- Ⓡ RAMP



KEY PLAN N.T.S

EXISTING SERVICES	DRAWING #. SOURCE	DATE	CONSTRUCTED SERVICES	COMPLETION	DETAILS		No.	REVISIONS	DATE	CONSULTANT
					DESIGN	JJM				
					DRAWN BY	JAC				
					CHECKED	JJM				
					APPROVED	JJM				
					DATE	MAR. 2018				

CONSULTANT OR DIVISION

MTE
Engineers |Scientists |Surveyors

ONTARIO CANADA
ST. MARYS

SCALE

THAMES CREST SUBDIVISION – PHASE 2
THAMES CREST FARMS LIMITED

CONCEPTUAL TRAIL
CROSSING

PROJECT No. 35499-200
FIGURE No. TC1
PLAN FILE No.