

APPENDIX H

Drainage & Stormwater Management Report

DRAINAGE & STORMWATER MANAGEMENT REPORT – FINAL

HIGHWAY 404 RAMP EXTENSION AT MAJOR MACKENZIE DRIVE
SCHEDULE 'C' MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT

CITY OF MARKHAM

May 2026

FIRM PROJECT NO.: 074748



Prepared for:
City of Markham



1 TABLE OF CONTENTS

1	Introduction	1
1.1	Scope and Location	1
1.2	Objectives	2
1.3	Reference Data	2
1.4	Approach	2
2	Drainage Criteria and SWM Objectives	3
2.1	Applicable Standards and Guidelines	3
2.2	Drainage Criteria	3
2.3	SWM Objectives	4
3	Existing Conditions	5
3.1	Site Characteristics	5
3.2	Soil and Groundwater Conditions	5
3.3	Existing Drainage Infrastructure	6
3.3.1	Outfalls	6
3.4	Existing Hydrologic Analysis	7
4	Proposed Conditions	8
4.1	Site Characteristics	8
4.1.1	Receiving Outfalls	9
4.2	Drainage Infrastructure	9
4.2.1	Minor System Conveyance - Storm Sewers	9
4.2.2	LID Controls	10
4.2.3	Water Quantity	10
4.2.4	Water Quality	11
4.2.5	Proposed Culverts	12
4.3	Proposed Hydrologic Analysis	14
5	Criteria Summary	15
6	Conclusions	16

2 FIGURES

Figure 1. Study Area 1

Figure 2: Proposed Highway 404 Ramp Extension ROW 8

Figure 3: Proposed Highway 404 E-N Ramp Section 8

3 TABLES

Table 1: Design classification and sizing criteria 3

Table 2: Outfall Summary 6

Table 3. Existing Peak Flows 7

Table 4: Annual TSS Removal Performance 11

Table 5: Hydraulic Parameters – Proposed Culverts 11

Table 6: Hydraulics Details – Proposed Culverts 11

Table 7: Proposed Outfall Flows – Uncontrolled 14

Table 8. Proposed Outfall Flows – Controlled 14

Table 9. Flow Comparison Summary 14

4 APPENDICES

- Appendix A – Background Information
- Appendix B – Hydrologic Analysis
- Appendix C – Hydraulic Analysis
- Appendix D – Catchment Plans

1 INTRODUCTION

A Schedule 'C' Environmental Assessment (EA) was completed (MRC, 2009) for a road extending from the Hwy 404 northbound ramp to Major Mackenzie Drive to the development lands to the north. Gannett Fleming was retained by the City of Markham to provide an addendum to the 2009 EA. The lapse of time between study completion and implementation necessitates an addendum to the EA before proceeding with project implementation. The drainage and stormwater management design will primarily consist of reviewing the background information from the EA and refining the new preliminary design as an addendum while validating the 2009 EA's core elements.

1.1 Scope and Location

The drainage and stormwater management (SWM) scope entails but is not limited to data/information collections, drainage pattern analysis to the receiving environment, hydrologic and hydraulic analysis, evaluating SWM options and preliminary drainage design. As part of the updated reporting and analysis, this EA addendum intends to provide recommendations and mitigation measures for the proposed design options. The Highway 404 Ramp Extension EA study area is generally bounded by Major Mackenzie Drive to the south, Highway 404 to the west and Markland Street to the North-East.



Figure 1. Study Area

1.2 Objectives

The goals of this drainage and stormwater management for the EA includes the following:

- Validate the reference data and approach for the stormwater management (SWM) and drainage design within the Highway 404 Ramp Extension right-of-way (ROW).
- Provide the drainage criteria and SWM objectives utilized to evaluate the existing and proposed site conditions.
- Reviewing the existing drainage network and stormwater infrastructure to ensure no negative changes to drainage patterns for the local environment and/or downstream sewer systems.
- Prepare the proposed drainage and SWM conditions, in compliance with current standards and best practices (i.e the City's Engineering Standards – Section E) while considering the impacts of the proposed ROW improvements and existing site characteristics.
- Compare the proposed design against the established City of Markham, Toronto Region Conservation Authority (TRCA) and Ministry of Environment (MOE) stormwater and drainage criteria.

1.3 Reference Data

The following is a list of the reference data used in the SWM study:

- Rainfall data for the 2 to 100-year rainfall IDF curve information is in accordance with the City of Markham Engineering Design Criteria, June 2016.
- As-Built and topographic data provided by the City of Markham
- Site Plans for the adjacent development at 710 Markland Street.

Supporting reference data is contained within Appendix A.

1.4 Approach

To support the drainage and analysis the team has undertaken the following:

- Design Storm – 2 to 100-year rainfall IDF curve information in accordance with the City of Markham Engineering Design Criteria.
 - IDF curve data will be used for storm sewer and ROW design.
 - 12-hour AES distribution storms will be used for the hydrologic modelling in accordance with the Flood (Quantity) Control Criteria for the Rouge River Watershed
- Catchment Boundary and Parameters – Refined from the 2009 EA and delineated based on independent review and survey data.
- Hydrologic Modelling – Modelling will be conducted using Visual OTTHYMO and the Rational Method.
 - Storm Sewer will be designed using the Rational Method Calculation, based on the City of Markham Engineering Design Criteria.
 - Visual OTTHYMO will be used to analyze the surrounding watersheds and external drainage areas adjacent to the Highway 404 Ramp Extension.
- Hydraulic Modelling – Modelling conducted using HY-8 software to confirm conveyance of the Highway 404 road underpass culvert.
- The following sub-tasks have been undertaken as part of the proposed design:
 - Review the existing drainage patterns and overland flow under the proposed ROW conditions.
 - Propose a new storm sewer system to meet the new urbanized roadway layout (i.e., altered curbs, etc.) and review propose suitable connection points.
 - Document proposed sewer / stormwater outlets and site improvements.

2 DRAINAGE CRITERIA AND SWM OBJECTIVES

2.1 Applicable Standards and Guidelines

The applicable design standards and guidelines considered within the design include the following:

- City of Markham Engineering Design Criteria. Section E – Storm Drainage & Stormwater Management
- Toronto and Region Conservation Stormwater Management Criteria, August 2012
- Ministry of the Environment Stormwater Management Planning and Design Manual, March 2003.
- MTO Highway Drainage Design Standards (2003, 2024),
- MTO Drainage Management Manual (1997)
- City of Markham CLI ECA 021-S701 (February 14, 2025).

2.2 Drainage Criteria

The drainage criteria are summarized as follows:

- Storm Sewer Drainage:
 - Minor System
 - All existing storm sewers will be analyzed for 5-year storm conveyance.
 - Major System
 - The site will convey the 100-year event to each respective outfall.
 - Review of major system and potential impacts to the safe passage of vehicles.

The following are the critical target criteria utilized for the crossing, following MTO Highway Drainage Design Standards (March 2024):

- The proposed culvert structure at this location, urban arterial road, would be required to convey the design storm (50-year event) for culverts spanning less than 6.0m (WC-1, Section 1.1.1)

Tables 1 presents the design criteria from the HDDS used to assess the centerline culvert along the Highway 404 Extension Road.

Table 1: Design classification and sizing criteria

Design Criteria	Site Requirements	Reference
Roadway Classification	Urban Arterial	Functional classification map
Minimum Culvert Size	800 mm diameter for circular culverts 800 mm rise for elliptical or arch culverts 900 mm rise for box culverts	WC-8 Section 3.1
Design Flow (span < 6.0m)	50-yr Return Period	WC-1 Section 1.1.1
Range of Flows and Upstream Water Surface Elevations	5-yr to 100-yr	WC -1 Sections 2.2
Flood Depth at Culvert	$HW/D \leq 1.5$ for culverts with diameter or rise <3m	WC-7 Section 3.5
Freeboard	≥ 1.0 m to the edge of the travelled lane (25-yr storm)	WC-7 Section 3.2

Design Criteria	Site Requirements	Reference
Water Level Generated by the Check Flow	Water Level from Check Flow (115% of 100-yr)	WC-7 Section 3.6
	Water Level < Edge of the travelled lane	

2.3 SWM Objectives

The SWM objectives are summarized as follows:

- Water Quality:
 - Provide a long-term average removal of 80% of total suspended solids (TSS) from the storm runoff of additional impervious areas (TRCA Guidelines).
 - Storage Requirements to achieve Enhanced level of protection (80% TSS Removal) is based on the Water Quality Sizing Criteria from Table 3.2 of the Stormwater Management Planning and Design Manual (MOE, 2003).
- Water Quantity:
 - Control post-development peak flows to pre-development levels for all storms up to and including the 100-year storm for the Rouge River and tributaries upstream of Major Mackenzie Drive.

3 EXISTING CONDITIONS

3.1 Site Characteristics

The existing site is bounded by the Regional major arterial road Major Mackenzie Drive, intersecting with Markland Street and the Highway 404 interchange ramp. Previously during the 2009 Class EA, the pervious areas within the study consisted of grassed lots and wooded areas. The impervious areas through the study area include nearby urban residential properties and the existing ROW for the roads noted above. More recent site plan developments at 770 Markland have been submitted east of the study area, including a 5.4 acre Site A building and parking lot, alongside a 8.29 acre future commercial development.

The existing drainage features includes ephemeral drainage ditches long the Highway 404 interchange ramp which drains in a southeastern direction through the site to the existing Highway 404 Culvert and ultimately to the Major Mackenzie Drive culvert. This surface water drainage was previously originated west of Highway 404 in the Town of Richmond Hill, formerly known as Applewood Creek and is now piped for most of its length starting at Major Mackenzie Drive. See Appendix D for the existing catchment plan.

The study limits contain three (3) distinct outfalls at the Highway 404 OnRamp (OF1), Markland Street (OF2) and Major Mackenzie Drive Culvert (OF3). Within the study limits, there are no existing SWM/LID features.

Highway 404 Onramp Outfall (OF1):

- 300mm PVC outfall at the southern ditch of the north Highway 404 Onramp
 - Stormwater collection and conveyance through road gutter catchbasins

Markland Street Stub (OF2):

- 750mm bulkhead from Markland Street's existing storm sewer network
 - Stormwater collection and conveyance through existing roadway catchbasins to the 1200mm concrete storm mainline.
 - Storm sewer flows ultimately convey to Woodbine Pond.

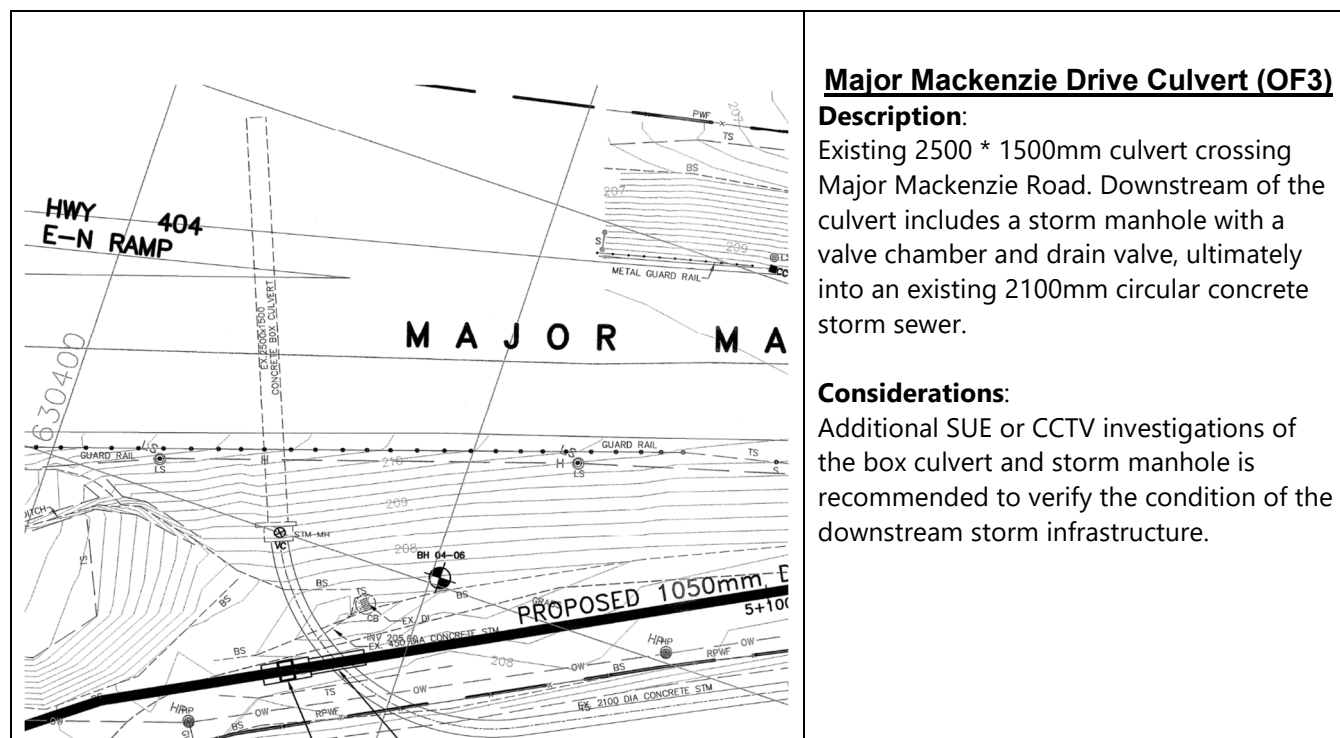
Major Mackenzie Drive Culvert (OF3):

- Existing 2500mm*1500mm Concrete Box Culvert conveying rural overland flow to the south project limits.
 - Stormwater collection and conveyance through the Highway 404/MTO Ditch.
 - Site A roof and parking lot drainage from the 710 Markland developer to be conveyed to a UGS for site quantity control, ultimately to the existing Major Mackenzie culvert.

3.2 Soil and Groundwater Conditions

The groundwater level within the project limits is reported to be dry upon completion of drilling, but this condition is not considered to be a stabilized groundwater condition and is expected to fluctuate (Geotechnical Site Investigation by GEMTEC, July 2024). It is noted groundwater levels may be higher during wet periods of the year such as early spring or following periods of precipitation.

With the limited information available, prior to incorporating any low impact development (LID) infiltration facilities, it is recommended that additional monitoring is performed during the detailed design stages of the project to capture seasonal groundwater fluctuations and to confirm the suitability of any LID approaches.



3.4 Existing Hydrologic Analysis

Under existing conditions, Hydrologic analysis was completed for each existing outfall.

- OF1 and OF2 assessed in Visual OTTHYMO 5.0 (VO5) modelling software.
- OF3 adopted from the EA, 2009.

Table 3 summarizes the revised site areas with the EA addendum and will serve as the target outflows for the proposed conditions.

Table 3. Existing Peak Flows

Outfall (OF#)	Design Storm [m ³ /s]					
	2-year	5-year	10-year	25-year	50-year	100-year
1	0.004	0.006	0.008	0.011	0.013	0.015
2	0.01	0.016	0.021	0.027	0.031	0.036

For detailed hydrologic analysis results refer to **Appendix B**.

4 PROPOSED CONDITIONS

4.1 Site Characteristics

The Highway 404 Ramp Extension EA proposes a two-lane urbanized cross section with 1.7m bike lanes, sidewalk and an improved multi-use path to support pedestrian traffic illustrated in Figure 2 below. The following drainage strategy and discussion aligns with the City's preferred option for retaining walls as the recommended mitigation measure.

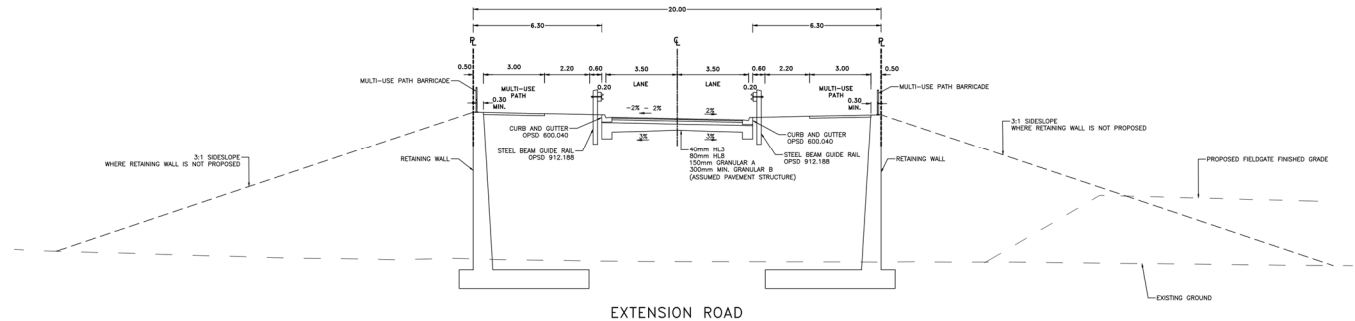


Figure 2: Proposed Highway 404 Ramp Extension ROW

In consultation with the MTO, there is additional preference not to expose the sub-base material to drainage infiltration from the south side of the Highway 404 E-N Ramp.

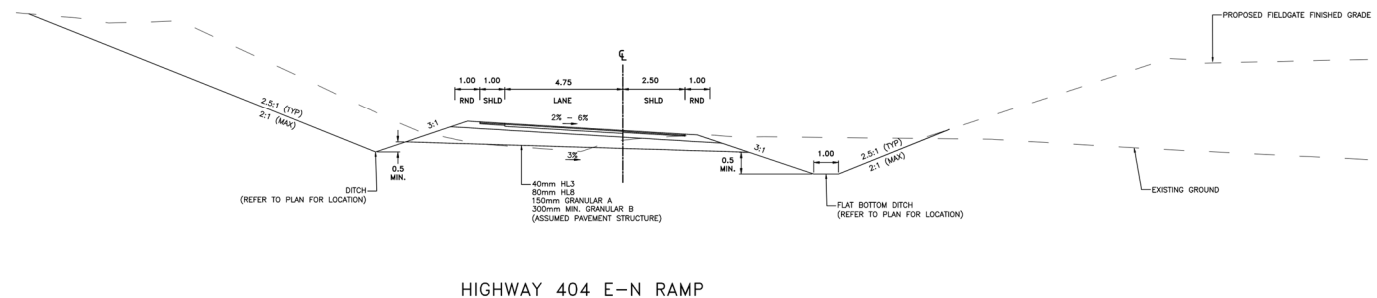


Figure 3: Proposed Highway 404 E-N Ramp Section

The proposed conditions SWM plan will provide recommendations for the outfall improvements, storm drainage system and the stormwater management infrastructure to meet the City and TRCA requirements.

4.1.1 Receiving Outfalls

Based on the field investigation, survey data, and proposed design strategy, the following are the recommendations for each outfall: See Appendix D outlining the outfall locations.

- OF1
 - Maintain existing outfall
 - Limit drainage area to confined low point
 - Daylight lateral sewer along embankment to new onramp ditch with proposed riprap / erosion protection downstream of the pipe outlet.
- OF2
 - Maintain existing outfall
 - Maintain connection to Markland Street (provided 600mm stub connection)
 - Implement Best Management Practices where feasible prior to connection
- OF3
 - Maintain existing flow paths to OF3
 - Provide safe conveyance of flow to OF3 with the new overpass
 - Implement crossing culvert(s) at the proposed overpass that meet HDDS criteria

4.2 Drainage Infrastructure

4.2.1 Minor System Conveyance - Storm Sewers

The Highway 404 Road extension improvements will require the implementation of a new storm sewer system. Storm sewer sizing was completed by the Rational Method and assessment is included in Appendix C. Additionally, the proposed Storm Sewer layout is included in Appendix D. The following are the proposed Highway 404 Road Extension storm network features:

Storm Sewer to OF1

- 20m of 300mm storm sewer catchbasin leads conveying runoff to the southern Highway 404 Onramp.
 - Quality Control Requirements (i.e OGS units) are not being provided due to the small catchment area. It is unknown at this stage of the ultimate discharge point and if any existing quality control measures are available.
 - Recommended during the detailed design stage of the project to pursue further investigations are undertaken to ensure quality control measures are being instituted.

Storm Sewer to OF2

- 307m of 300 - 375mm storm sewer conveying runoff towards Markland Street.
 - Connection point at the 600mm Stub (OF2) via the existing STM MH R803. See Appendix A.
 - Sewer network ultimately discharges to Woodbine Pond.
 - The City has confirmed half of the OF2 drainage area of the proposed road alignment has been accounted for in the drainage area of the Woodbine Pond. The downstream Woodbine Pond can accommodate the additional drainage area provided that the downstream sewer capacity assessment be completed during detailed design prior to tying into the existing 600mm stub.

4.2.2 LID Controls

The roadway improvements from the Highway 404 Ramp Extension will capture and convey runoff to the proposed storm sewers noted in Section 4.2.1. As part of the improvements, SWM and LID features have been considered to satisfy the increase in impervious levels for the new ROW. As described in Section 4.2.1, further verification of the water quality treatment provided by Woodbine Pond is required during detailed design. As an option to provide pre-treatment, infiltration trenches along the corridor and OGS units are recommended to provide filtration prior to discharging to OF2 (Markland Street) and meet servicing requirements for water quantity, quality and balance.

4.2.3 Water Quantity

Visual OTTHYMO was used to control post-development peak flows to pre-development levels for all storms up to and including the 100-year storm for OF2.

- A storage requirement of **~222 m³** is required to control the 100-year post development peak flow to pre development levels.
- Refer to Table 11. Flow Comparison Summary in the following Section 4.3.

As a result of the Visual OTTHYMO 5.0 (VO5) modelling and the MOE SWM Planning and Design Manual (2003) design criteria, infiltration trenches have been proposed along the ROW of the Highway 404 Ramp Extension near the Markland Street intersection. Please see Table 4 below and the preliminary design drawings for more detail.

Table 4. Proposed Low Impact Development (LID) Locations and Dimensions

Outfall	LID #	Location	Approx Station [m]	Dimensions			Void Ratio	Volume [m ³]	Total Volume [m ³]
				Length [m]	Width [m]	Depth [m]			
Outfall 2	1	Hwy 404 Ramp Extension near Markland Street. East Boulevard.	1+316 to 1+367	50	2.9	2	0.4	116	232
	2	Hwy 404 Ramp Extension near Markland Street. West Boulevard.	1+317 to 1+367	50	2.9	2	0.4	116	

The City of Markham has provided confirmation that the downstream Woodbine Pond can accommodate half of the additional drainage area at OF2. Following the soil and groundwater conditions from the geotechnical investigations (GEMTEC, 2024) in Section 3.2, it is recommended that additional monitoring is performed during the detailed design stages of the project to capture seasonal groundwater fluctuations and confirm the suitability of any LID approaches. During detailed design, further review of the applicability of other quantity control practices (i.e super pipes) shall be undertaken to address the additional drainage outside of the Woodbine Pond capacity.

Due to the small drainage contributing drainage area from OF1, there is a negligible increase in flows to the outfall. Additionally, as OF3 has no increase to the existing contributing drainage area outletting to the Major

Mackenzie Drive Culvert, the proposed design has no significant increase on the flows, and the discharge is expected to continue as under existing conditions. Thus, water quantity control measures are not required for OF1 and OF3.

4.2.4 Water Quality

The roadway improvements along the proposed Highway 404 Extension Road will capture and convey runoff through the proposed storm sewers to Markland Street for OF2. As part of the improvements, long-term average removal of 80% of total suspended solids (TSS) from the storm runoff of additional impervious areas shall be met. Storage Requirements to achieve Enhanced level of protection (80% TSS Removal) is based on the Water Quality Sizing Criteria from Table 3.2 of the Stormwater Management Planning and Design Manual (MOE, 2003).

Table 5: Water Quality Sizing Criteria for Enhanced 80% TSS Removal

Outfall (OF#)	Total Impervious Area [ha]	Storage Volume Required (Enhanced 80% Long Term S.S Removal) [m3]
OF2 (Markland Street)	0.40	18.02

The infiltration trenches sized in Table 4 meets 80% TSS removal based on the MOE water quality criteria. Additionally, OGS units are recommended to provide pre-treatment prior to discharging to OF2 (Markland Street). Preliminary sizing using Stormceptor® EFO series has been completed for the pre-treatment of long-term annual sediment load reduction estimates at OF2. Recommendations are summarized in Table 6 and sizing reports in Appendix C.

Table 6: Annual TSS Removal Performance.

Discharge Outfall	Drainage Area (ha) / % Impervious	Target TSS Removal (%)	Estimated Net Annual Sediment Load Reduction (%)	Water Quality Runoff Volume Capture (%)	Recommended Stormceptor Model
OF2 (Markland Street)	0.55 / 100	60	62	>90	EF6

The combination of mechanical separation and infiltration trenches provides a treatment train approach for water quality benefits.

Equation 1 below demonstrates the total TSS removal rate for two BMPs in series.

Equation 1. Water Quality Treatment Train

$$R = A + B - \frac{A * B}{100}$$

[R] = Total TSS Removal Rate

[A] = TSS Removal Rate of first or upstream BMP (Infiltration Trench)

[B] = TSS Removal Rate of second or downstream BMP (OGS)



$$R = 80 + 60 - \frac{80 * 60}{100}$$

$$R = 92\% \text{ Total TSS Removal}$$

For OF1 and OF3, a proposed 1m wide flat bottom ditch provides inherent water quality benefits and conveys flows downstream of the 3000 * 2400mm box culvert underneath extension road, and the proposed 800mm culvert along the Highway 404 E-N Ramp. Further water quality benefits are available through the use of vegetated embankments along the ditch, and riprap downstream of OF1.

4.2.5 Proposed Culverts

Expanding from the 2009 MCEA, a hydraulic assessment was carried out for the proposed Highway 404 E-N ramp realignment and the proposed road overpass. The 100-year peak flows within the study area were adopted from the 2009 MCEA to perform analysis on the proposed concrete box culvert located where the realigned 404 ramp crosses below the proposed road overpass.

From the 2009 MCEA, the 10-year storm event flow is 2.278 m³/s and the 100-year storm event flow is 6.53 m³/s. The design event of the culvert conveyed along Highway 404 Ramp to Major Mackenzie Drive is the 100-year storm event. The proposed approach within the 2009 MCEA was to manage the flows within 2 separate systems, a proposed box culvert receiving 4.251 m³/s (100-year storm event) and a new proposed storm sewer receiving 2.278 m³/s (10-year storm event). However, upon review of the system, it was determined the implementation of a proposed storm sewer would require work outside the site limits along the Highway 404 Ramp and Major Mackenzie Drive which was not within the site limits. It was therefore determined the best course of action would be to implement a crossing culvert across the proposed overpass to convey flows along the re-aligned Highway 404 Ramp.

Hydraulic analysis using HY-8 modelling software determined that a 3000mm x 2400mm concrete box culvert is required to convey the design flow and provide 1.0m freeboard from the edge of the re-aligned Highway 404 ramp. The criterion for assessment is per the MTO Highway Drainage Design Standards (HDDS) and results are demonstrated in Table 7 and Table 8 below.

Table 7: Hydraulic Parameters – Proposed Culverts

Characteristic	Proposed Extension Road Culvert	Proposed 800mm West Onramp Culvert
Crest Elevation (m) (Top of Road)	214.934	208.668
Edge of Pavement Elevation (m)	215.220	208.479
Upstream Invert (m)	206.750	207.645
Downstream Invert (m)	206.560	206.800

Table 8: Hydraulics Details – Proposed Culverts

Result	Proposed Extension Road Culvert		Proposed 800mm West Onramp Culvert	
	10- Year Storm	100- Year	10- Year Storm	100- Year
Peak Flow (m ³ /s)	2.28	6.53	0.05	0.08
Water Surface Elevation (m)	207.41	208.09	208.09	208.09
Freeboard (m)*	7.81	7.13	0.39**	0.39**
Headwater-Depth Ratio (HW/D)	0.28	0.56	0.56	0.56
Velocity (m/s)	1.35	2.4	0.10	0.15

* Note: Subgrade depth assumed at 0.6m (freeboard requirement for onramp is 0.9m)

** Freeboard calculated at downstream of culvert based on upstream headwater of the West Onramp Culvert due to road superelevation and minor upstream flows.

Based on the hydraulic analysis, the proposed extension road culvert and West Onramp culvert meets MTO HDDS criteria for a minimum freeboard to the traveled lane. The analysis of the proposed condition indicates that the proposed culverts satisfies all MTO HDDS criteria, including freeboard, flow depth, HW/D ratio, and flow containment. Additionally, as velocities exceed maximum permissible velocity of 1.5 m/s, erosion control measures will be required for assessment during the detailed design stage of the project. For detailed analysis results and HY-8 output files, refer to Appendix D.

Future considerations during the detailed design stage will be required for the 800mm Onramp east culvert. Drainage of the onramp may be required through collection from ditch inlets to meet MTO HDDS Criteria (i.e minimum culvert crossing size of 800mm). At this stage, the proposed crossing culvert is unable to achieve clearance from the ramp pavement structure due to the limitations of the downstream ditch depth. At this preliminary stage, without detailed design of the onramp, future considerations will be required to ensure MTO HDDS Criteria is met.

4.3 Proposed Hydrologic Analysis

The hydrologic analysis of the study area was completed using Visual OTTHYMO 5.0 (VO5) modelling software. The uncontrolled proposed conditions flow rates at each outfall are summarized in Table 9.

Table 9: Proposed Outfall Flows – Uncontrolled

Outfall (OF#)	Design Storm [m ³ /s]					
	2-year	5-year	10-year	25-year	50-year	100-year
OF1	0.011	0.015	0.017	0.020	0.022	0.024
OF2	0.028	0.037	0.043	0.050	0.055	0.061

For detailed analysis results refer to Appendix C. Outfall flows summarized in Table 10 includes the quantity measures described above and its post to pre-development flow rate reductions.

Table 10: Proposed Outfall Flows – Controlled

Outfall (OF#)	Design Storm [m ³ /s]					
	2-year	5-year	10-year	25-year	50-year	100-year
OF1	-	-	-	-	-	-
OF2	0.010	0.016	0.021	0.027	0.031	0.035

For detailed analysis results refer to Appendix C. The outfall flow comparison table summarized in Table 11 demonstrates the change at each outfall between existing and proposed conditions for the 100-year design storm.

Table 11: Flow Comparison Summary

Outfall (OF#)	Design Storm [m ³ /s]			
	Existing 100-year	Proposed 100-year Uncontrolled	Proposed 100-year with LID	Proposed 100-year with LID - Existing
OF1	0.015	0.024	-	-
OF2	0.036	0.061	0.035	-0.026

For detailed analysis results refer to Appendix C.

The 100-year storm (as well as all storm events, 2 through to 100-year) documented within the VO Model results in Appendix C demonstrates the post development flows will be at or less than existing flow rates.

5 CRITERIA SUMMARY

Drainage Criteria:

The drainage criteria are summarized in the following sections:

Storm Sewers

- Minor System - The storm sewer along the Highway 404 Ramp Extension has been designed to convey the 5-year storm event. The ultimate discharge point of OF2 is Woodbine Pond, conveyed through the minor system of Markland Street, Russell Dawson Road and Princess Diana Dr.
- Major System - The proposed roadway profile and onramp allows for suitable drainage of the 100-year major storm to the Major Mackenzie Drive Culvert in the event of occurrence. Flow depths have not been completed at this stage of the project, and it is recommended that the MNRF flood hazard guidelines be incorporated in the assessment during the detailed design stages of the project.

Water Quality

- The City has provided confirmation that the downstream Woodbine Pond can accommodate half of the additional drainage area from OF2.
- Infiltration Trenches and OGS Units are recommended as part of a treatment train approach to meet water quality objectives for OF2.
- For OF1 and OF3, a proposed 1m wide flat bottom ditch provides inherent water quality benefits and conveys flows downstream of the 3000 * 2400mm box culvert underneath extension road, and the proposed 800mm culvert along the Highway 404 E-N Ramp. Further water quality benefits are available through the use of vegetated embankments along the ditch, and riprap downstream of OF1.

Water Quantity

- Infiltration Trenches have been sized to meet the storage volume required to control post-development peak flows to pre-development levels for all storms up to and including the 100-year storm
 - During detailed design, review the applicability of implementing a variety of quantity control practices (i.e super pipes) to address the additional drainage outside of the Woodbine Pond capacity.
- Water quantity control measures are not required for OF1 and OF3.
 - Due to the small drainage contributing drainage area from OF1, there is a negligible increase in flows to the outfall.
 - OF3 has no increase to the existing contributing drainage area outletting to the Major Mackenzie Drive Culvert, the proposed design has no significant increase on the flows, and the discharge is expected to continue as under existing conditions.

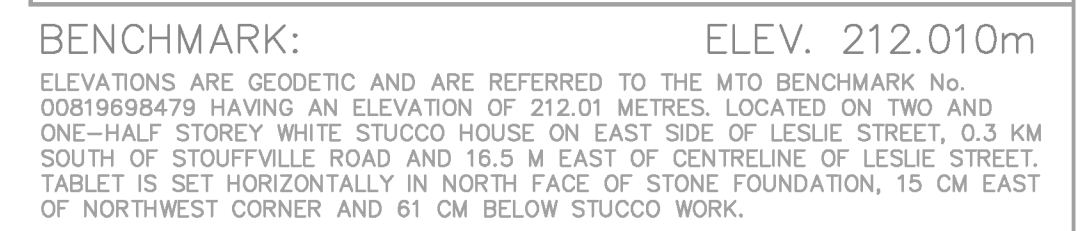
6 CONCLUSIONS

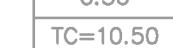
The following illustrates the conclusions associated with the Highway 404 Ramp Extension EA:

- The supporting background reference data, approach and criteria and objectives for stormwater management (SWM) and drainage design have been documented.
- The drainage and SWM conditions have been documented for the Highway 404 Ramp Extension EA with the three (3) outfall locations.
 - OF1 – Outfall to the Highway 404 N-E Onramp.
 - OF2 – Existing 600mm storm stub at Markland Street.
 - OF3 – Existing 2500 * 1500mm culvert crossing Major Mackenzie Road.
- The proposed drainage and SWM conditions were documented for the Highway 404 Ramp Extension EA improvements, which included the proposed storm sewer network for conveyance of the road ROW.
- The City has provided confirmation that the downstream Woodbine Pond can accommodate half of the additional drainage area from OF2.
- During detailed design, review the applicability of implementing a variety of quantity control practices (i.e. super pipes) to address the additional drainage outside of the Woodbine Pond capacity.
- The proposed underpass (3000mm * 2400mm) concrete box culvert and West Onramp Culvert meets HDDS Criteria.
- At this stage, the proposed East Onramp culvert is unable to achieve clearance from the ramp pavement structure due to the limitations of the downstream ditch depth. At this preliminary stage, without detailed design of the onramp, future considerations will be required to ensure MTO HDDS Criteria is met (i.e., ditch inlets) to meet MTO HDDS Criteria (i.e., minimum culvert crossing size of 800mm)

APPENDIX A

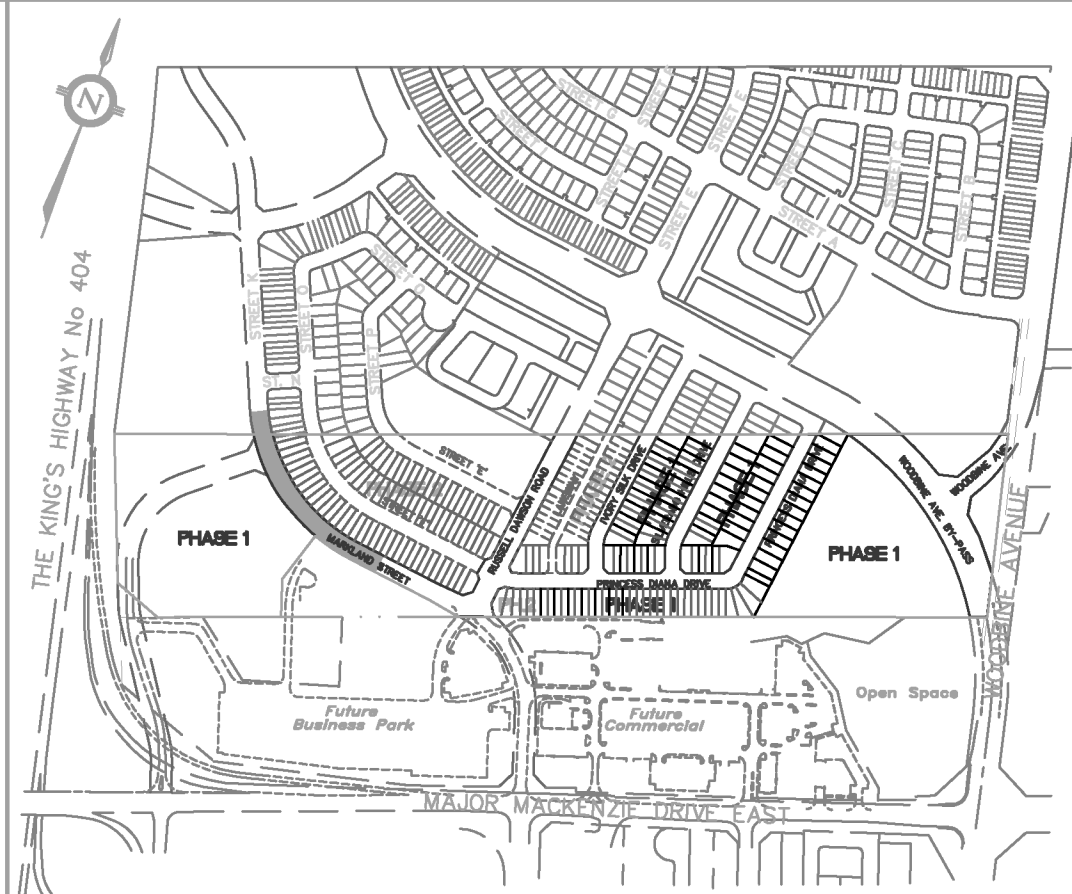
BACKGROUND INFORMATION



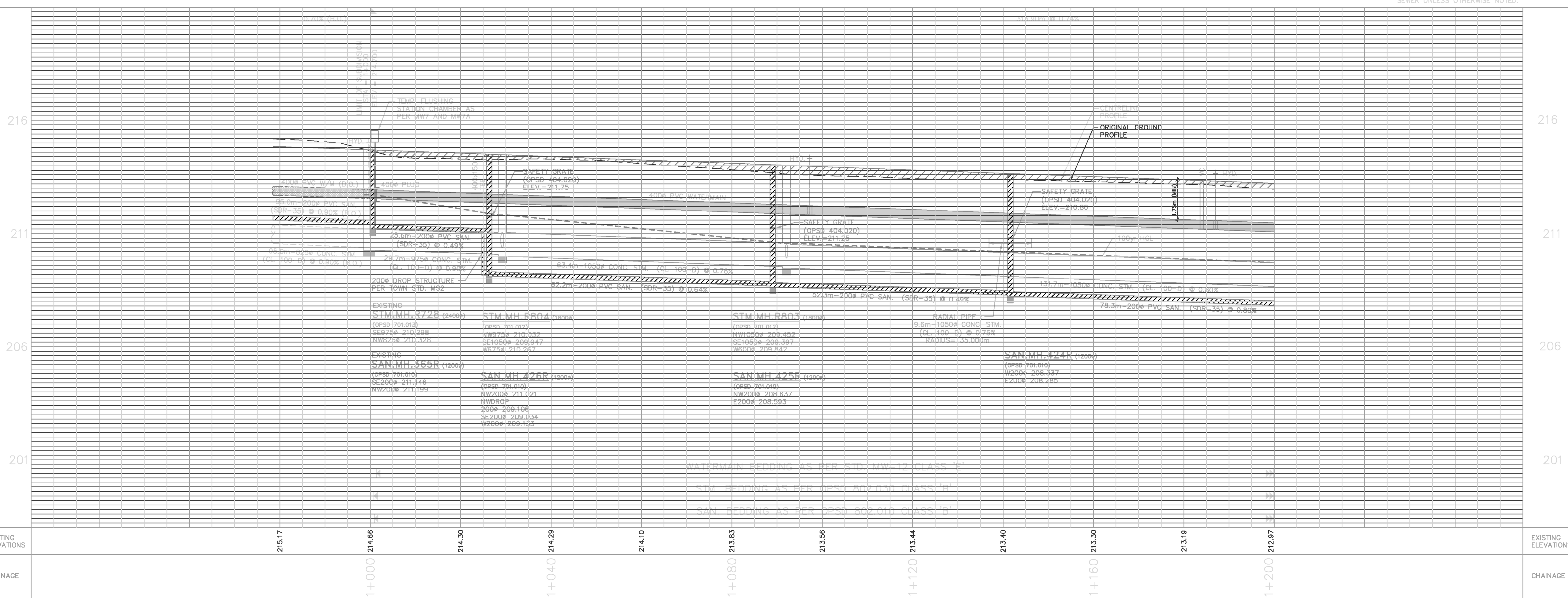
- | | |
|---|--|
|  | DRAINAGE AREA BOUNDARY |
|  | LIMIT OF PHASE 1 |
|  | SINGLE SERVICE CONNECTION |
|  | DUAL SERVICE CONNECTION |
|  | STORM SEWER AND MANHOLE |
|  | SINGLE CATCHBASIN |
|  | DOUBLE CATCHBASIN |
|  | DRAINAGE AREA (ha)
RUNOFF COEFFICIENT |
|  | EXTERNAL AREA
DRAINAGE AREA (ha)
RUNOFF COEFFICIENT
TIME OF CONCENTRATION |
|  | MAJOR SYSTEM FLOW DIRECTION |
|  | TEMPORARY DEAD END BARRICADE |

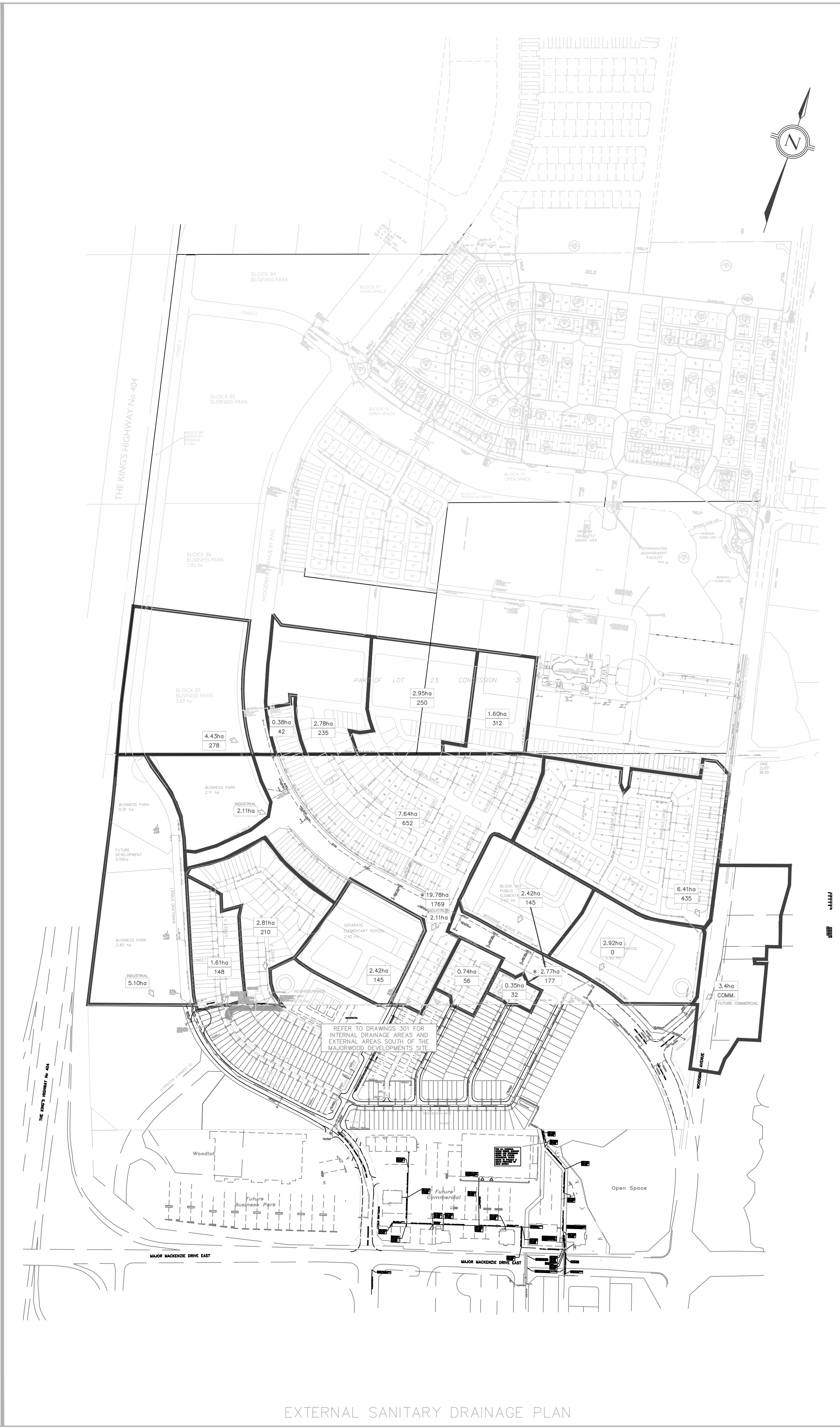
- INLET CONTROLS FOR ROAD LOCATIONS ONLY
- ☐ NO ICD REQUIRED
- ☐ CB EQUIPPED WITH—19.8 l/s ICD (TYPE'A')
- ☐ CB EQUIPPED WITH—28.3 l/s ICD (TYPE'B')
- ☒ CB EQUIPPED WITH—36.8 l/s ICD (TYPE'C')

AS RECORDED							
1.	AS RECORDED SUBMISSION	24/02/09	M.D.				
No.	DESCRIPTION	DATE	BY	APPROVED			
REVISIONS							
 MARKHAM ENGINEERING DEPARTMENT							
		MAJORWOOD DEVELOPMENTS INC. LAKEVIEW HOMES INC. (Phase 1) STORM DRAINAGE PLAN 2					
		 Stantec Consulting Ltd. 7270 WOODBINE AVE., SUITE 300 MARKHAM, ONTARIO L3R 4B9 TELEPHONE: (905) 474-0455 FAX: (905) 474-9889					
		DESIGN BY: M.D. / P.M. DRAWN BY: M.D. SCALE : 1:1000					
		CHECKED BY: H.W. CHECKED BY: P.M. DATE: AUGUST 2006				PROJECT No. 160621169	
Approved as to form in reliance upon the professional skill and ability of Stantec Consulting Engineers as to design and specification.							
ORIGINALS SIGNED  Brian Lee, P.Eng Manager of Development Engineering							
				JULY 27, 2007 Date		202	



		 ENGINEERING DEPARTMENT	
		MAJORWOOD DEVELOPMENTS INC. LAKEVIEW HOMES INC. (Phase 1)	
		MARKLAND STREET STA 1+000 TO STA 1+200	
		 Stantec Consulting Ltd. 7270 WOODBINE AVE., SUITE 300 MARKHAM, ONTARIO L3R 4B9 TELEPHONE: (905) 474-0455 FAX: (905) 474-9889	
DESIGN BY: M.D. / P.M. DRAWN BY: M.D. SCALE : 1 : 500 (H) 1 : 100 (V)		CHECKED BY: H.W. CHECKED BY: P.M. DATE: AUGUST 2006	
APPROVED AS TO FORM IN RELIANCE upon the professional skill and ability of Stantec Consulting Engineers as to form and specification.		PROJECT No. 160621169	
ORIGINALS SIGNED Brian Lee, P.Eng. Manager of Development Engineering		DRAWING No. 409	
		JULY 27, 2007 Date	





KEY PLAN
NTS

BENCHMARK: ELEV. 212.010m
ELEVATIONS ARE GEODETIC AND ARE REFERRED TO THE MTO BENCHMARK No. 00819698479 HAVING AN ELEVATION OF 212.01 METRES. LOCATED ON TWO AND ONE-HALF STOREY WHITE STUCCO HOUSE ON EAST SIDE OF LESLIE STREET, 0.3 KM SOUTH OF STOUFFVILLE ROAD AND 16.5 M EAST OF CENTRELIN OF LESLIE STREET. TABLET IS SET HORIZONTALLY IN NORTH FACE OF STONE FOUNDATION, 15 CM EAST OF NORTHWEST CORNER AND 61 CM BELOW STUCCO WORK.

STORM LEGEND

- DRAINAGE AREA BOUNDARY
- 1.14ha DRAINAGE AREA (ha)
- 0.50 RUNOFF COEFFICIENT
- TC=10.50 TIME OF CONCENTRATION
- ➔ MAJOR SYSTEM FLOW DIRECTION
- * COMBINED DRAINAGE AREA

SANITARY LEGEND

- DRAINAGE AREA BOUNDARY
- 2.22ha CATCHMENT AREA (ha)
- 222 TOTAL POPULATION
- * COMBINED DRAINAGE AREA

AS RECORDED

No.	DESCRIPTION	DATE	BY	APPROVED
1.	AS RECORDED SUBMISSION	NOV/2012	H.W.	

REVISIONS

MARKHAM
ENGINEERING DEPARTMENT

MAJORWOOD DEVELOPMENTS INC.
LAKEVIEW HOMES INC. (PHASE 2)
EXTERNAL DRAINAGE PLANS

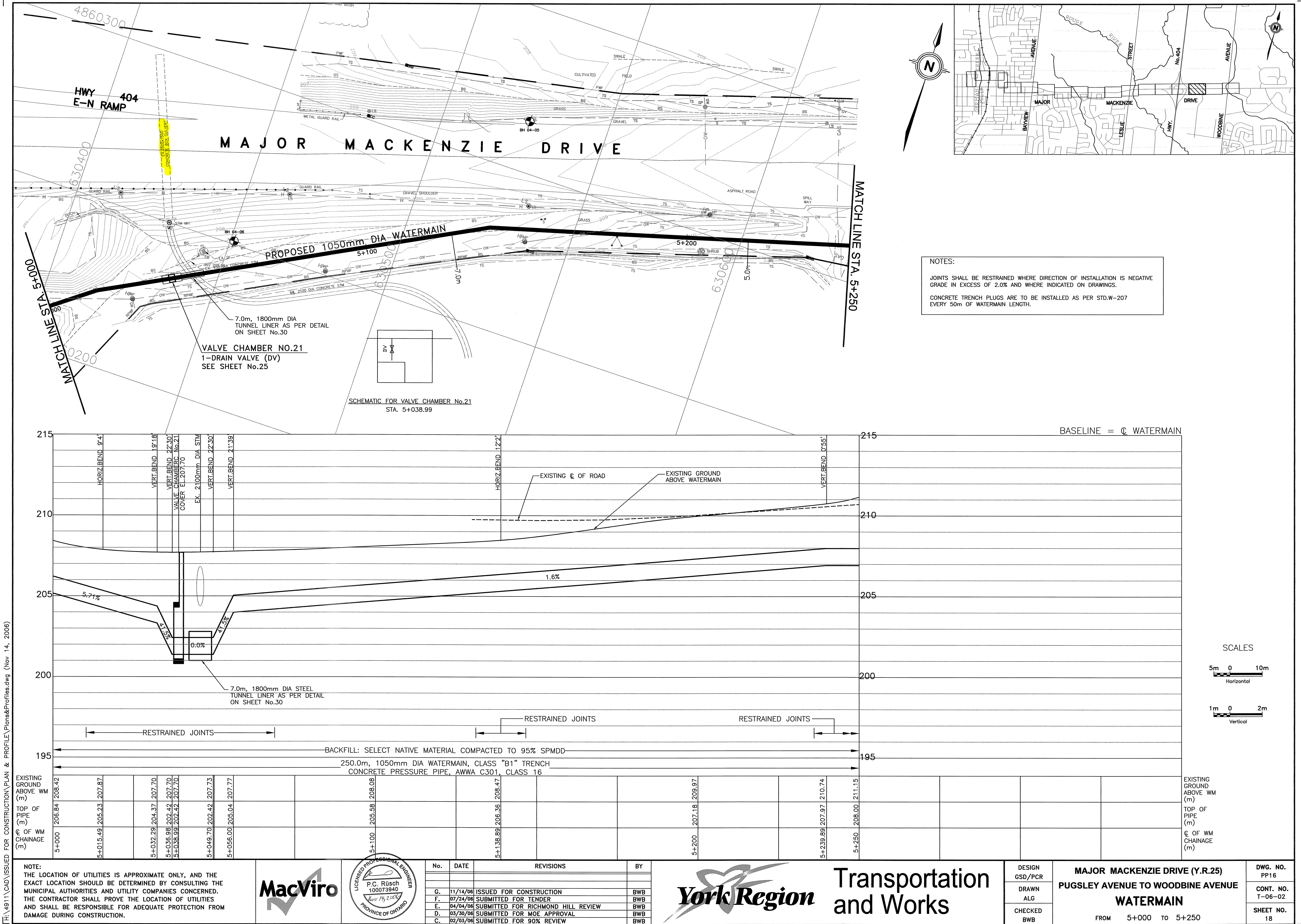
Stantec Consulting Ltd.
300-675 COCHRANE DRIVE WEST TOWER
MARKHAM, ONTARIO L3R 0B8
TELEPHONE: (905) 944-7777
FAX: (905) 474-9889

DESIGN BY: M.D. / P.M.
DRAWN BY: M.D.
SCALE: 1:4000

CHECKED BY: H.W.
CHECKED BY: T.R.
DATE: NOVEMBER 2012

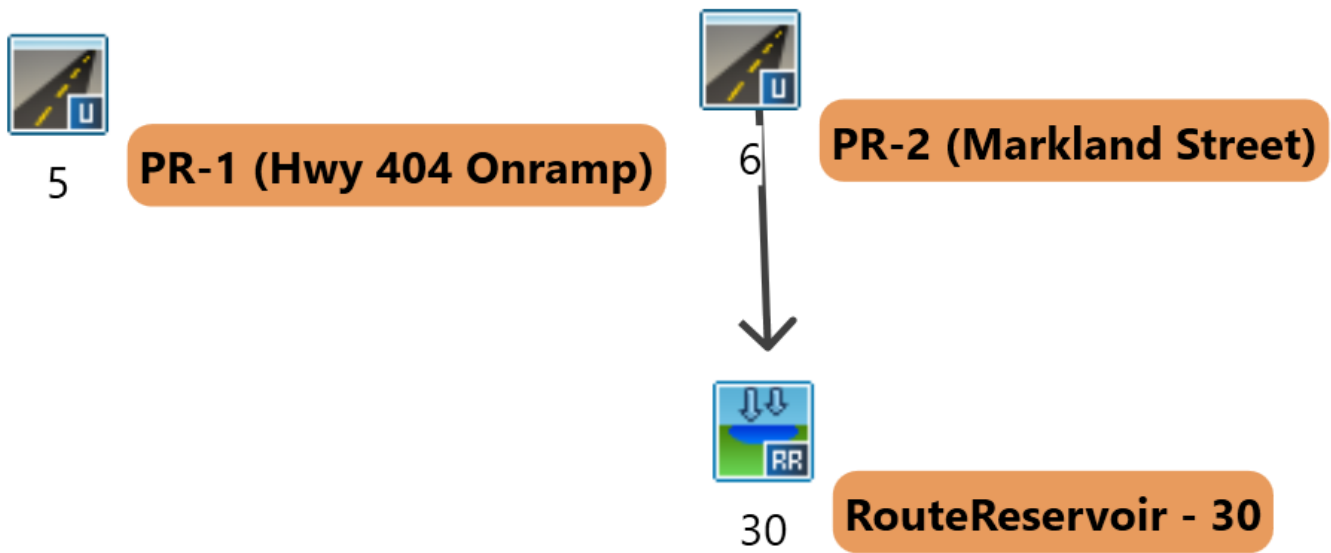
PROJECT No. 160621169
DRAWING No. 200

Brian Lee July 27, 2007
Brian Lee, P.Eng.
Manager of Development Engineering and Transportation



APPENDIX B

HYDROLOGIC ANALYSIS



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

```

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

```

```

000   TTTTT TTTTT H   H   Y   Y   M   M   000   TM
0   0   T       T   H   H   Y Y   MM MM 0   0
0   0   T       T   H   H   Y   M   M 0   0
000   T       T   H   H   Y   M   M 000

```

Developed and Distributed by Smart City Water Inc
 Copyright 2007 - 2022 Smart City Water Inc
 All rights reserved.

***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\V02\voin.dat

Output filename:

C:\Users\Gho\AppData\Local\Civica\XH5\e1c6be58-a9e2-48fa-8862-b94ee87dad4f\db43d6e3-8f4e-4886-ac51-2011a8445c6b\scenario

Summary filename:

C:\Users\Gho\AppData\Local\Civica\XH5\e1c6be58-a9e2-48fa-8862-b94ee87dad4f\db43d6e3-8f4e-4886-ac51-2011a8445c6b\scenario

DATE: 09/30/2024

TIME: 03:51:35

USER:

COMMENTS: _____

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

```

*****
** SIMULATION : 100yr 12 hour AES Distributio **
*****

```

```
-----
|   READ STORM   |
|                |

```

Filename: C:\Users\Gho\AppData\Local\Temp\

91703447-496f-4f16-97a4-9b697a048b7b\cf1f8e98
 Ptotal= 88.54 mm | Comments: 100 Year 12 Hour AES (Bloor, TRCA)

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.00	0.00	3.25	15.05	6.50	6.20	9.75	0.89
0.25	0.89	3.50	15.05	6.75	6.20	10.00	0.89
0.50	0.89	3.75	15.05	7.00	6.20	10.25	0.89
0.75	0.89	4.00	15.05	7.25	3.54	10.50	0.89
1.00	0.89	4.25	40.71	7.50	3.54	10.75	0.89
1.25	0.89	4.50	40.71	7.75	3.54	11.00	0.89
1.50	0.89	4.75	40.71	8.00	3.54	11.25	0.89
1.75	0.89	5.00	40.71	8.25	1.77	11.50	0.89
2.00	0.89	5.25	11.51	8.50	1.77	11.75	0.89
2.25	5.31	5.50	11.51	8.75	1.77	12.00	0.89
2.50	5.31	5.75	11.51	9.00	1.77		
2.75	5.31	6.00	11.51	9.25	0.89		
3.00	5.31	6.25	6.20	9.50	0.89		

CALIB
 NASHYD (0002) | Area (ha)= 1.12 Curve Number (CN)= 76.0
 ID= 1 DT= 5.0 min | Ia (mm)= 6.00 # of Linear Res.(N)= 3.00
 U.H. Tp(hrs)= 0.30

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

----- TRANSFORMED HYETOGRAPH -----

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	0.00	3.167	5.31	6.250	11.51	9.33	0.89
0.167	0.00	3.250	5.31	6.333	6.20	9.42	0.89
0.250	0.00	3.333	15.05	6.417	6.20	9.50	0.89
0.333	0.89	3.417	15.05	6.500	6.20	9.58	0.89
0.417	0.89	3.500	15.05	6.583	6.20	9.67	0.89
0.500	0.89	3.583	15.05	6.667	6.20	9.75	0.89
0.583	0.89	3.667	15.05	6.750	6.20	9.83	0.89
0.667	0.89	3.750	15.05	6.833	6.20	9.92	0.89
0.750	0.89	3.833	15.05	6.917	6.20	10.00	0.89
0.833	0.89	3.917	15.05	7.000	6.20	10.08	0.89
0.917	0.89	4.000	15.05	7.083	6.20	10.17	0.89
1.000	0.89	4.083	15.05	7.167	6.20	10.25	0.89
1.083	0.89	4.167	15.05	7.250	6.20	10.33	0.89
1.167	0.89	4.250	15.05	7.333	3.54	10.42	0.89
1.250	0.89	4.333	40.71	7.417	3.54	10.50	0.89
1.333	0.89	4.417	40.71	7.500	3.54	10.58	0.89
1.417	0.89	4.500	40.71	7.583	3.54	10.67	0.89

1.500	0.89	4.583	40.71	7.667	3.54	10.75	0.89
1.583	0.89	4.667	40.71	7.750	3.54	10.83	0.89
1.667	0.89	4.750	40.71	7.833	3.54	10.92	0.89
1.750	0.89	4.833	40.71	7.917	3.54	11.00	0.89
1.833	0.89	4.917	40.71	8.000	3.54	11.08	0.89
1.917	0.89	5.000	40.71	8.083	3.54	11.17	0.89
2.000	0.89	5.083	40.71	8.167	3.54	11.25	0.89
2.083	0.89	5.167	40.71	8.250	3.54	11.33	0.89
2.167	0.89	5.250	40.71	8.333	1.77	11.42	0.89
2.250	0.89	5.333	11.51	8.417	1.77	11.50	0.89
2.333	5.31	5.417	11.51	8.500	1.77	11.58	0.89
2.417	5.31	5.500	11.51	8.583	1.77	11.67	0.89
2.500	5.31	5.583	11.51	8.667	1.77	11.75	0.89
2.583	5.31	5.667	11.51	8.750	1.77	11.83	0.89
2.667	5.31	5.750	11.51	8.833	1.77	11.92	0.89
2.750	5.31	5.833	11.51	8.917	1.77	12.00	0.89
2.833	5.31	5.917	11.51	9.000	1.77	12.08	0.89
2.917	5.31	6.000	11.51	9.083	1.77	12.17	0.89
3.000	5.31	6.083	11.51	9.167	1.77	12.25	0.89
3.083	5.31	6.167	11.51	9.250	1.77		

Unit Hyd Qpeak (cms)= 0.143

PEAK FLOW (cms)= 0.069 (i)

TIME TO PEAK (hrs)= 5.333

RUNOFF VOLUME (mm)= 41.844

TOTAL RAINFALL (mm)= 88.540

RUNOFF COEFFICIENT = 0.473

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

CALIB			
NASHYD (0001)			
ID= 1 DT= 5.0 min			

Area (ha)= 22.50		Curve Number (CN)= 76.0	
Ia (mm)= 6.00		# of Linear Res.(N)= 3.00	
U.H. Tp(hrs)= 0.76			

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

----- TRANSFORMED HYETOGRAPH -----							
TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	0.00	3.167	5.31	6.250	11.51	9.33	0.89
0.167	0.00	3.250	5.31	6.333	6.20	9.42	0.89
0.250	0.00	3.333	15.05	6.417	6.20	9.50	0.89
0.333	0.89	3.417	15.05	6.500	6.20	9.58	0.89
0.417	0.89	3.500	15.05	6.583	6.20	9.67	0.89
0.500	0.89	3.583	15.05	6.667	6.20	9.75	0.89

0.583	0.89	3.667	15.05	6.750	6.20	9.83	0.89
0.667	0.89	3.750	15.05	6.833	6.20	9.92	0.89
0.750	0.89	3.833	15.05	6.917	6.20	10.00	0.89
0.833	0.89	3.917	15.05	7.000	6.20	10.08	0.89
0.917	0.89	4.000	15.05	7.083	6.20	10.17	0.89
1.000	0.89	4.083	15.05	7.167	6.20	10.25	0.89
1.083	0.89	4.167	15.05	7.250	6.20	10.33	0.89
1.167	0.89	4.250	15.05	7.333	3.54	10.42	0.89
1.250	0.89	4.333	40.71	7.417	3.54	10.50	0.89
1.333	0.89	4.417	40.71	7.500	3.54	10.58	0.89
1.417	0.89	4.500	40.71	7.583	3.54	10.67	0.89
1.500	0.89	4.583	40.71	7.667	3.54	10.75	0.89
1.583	0.89	4.667	40.71	7.750	3.54	10.83	0.89
1.667	0.89	4.750	40.71	7.833	3.54	10.92	0.89
1.750	0.89	4.833	40.71	7.917	3.54	11.00	0.89
1.833	0.89	4.917	40.71	8.000	3.54	11.08	0.89
1.917	0.89	5.000	40.71	8.083	3.54	11.17	0.89
2.000	0.89	5.083	40.71	8.167	3.54	11.25	0.89
2.083	0.89	5.167	40.71	8.250	3.54	11.33	0.89
2.167	0.89	5.250	40.71	8.333	1.77	11.42	0.89
2.250	0.89	5.333	11.51	8.417	1.77	11.50	0.89
2.333	5.31	5.417	11.51	8.500	1.77	11.58	0.89
2.417	5.31	5.500	11.51	8.583	1.77	11.67	0.89
2.500	5.31	5.583	11.51	8.667	1.77	11.75	0.89
2.583	5.31	5.667	11.51	8.750	1.77	11.83	0.89
2.667	5.31	5.750	11.51	8.833	1.77	11.92	0.89
2.750	5.31	5.833	11.51	8.917	1.77	12.00	0.89
2.833	5.31	5.917	11.51	9.000	1.77	12.08	0.89
2.917	5.31	6.000	11.51	9.083	1.77	12.17	0.89
3.000	5.31	6.083	11.51	9.167	1.77	12.25	0.89
3.083	5.31	6.167	11.51	9.250	1.77		

Unit Hyd Qpeak (cms)= 1.131

PEAK FLOW (cms)= 0.927 (i)

TIME TO PEAK (hrs)= 5.750

RUNOFF VOLUME (mm)= 41.860

TOTAL RAINFALL (mm)= 88.540

RUNOFF COEFFICIENT = 0.473

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

CALIB			
NASHYD (0003)			
ID= 1 DT= 5.0 min			

Area (ha)=		4.75	Curve Number (CN)= 95.2
Ia (mm)=		1.00	# of Linear Res.(N)= 3.00
U.H. Tp(hrs)=		0.22	

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

----- TRANSFORMED HYETOGRAPH -----							
TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	0.00	3.167	5.31	6.250	11.51	9.33	0.89
0.167	0.00	3.250	5.31	6.333	6.20	9.42	0.89
0.250	0.00	3.333	15.05	6.417	6.20	9.50	0.89
0.333	0.89	3.417	15.05	6.500	6.20	9.58	0.89
0.417	0.89	3.500	15.05	6.583	6.20	9.67	0.89
0.500	0.89	3.583	15.05	6.667	6.20	9.75	0.89
0.583	0.89	3.667	15.05	6.750	6.20	9.83	0.89
0.667	0.89	3.750	15.05	6.833	6.20	9.92	0.89
0.750	0.89	3.833	15.05	6.917	6.20	10.00	0.89
0.833	0.89	3.917	15.05	7.000	6.20	10.08	0.89
0.917	0.89	4.000	15.05	7.083	6.20	10.17	0.89
1.000	0.89	4.083	15.05	7.167	6.20	10.25	0.89
1.083	0.89	4.167	15.05	7.250	6.20	10.33	0.89
1.167	0.89	4.250	15.05	7.333	3.54	10.42	0.89
1.250	0.89	4.333	40.71	7.417	3.54	10.50	0.89
1.333	0.89	4.417	40.71	7.500	3.54	10.58	0.89
1.417	0.89	4.500	40.71	7.583	3.54	10.67	0.89
1.500	0.89	4.583	40.71	7.667	3.54	10.75	0.89
1.583	0.89	4.667	40.71	7.750	3.54	10.83	0.89
1.667	0.89	4.750	40.71	7.833	3.54	10.92	0.89
1.750	0.89	4.833	40.71	7.917	3.54	11.00	0.89
1.833	0.89	4.917	40.71	8.000	3.54	11.08	0.89
1.917	0.89	5.000	40.71	8.083	3.54	11.17	0.89
2.000	0.89	5.083	40.71	8.167	3.54	11.25	0.89
2.083	0.89	5.167	40.71	8.250	3.54	11.33	0.89
2.167	0.89	5.250	40.71	8.333	1.77	11.42	0.89
2.250	0.89	5.333	11.51	8.417	1.77	11.50	0.89
2.333	5.31	5.417	11.51	8.500	1.77	11.58	0.89
2.417	5.31	5.500	11.51	8.583	1.77	11.67	0.89
2.500	5.31	5.583	11.51	8.667	1.77	11.75	0.89
2.583	5.31	5.667	11.51	8.750	1.77	11.83	0.89
2.667	5.31	5.750	11.51	8.833	1.77	11.92	0.89
2.750	5.31	5.833	11.51	8.917	1.77	12.00	0.89
2.833	5.31	5.917	11.51	9.000	1.77	12.08	0.89
2.917	5.31	6.000	11.51	9.083	1.77	12.17	0.89
3.000	5.31	6.083	11.51	9.167	1.77	12.25	0.89
3.083	5.31	6.167	11.51	9.250	1.77		

Unit Hyd Qpeak (cms)= 0.825

PEAK FLOW (cms)= 0.512 (i)

TIME TO PEAK (hrs)= 5.250

RUNOFF VOLUME (mm)= 76.267

TOTAL RAINFALL (mm)= 88.540

RUNOFF COEFFICIENT = 0.861

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

```

-----
| CALIB |
| NASHYD ( 0004) | Area (ha)= 0.55 Curve Number (CN)= 76.0
| ID= 1 DT= 5.0 min | Ia (mm)= 6.00 # of Linear Res.(N)= 3.00
|-----| U.H. Tp(hrs)= 0.22

```

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

```

----- TRANSFORMED HYETOGRAPH -----

```

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	0.00	3.167	5.31	6.250	11.51	9.33	0.89
0.167	0.00	3.250	5.31	6.333	6.20	9.42	0.89
0.250	0.00	3.333	15.05	6.417	6.20	9.50	0.89
0.333	0.89	3.417	15.05	6.500	6.20	9.58	0.89
0.417	0.89	3.500	15.05	6.583	6.20	9.67	0.89
0.500	0.89	3.583	15.05	6.667	6.20	9.75	0.89
0.583	0.89	3.667	15.05	6.750	6.20	9.83	0.89
0.667	0.89	3.750	15.05	6.833	6.20	9.92	0.89
0.750	0.89	3.833	15.05	6.917	6.20	10.00	0.89
0.833	0.89	3.917	15.05	7.000	6.20	10.08	0.89
0.917	0.89	4.000	15.05	7.083	6.20	10.17	0.89
1.000	0.89	4.083	15.05	7.167	6.20	10.25	0.89
1.083	0.89	4.167	15.05	7.250	6.20	10.33	0.89
1.167	0.89	4.250	15.05	7.333	3.54	10.42	0.89
1.250	0.89	4.333	40.71	7.417	3.54	10.50	0.89
1.333	0.89	4.417	40.71	7.500	3.54	10.58	0.89
1.417	0.89	4.500	40.71	7.583	3.54	10.67	0.89
1.500	0.89	4.583	40.71	7.667	3.54	10.75	0.89
1.583	0.89	4.667	40.71	7.750	3.54	10.83	0.89
1.667	0.89	4.750	40.71	7.833	3.54	10.92	0.89
1.750	0.89	4.833	40.71	7.917	3.54	11.00	0.89
1.833	0.89	4.917	40.71	8.000	3.54	11.08	0.89
1.917	0.89	5.000	40.71	8.083	3.54	11.17	0.89
2.000	0.89	5.083	40.71	8.167	3.54	11.25	0.89
2.083	0.89	5.167	40.71	8.250	3.54	11.33	0.89
2.167	0.89	5.250	40.71	8.333	1.77	11.42	0.89
2.250	0.89	5.333	11.51	8.417	1.77	11.50	0.89
2.333	5.31	5.417	11.51	8.500	1.77	11.58	0.89
2.417	5.31	5.500	11.51	8.583	1.77	11.67	0.89
2.500	5.31	5.583	11.51	8.667	1.77	11.75	0.89
2.583	5.31	5.667	11.51	8.750	1.77	11.83	0.89
2.667	5.31	5.750	11.51	8.833	1.77	11.92	0.89
2.750	5.31	5.833	11.51	8.917	1.77	12.00	0.89
2.833	5.31	5.917	11.51	9.000	1.77	12.08	0.89

2.917	5.31	6.000	11.51	9.083	1.77	12.17	0.89
3.000	5.31	6.083	11.51	9.167	1.77	12.25	0.89
3.083	5.31	6.167	11.51	9.250	1.77		

Unit Hyd Qpeak (cms)= 0.095

PEAK FLOW (cms)= 0.036 (i)

TIME TO PEAK (hrs)= 5.250

RUNOFF VOLUME (mm)= 41.805

TOTAL RAINFALL (mm)= 88.540

RUNOFF COEFFICIENT = 0.472

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

CALIB	
STANDHYD (0005)	Area (ha)= 0.22
ID= 1 DT= 5.0 min	Total Imp(%)= 90.00 Dir. Conn.(%)= 90.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.20	0.02
Dep. Storage (mm)=	1.00	1.50
Average Slope (%)=	0.66	2.00
Length (m)=	38.30	40.00
Mannings n =	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----							
TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	0.00	3.167	5.31	6.250	11.51	9.33	0.89
0.167	0.00	3.250	5.31	6.333	6.20	9.42	0.89
0.250	0.00	3.333	15.05	6.417	6.20	9.50	0.89
0.333	0.89	3.417	15.05	6.500	6.20	9.58	0.89
0.417	0.89	3.500	15.05	6.583	6.20	9.67	0.89
0.500	0.89	3.583	15.05	6.667	6.20	9.75	0.89
0.583	0.89	3.667	15.05	6.750	6.20	9.83	0.89
0.667	0.89	3.750	15.05	6.833	6.20	9.92	0.89
0.750	0.89	3.833	15.05	6.917	6.20	10.00	0.89
0.833	0.89	3.917	15.05	7.000	6.20	10.08	0.89
0.917	0.89	4.000	15.05	7.083	6.20	10.17	0.89
1.000	0.89	4.083	15.05	7.167	6.20	10.25	0.89
1.083	0.89	4.167	15.05	7.250	6.20	10.33	0.89
1.167	0.89	4.250	15.05	7.333	3.54	10.42	0.89
1.250	0.89	4.333	40.71	7.417	3.54	10.50	0.89
1.333	0.89	4.417	40.71	7.500	3.54	10.58	0.89
1.417	0.89	4.500	40.71	7.583	3.54	10.67	0.89

1.500	0.89	4.583	40.71	7.667	3.54	10.75	0.89
1.583	0.89	4.667	40.71	7.750	3.54	10.83	0.89
1.667	0.89	4.750	40.71	7.833	3.54	10.92	0.89
1.750	0.89	4.833	40.71	7.917	3.54	11.00	0.89
1.833	0.89	4.917	40.71	8.000	3.54	11.08	0.89
1.917	0.89	5.000	40.71	8.083	3.54	11.17	0.89
2.000	0.89	5.083	40.71	8.167	3.54	11.25	0.89
2.083	0.89	5.167	40.71	8.250	3.54	11.33	0.89
2.167	0.89	5.250	40.71	8.333	1.77	11.42	0.89
2.250	0.89	5.333	11.51	8.417	1.77	11.50	0.89
2.333	5.31	5.417	11.51	8.500	1.77	11.58	0.89
2.417	5.31	5.500	11.51	8.583	1.77	11.67	0.89
2.500	5.31	5.583	11.51	8.667	1.77	11.75	0.89
2.583	5.31	5.667	11.51	8.750	1.77	11.83	0.89
2.667	5.31	5.750	11.51	8.833	1.77	11.92	0.89
2.750	5.31	5.833	11.51	8.917	1.77	12.00	0.89
2.833	5.31	5.917	11.51	9.000	1.77	12.08	0.89
2.917	5.31	6.000	11.51	9.083	1.77	12.17	0.89
3.000	5.31	6.083	11.51	9.167	1.77	12.25	0.89
3.083	5.31	6.167	11.51	9.250	1.77		

Max.Eff.Inten.(mm/hr)= 40.71 32.96
over (min) 5.00 10.00
Storage Coeff. (min)= 2.33 (ii) 6.53 (ii)
Unit Hyd. Tpeak (min)= 5.00 10.00
Unit Hyd. peak (cms)= 0.30 0.14

TOTALS

PEAK FLOW (cms)= 0.02 0.00 0.024 (iii)
TIME TO PEAK (hrs)= 5.08 5.25 5.25
RUNOFF VOLUME (mm)= 87.54 57.45 84.51
TOTAL RAINFALL (mm)= 88.54 88.54 88.54
RUNOFF COEFFICIENT = 0.99 0.65 0.95

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 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.

| CALIB |
| STANDHYD (0006) | Area (ha)= 0.55
| ID= 1 DT= 5.0 min | Total Imp(%)= 90.00 Dir. Conn.(%)= 90.00

IMPERVIOUS PERVIOUS (i)
Surface Area (ha)= 0.50 0.06
Dep. Storage (mm)= 1.00 1.50

Average Slope (%)= 0.35 2.00
 Length (m)= 38.30 40.00
 Mannings n = 0.013 0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----							
TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	0.00	3.167	5.31	6.250	11.51	9.33	0.89
0.167	0.00	3.250	5.31	6.333	6.20	9.42	0.89
0.250	0.00	3.333	15.05	6.417	6.20	9.50	0.89
0.333	0.89	3.417	15.05	6.500	6.20	9.58	0.89
0.417	0.89	3.500	15.05	6.583	6.20	9.67	0.89
0.500	0.89	3.583	15.05	6.667	6.20	9.75	0.89
0.583	0.89	3.667	15.05	6.750	6.20	9.83	0.89
0.667	0.89	3.750	15.05	6.833	6.20	9.92	0.89
0.750	0.89	3.833	15.05	6.917	6.20	10.00	0.89
0.833	0.89	3.917	15.05	7.000	6.20	10.08	0.89
0.917	0.89	4.000	15.05	7.083	6.20	10.17	0.89
1.000	0.89	4.083	15.05	7.167	6.20	10.25	0.89
1.083	0.89	4.167	15.05	7.250	6.20	10.33	0.89
1.167	0.89	4.250	15.05	7.333	3.54	10.42	0.89
1.250	0.89	4.333	40.71	7.417	3.54	10.50	0.89
1.333	0.89	4.417	40.71	7.500	3.54	10.58	0.89
1.417	0.89	4.500	40.71	7.583	3.54	10.67	0.89
1.500	0.89	4.583	40.71	7.667	3.54	10.75	0.89
1.583	0.89	4.667	40.71	7.750	3.54	10.83	0.89
1.667	0.89	4.750	40.71	7.833	3.54	10.92	0.89
1.750	0.89	4.833	40.71	7.917	3.54	11.00	0.89
1.833	0.89	4.917	40.71	8.000	3.54	11.08	0.89
1.917	0.89	5.000	40.71	8.083	3.54	11.17	0.89
2.000	0.89	5.083	40.71	8.167	3.54	11.25	0.89
2.083	0.89	5.167	40.71	8.250	3.54	11.33	0.89
2.167	0.89	5.250	40.71	8.333	1.77	11.42	0.89
2.250	0.89	5.333	11.51	8.417	1.77	11.50	0.89
2.333	5.31	5.417	11.51	8.500	1.77	11.58	0.89
2.417	5.31	5.500	11.51	8.583	1.77	11.67	0.89
2.500	5.31	5.583	11.51	8.667	1.77	11.75	0.89
2.583	5.31	5.667	11.51	8.750	1.77	11.83	0.89
2.667	5.31	5.750	11.51	8.833	1.77	11.92	0.89
2.750	5.31	5.833	11.51	8.917	1.77	12.00	0.89
2.833	5.31	5.917	11.51	9.000	1.77	12.08	0.89
2.917	5.31	6.000	11.51	9.083	1.77	12.17	0.89
3.000	5.31	6.083	11.51	9.167	1.77	12.25	0.89
3.083	5.31	6.167	11.51	9.250	1.77		

Max.Eff.Inten.(mm/hr)= 40.71 32.96
 over (min) 5.00 10.00

Storage Coeff. (min)=	2.82 (ii)	7.02 (ii)	
Unit Hyd. Tpeak (min)=	5.00	10.00	
Unit Hyd. peak (cms)=	0.28	0.14	
			TOTALS
PEAK FLOW (cms)=	0.06	0.00	0.061 (iii)
TIME TO PEAK (hrs)=	5.08	5.25	5.25
RUNOFF VOLUME (mm)=	87.54	57.45	84.52
TOTAL RAINFALL (mm)=	88.54	88.54	88.54
RUNOFF COEFFICIENT =	0.99	0.65	0.95

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
 CN* = 85.0 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.

```

-----
| RESERVOIR( 0030) | OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT= 5.0 min      |
-----

```

	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
**** WARNING : FIRST OUTFLOW IS NOT ZERO.	0.0100	0.0110	0.0270	0.0188
	0.0160	0.0143	0.0310	0.0205
	0.0210	0.0164	0.0360	0.0222

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0006)	0.550	0.061	5.25	84.52
OUTFLOW: ID= 1 (0030)	0.550	0.035	5.33	84.03

PEAK FLOW REDUCTION [Qout/Qin](%)=	58.19
TIME SHIFT OF PEAK FLOW (min)=	5.00
MAXIMUM STORAGE USED (ha.m.)=	0.0221

FINISH

=====

=====



4

EX-2 - Hwy 404 Ramp - Markland OF2



5

EX-1 - Hwy 404 Ramp - OnRamp OF1

 ** SIMULATION:100yr 12 hour AES Distribution **

```

-----
| CALIB                      |
| NASHYD ( 0004)            | Area   (ha)=  0.55   Curve Number (CN)= 76.0
| ID= 1 DT= 5.0 min         | Ia     (mm)=  6.00   # of Linear Res.(N)= 3.00
|-----|                   | U.H. Tp(hrs)=  0.22

```

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

```

----- TRANSFORMED HYETOGRAPH -----

```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.00	3.167	5.31	6.250	11.51	9.33	0.89
0.167	0.00	3.250	5.31	6.333	6.20	9.42	0.89
0.250	0.00	3.333	15.05	6.417	6.20	9.50	0.89
0.333	0.89	3.417	15.05	6.500	6.20	9.58	0.89
0.417	0.89	3.500	15.05	6.583	6.20	9.67	0.89
0.500	0.89	3.583	15.05	6.667	6.20	9.75	0.89
0.583	0.89	3.667	15.05	6.750	6.20	9.83	0.89
0.667	0.89	3.750	15.05	6.833	6.20	9.92	0.89
0.750	0.89	3.833	15.05	6.917	6.20	10.00	0.89
0.833	0.89	3.917	15.05	7.000	6.20	10.08	0.89
0.917	0.89	4.000	15.05	7.083	6.20	10.17	0.89
1.000	0.89	4.083	15.05	7.167	6.20	10.25	0.89
1.083	0.89	4.167	15.05	7.250	6.20	10.33	0.89
1.167	0.89	4.250	15.05	7.333	3.54	10.42	0.89
1.250	0.89	4.333	40.71	7.417	3.54	10.50	0.89
1.333	0.89	4.417	40.71	7.500	3.54	10.58	0.89
1.417	0.89	4.500	40.71	7.583	3.54	10.67	0.89
1.500	0.89	4.583	40.71	7.667	3.54	10.75	0.89
1.583	0.89	4.667	40.71	7.750	3.54	10.83	0.89
1.667	0.89	4.750	40.71	7.833	3.54	10.92	0.89
1.750	0.89	4.833	40.71	7.917	3.54	11.00	0.89
1.833	0.89	4.917	40.71	8.000	3.54	11.08	0.89
1.917	0.89	5.000	40.71	8.083	3.54	11.17	0.89
2.000	0.89	5.083	40.71	8.167	3.54	11.25	0.89
2.083	0.89	5.167	40.71	8.250	3.54	11.33	0.89
2.167	0.89	5.250	40.71	8.333	1.77	11.42	0.89
2.250	0.89	5.333	11.51	8.417	1.77	11.50	0.89
2.333	5.31	5.417	11.51	8.500	1.77	11.58	0.89
2.417	5.31	5.500	11.51	8.583	1.77	11.67	0.89
2.500	5.31	5.583	11.51	8.667	1.77	11.75	0.89
2.583	5.31	5.667	11.51	8.750	1.77	11.83	0.89
2.667	5.31	5.750	11.51	8.833	1.77	11.92	0.89
2.750	5.31	5.833	11.51	8.917	1.77	12.00	0.89
2.833	5.31	5.917	11.51	9.000	1.77	12.08	0.89
2.917	5.31	6.000	11.51	9.083	1.77	12.17	0.89

3.000	5.31	6.083	11.51	9.167	1.77	12.25	0.89
3.083	5.31	6.167	11.51	9.250	1.77		

Unit Hyd Qpeak (cms)= 0.095

PEAK FLOW (cms)= 0.036 (i)

TIME TO PEAK (hrs)= 5.250

RUNOFF VOLUME (mm)= 41.805

TOTAL RAINFALL (mm)= 88.540

RUNOFF COEFFICIENT = 0.472

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

CALIB			
NASHYD (0005)	Area (ha)= 0.22	Curve Number (CN)= 76.0	
ID= 1 DT= 5.0 min	Ia (mm)= 6.00	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= 0.22		

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

----- TRANSFORMED HYETOGRAPH -----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.00	3.167	5.31	6.250	11.51	9.33	0.89
0.167	0.00	3.250	5.31	6.333	6.20	9.42	0.89
0.250	0.00	3.333	15.05	6.417	6.20	9.50	0.89
0.333	0.89	3.417	15.05	6.500	6.20	9.58	0.89
0.417	0.89	3.500	15.05	6.583	6.20	9.67	0.89
0.500	0.89	3.583	15.05	6.667	6.20	9.75	0.89
0.583	0.89	3.667	15.05	6.750	6.20	9.83	0.89
0.667	0.89	3.750	15.05	6.833	6.20	9.92	0.89
0.750	0.89	3.833	15.05	6.917	6.20	10.00	0.89
0.833	0.89	3.917	15.05	7.000	6.20	10.08	0.89
0.917	0.89	4.000	15.05	7.083	6.20	10.17	0.89
1.000	0.89	4.083	15.05	7.167	6.20	10.25	0.89
1.083	0.89	4.167	15.05	7.250	6.20	10.33	0.89
1.167	0.89	4.250	15.05	7.333	3.54	10.42	0.89
1.250	0.89	4.333	40.71	7.417	3.54	10.50	0.89
1.333	0.89	4.417	40.71	7.500	3.54	10.58	0.89
1.417	0.89	4.500	40.71	7.583	3.54	10.67	0.89
1.500	0.89	4.583	40.71	7.667	3.54	10.75	0.89
1.583	0.89	4.667	40.71	7.750	3.54	10.83	0.89
1.667	0.89	4.750	40.71	7.833	3.54	10.92	0.89
1.750	0.89	4.833	40.71	7.917	3.54	11.00	0.89
1.833	0.89	4.917	40.71	8.000	3.54	11.08	0.89
1.917	0.89	5.000	40.71	8.083	3.54	11.17	0.89
2.000	0.89	5.083	40.71	8.167	3.54	11.25	0.89

2.083	0.89	5.167	40.71	8.250	3.54	11.33	0.89
2.167	0.89	5.250	40.71	8.333	1.77	11.42	0.89
2.250	0.89	5.333	11.51	8.417	1.77	11.50	0.89
2.333	5.31	5.417	11.51	8.500	1.77	11.58	0.89
2.417	5.31	5.500	11.51	8.583	1.77	11.67	0.89
2.500	5.31	5.583	11.51	8.667	1.77	11.75	0.89
2.583	5.31	5.667	11.51	8.750	1.77	11.83	0.89
2.667	5.31	5.750	11.51	8.833	1.77	11.92	0.89
2.750	5.31	5.833	11.51	8.917	1.77	12.00	0.89
2.833	5.31	5.917	11.51	9.000	1.77	12.08	0.89
2.917	5.31	6.000	11.51	9.083	1.77	12.17	0.89
3.000	5.31	6.083	11.51	9.167	1.77	12.25	0.89
3.083	5.31	6.167	11.51	9.250	1.77		

Unit Hyd Qpeak (cms)= 0.038

PEAK FLOW (cms)= 0.015 (i)

TIME TO PEAK (hrs)= 5.250

RUNOFF VOLUME (mm)= 41.804

TOTAL RAINFALL (mm)= 88.540

RUNOFF COEFFICIENT = 0.472

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

** SIMULATION:10yr 12 hour AES Distribution **

```

-----
| CALIB |
| NASHYD ( 0004) | Area (ha)= 0.55 Curve Number (CN)= 76.0
| ID= 1 DT= 5.0 min | Ia (mm)= 6.00 # of Linear Res.(N)= 3.00
-----
| U.H. Tp(hrs)= 0.22

```

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	0.00	3.167	3.76	6.250	8.15	9.33	0.63
0.167	0.00	3.250	3.76	6.333	4.39	9.42	0.63
0.250	0.00	3.333	10.66	6.417	4.39	9.50	0.63
0.333	0.63	3.417	10.66	6.500	4.39	9.58	0.63
0.417	0.63	3.500	10.66	6.583	4.39	9.67	0.63
0.500	0.63	3.583	10.66	6.667	4.39	9.75	0.63
0.583	0.63	3.667	10.66	6.750	4.39	9.83	0.63
0.667	0.63	3.750	10.66	6.833	4.39	9.92	0.63
0.750	0.63	3.833	10.66	6.917	4.39	10.00	0.63
0.833	0.63	3.917	10.66	7.000	4.39	10.08	0.63

Visual OTTHYMO Schematic - Existing Peak Flows

0.917	0.63	4.000	10.66	7.083	4.39	10.17	0.63
1.000	0.63	4.083	10.66	7.167	4.39	10.25	0.63
1.083	0.63	4.167	10.66	7.250	4.39	10.33	0.63
1.167	0.63	4.250	10.66	7.333	2.51	10.42	0.63
1.250	0.63	4.333	28.84	7.417	2.51	10.50	0.63
1.333	0.63	4.417	28.84	7.500	2.51	10.58	0.63
1.417	0.63	4.500	28.84	7.583	2.51	10.67	0.63
1.500	0.63	4.583	28.84	7.667	2.51	10.75	0.63
1.583	0.63	4.667	28.84	7.750	2.51	10.83	0.63
1.667	0.63	4.750	28.84	7.833	2.51	10.92	0.63
1.750	0.63	4.833	28.84	7.917	2.51	11.00	0.63
1.833	0.63	4.917	28.84	8.000	2.51	11.08	0.63
1.917	0.63	5.000	28.84	8.083	2.51	11.17	0.63
2.000	0.63	5.083	28.84	8.167	2.51	11.25	0.63
2.083	0.63	5.167	28.84	8.250	2.51	11.33	0.63
2.167	0.63	5.250	28.84	8.333	1.25	11.42	0.63
2.250	0.63	5.333	8.15	8.417	1.25	11.50	0.63
2.333	3.76	5.417	8.15	8.500	1.25	11.58	0.63
2.417	3.76	5.500	8.15	8.583	1.25	11.67	0.63
2.500	3.76	5.583	8.15	8.667	1.25	11.75	0.63
2.583	3.76	5.667	8.15	8.750	1.25	11.83	0.63
2.667	3.76	5.750	8.15	8.833	1.25	11.92	0.63
2.750	3.76	5.833	8.15	8.917	1.25	12.00	0.63
2.833	3.76	5.917	8.15	9.000	1.25	12.08	0.63
2.917	3.76	6.000	8.15	9.083	1.25	12.17	0.63
3.000	3.76	6.083	8.15	9.167	1.25	12.25	0.63
3.083	3.76	6.167	8.15	9.250	1.25		

Unit Hyd Qpeak (cms)= 0.095

PEAK FLOW (cms)= 0.021 (i)

TIME TO PEAK (hrs)= 5.250

RUNOFF VOLUME (mm)= 23.456

TOTAL RAINFALL (mm)= 62.710

RUNOFF COEFFICIENT = 0.374

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

CALIB			
NASHYD (0005)			
ID= 1 DT= 5.0 min			

Area	(ha)=	0.22	Curve Number (CN)= 76.0
Ia	(mm)=	6.00	# of Linear Res.(N)= 3.00
U.H. Tp	(hrs)=	0.22	

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

----- TRANSFORMED HYETOGRAPH -----

TIME	RAIN		TIME	RAIN		TIME	RAIN		TIME	RAIN
------	------	--	------	------	--	------	------	--	------	------

Visual OTTHYMO Schematic - Existing Peak Flows

hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	0.00	3.167	3.76	6.250	8.15	9.33	0.63
0.167	0.00	3.250	3.76	6.333	4.39	9.42	0.63
0.250	0.00	3.333	10.66	6.417	4.39	9.50	0.63
0.333	0.63	3.417	10.66	6.500	4.39	9.58	0.63
0.417	0.63	3.500	10.66	6.583	4.39	9.67	0.63
0.500	0.63	3.583	10.66	6.667	4.39	9.75	0.63
0.583	0.63	3.667	10.66	6.750	4.39	9.83	0.63
0.667	0.63	3.750	10.66	6.833	4.39	9.92	0.63
0.750	0.63	3.833	10.66	6.917	4.39	10.00	0.63
0.833	0.63	3.917	10.66	7.000	4.39	10.08	0.63
0.917	0.63	4.000	10.66	7.083	4.39	10.17	0.63
1.000	0.63	4.083	10.66	7.167	4.39	10.25	0.63
1.083	0.63	4.167	10.66	7.250	4.39	10.33	0.63
1.167	0.63	4.250	10.66	7.333	2.51	10.42	0.63
1.250	0.63	4.333	28.84	7.417	2.51	10.50	0.63
1.333	0.63	4.417	28.84	7.500	2.51	10.58	0.63
1.417	0.63	4.500	28.84	7.583	2.51	10.67	0.63
1.500	0.63	4.583	28.84	7.667	2.51	10.75	0.63
1.583	0.63	4.667	28.84	7.750	2.51	10.83	0.63
1.667	0.63	4.750	28.84	7.833	2.51	10.92	0.63
1.750	0.63	4.833	28.84	7.917	2.51	11.00	0.63
1.833	0.63	4.917	28.84	8.000	2.51	11.08	0.63
1.917	0.63	5.000	28.84	8.083	2.51	11.17	0.63
2.000	0.63	5.083	28.84	8.167	2.51	11.25	0.63
2.083	0.63	5.167	28.84	8.250	2.51	11.33	0.63
2.167	0.63	5.250	28.84	8.333	1.25	11.42	0.63
2.250	0.63	5.333	8.15	8.417	1.25	11.50	0.63
2.333	3.76	5.417	8.15	8.500	1.25	11.58	0.63
2.417	3.76	5.500	8.15	8.583	1.25	11.67	0.63
2.500	3.76	5.583	8.15	8.667	1.25	11.75	0.63
2.583	3.76	5.667	8.15	8.750	1.25	11.83	0.63
2.667	3.76	5.750	8.15	8.833	1.25	11.92	0.63
2.750	3.76	5.833	8.15	8.917	1.25	12.00	0.63
2.833	3.76	5.917	8.15	9.000	1.25	12.08	0.63
2.917	3.76	6.000	8.15	9.083	1.25	12.17	0.63
3.000	3.76	6.083	8.15	9.167	1.25	12.25	0.63
3.083	3.76	6.167	8.15	9.250	1.25		

Unit Hyd Qpeak (cms)= 0.038

PEAK FLOW (cms)= 0.008 (i)

TIME TO PEAK (hrs)= 5.250

RUNOFF VOLUME (mm)= 23.455

TOTAL RAINFALL (mm)= 62.710

RUNOFF COEFFICIENT = 0.374

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

 ** SIMULATION:25yr 12 hour AES Distribution **

```

-----
| CALIB                      |
| NASHYD ( 0004)            | Area   (ha)= 0.55   Curve Number (CN)= 76.0
| ID= 1 DT= 5.0 min         | Ia     (mm)= 6.00   # of Linear Res.(N)= 3.00
|-----|                   | U.H. Tp(hrs)= 0.22

```

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

```

----- TRANSFORMED HYETOGRAPH -----

```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.00	3.167	4.39	6.250	9.50	9.33	0.73
0.167	0.00	3.250	4.39	6.333	5.12	9.42	0.73
0.250	0.00	3.333	12.43	6.417	5.12	9.50	0.73
0.333	0.73	3.417	12.43	6.500	5.12	9.58	0.73
0.417	0.73	3.500	12.43	6.583	5.12	9.67	0.73
0.500	0.73	3.583	12.43	6.667	5.12	9.75	0.73
0.583	0.73	3.667	12.43	6.750	5.12	9.83	0.73
0.667	0.73	3.750	12.43	6.833	5.12	9.92	0.73
0.750	0.73	3.833	12.43	6.917	5.12	10.00	0.73
0.833	0.73	3.917	12.43	7.000	5.12	10.08	0.73
0.917	0.73	4.000	12.43	7.083	5.12	10.17	0.73
1.000	0.73	4.083	12.43	7.167	5.12	10.25	0.73
1.083	0.73	4.167	12.43	7.250	5.12	10.33	0.73
1.167	0.73	4.250	12.43	7.333	2.92	10.42	0.73
1.250	0.73	4.333	33.63	7.417	2.92	10.50	0.73
1.333	0.73	4.417	33.63	7.500	2.92	10.58	0.73
1.417	0.73	4.500	33.63	7.583	2.92	10.67	0.73
1.500	0.73	4.583	33.63	7.667	2.92	10.75	0.73
1.583	0.73	4.667	33.63	7.750	2.92	10.83	0.73
1.667	0.73	4.750	33.63	7.833	2.92	10.92	0.73
1.750	0.73	4.833	33.63	7.917	2.92	11.00	0.73
1.833	0.73	4.917	33.63	8.000	2.92	11.08	0.73
1.917	0.73	5.000	33.63	8.083	2.92	11.17	0.73
2.000	0.73	5.083	33.63	8.167	2.92	11.25	0.73
2.083	0.73	5.167	33.63	8.250	2.92	11.33	0.73
2.167	0.73	5.250	33.63	8.333	1.46	11.42	0.73
2.250	0.73	5.333	9.50	8.417	1.46	11.50	0.73
2.333	4.39	5.417	9.50	8.500	1.46	11.58	0.73
2.417	4.39	5.500	9.50	8.583	1.46	11.67	0.73
2.500	4.39	5.583	9.50	8.667	1.46	11.75	0.73
2.583	4.39	5.667	9.50	8.750	1.46	11.83	0.73
2.667	4.39	5.750	9.50	8.833	1.46	11.92	0.73
2.750	4.39	5.833	9.50	8.917	1.46	12.00	0.73
2.833	4.39	5.917	9.50	9.000	1.46	12.08	0.73
2.917	4.39	6.000	9.50	9.083	1.46	12.17	0.73

3.000	4.39	6.083	9.50	9.167	1.46	12.25	0.73
3.083	4.39	6.167	9.50	9.250	1.46		

Unit Hyd Qpeak (cms)= 0.095

PEAK FLOW (cms)= 0.027 (i)

TIME TO PEAK (hrs)= 5.250

RUNOFF VOLUME (mm)= 30.523

TOTAL RAINFALL (mm)= 73.100

RUNOFF COEFFICIENT = 0.418

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

CALIB			
NASHYD (0005)	Area (ha)= 0.22	Curve Number (CN)= 76.0	
ID= 1 DT= 5.0 min	Ia (mm)= 6.00	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= 0.22		

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

----- TRANSFORMED HYETOGRAPH -----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.00	3.167	4.39	6.250	9.50	9.33	0.73
0.167	0.00	3.250	4.39	6.333	5.12	9.42	0.73
0.250	0.00	3.333	12.43	6.417	5.12	9.50	0.73
0.333	0.73	3.417	12.43	6.500	5.12	9.58	0.73
0.417	0.73	3.500	12.43	6.583	5.12	9.67	0.73
0.500	0.73	3.583	12.43	6.667	5.12	9.75	0.73
0.583	0.73	3.667	12.43	6.750	5.12	9.83	0.73
0.667	0.73	3.750	12.43	6.833	5.12	9.92	0.73
0.750	0.73	3.833	12.43	6.917	5.12	10.00	0.73
0.833	0.73	3.917	12.43	7.000	5.12	10.08	0.73
0.917	0.73	4.000	12.43	7.083	5.12	10.17	0.73
1.000	0.73	4.083	12.43	7.167	5.12	10.25	0.73
1.083	0.73	4.167	12.43	7.250	5.12	10.33	0.73
1.167	0.73	4.250	12.43	7.333	2.92	10.42	0.73
1.250	0.73	4.333	33.63	7.417	2.92	10.50	0.73
1.333	0.73	4.417	33.63	7.500	2.92	10.58	0.73
1.417	0.73	4.500	33.63	7.583	2.92	10.67	0.73
1.500	0.73	4.583	33.63	7.667	2.92	10.75	0.73
1.583	0.73	4.667	33.63	7.750	2.92	10.83	0.73
1.667	0.73	4.750	33.63	7.833	2.92	10.92	0.73
1.750	0.73	4.833	33.63	7.917	2.92	11.00	0.73
1.833	0.73	4.917	33.63	8.000	2.92	11.08	0.73
1.917	0.73	5.000	33.63	8.083	2.92	11.17	0.73
2.000	0.73	5.083	33.63	8.167	2.92	11.25	0.73

2.083	0.73	5.167	33.63	8.250	2.92	11.33	0.73
2.167	0.73	5.250	33.63	8.333	1.46	11.42	0.73
2.250	0.73	5.333	9.50	8.417	1.46	11.50	0.73
2.333	4.39	5.417	9.50	8.500	1.46	11.58	0.73
2.417	4.39	5.500	9.50	8.583	1.46	11.67	0.73
2.500	4.39	5.583	9.50	8.667	1.46	11.75	0.73
2.583	4.39	5.667	9.50	8.750	1.46	11.83	0.73
2.667	4.39	5.750	9.50	8.833	1.46	11.92	0.73
2.750	4.39	5.833	9.50	8.917	1.46	12.00	0.73
2.833	4.39	5.917	9.50	9.000	1.46	12.08	0.73
2.917	4.39	6.000	9.50	9.083	1.46	12.17	0.73
3.000	4.39	6.083	9.50	9.167	1.46	12.25	0.73
3.083	4.39	6.167	9.50	9.250	1.46		

Unit Hyd Qpeak (cms)= 0.038

PEAK FLOW (cms)= 0.011 (i)

TIME TO PEAK (hrs)= 5.250

RUNOFF VOLUME (mm)= 30.521

TOTAL RAINFALL (mm)= 73.100

RUNOFF COEFFICIENT = 0.418

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

** SIMULATION:2yr 12 hour AES Distribution **

CALIB				
NASHYD (0004)	Area (ha)=	0.55	Curve Number (CN)=	76.0
ID= 1 DT= 5.0 min	Ia (mm)=	6.00	# of Linear Res.(N)=	3.00
	U.H. Tp(hrs)=	0.22		

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.00	3.167	2.52	6.250	5.46	9.33	0.42
0.167	0.00	3.250	2.52	6.333	2.94	9.42	0.42
0.250	0.00	3.333	7.14	6.417	2.94	9.50	0.42
0.333	0.42	3.417	7.14	6.500	2.94	9.58	0.42
0.417	0.42	3.500	7.14	6.583	2.94	9.67	0.42
0.500	0.42	3.583	7.14	6.667	2.94	9.75	0.42
0.583	0.42	3.667	7.14	6.750	2.94	9.83	0.42
0.667	0.42	3.750	7.14	6.833	2.94	9.92	0.42
0.750	0.42	3.833	7.14	6.917	2.94	10.00	0.42
0.833	0.42	3.917	7.14	7.000	2.94	10.08	0.42

Visual OTTHYMO Schematic - Existing Peak Flows

0.917	0.42	4.000	7.14	7.083	2.94	10.17	0.42
1.000	0.42	4.083	7.14	7.167	2.94	10.25	0.42
1.083	0.42	4.167	7.14	7.250	2.94	10.33	0.42
1.167	0.42	4.250	7.14	7.333	1.68	10.42	0.42
1.250	0.42	4.333	19.32	7.417	1.68	10.50	0.42
1.333	0.42	4.417	19.32	7.500	1.68	10.58	0.42
1.417	0.42	4.500	19.32	7.583	1.68	10.67	0.42
1.500	0.42	4.583	19.32	7.667	1.68	10.75	0.42
1.583	0.42	4.667	19.32	7.750	1.68	10.83	0.42
1.667	0.42	4.750	19.32	7.833	1.68	10.92	0.42
1.750	0.42	4.833	19.32	7.917	1.68	11.00	0.42
1.833	0.42	4.917	19.32	8.000	1.68	11.08	0.42
1.917	0.42	5.000	19.32	8.083	1.68	11.17	0.42
2.000	0.42	5.083	19.32	8.167	1.68	11.25	0.42
2.083	0.42	5.167	19.32	8.250	1.68	11.33	0.42
2.167	0.42	5.250	19.32	8.333	0.84	11.42	0.42
2.250	0.42	5.333	5.46	8.417	0.84	11.50	0.42
2.333	2.52	5.417	5.46	8.500	0.84	11.58	0.42
2.417	2.52	5.500	5.46	8.583	0.84	11.67	0.42
2.500	2.52	5.583	5.46	8.667	0.84	11.75	0.42
2.583	2.52	5.667	5.46	8.750	0.84	11.83	0.42
2.667	2.52	5.750	5.46	8.833	0.84	11.92	0.42
2.750	2.52	5.833	5.46	8.917	0.84	12.00	0.42
2.833	2.52	5.917	5.46	9.000	0.84	12.08	0.42
2.917	2.52	6.000	5.46	9.083	0.84	12.17	0.42
3.000	2.52	6.083	5.46	9.167	0.84	12.25	0.42
3.083	2.52	6.167	5.46	9.250	0.84		

Unit Hyd Qpeak (cms)= 0.095

PEAK FLOW (cms)= 0.010 (i)

TIME TO PEAK (hrs)= 5.250

RUNOFF VOLUME (mm)= 11.136

TOTAL RAINFALL (mm)= 42.000

RUNOFF COEFFICIENT = 0.265

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

CALIB			
NASHYD (0005)			
ID= 1 DT= 5.0 min			

Area	(ha)=	0.22	Curve Number (CN)= 76.0
Ia	(mm)=	6.00	# of Linear Res.(N)= 3.00
U.H. Tp	(hrs)=	0.22	

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

----- TRANSFORMED HYETOGRAPH -----

TIME	RAIN		TIME	RAIN		TIME	RAIN		TIME	RAIN
------	------	--	------	------	--	------	------	--	------	------

Visual OTTHYMO Schematic - Existing Peak Flows

hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	0.00	3.167	2.52	6.250	5.46	9.33	0.42
0.167	0.00	3.250	2.52	6.333	2.94	9.42	0.42
0.250	0.00	3.333	7.14	6.417	2.94	9.50	0.42
0.333	0.42	3.417	7.14	6.500	2.94	9.58	0.42
0.417	0.42	3.500	7.14	6.583	2.94	9.67	0.42
0.500	0.42	3.583	7.14	6.667	2.94	9.75	0.42
0.583	0.42	3.667	7.14	6.750	2.94	9.83	0.42
0.667	0.42	3.750	7.14	6.833	2.94	9.92	0.42
0.750	0.42	3.833	7.14	6.917	2.94	10.00	0.42
0.833	0.42	3.917	7.14	7.000	2.94	10.08	0.42
0.917	0.42	4.000	7.14	7.083	2.94	10.17	0.42
1.000	0.42	4.083	7.14	7.167	2.94	10.25	0.42
1.083	0.42	4.167	7.14	7.250	2.94	10.33	0.42
1.167	0.42	4.250	7.14	7.333	1.68	10.42	0.42
1.250	0.42	4.333	19.32	7.417	1.68	10.50	0.42
1.333	0.42	4.417	19.32	7.500	1.68	10.58	0.42
1.417	0.42	4.500	19.32	7.583	1.68	10.67	0.42
1.500	0.42	4.583	19.32	7.667	1.68	10.75	0.42
1.583	0.42	4.667	19.32	7.750	1.68	10.83	0.42
1.667	0.42	4.750	19.32	7.833	1.68	10.92	0.42
1.750	0.42	4.833	19.32	7.917	1.68	11.00	0.42
1.833	0.42	4.917	19.32	8.000	1.68	11.08	0.42
1.917	0.42	5.000	19.32	8.083	1.68	11.17	0.42
2.000	0.42	5.083	19.32	8.167	1.68	11.25	0.42
2.083	0.42	5.167	19.32	8.250	1.68	11.33	0.42
2.167	0.42	5.250	19.32	8.333	0.84	11.42	0.42
2.250	0.42	5.333	5.46	8.417	0.84	11.50	0.42
2.333	2.52	5.417	5.46	8.500	0.84	11.58	0.42
2.417	2.52	5.500	5.46	8.583	0.84	11.67	0.42
2.500	2.52	5.583	5.46	8.667	0.84	11.75	0.42
2.583	2.52	5.667	5.46	8.750	0.84	11.83	0.42
2.667	2.52	5.750	5.46	8.833	0.84	11.92	0.42
2.750	2.52	5.833	5.46	8.917	0.84	12.00	0.42
2.833	2.52	5.917	5.46	9.000	0.84	12.08	0.42
2.917	2.52	6.000	5.46	9.083	0.84	12.17	0.42
3.000	2.52	6.083	5.46	9.167	0.84	12.25	0.42
3.083	2.52	6.167	5.46	9.250	0.84		

Unit Hyd Qpeak (cms)= 0.038

PEAK FLOW (cms)= 0.004 (i)

TIME TO PEAK (hrs)= 5.250

RUNOFF VOLUME (mm)= 11.135

TOTAL RAINFALL (mm)= 42.000

RUNOFF COEFFICIENT = 0.265

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

 ** SIMULATION:50yr 12 hour AES Distribution **

```

-----
| CALIB                      |
| NASHYD ( 0004)            | Area   (ha)= 0.55   Curve Number (CN)= 76.0
| ID= 1 DT= 5.0 min         | Ia     (mm)= 6.00   # of Linear Res.(N)= 3.00
|                           | U.H. Tp(hrs)= 0.22
-----

```

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

```

----- TRANSFORMED HYETOGRAPH -----

```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.00	3.167	4.85	6.250	10.50	9.33	0.81
0.167	0.00	3.250	4.85	6.333	5.66	9.42	0.81
0.250	0.00	3.333	13.74	6.417	5.66	9.50	0.81
0.333	0.81	3.417	13.74	6.500	5.66	9.58	0.81
0.417	0.81	3.500	13.74	6.583	5.66	9.67	0.81
0.500	0.81	3.583	13.74	6.667	5.66	9.75	0.81
0.583	0.81	3.667	13.74	6.750	5.66	9.83	0.81
0.667	0.81	3.750	13.74	6.833	5.66	9.92	0.81
0.750	0.81	3.833	13.74	6.917	5.66	10.00	0.81
0.833	0.81	3.917	13.74	7.000	5.66	10.08	0.81
0.917	0.81	4.000	13.74	7.083	5.66	10.17	0.81
1.000	0.81	4.083	13.74	7.167	5.66	10.25	0.81
1.083	0.81	4.167	13.74	7.250	5.66	10.33	0.81
1.167	0.81	4.250	13.74	7.333	3.23	10.42	0.81
1.250	0.81	4.333	37.17	7.417	3.23	10.50	0.81
1.333	0.81	4.417	37.17	7.500	3.23	10.58	0.81
1.417	0.81	4.500	37.17	7.583	3.23	10.67	0.81
1.500	0.81	4.583	37.17	7.667	3.23	10.75	0.81
1.583	0.81	4.667	37.17	7.750	3.23	10.83	0.81
1.667	0.81	4.750	37.17	7.833	3.23	10.92	0.81
1.750	0.81	4.833	37.17	7.917	3.23	11.00	0.81
1.833	0.81	4.917	37.17	8.000	3.23	11.08	0.81
1.917	0.81	5.000	37.17	8.083	3.23	11.17	0.81
2.000	0.81	5.083	37.17	8.167	3.23	11.25	0.81
2.083	0.81	5.167	37.17	8.250	3.23	11.33	0.81
2.167	0.81	5.250	37.17	8.333	1.62	11.42	0.81
2.250	0.81	5.333	10.50	8.417	1.62	11.50	0.81
2.333	4.85	5.417	10.50	8.500	1.62	11.58	0.81
2.417	4.85	5.500	10.50	8.583	1.62	11.67	0.81
2.500	4.85	5.583	10.50	8.667	1.62	11.75	0.81
2.583	4.85	5.667	10.50	8.750	1.62	11.83	0.81
2.667	4.85	5.750	10.50	8.833	1.62	11.92	0.81
2.750	4.85	5.833	10.50	8.917	1.62	12.00	0.81
2.833	4.85	5.917	10.50	9.000	1.62	12.08	0.81
2.917	4.85	6.000	10.50	9.083	1.62	12.17	0.81

3.000	4.85	6.083	10.50	9.167	1.62	12.25	0.81
3.083	4.85	6.167	10.50	9.250	1.62		

Unit Hyd Qpeak (cms)= 0.095

PEAK FLOW (cms)= 0.031 (i)

TIME TO PEAK (hrs)= 5.250

RUNOFF VOLUME (mm)= 36.061

TOTAL RAINFALL (mm)= 80.820

RUNOFF COEFFICIENT = 0.446

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

CALIB			
NASHYD (0005)	Area (ha)= 0.22	Curve Number (CN)= 76.0	
ID= 1 DT= 5.0 min	Ia (mm)= 6.00	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= 0.22		

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

----- TRANSFORMED HYETOGRAPH -----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.00	3.167	4.85	6.250	10.50	9.33	0.81
0.167	0.00	3.250	4.85	6.333	5.66	9.42	0.81
0.250	0.00	3.333	13.74	6.417	5.66	9.50	0.81
0.333	0.81	3.417	13.74	6.500	5.66	9.58	0.81
0.417	0.81	3.500	13.74	6.583	5.66	9.67	0.81
0.500	0.81	3.583	13.74	6.667	5.66	9.75	0.81
0.583	0.81	3.667	13.74	6.750	5.66	9.83	0.81
0.667	0.81	3.750	13.74	6.833	5.66	9.92	0.81
0.750	0.81	3.833	13.74	6.917	5.66	10.00	0.81
0.833	0.81	3.917	13.74	7.000	5.66	10.08	0.81
0.917	0.81	4.000	13.74	7.083	5.66	10.17	0.81
1.000	0.81	4.083	13.74	7.167	5.66	10.25	0.81
1.083	0.81	4.167	13.74	7.250	5.66	10.33	0.81
1.167	0.81	4.250	13.74	7.333	3.23	10.42	0.81
1.250	0.81	4.333	37.17	7.417	3.23	10.50	0.81
1.333	0.81	4.417	37.17	7.500	3.23	10.58	0.81
1.417	0.81	4.500	37.17	7.583	3.23	10.67	0.81
1.500	0.81	4.583	37.17	7.667	3.23	10.75	0.81
1.583	0.81	4.667	37.17	7.750	3.23	10.83	0.81
1.667	0.81	4.750	37.17	7.833	3.23	10.92	0.81
1.750	0.81	4.833	37.17	7.917	3.23	11.00	0.81
1.833	0.81	4.917	37.17	8.000	3.23	11.08	0.81
1.917	0.81	5.000	37.17	8.083	3.23	11.17	0.81
2.000	0.81	5.083	37.17	8.167	3.23	11.25	0.81

2.083	0.81	5.167	37.17	8.250	3.23	11.33	0.81
2.167	0.81	5.250	37.17	8.333	1.62	11.42	0.81
2.250	0.81	5.333	10.50	8.417	1.62	11.50	0.81
2.333	4.85	5.417	10.50	8.500	1.62	11.58	0.81
2.417	4.85	5.500	10.50	8.583	1.62	11.67	0.81
2.500	4.85	5.583	10.50	8.667	1.62	11.75	0.81
2.583	4.85	5.667	10.50	8.750	1.62	11.83	0.81
2.667	4.85	5.750	10.50	8.833	1.62	11.92	0.81
2.750	4.85	5.833	10.50	8.917	1.62	12.00	0.81
2.833	4.85	5.917	10.50	9.000	1.62	12.08	0.81
2.917	4.85	6.000	10.50	9.083	1.62	12.17	0.81
3.000	4.85	6.083	10.50	9.167	1.62	12.25	0.81
3.083	4.85	6.167	10.50	9.250	1.62		

Unit Hyd Qpeak (cms)= 0.038

PEAK FLOW (cms)= 0.013 (i)

TIME TO PEAK (hrs)= 5.250

RUNOFF VOLUME (mm)= 36.059

TOTAL RAINFALL (mm)= 80.820

RUNOFF COEFFICIENT = 0.446

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

** SIMULATION:5yr 12 hour AES Distribution **

```

-----
| CALIB |
| NASHYD ( 0004) | Area (ha)= 0.55 Curve Number (CN)= 76.0
| ID= 1 DT= 5.0 min | Ia (mm)= 6.00 # of Linear Res.(N)= 3.00
-----
| U.H. Tp(hrs)= 0.22

```

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	0.00	3.167	3.26	6.250	7.07	9.33	0.54
0.167	0.00	3.250	3.26	6.333	3.81	9.42	0.54
0.250	0.00	3.333	9.25	6.417	3.81	9.50	0.54
0.333	0.54	3.417	9.25	6.500	3.81	9.58	0.54
0.417	0.54	3.500	9.25	6.583	3.81	9.67	0.54
0.500	0.54	3.583	9.25	6.667	3.81	9.75	0.54
0.583	0.54	3.667	9.25	6.750	3.81	9.83	0.54
0.667	0.54	3.750	9.25	6.833	3.81	9.92	0.54
0.750	0.54	3.833	9.25	6.917	3.81	10.00	0.54
0.833	0.54	3.917	9.25	7.000	3.81	10.08	0.54

Visual OTTHYMO Schematic - Existing Peak Flows

0.917	0.54	4.000	9.25	7.083	3.81	10.17	0.54
1.000	0.54	4.083	9.25	7.167	3.81	10.25	0.54
1.083	0.54	4.167	9.25	7.250	3.81	10.33	0.54
1.167	0.54	4.250	9.25	7.333	2.18	10.42	0.54
1.250	0.54	4.333	25.02	7.417	2.18	10.50	0.54
1.333	0.54	4.417	25.02	7.500	2.18	10.58	0.54
1.417	0.54	4.500	25.02	7.583	2.18	10.67	0.54
1.500	0.54	4.583	25.02	7.667	2.18	10.75	0.54
1.583	0.54	4.667	25.02	7.750	2.18	10.83	0.54
1.667	0.54	4.750	25.02	7.833	2.18	10.92	0.54
1.750	0.54	4.833	25.02	7.917	2.18	11.00	0.54
1.833	0.54	4.917	25.02	8.000	2.18	11.08	0.54
1.917	0.54	5.000	25.02	8.083	2.18	11.17	0.54
2.000	0.54	5.083	25.02	8.167	2.18	11.25	0.54
2.083	0.54	5.167	25.02	8.250	2.18	11.33	0.54
2.167	0.54	5.250	25.02	8.333	1.09	11.42	0.54
2.250	0.54	5.333	7.07	8.417	1.09	11.50	0.54
2.333	3.26	5.417	7.07	8.500	1.09	11.58	0.54
2.417	3.26	5.500	7.07	8.583	1.09	11.67	0.54
2.500	3.26	5.583	7.07	8.667	1.09	11.75	0.54
2.583	3.26	5.667	7.07	8.750	1.09	11.83	0.54
2.667	3.26	5.750	7.07	8.833	1.09	11.92	0.54
2.750	3.26	5.833	7.07	8.917	1.09	12.00	0.54
2.833	3.26	5.917	7.07	9.000	1.09	12.08	0.54
2.917	3.26	6.000	7.07	9.083	1.09	12.17	0.54
3.000	3.26	6.083	7.07	9.167	1.09	12.25	0.54
3.083	3.26	6.167	7.07	9.250	1.09		

Unit Hyd Qpeak (cms)= 0.095

PEAK FLOW (cms)= 0.016 (i)

TIME TO PEAK (hrs)= 5.250

RUNOFF VOLUME (mm)= 18.177

TOTAL RAINFALL (mm)= 54.380

RUNOFF COEFFICIENT = 0.334

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

CALIB			
NASHYD (0005)			
ID= 1 DT= 5.0 min			

Area (ha)= 0.22		Curve Number (CN)= 76.0	
Ia (mm)= 6.00		# of Linear Res.(N)= 3.00	
U.H. Tp(hrs)= 0.22			

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

----- TRANSFORMED HYETOGRAPH -----

TIME	RAIN		TIME	RAIN		TIME	RAIN		TIME	RAIN
------	------	--	------	------	--	------	------	--	------	------

Visual OTTHYMO Schematic - Existing Peak Flows

hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	0.00	3.167	3.26	6.250	7.07	9.33	0.54
0.167	0.00	3.250	3.26	6.333	3.81	9.42	0.54
0.250	0.00	3.333	9.25	6.417	3.81	9.50	0.54
0.333	0.54	3.417	9.25	6.500	3.81	9.58	0.54
0.417	0.54	3.500	9.25	6.583	3.81	9.67	0.54
0.500	0.54	3.583	9.25	6.667	3.81	9.75	0.54
0.583	0.54	3.667	9.25	6.750	3.81	9.83	0.54
0.667	0.54	3.750	9.25	6.833	3.81	9.92	0.54
0.750	0.54	3.833	9.25	6.917	3.81	10.00	0.54
0.833	0.54	3.917	9.25	7.000	3.81	10.08	0.54
0.917	0.54	4.000	9.25	7.083	3.81	10.17	0.54
1.000	0.54	4.083	9.25	7.167	3.81	10.25	0.54
1.083	0.54	4.167	9.25	7.250	3.81	10.33	0.54
1.167	0.54	4.250	9.25	7.333	2.18	10.42	0.54
1.250	0.54	4.333	25.02	7.417	2.18	10.50	0.54
1.333	0.54	4.417	25.02	7.500	2.18	10.58	0.54
1.417	0.54	4.500	25.02	7.583	2.18	10.67	0.54
1.500	0.54	4.583	25.02	7.667	2.18	10.75	0.54
1.583	0.54	4.667	25.02	7.750	2.18	10.83	0.54
1.667	0.54	4.750	25.02	7.833	2.18	10.92	0.54
1.750	0.54	4.833	25.02	7.917	2.18	11.00	0.54
1.833	0.54	4.917	25.02	8.000	2.18	11.08	0.54
1.917	0.54	5.000	25.02	8.083	2.18	11.17	0.54
2.000	0.54	5.083	25.02	8.167	2.18	11.25	0.54
2.083	0.54	5.167	25.02	8.250	2.18	11.33	0.54
2.167	0.54	5.250	25.02	8.333	1.09	11.42	0.54
2.250	0.54	5.333	7.07	8.417	1.09	11.50	0.54
2.333	3.26	5.417	7.07	8.500	1.09	11.58	0.54
2.417	3.26	5.500	7.07	8.583	1.09	11.67	0.54
2.500	3.26	5.583	7.07	8.667	1.09	11.75	0.54
2.583	3.26	5.667	7.07	8.750	1.09	11.83	0.54
2.667	3.26	5.750	7.07	8.833	1.09	11.92	0.54
2.750	3.26	5.833	7.07	8.917	1.09	12.00	0.54
2.833	3.26	5.917	7.07	9.000	1.09	12.08	0.54
2.917	3.26	6.000	7.07	9.083	1.09	12.17	0.54
3.000	3.26	6.083	7.07	9.167	1.09	12.25	0.54
3.083	3.26	6.167	7.07	9.250	1.09		

Unit Hyd Qpeak (cms)= 0.038

PEAK FLOW (cms)= 0.006 (i)

TIME TO PEAK (hrs)= 5.250

RUNOFF VOLUME (mm)= 18.175

TOTAL RAINFALL (mm)= 54.380

RUNOFF COEFFICIENT = 0.334

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



5

PR-1 (Hwy 404 Onramp)



6

PR-2 (Major Mac)

 ** SIMULATION:100yr 12 hour AES Distribution **

```

-----
| CALIB                      |
| STANDHYD ( 0005)          | Area   (ha)=   0.22
| ID= 1 DT= 5.0 min         | Total Imp(%)= 90.00   Dir. Conn.(%)= 90.00
-----

```

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.20	0.02
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	0.66	2.00
Length	(m)=	103.00	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

```

----- TRANSFORMED HYETOGRAPH -----

```

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	0.00	3.167	5.31	6.250	11.51	9.33	0.89
0.167	0.00	3.250	5.31	6.333	6.20	9.42	0.89
0.250	0.00	3.333	15.05	6.417	6.20	9.50	0.89
0.333	0.89	3.417	15.05	6.500	6.20	9.58	0.89
0.417	0.89	3.500	15.05	6.583	6.20	9.67	0.89
0.500	0.89	3.583	15.05	6.667	6.20	9.75	0.89
0.583	0.89	3.667	15.05	6.750	6.20	9.83	0.89
0.667	0.89	3.750	15.05	6.833	6.20	9.92	0.89
0.750	0.89	3.833	15.05	6.917	6.20	10.00	0.89
0.833	0.89	3.917	15.05	7.000	6.20	10.08	0.89
0.917	0.89	4.000	15.05	7.083	6.20	10.17	0.89
1.000	0.89	4.083	15.05	7.167	6.20	10.25	0.89
1.083	0.89	4.167	15.05	7.250	6.20	10.33	0.89
1.167	0.89	4.250	15.05	7.333	3.54	10.42	0.89
1.250	0.89	4.333	40.71	7.417	3.54	10.50	0.89
1.333	0.89	4.417	40.71	7.500	3.54	10.58	0.89
1.417	0.89	4.500	40.71	7.583	3.54	10.67	0.89
1.500	0.89	4.583	40.71	7.667	3.54	10.75	0.89
1.583	0.89	4.667	40.71	7.750	3.54	10.83	0.89
1.667	0.89	4.750	40.71	7.833	3.54	10.92	0.89
1.750	0.89	4.833	40.71	7.917	3.54	11.00	0.89
1.833	0.89	4.917	40.71	8.000	3.54	11.08	0.89
1.917	0.89	5.000	40.71	8.083	3.54	11.17	0.89
2.000	0.89	5.083	40.71	8.167	3.54	11.25	0.89
2.083	0.89	5.167	40.71	8.250	3.54	11.33	0.89
2.167	0.89	5.250	40.71	8.333	1.77	11.42	0.89
2.250	0.89	5.333	11.51	8.417	1.77	11.50	0.89
2.333	5.31	5.417	11.51	8.500	1.77	11.58	0.89
2.417	5.31	5.500	11.51	8.583	1.77	11.67	0.89

2.500	5.31	5.583	11.51	8.667	1.77	11.75	0.89
2.583	5.31	5.667	11.51	8.750	1.77	11.83	0.89
2.667	5.31	5.750	11.51	8.833	1.77	11.92	0.89
2.750	5.31	5.833	11.51	8.917	1.77	12.00	0.89
2.833	5.31	5.917	11.51	9.000	1.77	12.08	0.89
2.917	5.31	6.000	11.51	9.083	1.77	12.17	0.89
3.000	5.31	6.083	11.51	9.167	1.77	12.25	0.89
3.083	5.31	6.167	11.51	9.250	1.77		

Max.Eff.Inten.(mm/hr)= 40.71 32.96
over (min) 5.00 10.00
Storage Coeff. (min)= 4.22 (ii) 8.42 (ii)
Unit Hyd. Tpeak (min)= 5.00 10.00
Unit Hyd. peak (cms)= 0.24 0.12

TOTALS

PEAK FLOW (cms)= 0.02 0.00 0.024 (iii)
TIME TO PEAK (hrs)= 5.08 5.25 5.25
RUNOFF VOLUME (mm)= 87.54 57.45 84.52
TOTAL RAINFALL (mm)= 88.54 88.54 88.54
RUNOFF COEFFICIENT = 0.99 0.65 0.95

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 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.

CALIB			
STANDHYD (0006)			
ID= 1 DT= 5.0 min			

		Area (ha)=	0.55
		Total Imp(%)=	90.00 Dir. Conn.(%)= 90.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.50	0.06
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	0.35	2.00
Length	(m)=	38.30	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

----- TRANSFORMED HYETOGRAPH -----							
TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	0.00	3.167	5.31	6.250	11.51	9.33	0.89
0.167	0.00	3.250	5.31	6.333	6.20	9.42	0.89

Visual OTTHYMO Schematic - Uncontrolled Proposed Peak Flows

0.250	0.00	3.333	15.05	6.417	6.20	9.50	0.89
0.333	0.89	3.417	15.05	6.500	6.20	9.58	0.89
0.417	0.89	3.500	15.05	6.583	6.20	9.67	0.89
0.500	0.89	3.583	15.05	6.667	6.20	9.75	0.89
0.583	0.89	3.667	15.05	6.750	6.20	9.83	0.89
0.667	0.89	3.750	15.05	6.833	6.20	9.92	0.89
0.750	0.89	3.833	15.05	6.917	6.20	10.00	0.89
0.833	0.89	3.917	15.05	7.000	6.20	10.08	0.89
0.917	0.89	4.000	15.05	7.083	6.20	10.17	0.89
1.000	0.89	4.083	15.05	7.167	6.20	10.25	0.89
1.083	0.89	4.167	15.05	7.250	6.20	10.33	0.89
1.167	0.89	4.250	15.05	7.333	3.54	10.42	0.89
1.250	0.89	4.333	40.71	7.417	3.54	10.50	0.89
1.333	0.89	4.417	40.71	7.500	3.54	10.58	0.89
1.417	0.89	4.500	40.71	7.583	3.54	10.67	0.89
1.500	0.89	4.583	40.71	7.667	3.54	10.75	0.89
1.583	0.89	4.667	40.71	7.750	3.54	10.83	0.89
1.667	0.89	4.750	40.71	7.833	3.54	10.92	0.89
1.750	0.89	4.833	40.71	7.917	3.54	11.00	0.89
1.833	0.89	4.917	40.71	8.000	3.54	11.08	0.89
1.917	0.89	5.000	40.71	8.083	3.54	11.17	0.89
2.000	0.89	5.083	40.71	8.167	3.54	11.25	0.89
2.083	0.89	5.167	40.71	8.250	3.54	11.33	0.89
2.167	0.89	5.250	40.71	8.333	1.77	11.42	0.89
2.250	0.89	5.333	11.51	8.417	1.77	11.50	0.89
2.333	5.31	5.417	11.51	8.500	1.77	11.58	0.89
2.417	5.31	5.500	11.51	8.583	1.77	11.67	0.89
2.500	5.31	5.583	11.51	8.667	1.77	11.75	0.89
2.583	5.31	5.667	11.51	8.750	1.77	11.83	0.89
2.667	5.31	5.750	11.51	8.833	1.77	11.92	0.89
2.750	5.31	5.833	11.51	8.917	1.77	12.00	0.89
2.833	5.31	5.917	11.51	9.000	1.77	12.08	0.89
2.917	5.31	6.000	11.51	9.083	1.77	12.17	0.89
3.000	5.31	6.083	11.51	9.167	1.77	12.25	0.89
3.083	5.31	6.167	11.51	9.250	1.77		

Max.Eff.Inten.(mm/hr)=	40.71	32.96
over (min)	5.00	10.00
Storage Coeff. (min)=	2.82 (ii)	7.02 (ii)
Unit Hyd. Tpeak (min)=	5.00	10.00
Unit Hyd. peak (cms)=	0.28	0.14

TOTALS

PEAK FLOW (cms)=	0.06	0.00	0.061 (iii)
TIME TO PEAK (hrs)=	5.08	5.25	5.25
RUNOFF VOLUME (mm)=	87.54	57.45	84.52
TOTAL RAINFALL (mm)=	88.54	88.54	88.54
RUNOFF COEFFICIENT =	0.99	0.65	0.95

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
 CN* = 85.0 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.

** SIMULATION:10yr 12 hour AES Distribution **

```

-----
| CALIB                               |
| STANDHYD ( 0005) | Area (ha)= 0.22 |
| ID= 1 DT= 5.0 min | Total Imp(%)= 90.00 Dir. Conn.(%)= 90.00
-----

```

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.20	0.02
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	0.66	2.00
Length	(m)=	103.00	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	0.00	3.167	3.76	6.250	8.15	9.33	0.63
0.167	0.00	3.250	3.76	6.333	4.39	9.42	0.63
0.250	0.00	3.333	10.66	6.417	4.39	9.50	0.63
0.333	0.63	3.417	10.66	6.500	4.39	9.58	0.63
0.417	0.63	3.500	10.66	6.583	4.39	9.67	0.63
0.500	0.63	3.583	10.66	6.667	4.39	9.75	0.63
0.583	0.63	3.667	10.66	6.750	4.39	9.83	0.63
0.667	0.63	3.750	10.66	6.833	4.39	9.92	0.63
0.750	0.63	3.833	10.66	6.917	4.39	10.00	0.63
0.833	0.63	3.917	10.66	7.000	4.39	10.08	0.63
0.917	0.63	4.000	10.66	7.083	4.39	10.17	0.63
1.000	0.63	4.083	10.66	7.167	4.39	10.25	0.63
1.083	0.63	4.167	10.66	7.250	4.39	10.33	0.63
1.167	0.63	4.250	10.66	7.333	2.51	10.42	0.63
1.250	0.63	4.333	28.84	7.417	2.51	10.50	0.63
1.333	0.63	4.417	28.84	7.500	2.51	10.58	0.63
1.417	0.63	4.500	28.84	7.583	2.51	10.67	0.63
1.500	0.63	4.583	28.84	7.667	2.51	10.75	0.63
1.583	0.63	4.667	28.84	7.750	2.51	10.83	0.63
1.667	0.63	4.750	28.84	7.833	2.51	10.92	0.63
1.750	0.63	4.833	28.84	7.917	2.51	11.00	0.63
1.833	0.63	4.917	28.84	8.000	2.51	11.08	0.63

1.917	0.63	5.000	28.84	8.083	2.51	11.17	0.63
2.000	0.63	5.083	28.84	8.167	2.51	11.25	0.63
2.083	0.63	5.167	28.84	8.250	2.51	11.33	0.63
2.167	0.63	5.250	28.84	8.333	1.25	11.42	0.63
2.250	0.63	5.333	8.15	8.417	1.25	11.50	0.63
2.333	3.76	5.417	8.15	8.500	1.25	11.58	0.63
2.417	3.76	5.500	8.15	8.583	1.25	11.67	0.63
2.500	3.76	5.583	8.15	8.667	1.25	11.75	0.63
2.583	3.76	5.667	8.15	8.750	1.25	11.83	0.63
2.667	3.76	5.750	8.15	8.833	1.25	11.92	0.63
2.750	3.76	5.833	8.15	8.917	1.25	12.00	0.63
2.833	3.76	5.917	8.15	9.000	1.25	12.08	0.63
2.917	3.76	6.000	8.15	9.083	1.25	12.17	0.63
3.000	3.76	6.083	8.15	9.167	1.25	12.25	0.63
3.083	3.76	6.167	8.15	9.250	1.25		

Max.Eff.Inten.(mm/hr)= 28.84 20.90
over (min) 5.00 10.00
Storage Coeff. (min)= 4.84 (ii) 9.66 (ii)
Unit Hyd. Tpeak (min)= 5.00 10.00
Unit Hyd. peak (cms)= 0.22 0.11

TOTALS

PEAK FLOW (cms)= 0.02 0.00 0.017 (iii)
TIME TO PEAK (hrs)= 5.17 5.25 5.25
RUNOFF VOLUME (mm)= 61.71 35.33 59.06
TOTAL RAINFALL (mm)= 62.71 62.71 62.71
RUNOFF COEFFICIENT = 0.98 0.56 0.94

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 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.

CALIB		Area (ha)=	0.55
STANDHYD (0006)		Total Imp(%)=	90.00 Dir. Conn.(%)= 90.00
ID= 1 DT= 5.0 min			

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.50	0.06
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	0.35	2.00
Length	(m)=	38.30	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

----- TRANSFORMED HYETOGRAPH -----

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	0.00	3.167	3.76	6.250	8.15	9.33	0.63
0.167	0.00	3.250	3.76	6.333	4.39	9.42	0.63
0.250	0.00	3.333	10.66	6.417	4.39	9.50	0.63
0.333	0.63	3.417	10.66	6.500	4.39	9.58	0.63
0.417	0.63	3.500	10.66	6.583	4.39	9.67	0.63
0.500	0.63	3.583	10.66	6.667	4.39	9.75	0.63
0.583	0.63	3.667	10.66	6.750	4.39	9.83	0.63
0.667	0.63	3.750	10.66	6.833	4.39	9.92	0.63
0.750	0.63	3.833	10.66	6.917	4.39	10.00	0.63
0.833	0.63	3.917	10.66	7.000	4.39	10.08	0.63
0.917	0.63	4.000	10.66	7.083	4.39	10.17	0.63
1.000	0.63	4.083	10.66	7.167	4.39	10.25	0.63
1.083	0.63	4.167	10.66	7.250	4.39	10.33	0.63
1.167	0.63	4.250	10.66	7.333	2.51	10.42	0.63
1.250	0.63	4.333	28.84	7.417	2.51	10.50	0.63
1.333	0.63	4.417	28.84	7.500	2.51	10.58	0.63
1.417	0.63	4.500	28.84	7.583	2.51	10.67	0.63
1.500	0.63	4.583	28.84	7.667	2.51	10.75	0.63
1.583	0.63	4.667	28.84	7.750	2.51	10.83	0.63
1.667	0.63	4.750	28.84	7.833	2.51	10.92	0.63
1.750	0.63	4.833	28.84	7.917	2.51	11.00	0.63
1.833	0.63	4.917	28.84	8.000	2.51	11.08	0.63
1.917	0.63	5.000	28.84	8.083	2.51	11.17	0.63
2.000	0.63	5.083	28.84	8.167	2.51	11.25	0.63
2.083	0.63	5.167	28.84	8.250	2.51	11.33	0.63
2.167	0.63	5.250	28.84	8.333	1.25	11.42	0.63
2.250	0.63	5.333	8.15	8.417	1.25	11.50	0.63
2.333	3.76	5.417	8.15	8.500	1.25	11.58	0.63
2.417	3.76	5.500	8.15	8.583	1.25	11.67	0.63
2.500	3.76	5.583	8.15	8.667	1.25	11.75	0.63
2.583	3.76	5.667	8.15	8.750	1.25	11.83	0.63
2.667	3.76	5.750	8.15	8.833	1.25	11.92	0.63
2.750	3.76	5.833	8.15	8.917	1.25	12.00	0.63
2.833	3.76	5.917	8.15	9.000	1.25	12.08	0.63
2.917	3.76	6.000	8.15	9.083	1.25	12.17	0.63
3.000	3.76	6.083	8.15	9.167	1.25	12.25	0.63
3.083	3.76	6.167	8.15	9.250	1.25		

Max.Eff.Inten.(mm/hr)= 28.84 20.90
 over (min) 5.00 10.00
 Storage Coeff. (min)= 3.24 (ii) 8.06 (ii)
 Unit Hyd. Tpeak (min)= 5.00 10.00
 Unit Hyd. peak (cms)= 0.27 0.13

TOTALS

PEAK FLOW (cms)= 0.04 0.00 0.043 (iii)

TIME TO PEAK	(hrs)=	5.08	5.25	5.25
RUNOFF VOLUME	(mm)=	61.71	35.33	59.07
TOTAL RAINFALL	(mm)=	62.71	62.71	62.71
RUNOFF COEFFICIENT	=	0.98	0.56	0.94

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 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.

** SIMULATION:25yr 12 hour AES Distribution **

CALIB			
STANDHYD (0005)	Area	(ha)=	0.22
ID= 1 DT= 5.0 min	Total Imp(%)=	90.00	Dir. Conn.(%)= 90.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.20	0.02
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	0.66	2.00
Length	(m)=	103.00	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

----- TRANSFORMED HYETOGRAPH -----

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	0.00	3.167	4.39	6.250	9.50	9.33	0.73
0.167	0.00	3.250	4.39	6.333	5.12	9.42	0.73
0.250	0.00	3.333	12.43	6.417	5.12	9.50	0.73
0.333	0.73	3.417	12.43	6.500	5.12	9.58	0.73
0.417	0.73	3.500	12.43	6.583	5.12	9.67	0.73
0.500	0.73	3.583	12.43	6.667	5.12	9.75	0.73
0.583	0.73	3.667	12.43	6.750	5.12	9.83	0.73
0.667	0.73	3.750	12.43	6.833	5.12	9.92	0.73
0.750	0.73	3.833	12.43	6.917	5.12	10.00	0.73
0.833	0.73	3.917	12.43	7.000	5.12	10.08	0.73
0.917	0.73	4.000	12.43	7.083	5.12	10.17	0.73
1.000	0.73	4.083	12.43	7.167	5.12	10.25	0.73
1.083	0.73	4.167	12.43	7.250	5.12	10.33	0.73
1.167	0.73	4.250	12.43	7.333	2.92	10.42	0.73
1.250	0.73	4.333	33.63	7.417	2.92	10.50	0.73

1.333	0.73	4.417	33.63	7.500	2.92	10.58	0.73
1.417	0.73	4.500	33.63	7.583	2.92	10.67	0.73
1.500	0.73	4.583	33.63	7.667	2.92	10.75	0.73
1.583	0.73	4.667	33.63	7.750	2.92	10.83	0.73
1.667	0.73	4.750	33.63	7.833	2.92	10.92	0.73
1.750	0.73	4.833	33.63	7.917	2.92	11.00	0.73
1.833	0.73	4.917	33.63	8.000	2.92	11.08	0.73
1.917	0.73	5.000	33.63	8.083	2.92	11.17	0.73
2.000	0.73	5.083	33.63	8.167	2.92	11.25	0.73
2.083	0.73	5.167	33.63	8.250	2.92	11.33	0.73
2.167	0.73	5.250	33.63	8.333	1.46	11.42	0.73
2.250	0.73	5.333	9.50	8.417	1.46	11.50	0.73
2.333	4.39	5.417	9.50	8.500	1.46	11.58	0.73
2.417	4.39	5.500	9.50	8.583	1.46	11.67	0.73
2.500	4.39	5.583	9.50	8.667	1.46	11.75	0.73
2.583	4.39	5.667	9.50	8.750	1.46	11.83	0.73
2.667	4.39	5.750	9.50	8.833	1.46	11.92	0.73
2.750	4.39	5.833	9.50	8.917	1.46	12.00	0.73
2.833	4.39	5.917	9.50	9.000	1.46	12.08	0.73
2.917	4.39	6.000	9.50	9.083	1.46	12.17	0.73
3.000	4.39	6.083	9.50	9.167	1.46	12.25	0.73
3.083	4.39	6.167	9.50	9.250	1.46		

Max.Eff.Inten.(mm/hr)=	33.63	25.71
over (min)	5.00	10.00
Storage Coeff. (min)=	4.56 (ii)	9.09 (ii)
Unit Hyd. Tpeak (min)=	5.00	10.00
Unit Hyd. peak (cms)=	0.23	0.12

TOTALS

PEAK FLOW (cms)=	0.02	0.00	0.020 (iii)
TIME TO PEAK (hrs)=	5.17	5.25	5.25
RUNOFF VOLUME (mm)=	72.10	44.03	69.28
TOTAL RAINFALL (mm)=	73.10	73.10	73.10
RUNOFF COEFFICIENT =	0.99	0.60	0.95

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
 CN* = 85.0 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.

CALIB		
STANDHYD (0006)	Area (ha)= 0.55	
ID= 1 DT= 5.0 min	Total Imp(%)= 90.00	Dir. Conn.(%)= 90.00

IMPERVIOUS PERVIOUS (i)

Surface Area	(ha)=	0.50	0.06
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	0.35	2.00
Length	(m)=	38.30	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

----- TRANSFORMED HYETOGRAPH -----

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	0.00	3.167	4.39	6.250	9.50	9.33	0.73
0.167	0.00	3.250	4.39	6.333	5.12	9.42	0.73
0.250	0.00	3.333	12.43	6.417	5.12	9.50	0.73
0.333	0.73	3.417	12.43	6.500	5.12	9.58	0.73
0.417	0.73	3.500	12.43	6.583	5.12	9.67	0.73
0.500	0.73	3.583	12.43	6.667	5.12	9.75	0.73
0.583	0.73	3.667	12.43	6.750	5.12	9.83	0.73
0.667	0.73	3.750	12.43	6.833	5.12	9.92	0.73
0.750	0.73	3.833	12.43	6.917	5.12	10.00	0.73
0.833	0.73	3.917	12.43	7.000	5.12	10.08	0.73
0.917	0.73	4.000	12.43	7.083	5.12	10.17	0.73
1.000	0.73	4.083	12.43	7.167	5.12	10.25	0.73
1.083	0.73	4.167	12.43	7.250	5.12	10.33	0.73
1.167	0.73	4.250	12.43	7.333	2.92	10.42	0.73
1.250	0.73	4.333	33.63	7.417	2.92	10.50	0.73
1.333	0.73	4.417	33.63	7.500	2.92	10.58	0.73
1.417	0.73	4.500	33.63	7.583	2.92	10.67	0.73
1.500	0.73	4.583	33.63	7.667	2.92	10.75	0.73
1.583	0.73	4.667	33.63	7.750	2.92	10.83	0.73
1.667	0.73	4.750	33.63	7.833	2.92	10.92	0.73
1.750	0.73	4.833	33.63	7.917	2.92	11.00	0.73
1.833	0.73	4.917	33.63	8.000	2.92	11.08	0.73
1.917	0.73	5.000	33.63	8.083	2.92	11.17	0.73
2.000	0.73	5.083	33.63	8.167	2.92	11.25	0.73
2.083	0.73	5.167	33.63	8.250	2.92	11.33	0.73
2.167	0.73	5.250	33.63	8.333	1.46	11.42	0.73
2.250	0.73	5.333	9.50	8.417	1.46	11.50	0.73
2.333	4.39	5.417	9.50	8.500	1.46	11.58	0.73
2.417	4.39	5.500	9.50	8.583	1.46	11.67	0.73
2.500	4.39	5.583	9.50	8.667	1.46	11.75	0.73
2.583	4.39	5.667	9.50	8.750	1.46	11.83	0.73
2.667	4.39	5.750	9.50	8.833	1.46	11.92	0.73
2.750	4.39	5.833	9.50	8.917	1.46	12.00	0.73
2.833	4.39	5.917	9.50	9.000	1.46	12.08	0.73
2.917	4.39	6.000	9.50	9.083	1.46	12.17	0.73
3.000	4.39	6.083	9.50	9.167	1.46	12.25	0.73
3.083	4.39	6.167	9.50	9.250	1.46		

Max.Eff.Inten.(mm/hr)=	33.63	25.71	
over (min)	5.00	10.00	
Storage Coeff. (min)=	3.04 (ii)	7.58 (ii)	
Unit Hyd. Tpeak (min)=	5.00	10.00	
Unit Hyd. peak (cms)=	0.27	0.13	
			TOTALS
PEAK FLOW (cms)=	0.05	0.00	0.050 (iii)
TIME TO PEAK (hrs)=	5.08	5.25	5.25
RUNOFF VOLUME (mm)=	72.10	44.03	69.29
TOTAL RAINFALL (mm)=	73.10	73.10	73.10
RUNOFF COEFFICIENT =	0.99	0.60	0.95

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
 CN* = 85.0 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.

 ** SIMULATION:2yr 12 hour AES Distribution **

CALIB	
STANDHYD (0005)	Area (ha)= 0.22
ID= 1 DT= 5.0 min	Total Imp(%)= 90.00 Dir. Conn.(%)= 90.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.20	0.02
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	0.66	2.00
Length	(m)=	103.00	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	0.00	3.167	2.52	6.250	5.46	9.33	0.42
0.167	0.00	3.250	2.52	6.333	2.94	9.42	0.42
0.250	0.00	3.333	7.14	6.417	2.94	9.50	0.42
0.333	0.42	3.417	7.14	6.500	2.94	9.58	0.42
0.417	0.42	3.500	7.14	6.583	2.94	9.67	0.42
0.500	0.42	3.583	7.14	6.667	2.94	9.75	0.42
0.583	0.42	3.667	7.14	6.750	2.94	9.83	0.42
0.667	0.42	3.750	7.14	6.833	2.94	9.92	0.42

0.750	0.42	3.833	7.14	6.917	2.94	10.00	0.42
0.833	0.42	3.917	7.14	7.000	2.94	10.08	0.42
0.917	0.42	4.000	7.14	7.083	2.94	10.17	0.42
1.000	0.42	4.083	7.14	7.167	2.94	10.25	0.42
1.083	0.42	4.167	7.14	7.250	2.94	10.33	0.42
1.167	0.42	4.250	7.14	7.333	1.68	10.42	0.42
1.250	0.42	4.333	19.32	7.417	1.68	10.50	0.42
1.333	0.42	4.417	19.32	7.500	1.68	10.58	0.42
1.417	0.42	4.500	19.32	7.583	1.68	10.67	0.42
1.500	0.42	4.583	19.32	7.667	1.68	10.75	0.42
1.583	0.42	4.667	19.32	7.750	1.68	10.83	0.42
1.667	0.42	4.750	19.32	7.833	1.68	10.92	0.42
1.750	0.42	4.833	19.32	7.917	1.68	11.00	0.42
1.833	0.42	4.917	19.32	8.000	1.68	11.08	0.42
1.917	0.42	5.000	19.32	8.083	1.68	11.17	0.42
2.000	0.42	5.083	19.32	8.167	1.68	11.25	0.42
2.083	0.42	5.167	19.32	8.250	1.68	11.33	0.42
2.167	0.42	5.250	19.32	8.333	0.84	11.42	0.42
2.250	0.42	5.333	5.46	8.417	0.84	11.50	0.42
2.333	2.52	5.417	5.46	8.500	0.84	11.58	0.42
2.417	2.52	5.500	5.46	8.583	0.84	11.67	0.42
2.500	2.52	5.583	5.46	8.667	0.84	11.75	0.42
2.583	2.52	5.667	5.46	8.750	0.84	11.83	0.42
2.667	2.52	5.750	5.46	8.833	0.84	11.92	0.42
2.750	2.52	5.833	5.46	8.917	0.84	12.00	0.42
2.833	2.52	5.917	5.46	9.000	0.84	12.08	0.42
2.917	2.52	6.000	5.46	9.083	0.84	12.17	0.42
3.000	2.52	6.083	5.46	9.167	0.84	12.25	0.42
3.083	2.52	6.167	5.46	9.250	0.84		

Max.Eff.Inten.(mm/hr)=	19.32	11.36
over (min)	5.00	25.00
Storage Coeff. (min)=	5.69 (ii)	22.53 (ii)
Unit Hyd. Tpeak (min)=	5.00	25.00
Unit Hyd. peak (cms)=	0.20	0.05

TOTALS

PEAK FLOW (cms)=	0.01	0.00	0.011 (iii)
TIME TO PEAK (hrs)=	5.25	5.33	5.25
RUNOFF VOLUME (mm)=	41.00	19.22	38.80
TOTAL RAINFALL (mm)=	42.00	42.00	42.00
RUNOFF COEFFICIENT =	0.98	0.46	0.92

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:

CN* = 85.0 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.

```

-----
| CALIB |
| STANDHYD ( 0006) | Area (ha)= 0.55
| ID= 1 DT= 5.0 min | Total Imp(%)= 90.00 Dir. Conn.(%)= 90.00
-----

```

```

                IMPERVIOUS      PERVIOUS (i)
Surface Area    (ha)=          0.50          0.06
Dep. Storage    (mm)=          1.00          1.50
Average Slope    (%)=          0.35          2.00
Length          (m)=         38.30         40.00
Mannings n      =          0.013          0.250

```

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

----- TRANSFORMED HYETOGRAPH -----

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	0.00	3.167	2.52	6.250	5.46	9.33	0.42
0.167	0.00	3.250	2.52	6.333	2.94	9.42	0.42
0.250	0.00	3.333	7.14	6.417	2.94	9.50	0.42
0.333	0.42	3.417	7.14	6.500	2.94	9.58	0.42
0.417	0.42	3.500	7.14	6.583	2.94	9.67	0.42
0.500	0.42	3.583	7.14	6.667	2.94	9.75	0.42
0.583	0.42	3.667	7.14	6.750	2.94	9.83	0.42
0.667	0.42	3.750	7.14	6.833	2.94	9.92	0.42
0.750	0.42	3.833	7.14	6.917	2.94	10.00	0.42
0.833	0.42	3.917	7.14	7.000	2.94	10.08	0.42
0.917	0.42	4.000	7.14	7.083	2.94	10.17	0.42
1.000	0.42	4.083	7.14	7.167	2.94	10.25	0.42
1.083	0.42	4.167	7.14	7.250	2.94	10.33	0.42
1.167	0.42	4.250	7.14	7.333	1.68	10.42	0.42
1.250	0.42	4.333	19.32	7.417	1.68	10.50	0.42
1.333	0.42	4.417	19.32	7.500	1.68	10.58	0.42
1.417	0.42	4.500	19.32	7.583	1.68	10.67	0.42
1.500	0.42	4.583	19.32	7.667	1.68	10.75	0.42
1.583	0.42	4.667	19.32	7.750	1.68	10.83	0.42
1.667	0.42	4.750	19.32	7.833	1.68	10.92	0.42
1.750	0.42	4.833	19.32	7.917	1.68	11.00	0.42
1.833	0.42	4.917	19.32	8.000	1.68	11.08	0.42
1.917	0.42	5.000	19.32	8.083	1.68	11.17	0.42
2.000	0.42	5.083	19.32	8.167	1.68	11.25	0.42
2.083	0.42	5.167	19.32	8.250	1.68	11.33	0.42
2.167	0.42	5.250	19.32	8.333	0.84	11.42	0.42
2.250	0.42	5.333	5.46	8.417	0.84	11.50	0.42
2.333	2.52	5.417	5.46	8.500	0.84	11.58	0.42
2.417	2.52	5.500	5.46	8.583	0.84	11.67	0.42
2.500	2.52	5.583	5.46	8.667	0.84	11.75	0.42
2.583	2.52	5.667	5.46	8.750	0.84	11.83	0.42
2.667	2.52	5.750	5.46	8.833	0.84	11.92	0.42

2.750	2.52	5.833	5.46	8.917	0.84	12.00	0.42
2.833	2.52	5.917	5.46	9.000	0.84	12.08	0.42
2.917	2.52	6.000	5.46	9.083	0.84	12.17	0.42
3.000	2.52	6.083	5.46	9.167	0.84	12.25	0.42
3.083	2.52	6.167	5.46	9.250	0.84		

Max.Eff.Inten.(mm/hr)=	19.32	11.36	
over (min)	5.00	25.00	
Storage Coeff. (min)=	3.80 (ii)	20.64 (ii)	
Unit Hyd. Tpeak (min)=	5.00	25.00	
Unit Hyd. peak (cms)=	0.25	0.05	
TOTALS			
PEAK FLOW (cms)=	0.03	0.00	0.028 (iii)
TIME TO PEAK (hrs)=	5.08	5.33	5.25
RUNOFF VOLUME (mm)=	41.00	19.22	38.81
TOTAL RAINFALL (mm)=	42.00	42.00	42.00
RUNOFF COEFFICIENT =	0.98	0.46	0.92

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 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.

** SIMULATION:50yr 12 hour AES Distribution **

CALIB	
STANDHYD (0005)	Area (ha)= 0.22
ID= 1 DT= 5.0 min	Total Imp(%)= 90.00 Dir. Conn.(%)= 90.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.20	0.02
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	0.66	2.00
Length	(m)=	103.00	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----							
TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	0.00	3.167	4.85	6.250	10.50	9.33	0.81
0.167	0.00	3.250	4.85	6.333	5.66	9.42	0.81

Visual OTTHYMO Schematic - Uncontrolled Proposed Peak Flows

0.250	0.00	3.333	13.74	6.417	5.66	9.50	0.81
0.333	0.81	3.417	13.74	6.500	5.66	9.58	0.81
0.417	0.81	3.500	13.74	6.583	5.66	9.67	0.81
0.500	0.81	3.583	13.74	6.667	5.66	9.75	0.81
0.583	0.81	3.667	13.74	6.750	5.66	9.83	0.81
0.667	0.81	3.750	13.74	6.833	5.66	9.92	0.81
0.750	0.81	3.833	13.74	6.917	5.66	10.00	0.81
0.833	0.81	3.917	13.74	7.000	5.66	10.08	0.81
0.917	0.81	4.000	13.74	7.083	5.66	10.17	0.81
1.000	0.81	4.083	13.74	7.167	5.66	10.25	0.81
1.083	0.81	4.167	13.74	7.250	5.66	10.33	0.81
1.167	0.81	4.250	13.74	7.333	3.23	10.42	0.81
1.250	0.81	4.333	37.17	7.417	3.23	10.50	0.81
1.333	0.81	4.417	37.17	7.500	3.23	10.58	0.81
1.417	0.81	4.500	37.17	7.583	3.23	10.67	0.81
1.500	0.81	4.583	37.17	7.667	3.23	10.75	0.81
1.583	0.81	4.667	37.17	7.750	3.23	10.83	0.81
1.667	0.81	4.750	37.17	7.833	3.23	10.92	0.81
1.750	0.81	4.833	37.17	7.917	3.23	11.00	0.81
1.833	0.81	4.917	37.17	8.000	3.23	11.08	0.81
1.917	0.81	5.000	37.17	8.083	3.23	11.17	0.81
2.000	0.81	5.083	37.17	8.167	3.23	11.25	0.81
2.083	0.81	5.167	37.17	8.250	3.23	11.33	0.81
2.167	0.81	5.250	37.17	8.333	1.62	11.42	0.81
2.250	0.81	5.333	10.50	8.417	1.62	11.50	0.81
2.333	4.85	5.417	10.50	8.500	1.62	11.58	0.81
2.417	4.85	5.500	10.50	8.583	1.62	11.67	0.81
2.500	4.85	5.583	10.50	8.667	1.62	11.75	0.81
2.583	4.85	5.667	10.50	8.750	1.62	11.83	0.81
2.667	4.85	5.750	10.50	8.833	1.62	11.92	0.81
2.750	4.85	5.833	10.50	8.917	1.62	12.00	0.81
2.833	4.85	5.917	10.50	9.000	1.62	12.08	0.81
2.917	4.85	6.000	10.50	9.083	1.62	12.17	0.81
3.000	4.85	6.083	10.50	9.167	1.62	12.25	0.81
3.083	4.85	6.167	10.50	9.250	1.62		

Max.Eff.Inten.(mm/hr)=	37.17	29.32
over (min)	5.00	10.00
Storage Coeff. (min)=	4.38 (ii)	8.73 (ii)
Unit Hyd. Tpeak (min)=	5.00	10.00
Unit Hyd. peak (cms)=	0.23	0.12

TOTALS

PEAK FLOW (cms)=	0.02	0.00	0.022 (iii)
TIME TO PEAK (hrs)=	5.17	5.25	5.25
RUNOFF VOLUME (mm)=	79.82	50.68	76.89
TOTAL RAINFALL (mm)=	80.82	80.82	80.82
RUNOFF COEFFICIENT =	0.99	0.63	0.95

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
 CN* = 85.0 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.

```

-----
| CALIB |
| STANDHYD ( 0006) |
| ID= 1 DT= 5.0 min |
-----

```

Area (ha)= 0.55
 Total Imp(%)= 90.00 Dir. Conn.(%)= 90.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.50	0.06
Dep. Storage (mm)=	1.00	1.50
Average Slope (%)=	0.35	2.00
Length (m)=	38.30	40.00
Mannings n =	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

```

----- TRANSFORMED HYETOGRAPH -----

```

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	0.00	3.167	4.85	6.250	10.50	9.33	0.81
0.167	0.00	3.250	4.85	6.333	5.66	9.42	0.81
0.250	0.00	3.333	13.74	6.417	5.66	9.50	0.81
0.333	0.81	3.417	13.74	6.500	5.66	9.58	0.81
0.417	0.81	3.500	13.74	6.583	5.66	9.67	0.81
0.500	0.81	3.583	13.74	6.667	5.66	9.75	0.81
0.583	0.81	3.667	13.74	6.750	5.66	9.83	0.81
0.667	0.81	3.750	13.74	6.833	5.66	9.92	0.81
0.750	0.81	3.833	13.74	6.917	5.66	10.00	0.81
0.833	0.81	3.917	13.74	7.000	5.66	10.08	0.81
0.917	0.81	4.000	13.74	7.083	5.66	10.17	0.81
1.000	0.81	4.083	13.74	7.167	5.66	10.25	0.81
1.083	0.81	4.167	13.74	7.250	5.66	10.33	0.81
1.167	0.81	4.250	13.74	7.333	3.23	10.42	0.81
1.250	0.81	4.333	37.17	7.417	3.23	10.50	0.81
1.333	0.81	4.417	37.17	7.500	3.23	10.58	0.81
1.417	0.81	4.500	37.17	7.583	3.23	10.67	0.81
1.500	0.81	4.583	37.17	7.667	3.23	10.75	0.81
1.583	0.81	4.667	37.17	7.750	3.23	10.83	0.81
1.667	0.81	4.750	37.17	7.833	3.23	10.92	0.81
1.750	0.81	4.833	37.17	7.917	3.23	11.00	0.81
1.833	0.81	4.917	37.17	8.000	3.23	11.08	0.81
1.917	0.81	5.000	37.17	8.083	3.23	11.17	0.81
2.000	0.81	5.083	37.17	8.167	3.23	11.25	0.81
2.083	0.81	5.167	37.17	8.250	3.23	11.33	0.81

2.167	0.81	5.250	37.17	8.333	1.62	11.42	0.81
2.250	0.81	5.333	10.50	8.417	1.62	11.50	0.81
2.333	4.85	5.417	10.50	8.500	1.62	11.58	0.81
2.417	4.85	5.500	10.50	8.583	1.62	11.67	0.81
2.500	4.85	5.583	10.50	8.667	1.62	11.75	0.81
2.583	4.85	5.667	10.50	8.750	1.62	11.83	0.81
2.667	4.85	5.750	10.50	8.833	1.62	11.92	0.81
2.750	4.85	5.833	10.50	8.917	1.62	12.00	0.81
2.833	4.85	5.917	10.50	9.000	1.62	12.08	0.81
2.917	4.85	6.000	10.50	9.083	1.62	12.17	0.81
3.000	4.85	6.083	10.50	9.167	1.62	12.25	0.81
3.083	4.85	6.167	10.50	9.250	1.62		

Max.Eff.Inten.(mm/hr)= 37.17 29.32
over (min) 5.00 10.00
Storage Coeff. (min)= 2.92 (ii) 7.28 (ii)
Unit Hyd. Tpeak (min)= 5.00 10.00
Unit Hyd. peak (cms)= 0.28 0.14

TOTALS

PEAK FLOW (cms)= 0.05 0.00 0.055 (iii)
TIME TO PEAK (hrs)= 5.08 5.25 5.25
RUNOFF VOLUME (mm)= 79.82 50.68 76.90
TOTAL RAINFALL (mm)= 80.82 80.82 80.82
RUNOFF COEFFICIENT = 0.99 0.63 0.95

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 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.

** SIMULATION:5yr 12 hour AES Distribution **

CALIB		
STANDHYD (0005)	Area (ha)= 0.22	
ID= 1 DT= 5.0 min	Total Imp(%)= 90.00	Dir. Conn.(%)= 90.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.20	0.02
Dep. Storage (mm)=	1.00	1.50
Average Slope (%)=	0.66	2.00
Length (m)=	103.00	40.00
Mannings n =	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

----- TRANSFORMED HYETOGRAPH -----

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	0.00	3.167	3.26	6.250	7.07	9.33	0.54
0.167	0.00	3.250	3.26	6.333	3.81	9.42	0.54
0.250	0.00	3.333	9.25	6.417	3.81	9.50	0.54
0.333	0.54	3.417	9.25	6.500	3.81	9.58	0.54
0.417	0.54	3.500	9.25	6.583	3.81	9.67	0.54
0.500	0.54	3.583	9.25	6.667	3.81	9.75	0.54
0.583	0.54	3.667	9.25	6.750	3.81	9.83	0.54
0.667	0.54	3.750	9.25	6.833	3.81	9.92	0.54
0.750	0.54	3.833	9.25	6.917	3.81	10.00	0.54
0.833	0.54	3.917	9.25	7.000	3.81	10.08	0.54
0.917	0.54	4.000	9.25	7.083	3.81	10.17	0.54
1.000	0.54	4.083	9.25	7.167	3.81	10.25	0.54
1.083	0.54	4.167	9.25	7.250	3.81	10.33	0.54
1.167	0.54	4.250	9.25	7.333	2.18	10.42	0.54
1.250	0.54	4.333	25.02	7.417	2.18	10.50	0.54
1.333	0.54	4.417	25.02	7.500	2.18	10.58	0.54
1.417	0.54	4.500	25.02	7.583	2.18	10.67	0.54
1.500	0.54	4.583	25.02	7.667	2.18	10.75	0.54
1.583	0.54	4.667	25.02	7.750	2.18	10.83	0.54
1.667	0.54	4.750	25.02	7.833	2.18	10.92	0.54
1.750	0.54	4.833	25.02	7.917	2.18	11.00	0.54
1.833	0.54	4.917	25.02	8.000	2.18	11.08	0.54
1.917	0.54	5.000	25.02	8.083	2.18	11.17	0.54
2.000	0.54	5.083	25.02	8.167	2.18	11.25	0.54
2.083	0.54	5.167	25.02	8.250	2.18	11.33	0.54
2.167	0.54	5.250	25.02	8.333	1.09	11.42	0.54
2.250	0.54	5.333	7.07	8.417	1.09	11.50	0.54
2.333	3.26	5.417	7.07	8.500	1.09	11.58	0.54
2.417	3.26	5.500	7.07	8.583	1.09	11.67	0.54
2.500	3.26	5.583	7.07	8.667	1.09	11.75	0.54
2.583	3.26	5.667	7.07	8.750	1.09	11.83	0.54
2.667	3.26	5.750	7.07	8.833	1.09	11.92	0.54
2.750	3.26	5.833	7.07	8.917	1.09	12.00	0.54
2.833	3.26	5.917	7.07	9.000	1.09	12.08	0.54
2.917	3.26	6.000	7.07	9.083	1.09	12.17	0.54
3.000	3.26	6.083	7.07	9.167	1.09	12.25	0.54
3.083	3.26	6.167	7.07	9.250	1.09		

Max.Eff.Inten.(mm/hr)= 25.02 16.91
 over (min) 5.00 20.00
 Storage Coeff. (min)= 5.13 (ii) 19.49 (ii)
 Unit Hyd. Tpeak (min)= 5.00 20.00
 Unit Hyd. peak (cms)= 0.21 0.06

TOTALS

PEAK FLOW (cms)= 0.01 0.00 0.015 (iii)

TIME TO PEAK	(hrs)=	5.25	5.33	5.25
RUNOFF VOLUME	(mm)=	53.38	28.62	50.88
TOTAL RAINFALL	(mm)=	54.38	54.38	54.38
RUNOFF COEFFICIENT	=	0.98	0.53	0.94

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
 CN* = 85.0 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.

CALIB	
STANDHYD (0006)	Area (ha)= 0.55
ID= 1 DT= 5.0 min	Total Imp(%)= 90.00 Dir. Conn.(%)= 90.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.50	0.06
Dep. Storage (mm)=	1.00	1.50
Average Slope (%)=	0.35	2.00
Length (m)=	38.30	40.00
Mannings n =	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----							
TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	0.00	3.167	3.26	6.250	7.07	9.33	0.54
0.167	0.00	3.250	3.26	6.333	3.81	9.42	0.54
0.250	0.00	3.333	9.25	6.417	3.81	9.50	0.54
0.333	0.54	3.417	9.25	6.500	3.81	9.58	0.54
0.417	0.54	3.500	9.25	6.583	3.81	9.67	0.54
0.500	0.54	3.583	9.25	6.667	3.81	9.75	0.54
0.583	0.54	3.667	9.25	6.750	3.81	9.83	0.54
0.667	0.54	3.750	9.25	6.833	3.81	9.92	0.54
0.750	0.54	3.833	9.25	6.917	3.81	10.00	0.54
0.833	0.54	3.917	9.25	7.000	3.81	10.08	0.54
0.917	0.54	4.000	9.25	7.083	3.81	10.17	0.54
1.000	0.54	4.083	9.25	7.167	3.81	10.25	0.54
1.083	0.54	4.167	9.25	7.250	3.81	10.33	0.54
1.167	0.54	4.250	9.25	7.333	2.18	10.42	0.54
1.250	0.54	4.333	25.02	7.417	2.18	10.50	0.54
1.333	0.54	4.417	25.02	7.500	2.18	10.58	0.54
1.417	0.54	4.500	25.02	7.583	2.18	10.67	0.54
1.500	0.54	4.583	25.02	7.667	2.18	10.75	0.54
1.583	0.54	4.667	25.02	7.750	2.18	10.83	0.54

1.667	0.54	4.750	25.02	7.833	2.18	10.92	0.54
1.750	0.54	4.833	25.02	7.917	2.18	11.00	0.54
1.833	0.54	4.917	25.02	8.000	2.18	11.08	0.54
1.917	0.54	5.000	25.02	8.083	2.18	11.17	0.54
2.000	0.54	5.083	25.02	8.167	2.18	11.25	0.54
2.083	0.54	5.167	25.02	8.250	2.18	11.33	0.54
2.167	0.54	5.250	25.02	8.333	1.09	11.42	0.54
2.250	0.54	5.333	7.07	8.417	1.09	11.50	0.54
2.333	3.26	5.417	7.07	8.500	1.09	11.58	0.54
2.417	3.26	5.500	7.07	8.583	1.09	11.67	0.54
2.500	3.26	5.583	7.07	8.667	1.09	11.75	0.54
2.583	3.26	5.667	7.07	8.750	1.09	11.83	0.54
2.667	3.26	5.750	7.07	8.833	1.09	11.92	0.54
2.750	3.26	5.833	7.07	8.917	1.09	12.00	0.54
2.833	3.26	5.917	7.07	9.000	1.09	12.08	0.54
2.917	3.26	6.000	7.07	9.083	1.09	12.17	0.54
3.000	3.26	6.083	7.07	9.167	1.09	12.25	0.54
3.083	3.26	6.167	7.07	9.250	1.09		

Max.Eff.Inten.(mm/hr)=	25.02	16.91
over (min)	5.00	20.00
Storage Coeff. (min)=	3.43 (ii)	17.79 (ii)
Unit Hyd. Tpeak (min)=	5.00	20.00
Unit Hyd. peak (cms)=	0.26	0.06

TOTALS

PEAK FLOW (cms)=	0.03	0.00	0.037 (iii)
TIME TO PEAK (hrs)=	5.08	5.33	5.25
RUNOFF VOLUME (mm)=	53.38	28.62	50.89
TOTAL RAINFALL (mm)=	54.38	54.38	54.38
RUNOFF COEFFICIENT =	0.98	0.53	0.94

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 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.

APPENDIX C

HYDRAULIC ANALYSIS

CITY OF MARKHAM

"HIGHWAY 404 / MAJOR MACKENZIE RAMP EXTENSION "

Project #: 074748

EXISTING CONDITIONS HYDROLOGY										
Catchment Area	Catchment Land Coverage			Runoff Coefficient, C		SCS Curve Number, CN		Summary		
	Total Drainage Area	Impervious Area	Pervious Area	Impervious Area	Pervious Area	Impervious Area	Pervious Area	CN	Ia	
	[ha]	[ha]	[ha]	0.9	0.2	98	76			
External Area										
EXT-1 (Hwy 404)	22.50		22.50	0.0%	100.0%	0.0%	100.0%	0.20	76.0	6.0
EXT-2 (MTO Ditch)	1.12		1.12	0.0%	100.0%	0.0%	100.0%	0.20	76.0	6.0
EXT-3 (Adjacent Property)	4.53		4.53	0.0%	100.0%	0.0%	100.0%	0.20	76.0	6.0

CITY OF MARKHAM

"HIGHWAY 404 / MAJOR MACKENZIE RAMP EXTENSION "

Project #: 074748

PROPOSED CONDITIONS HYDROLOGY										
Catchment Area	Catchment Land Coverage			Runoff Coefficient, C		SCS Curve Number, CN		Summary		
	Total Drainage Area	Impervious Area	Pervious Area	Impervious Area	Pervious Area	Impervious Area	Pervious Area	CN	Ia	
	[ha]	[ha]	[ha]	0.9	0.2	98	76			
External Area										
EXT-1 (Hwy 404)	22.50		22.50	0.0%	100.0%	0.0%	100.0%	0.20	76.0	6.0
EXT-2 (MTO Ditch)	1.12		1.12	0.0%	100.0%	0.0%	100.0%	0.20	76.0	6.0
EXT-3 (Adjacent Property)	4.75	4.15	0.60	87.4%	12.6%	87.4%	12.6%	0.81	95.2	1.0
EXT-4 (Adjacent Property)	0.55	0.00	0.55	0.0%	100.0%	0.0%	100.0%	0.20	76.0	6.0
PR-1 (OF1)	0.22	0.22	0.00	100.0%	0.0%	100.0%	0.0%	0.90	98.0	0.4
PR-2 (OF2)	0.55	0.55	0.00	100.0%	0.0%	100.0%	0.0%	0.90	98.0	0.4

*Note: Runoff Coefficient for adjacent property estimated from developers drainage plans.

CITY OF MARKHAM

"HIGHWAY 404 / MAJOR MACKENZIE RAMP EXTENSION "

Project #: 074748

EXISTING CONDITION TIME TO PEAK CALCULATION										
Catchment Area	Catchment Characteristics					Time to Peak Calculation				
	Total Drainage Area	Slope	Flow Length	Catchment Width	C	HYMO	HYMO	Airport Formula		Average
	[ha]	[%]	[m]	[m]	[-]	Long	Short			
External Area										
EXT-1 (Hwy 404)	22.50	1.00	1700.00	132.35	0.20	0.37	0.42	1.33	0.58	0.76
EXT-2 (MTO Ditch)	1.12	1.04	263.00	42.59	0.20	0.09	0.16	0.52	0.29	0.30
EXT-3 (Adjacent Property)	4.53	3.08	204.00	222.06	0.20	0.08	0.15	0.32	0.26	0.22

CITY OF MARKHAM
"HIGHWAY 404 / MAJOR MACKENZIE RAMP EXTENSION "

Project #: 074748

PROPOSED CONDITION TIME TO PEAK CALCULATION										
Catchment Area	Catchment Characteristics					Time to Peak Calculation				
	Total Drainage Area	Slope	Flow Length	Catchment Width	C	HYMO	HYMO	Airport Formula		Average
	[ha]	[%]	[m]	[m]	[-]	Long	Short			
External Area										
EXT-1 (Hwy 404)	22.50	1.00	1700.00	132.35	0.20	0.37	0.42	1.33	0.58	0.76
EXT-2 (MTO Ditch)	1.12	1.04	263.00	42.59	0.20	0.09	0.16	0.52	0.29	0.30
EXT-3 (Adjacent Property)	4.75	3.08	204.00	232.84	0.81	0.08	0.15	0.10	0.26	0.15
EXT-4 (Adjacent Property)	0.55	1.68	92.00	59.78	0.20	0.05	0.10	0.26	0.20	0.17
PR-1 (OF1)	0.22	0.66	103.00	21.36	0.90	0.06	0.12	0.08	0.23	0.12
PR-2 (OF2)	0.55	0.35	252.00	21.83	0.90	0.13	0.23	0.16	0.34	0.21

CITY OF MARKHAM
"HIGHWAY 404 / MAJOR MACKENZIE RAMP EXTENSION "

Project #: 074748

IDF Info:		Design Info:	
a =	1045.41	Manning's 'n' =	0.013
b =	4.9	I (5-YEAR) =	a/(t+b) ^c
c =	0.83	Inlet Time =	10

STORM SEWER CAPACITY ASSESSMENT- PROPOSED CONDITIONS

Prepared By:	Gale Ho
Checked By:	
Date:	25-Nov-25

Structures				Area Breakdown					Rainfall Intensity	Flow	Storm Sewer Design Information						TIME		Pipe Capacity				
U/S		D/S		Area	Area as per Landuse			Cumulative (A°C)			Size	Slope	Length	Type	Q full	V full	Sectional	Cumulative					
ID	INV	ID	INV	(ha)	0.20	0.60	0.90	(ha)	(mm/hr)	(m³/s)	(mm)	(%)	(m)	PIPE	(m³/s)	(m/s)	(min.)	(min.)	%				
Major Mackenzie Road (Outlet #1)																		10.00					
DCB1	212.48	DCB2	212.41	0.14			0.14	0.13	111.06	0.040	375	1.01%	6.7	PVC	0.177	1.60	0.07	10.07	22%				
DCB2	212.31	Outfall 1	212.20	0.04			0.04	0.16	110.63	0.049	375	1.00%	11.1	PVC	0.175	1.59	0.12	10.19	28%				
Markland Street (Outlet #2)																						10.00	
MH1	212.91	MH2	212.41	0.04			0.04	0.03	111.06	0.011	300	1.00%	57.0	PVC	0.097	1.37	0.69	10.69	11%				
MH2	212.38	MH3	211.90	0.10			0.10	0.12	106.94	0.036	375	1.00%	67.4	PVC	0.175	1.59	0.71	11.40	21%				
MH3	211.87	MH4	211.33	0.07			0.07	0.19	103.07	0.053	375	1.00%	69.4	PVC	0.175	1.59	0.73	12.13	30%				
MH4	211.30	MH5	210.87	0.09			0.09	0.26	99.39	0.073	375	1.00%	71.4	PVC	0.175	1.59	0.75	12.88	42%				
MH5	210.84	OGS	210.13	0.00			0.02	0.28	95.90	0.075	375	1.00%	73.4	PVC	0.175	1.59	0.77	13.65	43%				
OGS	210.10	OF2 MH	209.90	0.00			0.02	0.30	92.59	0.077	375	1.00%	75.4	PVC	0.175	1.59	0.79	14.44	44%				
OF2 MH	209.87	OF2	209.84	0.00			0.00	0.30	89.43	0.074	375	1.00%	1.0	PVC	0.175	1.59	0.01	14.45	42%				

HY-8 Culvert Analysis Report

Project Data

Project Title:

Designer:

Project Date:Thursday, September 26, 2024

Project Notes:

Project Units: SI Units (Metric)

Outlet Control Option: Profiles

Exit Loss Option: Standard Method

Crossing Data: Extension Road

Crossing Notes:

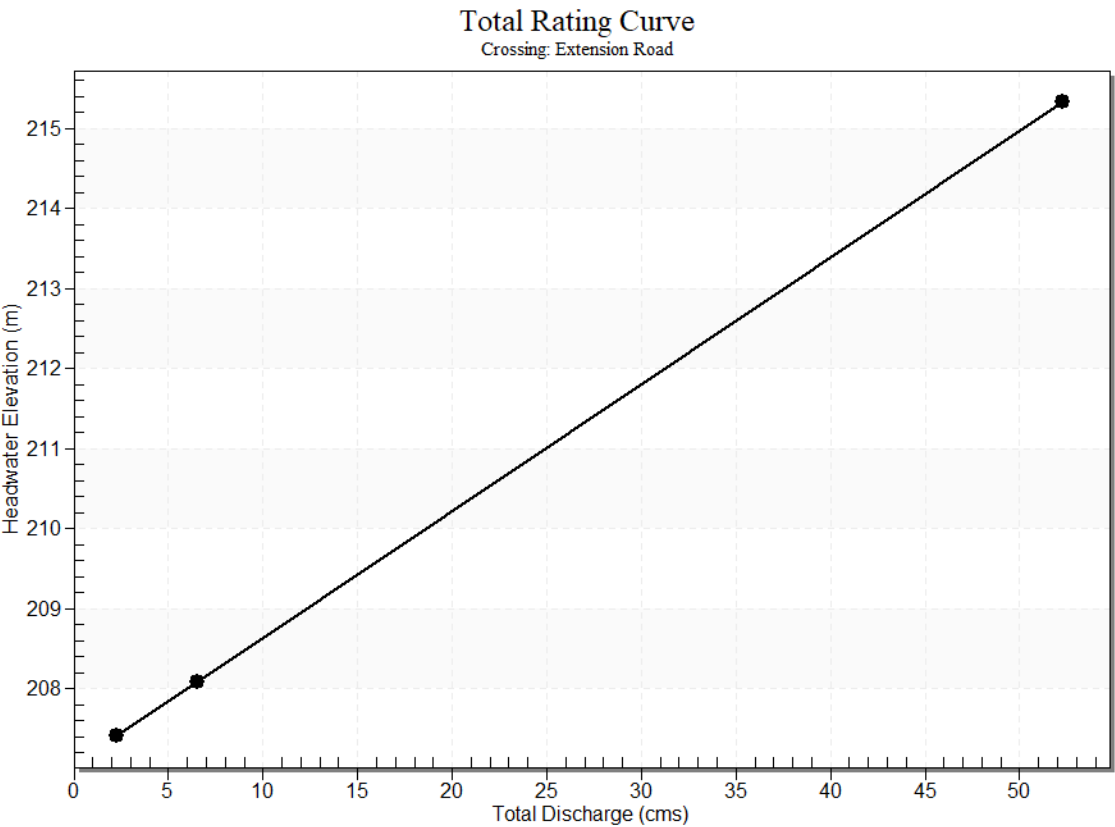
Crossing Discharge Data

Discharge Selection Method: User Defined

Table 1 - Summary of Culvert Flows at Crossing: Extension Road

Headwater Elevation (m)	Discharge Names	Total Discharge (cms)	Extension Road 3000*2400mm Discharge (cms)	Roadway Discharge (cms)	Iterations
207.41	10- Year	2.28	2.28	0.00	1
208.09	100-Year	6.53	6.53	0.00	1
215.22	Overtopping	50.13	50.13	0.00	Overtopping

Rating Curve Plot for Crossing: Extension Road



Culvert Data: Extension Road 3000*2400mm

Culvert Notes:

Table 1 - Culvert Summary Table: Extension Road 3000*2400mm

Disc harg e Nam es	Total Disc harg e (cms)	Culv ert Disc harg e (cms)	Head water Eleva tion (m)	Inle t Con trol Dep th (m)	Out let Con trol Dep th (m)	Fl o w Ty pe	Nor mal Dep th (m)	Crit ical De pth (m)	Ou tle t De pth (m)	Tail water r Dept h (m)	Outl et Vel ocit y (m/ s)	Tail water r Velo city (m/s)
10- Year	2.28 cms	2.28 cms	207.4 1	0.66	0.38 3	1- JS 1t	0.34	0.3 9	0.5 6	0.56	1.35	1.40
100- Year	6.53 cms	6.53 cms	208.0 9	1.34	0.79 1	1- JS 1t	0.70	0.7 8	0.9 1	0.91	2.40	1.83

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

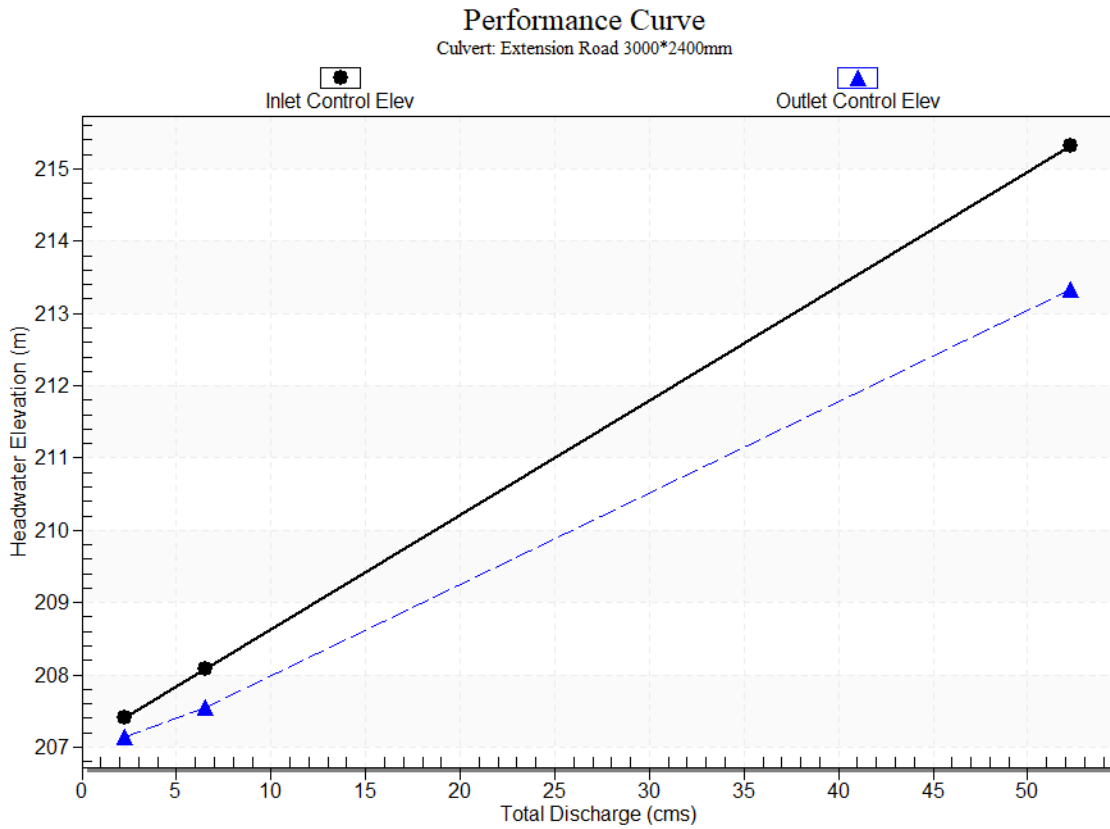
Inlet Elevation (invert): 206.75 m,

Outlet Elevation (invert): 206.56 m

Culvert Length: 43.00 m,

Culvert Slope: 0.0044

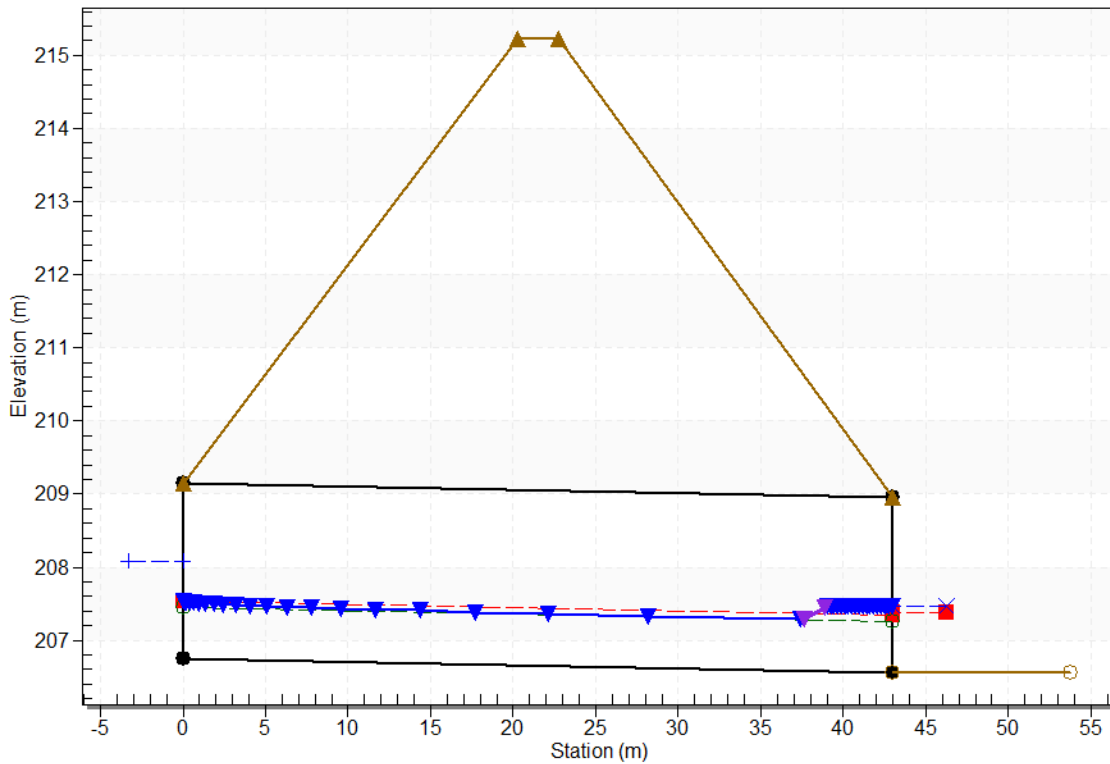
Culvert Performance Curve Plot: Extension Road 3000*2400mm



Water Surface Profile Plot for Culvert: Extension Road 3000*2400mm

Crossing - Extension Road, Design Discharge - 6.53 cms

Culvert - Extension Road 3000*2400mm, Culvert Discharge - 6.53 cms



Site Data - Extension Road 3000*2400mm

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 m

Inlet Elevation: 206.75 m

Outlet Station: 43.00 m

Outlet Elevation: 206.56 m

Number of Barrels: 1

Culvert Data Summary - Extension Road 3000*2400mm

Barrel Shape: Concrete Box

Barrel Span: 3000.00 mm

Barrel Rise: 2400.00 mm

Barrel Material: Concrete

Embedment: 0.00 mm

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge (90°) Headwall (Ke=0.5)

Inlet Depression: None

Tailwater Data for Crossing: Extension Road

Table 2 - Downstream Channel Rating Curve (Crossing: Extension Road)

Flow (cms)	Water Surface Elev (m)	Velocity (m/s)	Depth (m)	Shear (Pa)	Froude Number
2.28	207.12	0.56	1.40	55.26	0.75
6.53	207.47	0.91	1.83	89.03	0.80

Tailwater Channel Data - Extension Road

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 1.20 m

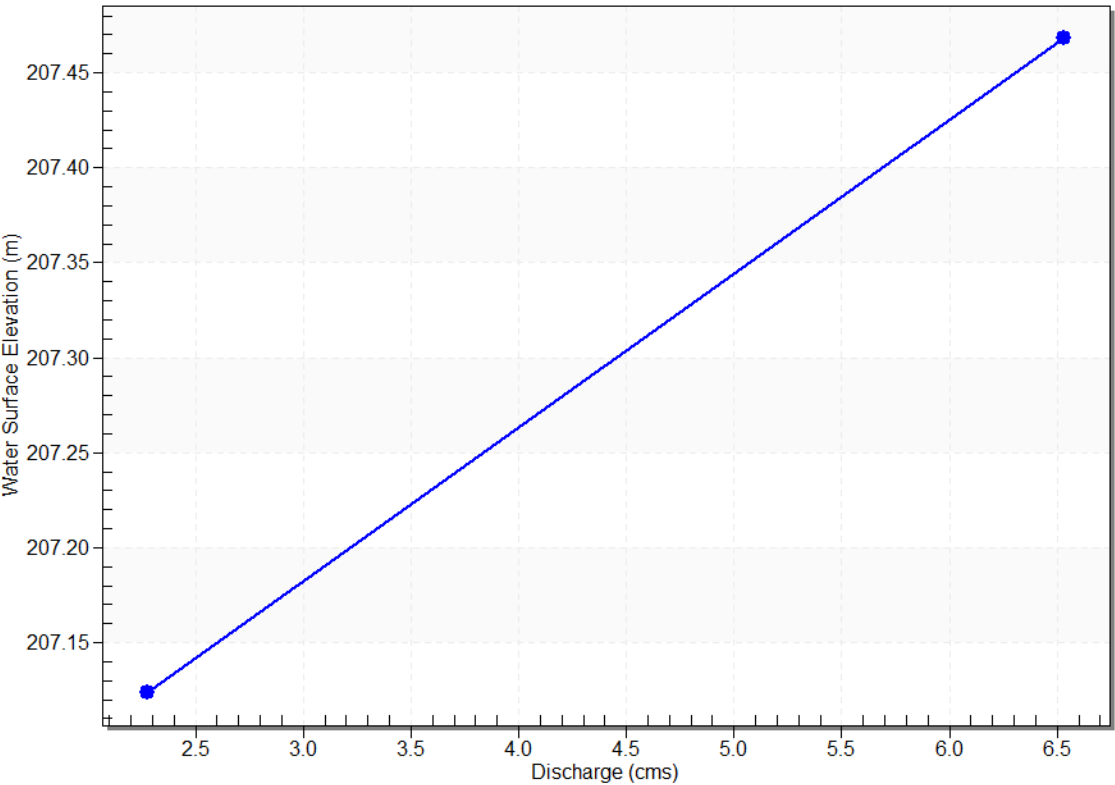
Side Slope (H:V): 3.00 (:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0350

Channel Invert Elevation: 206.56 m

Tailwater Rating Curve Plot for Crossing: Extension Road
Downstream Channel Rating Curve



Roadway Data for Crossing: Extension Road
Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 30.00 m
Crest Elevation: 215.22 m
Roadway Surface: Paved
Roadway Top Width: 2.50 m

Crossing Data: Crossing 2
Crossing Notes:

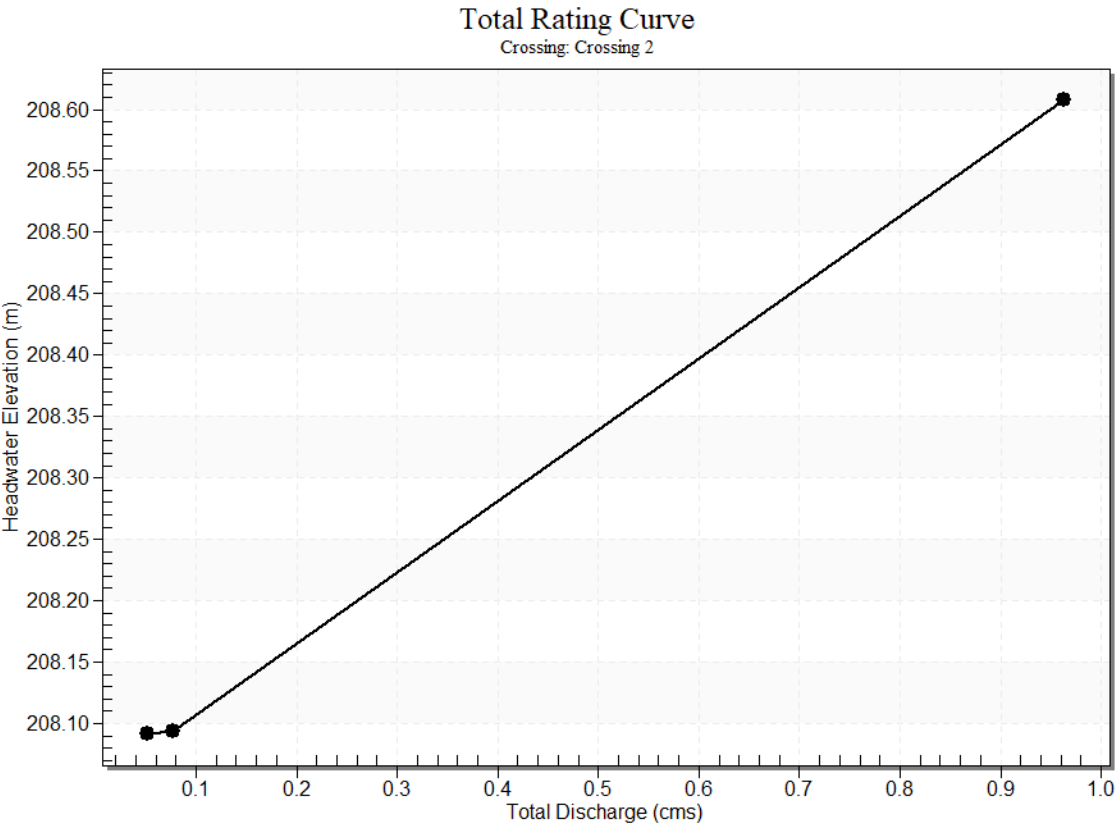
Crossing Discharge Data
Discharge Selection Method: User Defined

Table 3 - Summary of Culvert Flows at Crossing: Crossing 2

Headwater Elevation (m)	Discharge Names	Total Discharge (cms)	OnRamp Culvert West	Roadway Discharge (cms)	Iterations
-------------------------	-----------------	-----------------------	---------------------	-------------------------	------------

			800mm Discharge (cms)		
208.09	10-year	0.05	0.05	0.00	1
208.09	100-year	0.08	0.08	0.00	1
208.48	Overtopping	0.77	0.77	0.00	Overtopping

Rating Curve Plot for Crossing: Crossing 2



Culvert Data: OnRamp Culvert West 800mm

Culvert Notes:

Table 2 - Culvert Summary Table: OnRamp Culvert West 800mm

Disc harg e Nam es	Total Disc harg e (cms)	Culv ert Disc harg e (cms)	Head water Eleva tion (m)	Inle t Con trol Dep th (m)	Out let Con trol Dep th (m)	Fl o w Ty pe	Nor mal Dep th (m)	Crit ical De pth (m)	Ou tle t De pth (m)	Tail water r Dept h (m)	Outl et Vel ocit y (m/ s)	Tail water r Velo city (m/s)
10- year	0.05 cms	0.05 cms	208.0 9	0.18	0.44 7	1- S1 f	0.08	0.1 3	0.8 0	1.29	0.10	0.00
100-	0.08	0.08	208.0	0.22	0.44	1-	0.10	0.1	0.8	1.29	0.15	0.00

year	cms	cms	9	9	S1 f	6	0
------	-----	-----	---	---	---------	---	---

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

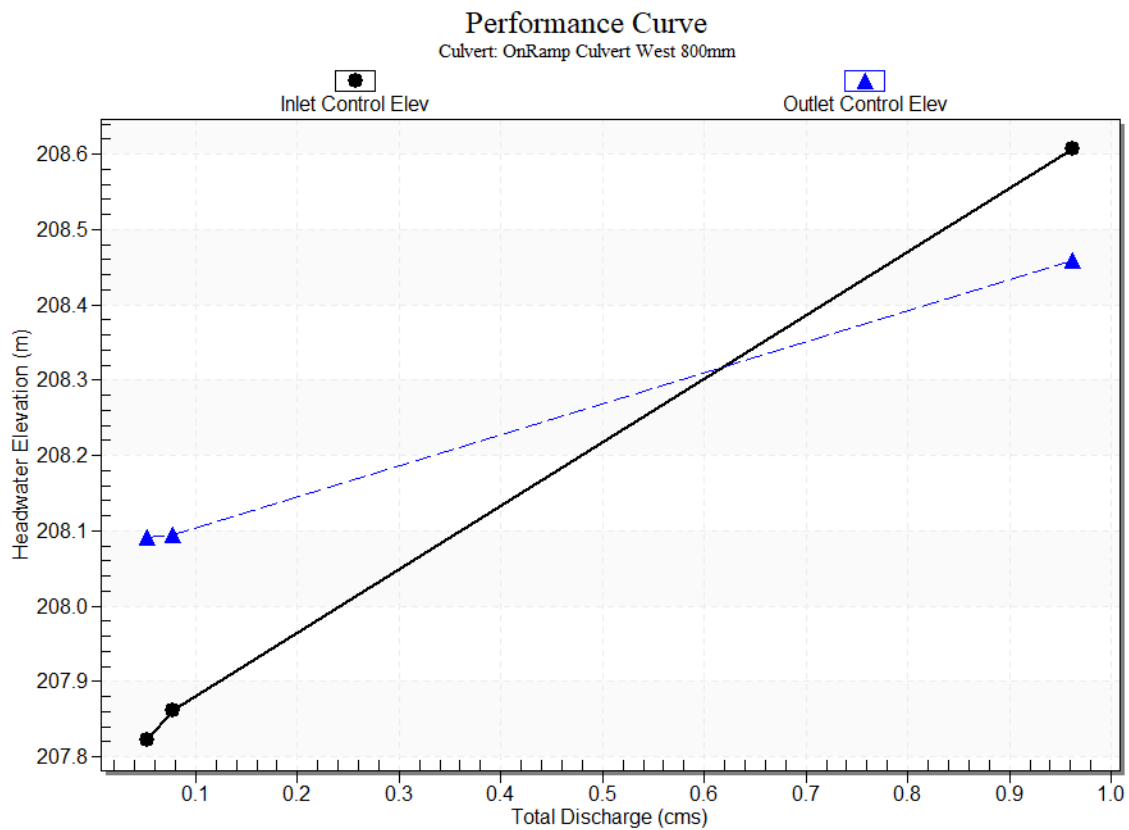
Inlet Elevation (invert): 207.65 m,

Outlet Elevation (invert): 206.80 m

Culvert Length: 28.01 m,

Culvert Slope: 0.0302

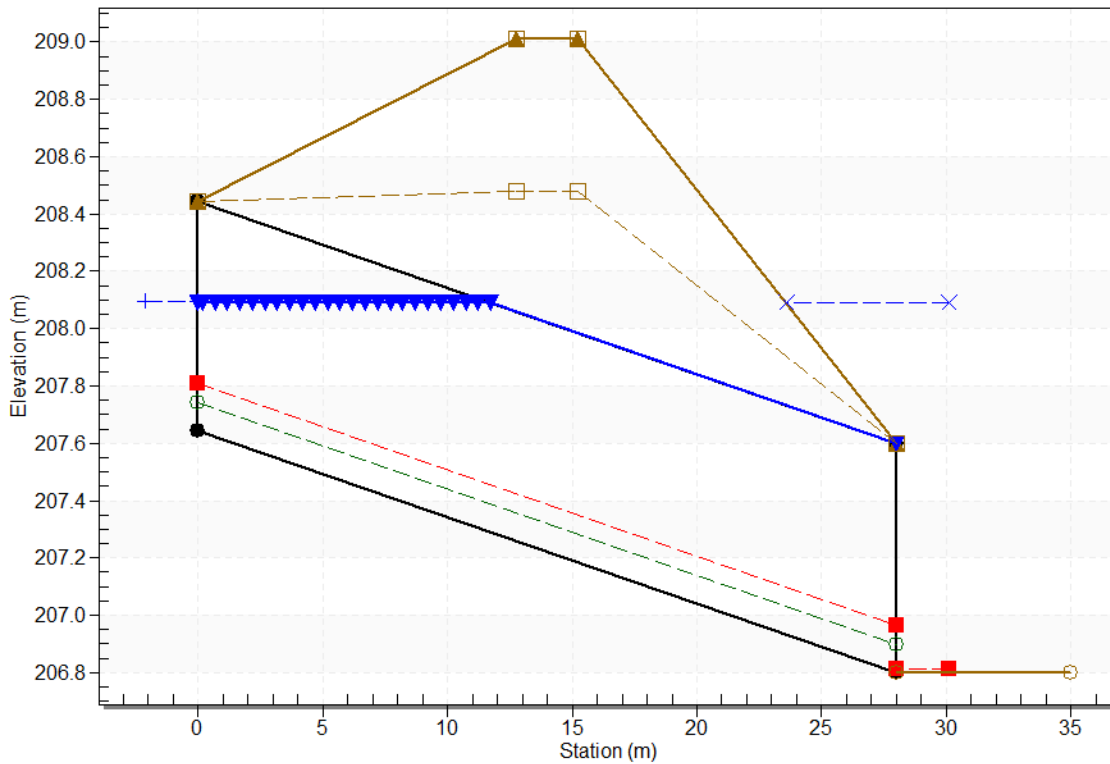
Culvert Performance Curve Plot: OnRamp Culvert West 800mm



Water Surface Profile Plot for Culvert: OnRamp Culvert West 800mm

Crossing - Crossing 2, Design Discharge - 0.08 cms

Culvert - OnRamp Culvert West 800mm, Culvert Discharge - 0.08 cms



Site Data - OnRamp Culvert West 800mm

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 m

Inlet Elevation: 207.65 m

Outlet Station: 28.00 m

Outlet Elevation: 206.80 m

Number of Barrels: 1

Culvert Data Summary - OnRamp Culvert West 800mm

Barrel Shape: Circular

Barrel Diameter: 800.00 mm

Barrel Material: Concrete

Embedment: 0.00 mm

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall ($K_e=0.5$)

Inlet Depression: None

Tailwater Data for Crossing: Crossing 2

Table 4 - Downstream Channel Rating Curve (Crossing: Crossing 2)

Flow (cms)	Water Surface Elev (m)	Depth (m)
0.05	208.09	1.29
0.08	208.09	1.29

Tailwater Channel Data - Crossing 2

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 208.09 m

Roadway Data for Crossing: Crossing 2

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section

Coord No.	Station (m)	Elevation (m)
0	12.88	209.01
1	18.62	208.67
2	21.12	208.48

Roadway Surface: Paved

Roadway Top Width: 2.50 m

Stormceptor®EF Sizing Report

Imbrium® Systems

ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

11/28/2025

Province:	Ontario	Project Name:	Highway 404 Ramp Extension
City:	Markham	Project Number:	65830
Nearest Rainfall Station:	TORONTO CITY	Designer Name:	Gale Ho
Climate Station Id:	6158355	Designer Company:	Gannett Flemming
Years of Rainfall Data:	20	Designer Email:	gho@gfnet.com
		Designer Phone:	226-972-5833
Site Name:	Highway 404 Ramp Extension	EOR Name:	
		EOR Company:	
Drainage Area (ha):	0.55	EOR Email:	
% Imperviousness:	100.00	EOR Phone:	###-###-####
Runoff Coefficient 'c': 0.90			

Particle Size Distribution:	CA ETV
Target TSS Removal (%):	60.0

Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	15.99
Oil / Fuel Spill Risk Site?	No
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	138.00
Influent TSS Concentration (mg/L):	200
Estimated Average Annual Sediment Load (kg/yr):	438
Estimated Average Annual Sediment Volume (L/yr):	356

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EF4	56
EF6	62
EF8	65
EF10	68
EF12	69

Recommended Stormceptor EF Model: **EF6**
Estimated Net Annual Sediment (TSS) Load Reduction (%): **62**
Water Quality Runoff Volume Capture (%): **> 90**

Stormceptor® EF Sizing Report

THIRD-PARTY TESTING AND VERIFICATION

► **Stormceptor® EF and Stormceptor® EFO** are the latest evolutions in the Stormceptor® oil-grit separator (OGS) technology series, and are designed to remove a wide variety of pollutants from stormwater and snowmelt runoff. These technologies have been third-party tested in accordance with the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators** and performance has been third-party verified in accordance with the **ISO 14034 Environmental Technology Verification (ETV)** protocol.

PERFORMANCE

► **Stormceptor® EF and EFO** remove stormwater pollutants through gravity separation and floatation, and feature a patent-pending design that generates positive removal of total suspended solids (TSS) throughout each storm event, including high-intensity storms. Captured pollutants include sediment, free oils, and sediment-bound pollutants such as nutrients, heavy metals, and petroleum hydrocarbons. Stormceptor is sized to remove a high level of TSS from the frequent rainfall events that contribute the vast majority of annual runoff volume and pollutant load. The technology incorporates an internal bypass to convey excessive stormwater flows from high-intensity storms through the device without resuspension and washout (scour) of previously captured pollutants. Proper routine maintenance ensures high pollutant removal performance and protection of downstream waterways.

PARTICLE SIZE DISTRIBUTION (PSD)

► The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a wide range of particle sizes in the sand and silt fractions, and is considered reasonably representative of the particle size fractions found in typical urban stormwater runoff.

Particle Size (µm)	Percent Less Than	Particle Size Fraction (µm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

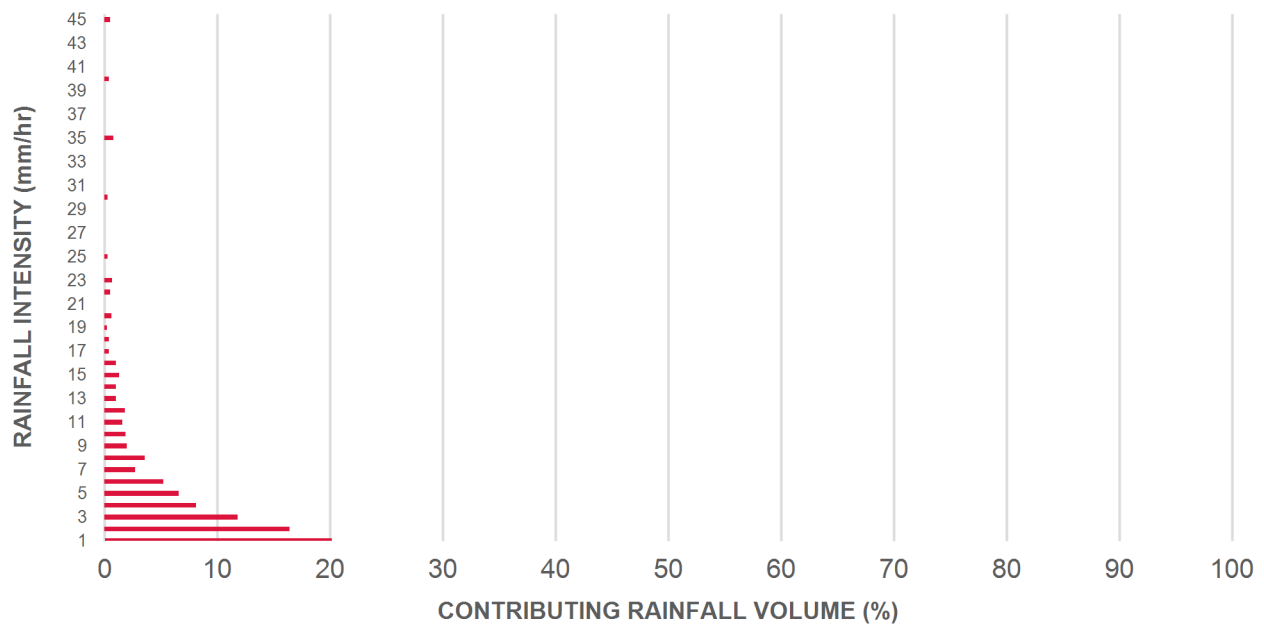
Stormceptor®EF Sizing Report

Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
0.50	8.7	8.7	0.69	41.0	16.0	70	6.1	6.1
1.00	20.2	28.9	1.38	83.0	31.0	70	14.2	20.4
2.00	16.4	45.3	2.75	165.0	63.0	67	11.0	31.4
3.00	11.8	57.1	4.13	248.0	94.0	63	7.4	38.8
4.00	8.1	65.2	5.50	330.0	126.0	61	4.9	43.8
5.00	6.6	71.9	6.88	413.0	157.0	58	3.9	47.6
6.00	5.2	77.1	8.26	495.0	188.0	56	2.9	50.5
7.00	2.7	79.8	9.63	578.0	220.0	53	1.4	51.9
8.00	3.6	83.4	11.01	661.0	251.0	53	1.9	53.8
9.00	2.0	85.4	12.38	743.0	283.0	52	1.0	54.9
10.00	1.9	87.3	13.76	826.0	314.0	51	1.0	55.8
11.00	1.6	88.9	15.14	908.0	345.0	50	0.8	56.6
12.00	1.8	90.7	16.51	991.0	377.0	49	0.9	57.5
13.00	1.0	91.6	17.89	1073.0	408.0	48	0.5	58.0
14.00	1.0	92.7	19.27	1156.0	440.0	48	0.5	58.5
15.00	1.3	93.9	20.64	1238.0	471.0	47	0.6	59.1
16.00	1.0	95.0	22.02	1321.0	502.0	47	0.5	59.6
17.00	0.4	95.3	23.39	1404.0	534.0	47	0.2	59.7
18.00	0.4	95.7	24.77	1486.0	565.0	46	0.2	59.9
19.00	0.2	95.9	26.15	1569.0	596.0	46	0.1	60.0
20.00	0.6	96.5	27.52	1651.0	628.0	46	0.3	60.3
21.00	0.0	96.5	28.90	1734.0	659.0	46	0.0	60.3
22.00	0.5	97.0	30.27	1816.0	691.0	46	0.2	60.5
23.00	0.7	97.7	31.65	1899.0	722.0	45	0.3	60.8
24.00	0.0	97.7	33.03	1982.0	753.0	45	0.0	60.8
25.00	0.3	98.0	34.40	2064.0	785.0	45	0.1	60.9
30.00	0.3	98.3	41.28	2477.0	942.0	44	0.1	61.1
35.00	0.8	99.1	48.16	2890.0	1099.0	45	0.3	61.4
40.00	0.4	99.5	55.04	3303.0	1256.0	47	0.2	61.6
45.00	0.5	100.0	61.92	3715.0	1413.0	49	0.3	61.9
Estimated Net Annual Sediment (TSS) Load Reduction =								62 %

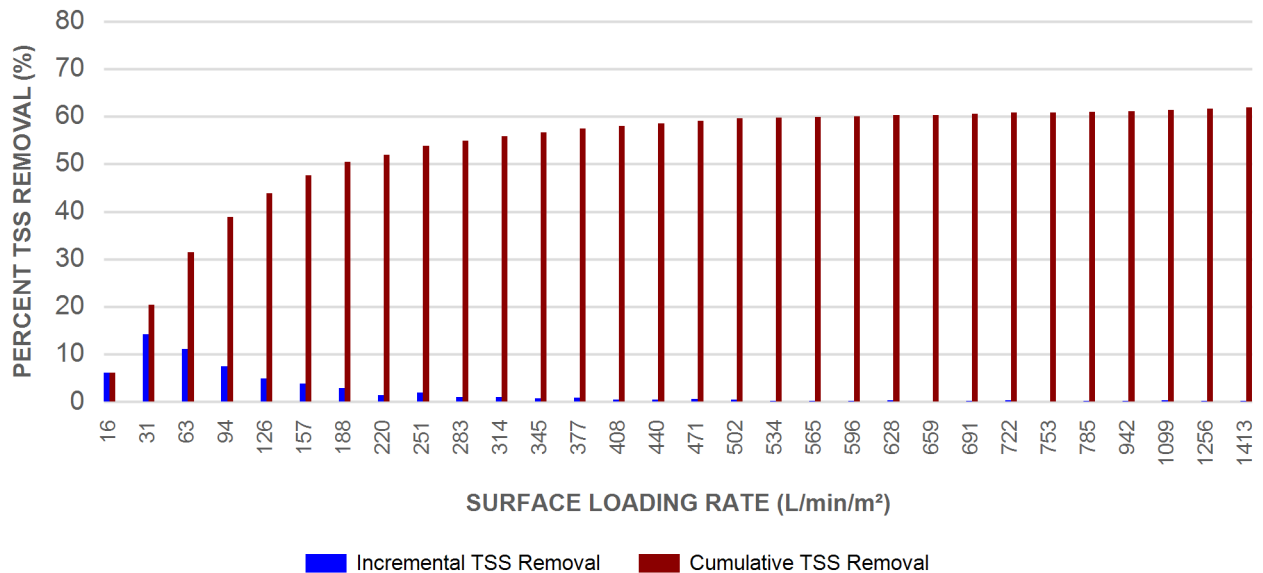
Climate Station ID: 6158355 Years of Rainfall Data: 20

Stormceptor®EF Sizing Report

RAINFALL DATA FROM TORONTO CITY RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



Stormceptor® EF Sizing Report

Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter		Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter		Max Outlet Pipe Diameter		Peak Conveyance Flow Rate	
	(m)	(ft)		(mm)	(in)	(mm)	(in)	(L/s)	(cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

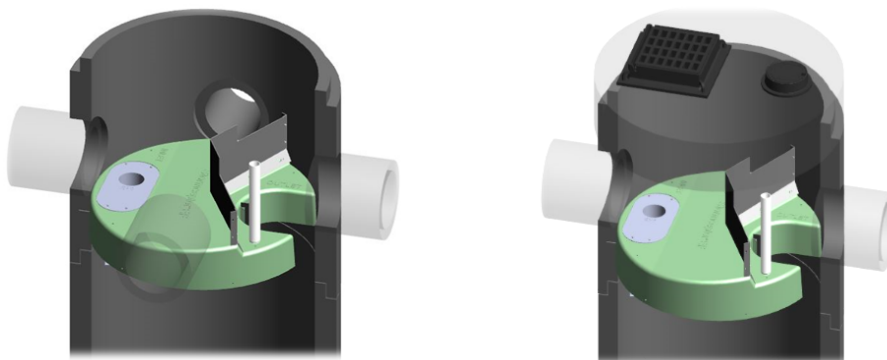
► **Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test performance has been third-party verified in accordance with the ISO 14034 ETV protocol. As a result, Stormceptor EF and EFO are approved for online installation, eliminating the need for costly additional bypass structures, piping, and installation expense.

DESIGN FLEXIBILITY

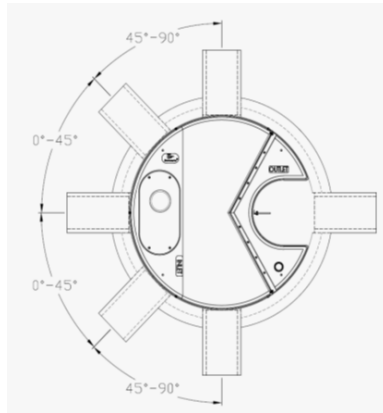
► **Stormceptor® EF and EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend angle, and can be modified to ensure performance in submerged conditions.

OIL CAPTURE AND RETENTION

► While Stormceptor® EF will capture and retain oil from dry weather spills and low intensity runoff, **Stormceptor® EFO** has demonstrated superior oil capture and greater than 99% oil retention in third-party testing according to the light liquid re-entrainment testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**. Stormceptor EFO is recommended for sites where oil capture and retention is a requirement.



Stormceptor® EF Sizing Report



INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.

0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.

45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1.

For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft³)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	2475	655	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity

** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft³)

Feature	Benefit	Feature Appeals To
Patent-pending enhanced flow treatment and scour prevention technology	Superior, verified third-party performance	Regulator, Specifying & Design Engineer
Third-party verified light liquid capture and retention for EFO version	Proven performance for fuel/oil hotspot locations	Regulator, Specifying & Design Engineer, Site Owner
Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer
Minimal drop between inlet and outlet	Site installation ease	Contractor
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner

STANDARD STORMCEPTOR EF/EFO DRAWINGS

For standard details, please visit <http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef>

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

For specifications, please visit <http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef>

Stormceptor® EF Sizing Report

Table of TSS Removal vs Surface Loading Rate Based on Third-Party Test Results
Stormceptor® EF

SLR (L/min/m ²)	TSS % REMOVAL	SLR (L/min/m ²)	TSS % REMOVAL	SLR (L/min/m ²)	TSS % REMOVAL	SLR (L/min/m ²)	TSS % REMOVAL
1	70	660	46	1320	48	1980	35
30	70	690	46	1350	48	2010	34
60	67	720	45	1380	49	2040	34
90	63	750	45	1410	49	2070	33
120	61	780	45	1440	48	2100	33
150	58	810	45	1470	47	2130	32
180	56	840	45	1500	46	2160	32
210	54	870	45	1530	45	2190	31
240	53	900	45	1560	44	2220	31
270	52	930	44	1590	43	2250	30
300	51	960	44	1620	42	2280	30
330	50	990	44	1650	42	2310	30
360	49	1020	44	1680	41	2340	29
390	48	1050	45	1710	40	2370	29
420	48	1080	45	1740	39	2400	29
450	48	1110	45	1770	39	2430	28
480	47	1140	46	1800	38	2460	28
510	47	1170	46	1830	37	2490	28
540	47	1200	47	1860	37	2520	27
570	46	1230	47	1890	36	2550	27
600	46	1260	47	1920	36	2580	27
630	46	1290	48	1950	35	2600	26

Stormceptor® **EF** Sizing Report**STANDARD PERFORMANCE SPECIFICATION FOR
“OIL GRIT SEPARATOR” (OGS) STORMWATER QUALITY TREATMENT DEVICE****PART 1 – GENERAL****1.1 WORK INCLUDED**

This section specifies requirements for selecting, sizing, and designing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, with third-party testing results and a Statement of Verification in accordance with ISO 14034 Environmental Management – Environmental Technology Verification (ETV).

1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental management – Environmental technology verification (ETV)

Canadian Environmental Technology Verification (ETV) Program’s **Procedure for Laboratory Testing of Oil-Grit Separators**.

1.3 SUBMITTALS

1.3.1 All submittals, including sizing reports & shop drawings, shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail all OGS components, elevations, and sequence of construction.

1.3.2 Alternative devices shall have features identical to or greater than the specified device, including: treatment chamber diameter, treatment chamber wet volume, sediment storage volume, and oil storage volume.

1.3.3 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be signed and sealed by a local registered Professional Engineer, based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record.

PART 2 – PRODUCTS**2.1 OGS POLLUTANT STORAGE**

The OGS device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The **minimum** sediment & petroleum hydrocarbon storage capacity shall be as follows:

2.1.1	4 ft (1219 mm) Diameter OGS Units:	1.19 m ³ sediment / 265 L oil
	6 ft (1829 mm) Diameter OGS Units:	3.48 m ³ sediment / 609 L oil
	8 ft (2438 mm) Diameter OGS Units:	8.78 m ³ sediment / 1,071 L oil
	10 ft (3048 mm) Diameter OGS Units:	17.78 m ³ sediment / 1,673 L oil
	12 ft (3657 mm) Diameter OGS Units:	31.23 m ³ sediment / 2,476 L oil

PART 3 – PERFORMANCE & DESIGN**3.1 GENERAL**

Stormceptor®EF Sizing Report

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing of the OGS shall be determined by use of a minimum ten (10) years of local historical rainfall data provided by Environment Canada. Sizing shall also be determined by use of the sediment removal performance data derived from the ISO 14034 ETV third-party verified laboratory testing data from testing conducted in accordance with the Canadian ETV protocol Procedure for Laboratory Testing of Oil-Grit Separators, as follows:

3.2.1 Sediment removal efficiency for a given surface loading rate and its associated flow rate shall be based on sediment removal efficiency demonstrated at the seven (7) tested surface loading rates specified in the protocol, ranging 40 L/min/m² to 1400 L/min/m², and as stated in the ISO 14034 ETV Verification Statement for the OGS device.

3.2.2 Sediment removal efficiency for surface loading rates between 40 L/min/m² and 1400 L/min/m² shall be based on linear interpolation of data between consecutive tested surface loading rates.

3.2.3 Sediment removal efficiency for surface loading rates less than the lowest tested surface loading rate of 40 L/min/m² shall be assumed to be identical to the sediment removal efficiency at 40 L/min/m². No extrapolation shall be allowed that results in a sediment removal efficiency that is greater than that demonstrated at 40 L/min/m².

3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m² shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m², and shall be calculated using a simple proportioning formula, with 1400 L/min/m² in the numerator and the higher surface loading rate in the denominator, and multiplying the resulting fraction times the sediment removal efficiency at 1400 L/min/m².

The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

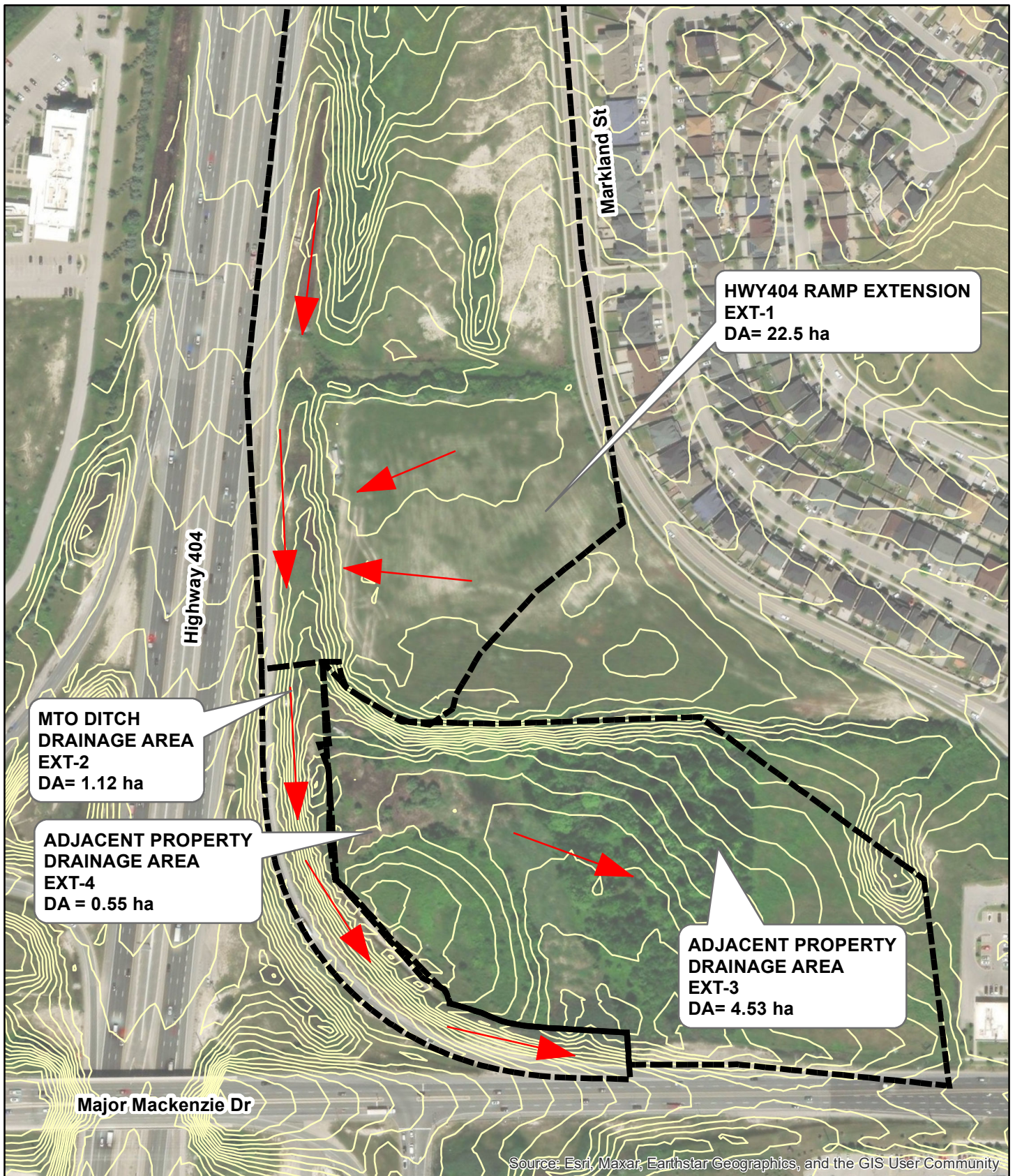
3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators**.

3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m².

APPENDIX D

CATCHMENT PLANS

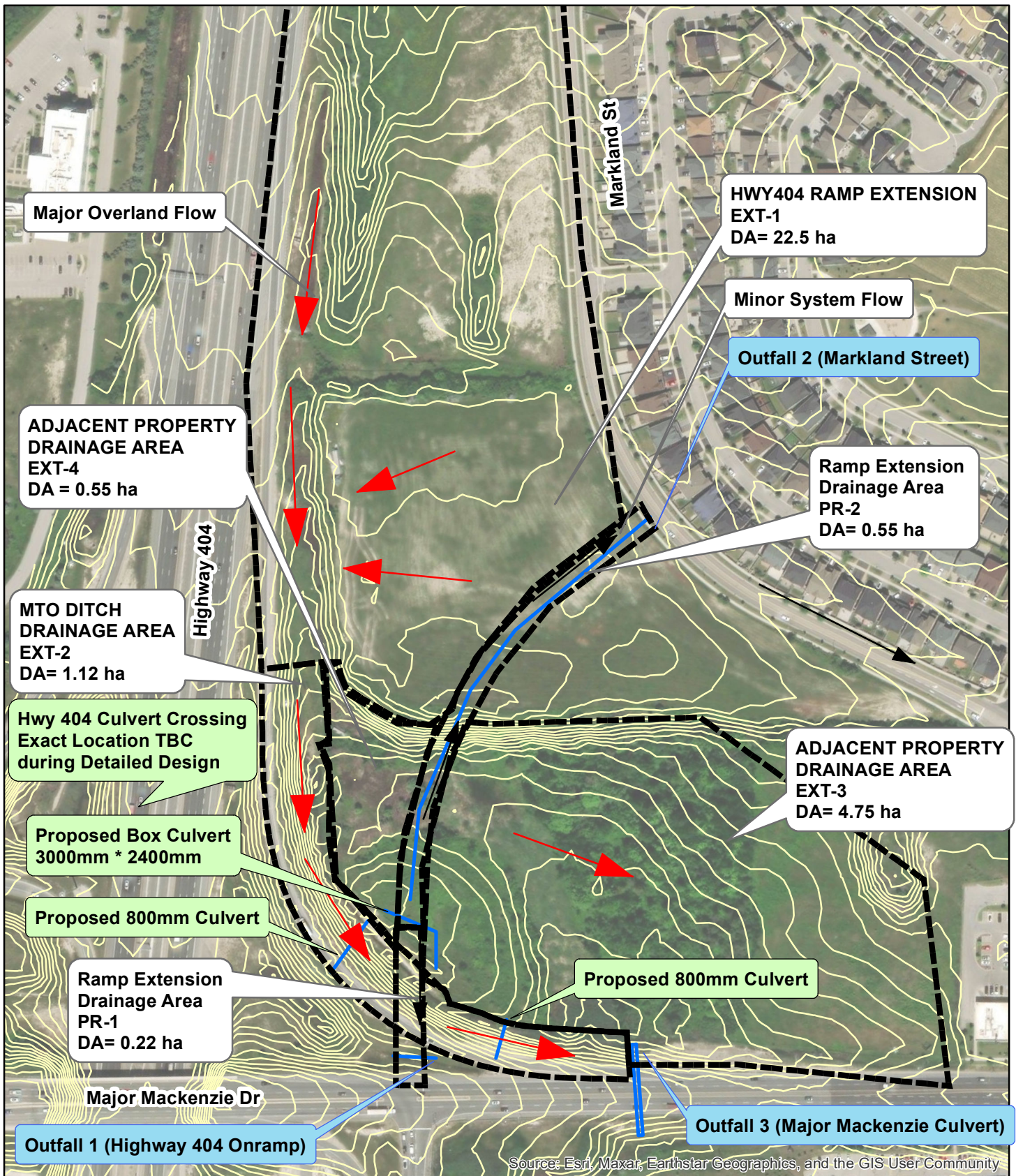


DRAWN BY:	N/A
DISCIP. ENGR.	N/A
SCALE:	1 cm = 30 m



Ramp Extension

DRAWING NO.	Highway 404 - Underpass DAP	REV.	0
-------------	-----------------------------	------	---



DRAWN BY:	N/A
DISCIP. ENGR.	N/A
SCALE:	1 cm = 30 m



**GANNETT
FLEMING**

Ramp Extension

DRAWING NO.	Highway 404 - Underpass DAP	REV.	0
-------------	-----------------------------	------	---