Appendix G

Drainage and Stormwater Management Report

Mayfield Road From Chinguacousy Road to Heart Lake Road Schedule C Class Environmental Assessment

Final Drainage and Stormwater Management Report

August 2014

Prepared for:
Region of Peel
10 Peel Centre Drive, Suite A and B
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Project No. 101-17262-00

GENIVAR

101-17262-00

29 August 2014

Mr. Neal Smith, Project Manager

Region of Peel
10 Peel Centre Drive
Suite A and B
Brampton, Ontario
L6T 4B9

Re: Mayfield Road From Chinguacousy Road to Heart Lake Road
Schedule C Class Environmental Assessment

Regional Municipality of Peel

Final Drainage and Stormwater Management Report

Dear Mr. Smith:

We are pleased to submit the Final Drainage and Stormwater Management Report for the above noted project.

If you have any questions, please contact the undersigned at (905) 475-8727 ext. 18685 or Sherif Iskandar (905) 475-8727 ext 18250.

Yours truly,

GENIVAR Inc

For.

Sherif Adly

William Heywood, P. Eng.

Wh/

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1. Introduction

1.1 Authorization

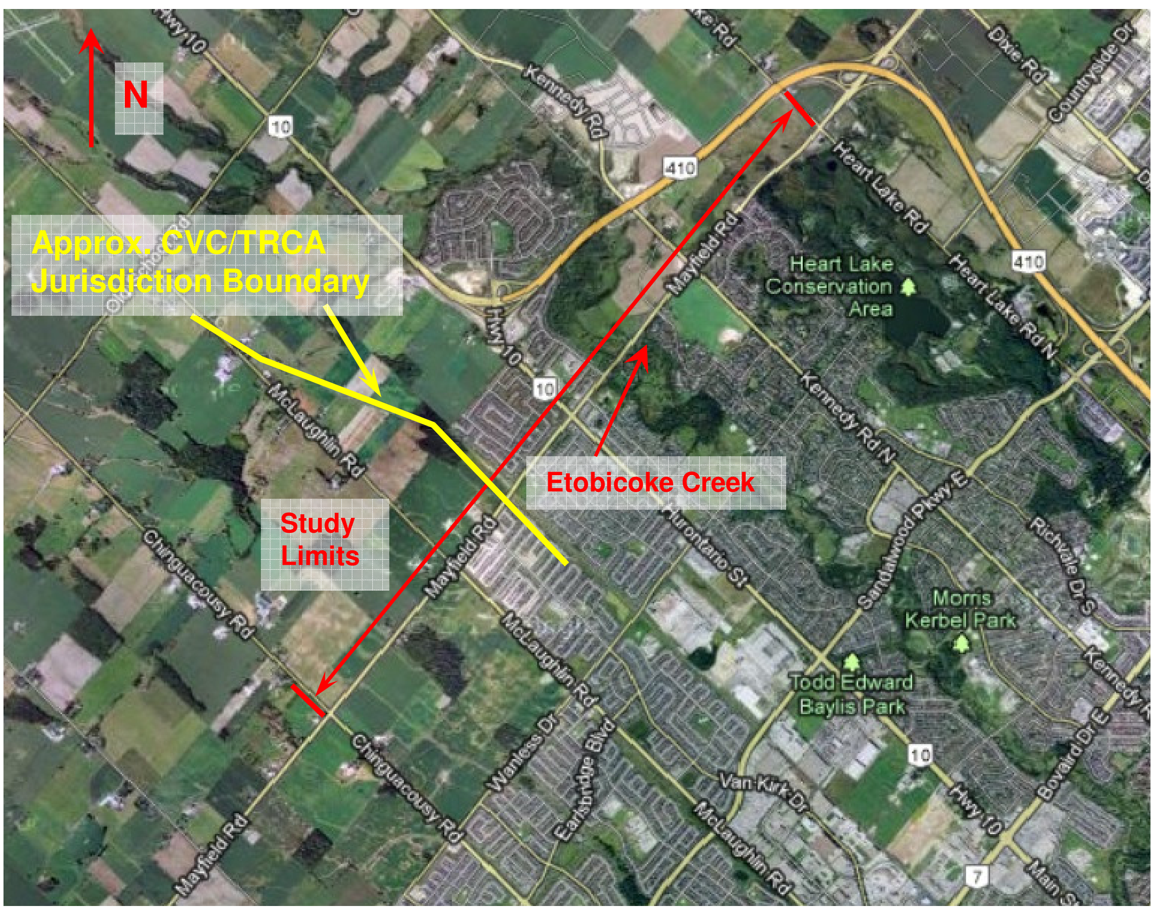
GENIVAR was retained by the Regional Municipality of Peel to undertake the Class Environmental Assessment Study for Mayfield Road from Chinguacousy Road to Heart Lake Road. The Study Area can be described as Part of Lots 17 and 18 on Concession 2 West of Centre Road, 17 and 18 on Concession 1 West of Centre Road, 17 and 18 on Concession 1 East of Centre Road and 17 and 18 on Concession 2 West of Centre Road, City of Brampton, Regional Municipality of Peel.

As part of the Class Environmental Assessment, a Drainage and Stormwater Management Study for the Mayfield Road preferred alternative was completed to assess impacts of the proposed improvement works on the drainage infrastructure elements.

1.2 Study Area

The Mayfield Road study area is located within the boundaries of the Regional Municipality of Peel and represents the boundary line between Town of Caledon and City of Brampton. The west section of the study area from Chinguacousy Road to east of the CNR Railway (railway) is under the jurisdiction of the Credit Valley Conservation Authority (CVC), while the east section of the study area from east of the railway to Heart Lake Road is under the jurisdiction of the Toronto and Region Conservation Authority (TRCA). The limits of the study area are shown in **Figure 1-1**.

Figure 1-1 Study Limits



1.3 Background

As part of the Regional Municipality of Peel transportation and roadway management strategies, future road network needs have been identified in the area of the Mayfield Road corridor from Chinguacousy Road to Heart Lake Road. Peel Region is undertaking a Class Environmental Assessment Study (Schedule "C") of Mayfield Road to assess alternatives that will address capacity and operational needs, and accommodate future adjacent land development.

The roadway improvements under investigation include widening the road to six (6) lanes with a variable width centre median. An urban roadway cross section with curb and gutter and boulevard area for sidewalk or multi-use trail will be provided in consideration of property and environmental constraints, and Regional practices. The typical cross sections for the proposed condition are included in **Appendix C**.

The purpose of this Drainage and Stormwater Management Study is to develop a stormwater management plan for the proposed Mayfield Road improvement works that will address both water quantity and quality issues by incorporating Best Management Practices (BMPs). In essence, the Stormwater Management Study has been carried out for the Mayfield Road Class Environmental Assessment from Chinguacousy Road to Heart Lake Road with the objective of minimizing the potential impacts of the proposed road widening on the natural environment and the adjacent watercourses.

1.4 Study Objectives

The objective of the drainage and stormwater management study is to develop a strategy for the project that will:

- Identify potential stormwater runoff (quality and quantity) impacts on both Fletcher Creek and Etobicoke Creek resulting from the increased paved areas under the preferred alternative;
- Address concerns from the review agencies including the Regional Municipality of Peel, The Credit Valley Conservation Authority (CVC), the Toronto and Region Conservation Authority (TRCA), Town of Caledon, City of Brampton, Ministry of Natural Resources, Ministry of Environment, as well as public interest groups and stakeholders; and
- Provide an appropriate pavement drainage system for roadway operation and safety.

In concert with the Drainage and Stormwater Management Study, preliminary drainage designs were prepared for the preferred road improvements.

2. Background Information

2.1 General

Previous studies and reports relating to hydrology, hydraulics, roadway drainage infrastructure, stormwater management, adjacent development plans, floodplain mapping and natural features were obtained from the appropriate sources and reviewed.

Peel Region has provided the relevant background information for the Mayfield Road Class EA Study within the project area.

Various agencies were contacted to obtain information relative to drainage and stormwater management within the project limits.

2.1.1 Previous Documents

- Various Contract Drawing packages provided by Region of Peel.

- “Mayfield Road, Hurontario Street to Heart Lake Road in the City of Brampton and Town of Caledon Class Environmental assessment – Environmental Study Report ” completed by Stantec Consulting Ltd. for the Region of Peel, November 2002.
- “Mount Pleasant Community Sustainable Natural Heritage System Planning - Huttonville and Fletcher’s Creeks Subwatershed Study” completed by AMEC Environment & Infrastructure for the City of Brampton, June 2011.
- “ENVIRONMENTAL IMPLEMENTATION Report - Mount Pleasant Sub-Area 51-2 within the Mount Pleasant Secondary Plan Area North West Brampton” prepared by Stonybrook Consulting Inc., Urbantech Consulting, R.J. Burnside & Associates Limited, Savanta Inc., JTB Environmental Systems, G + L Urban Planners Ltd. and STLA Inc. In December 2011.
- “Mayfield West Comprehensive Environmental Impact Study and Management Plan – Part C: Detailed Analysis and Implementation” completed by AMEC Environment & Infrastructure for the Town of Caledon, November 2012.
- “Mayfield Road Development at Kennedy Road Stormwater Management Design Brief, City of Brampton, Town of Caledon” completed by Stantec Consulting Ltd. for the Toronto and Region Conservation Authority, December 2007.“Mayfield Road Development at Heart Lake Road Stormwater Management Design Brief, City of Brampton, Town of Caledon” completed by Stantec Consulting Ltd. for the Toronto and Region Conservation Authority, November 2007.
- HEC-RAS Hydraulic Model for the Etobicoke Creek Watershed provided by TRCA.

2.2 Land Use

The western portion of the Study Area between Chinguacousy Road and McLaughlin Road is predominantly farmland with a number of small water courses crossing Mayfield Road at various locations.

The section of Mayfield Road between McLaughlin Road and Hurontario Street is predominantly residential, with pockets of agricultural fields to the northwest. A railway line crosses Mayfield Road at approximately Station 9+310 (new chainage).

The most notable feature of the section of Mayfield Road between Hurontario Street and Kennedy Road is the Etobicoke Creek and associated valley lands. Although the general area is predominantly residential or agricultural land, the Etobicoke Creek valley lands support native lowland forest and marsh wetland communities.

Between Kennedy Road and Heart Lake Road, there is a residential pocket on the south west section, while the remaining lands are rural. Two existing stormwater management ponds are located respectively on the north east corner of Mayfield Road and Kennedy Road and on the south west corner of Mayfield Road and Heart Lake Road.

3. Summary of Mayfield Road Drainage Field Investigation

3.1 Crossing Culverts within the Study Limits

Based on the conducted field investigation, conditions of the crossing culverts were assessed and summarized as presented in **Table 3-1**, while photos inventory for each crossing culvert is included in **Appendix A1.**

The crossing culvert recommendations presented in Table 3-1 are preliminary and based only on the field observations. Final culvert recommendations will be based on the overall proposed drainage scheme for Mayfield Road as well as on the Town of Caledon/City of Brampton Preferred Framework Plans.

It has to be noted that the station numbers shown in **Table 3-1** and **Table 3-2** include both the old and new station numbering systems. (old station numbers were used for the Culvert Inspection Report, while new station numbers are used for this current analysis and report). Future station references in both text and tables will only reference the updated (new) chainage.

Table 3-1: Crossing Culverts Inventory and Observations/Recommendations

Crossing Culvert ID	Approx. Station (Old)	Approx. Station (New)	Size wxh (mm) /Material	Approx. Depth of Fill (m)	Observations/Condition	Preliminary Recommendations
C1	10+180	7+348	750 PVC	1.2	New culvert in place – good condition. (Photos 1 and 2)	No action required
C2	10+610	7+778	600 PVC	1.1	New culvert in place – good condition. (Photos 3 and 4)	No action required
C3	10+695	7+863	900 PVC	1.3	New culvert in place – good condition. (Photos 5 and 6)	No action required
C4	11+080	8+248	600 PVC	0.6	New culvert in place – good condition. Culvert is on approximately 45o skew. (Photos 7 and 8)	No action required
C5	11+260	8+428	750 PVC	0.8	New culvert in place – good condition. (Photos 9 and 10)	No action required
C6	11+400	8+568	800 CSP	1.3	North end: good condition (Photos 11 and 12) South end: rusted and submerged (Photo 13)	Regrade ditch at the south end. Clean out south end and reassess conditions.
C7	11+740	8+908	North end: 500 CSP South end: 600 Conc.	0.8	North end: Poor condition, culvert rusted and bottom separated (Photos 14 and 15) South end: Good condition, newly installed 600mm concrete pipe with concrete headwall and stone wing walls (Photo 16) Two ditch inlets were observed that are connected to the culvert south side. The ditch inlets are in good conditions (photos 47 and 48).	Replace the north section (CSP) of the culvert.

Crossing Culvert ID	Approx. Station (Old)	Approx. Station (New)	Size wxh (mm) /Material	Approx. Depth of Fill (m)	Observations/Condition	Preliminary Recommendations
C8	11+780	8+948	North end: 1300 x 900 CSPA South end: 3.05 x 1.50 Conc. Box with open bottom.	1.2	North end: Material is in good condition; however culvert is deformed and settled at mid length (Photos 17 and 18). South end: Good condition, newly installed concrete box section with concrete headwall and stone wing walls (Photos 19 and 20).	Replace the north section (CSPA) of the culvert.
C9	11+970	9+138	500 CSP	0.8	Culvert is in poor condition at both ends, heavy rusted and bottom broken (Photos 21 to 24).	Replace culvert.
C10	12+090	9+258	600 CSP	0.8	North end: Poor condition with bottom broken (Photos 25 and 26). South end: Buried and not assessed. It was noted that a storm MH exists at the south end location (Photo 27).	Culvert is abandoned – no action required. (to be confirmed with Region of Peel)
C11	12+160	9+328	500 CSP	0.4	Culvert is in poor condition at both ends, heavy rusted and bottom broken (Photos 28 to 31).	Replace culvert.
C12	12+200	9+368	500 CSP	0.6	North end: Poor condition with top broken and heavy rusted inside (Photos 32 and 33). South end: 90% silted and not assessed, however the culvert top is rusted (Photo 34).	Replace culvert and clean out ditch at south end.
C13	12+510	9+678	800 CSP	1.4	Culvert is in poor condition at both ends, heavy rusted and bottom broken (Photos 35 to 38). Ditch inlet (DI4) was located just south of the culvert south end (Photo 50).	Replace culvert.

Crossing Culvert ID	Approx. Station (Old)	Approx. Station (New)	Size wxh (mm) /Material	Approx. Depth of Fill (m)	Observations/Condition	Preliminary Recommendations
C14 (Etobicoke Creek Bridge)	13+485	10+653			Bridge is in good condition (Photos 39 and 40).	No action required
C15	14+250	11+418	700 PVC	1.1	New culvert in place – good condition (Photos 41 and 42).	No action required
C16	15+180	12+348	1100 Steel pipe	8.0	Culvert is in fair condition at both ends with minor rust inside (Photos 43 to 46).	No action required

3.2 Other Drainage Elements within the Study Limits

As the Mayfield Road section from just west of Hurontario Street to Heart Lake Road has an urban cross section, catch basins were observed on both sides for this section of the Mayfield Road. All catch basins were found in good conditions.

Scattered ditch inlets were located at different locations on both sides of the Mayfield Road. A list of the located ditch inlets and conditions is presented in **Table 3-2**, while photos inventory for these ditch inlets is included in **Appendix A2.**

It was noted that two Storm Ceptors are installed at the storm sewer system outlets located on both sides of the Etobicoke Creek Crossing on the south side of Mayfield Road**. Five (5) existing** stormwater management (SWM) ponds are also located within the study limits. They are located north of Mayfield Road on both sides of Etobicoke Creek, on the northeast quadrant of Mayfield Road and Kennedy Road intersection and on the northwest and southwest quadrants of Mayfield Road and Heart Lake Road intersection. The stormwater pond in the southwest quadrant of Mayfield Road and Heart Lake Road intersection is located on TRCA property within the Heart Lake Conservation Area.

Table 3-2: Ditch Inlet Locations and Observations

Ditch Inlet ID	Approx. Station (Old)	Approx. Station (New)	Size wxh (mm)	Observations/Condition	Preliminary recommendations
DI1	11+735 rt	8+903 rt	600x600	New ditch inlet – good condition (Photo 47).	No action required
DI2	11+745 rt	8+913 rt	600x600	New ditch inlet – good condition (Photo 48).	No action required
DI3	12+040 rt	9+208 rt	1300x600	New ditch inlet – good condition (Photo 49).	No action required
DI4	12+510 rt	9+678 rt	600x600	Good condition (Photo 50).	No action required
DI5	13+800 lt	10+968 lt	Twin 1300x600	New ditch inlet – good condition (Photo 51).	No action required
DI6	13+820 lt	10+988 lt	600x600	New ditch inlet – good condition (Photo 52).	No action required

Ditch Inlet ID	Approx. Station (Old)	Approx. Station (New)	Size wxh (mm)	Observations/Condition	Preliminary recommendations
DI7	15+560 rt	12+728 rt	1300x600	New ditch inlet – good condition (Photo 53).	No action required
DI8	15+575 lt	12+743 lt	1300x600	New ditch inlet – good condition (Photo 54).	No action required
DI9	15+600 lt	12+768 lt	600x600	New ditch inlet – good condition	No action required

3.3 Existing Roadway Drainage Conditions

The study area covers a distance of approximately 5.5 km along Mayfield Road from Chinguacousy Road to Heart Lake Road.

From Chinguacousy Road to approximately 170m west of Hurontario Street, the typical existing cross section of Mayfield Road is a rural cross section consisting of one lane in each direction. This section of Mayfield Road drainage system consists primarily of ditches, entrance and sideroad culverts located on both sides of the road capturing runoff and conveying the flow to the crossing culverts located at different locations and then to the watercourses.

From approximately 170m west of Hurontario Street to approximately 600m west of Heart Lake Road, the typical existing cross section of Mayfield Road is an urban cross section consisting of two lanes in each direction. It has to be noted that the Etobicoke Creek Bridge was recently built and the bridge has an urban cross section consisting of three lanes in each direction. The existing Mayfield Road drainage system consists primarily of catch basins located on both sides of the road capturing runoff to the existing storm sewer systems. Four existing storm outlets were identified as follows:

- 975 mm concrete storm outlet at approximately Sta. 10+330 RT.
- 525 mm concrete storm outlet at approximately Sta. 10+620 RT (west of Etobicoke Creek)
- 675 mm concrete storm outlet at approximately Sta. 10+720 RT (east of Etobicoke Creek)
- 825 mm concrete storm outlet at approximately Sta. 11+480 LT

From approximately 600m west of Heart Lake Road to the east limit of the study area, the typical existing cross section of Mayfield Road is an urban cross section consisting of three lanes in each direction. The existing Mayfield Road drainage system consists primarily of catch basins located on both sides of the road capturing runoff to the existing storm sewer system and outleting to the SWM ponds located on the southwest quadrants of Mayfield Road and Heart Lake Road intersection.

4. Mayfield Road Future Drainage Conditions

4.1 From Chinguacousy Road to the Railway Crossing

4.1.1 Crossing Culverts

According to the “Mayfield West Comprehensive Environmental Impact Study and Management Plan – Part C: Detailed Analysis and Implementation” Study completed by AMEC Environment & Infrastructure for the Town of Caledon, November 2012, it was recommended to install six (6) stormwater management ponds just north of Mayfield Road between Chinguacousy Road and the railway crossing. The report also stated that the design volumes of the proposed SWM ponds accounted for the future Mayfield Road widening. The proposed road profile and the storm sewer networks were designed to allow for the storm sewer outlets to discharge to the SWM ponds and achieve the water quantity and quality control required, as a result of the proposed road widening and the expected increase in flow rates.

Based on the information provided by Laura Koyanagi, Water Resources Analyst and Project Manager at The Municipal Infrastructure Group Ltd. (TMIG), it was concluded that the Fletcher Creek Tributaries located between Chinguacousy Road and the Railway Crossing will be combined north of Mayfield Road and reduced to five (5) crossings, while the remaining existing crossing culverts are recommended to be abandoned as shown in **Table 4-1**.

Table 4-1: Proposed Water Crossings from Chinguacousy Road to the Railway Crossing

Existing Crossing Culvert ID	Approx. Station (New)	Existing Size wxh (mm) /Material	Recommended Size wxh (mm)	Preliminary Crossing Invert Elevation (m)
C1	7+348	750 PVC	1200	253.38
C2	7+778	600 PVC	To be abandoned	
C3	7+863	900 PVC	4 - 6m span X 1.5m height (Terrestrial crossing with open bottom)	253.38
C4	8+248	600 PVC	To be abandoned	
C5*	8+428	750 PVC	1200	254.31
C6	8+568	800 CSP	To be abandoned	
C7	8+908	North end: 500 CSP South end: 600 Conc.	To be abandoned	
C8	8+948	North end: 1300 x 900 CSPA South end: 3.05 x 1.50 Conc. Box with open bottom.	Culvert to remain and extended as required	254.33
C9	9+138	500 CSP	To be abandoned	
C10**	9+258	600 CSP	2.4 X 1.2 Box culvert	252.01

* *The crossing culvert C5 as proposed by The Municipal Infrastructure Group Ltd. (TMIG) would have a diameter of 1200mm and approx. invert elevation at 254.31m. This would result in conflict in elevations between C5 and the proposed storm sewer network at this location. To avoid this conflict, it is recommended to lower the proposed culvert C5 invert elevation to 254.00m. If lowering C5 invert elevation is not a valid option, then proposing twin crossing culverts each of 900mm diameter (instead of single 1200mm) would resolve the elevations conflict.*

** *The existing C10 (600mm CSP at Station 9+258) will be abandoned and replaced with a new 2400x1200mm box culvert at Station 9+278.*

4.1.2 Preliminary Storm Sewer Design

Between the Chinguacousy Road and the railway crossing, the Mayfield Road profile is quite flat and suitable for a rural cross section. However, for the proposed urban cross section with catch basins and storm sewer network, it was necessarily to adjust the road profile to create a positive drainage scheme.

This scheme will direct runoff towards the catch basins and accommodate a storm sewer network that conveys flow to the proposed outlet locations.

The Town of Caledon IDF Curves (a copy is attached in **Appendix B**) were obtained and utilized to carry out the preliminary storm sewer design. Based on the design criteria, the storm sewer networks were designed to convey flow values generated from the 10 year storm event, however, at sag locations, the pipe segments were sized to convey the 100 year storm event to avoid surface surcharge/ponding at the sag locations.

Catchment areas were delineated at each manhole and the proposed Mayfield cross sections (Attached in **Appendix C**) were utilized to calculate each catchment area. The minimum initial time of concentration (inlet time) were selected as 10 minutes. The weighted average runoff coefficient was calculated for each catchment area.

Between the Chinguacousy Road and the railway crossing, seven (7) storm sewer networks were designed and the location of each storm sewer network outlet was selected to discharge to one of the proposed six (6) stormwater management ponds according to the "Mayfield West Comprehensive Environmental Impact Study and Management Plan – Part C: Detailed Analysis and Implementation" Study. The preliminary storm sewer network design spread sheet is included in **Appendix D**.

Since the proposed roadway will consist of an urban cross section, the existing driveway culverts running parallel to Mayfield Road will be removed as a result of the road widening.

Table 4-2 presents a summary of the proposed minor system configurations between the Chinguacousy Road and the railway crossing**.**

Table 4-2 Summary of Proposed Minor System Configurations for Mayfield Road between the Chinguacousy Road and the Railway Crossing

From Station to Station	Description	Outlet Locations
Sta. 7+208 to Sta. 7+390	Roadway drainage for this section will be collected by catch basins and conveyed by storm sewer network to Outlet 1.	Outlet 1 is located at approximately Station 7+320 and will discharge on the north side of the roadway to a proposed SWM pond.
Sta. 7+390 to Sta. 7+900	Roadway drainage for this section will be collected by catch basins and conveyed by storm sewer network to Outlet 2.	Outlet 2 is located at approximately Station 7+760 and will discharge on the north side of the roadway to a proposed SWM pond.
Sta. 7+900 to Sta. 8+246	Roadway drainage for this section will be collected by catch basins and conveyed by storm sewer network to Outlet 3.	Outlet 3 is located at approximately Station 8+100 and will discharge on the north side of the roadway to a proposed SWM pond.
Sta. 8+246 to Sta. 8+600	Roadway drainage for this section will be collected by catch basins and conveyed by storm sewer network to Outlet 4.	Outlet 4 is located at approximately Station 8+600 and will discharge on the north side of the roadway to a proposed SWM pond.
Sta. 8+600 to Sta. 8+930	Roadway drainage for this section will be collected by catch basins and conveyed by storm sewer network to Outlet 5.	Outlet 5 is located at approximately Station 8+760 and will discharge on the north side of the roadway to a proposed SWM pond.
Sta. 8+930 to Sta. 9+200	Roadway drainage for this section will be collected by catch basins and conveyed by storm sewer network to Outlet 6.	Outlet 6 is located at approximately Station 9+200 and will discharge on the north side of the roadway to a proposed SWM pond.
Sta. 9+200 to Sta. 9+275*	Roadway drainage for this section will be collected by catch basins and conveyed by storm sewer network to Outlet 7.	Outlet 7 is located at approximately Station 9+275 and will discharge on the north side of the roadway to a proposed SWM pond.

* between Station 9+275 and Station 9+300, runoff will be conveyed by road gutters on both sides easterly and discharged by spillways to the existing ditch lines located on the west side of the railway.

4.2 From the Railway Crossing to Heart Lake Road

4.2.1 Crossing Culverts

Based on the proposed road urban cross sections, it was decided that existing crossing culverts C12 and C13 will not be required and should be abandoned. Crossing Culvert C11 was found in poor condition based on the field investigation and should be replaced and extended as required. Crossing Culverts C15 and C16 were found in good to fair conditions and should only be extended as shown in **Table 4-3.**

Table 4-3: Proposed Water Crossings from the Railway Crossing to Heart Lake Road

Crossing Culvert ID	Approx. Station (New)	Existing Size wxh (mm) /Material	Recommended Size wxh (mm)
C11	9+328	500 CSP	Replace existing culvert with 600mm diameter and extend it as required
C12	9+368	500 CSP	To be abandoned
C13	9+678	800 CSP	To be abandoned
C14* (Etobicoke Creek Bridge)	10+653	The bridge was built to accommodate the proposed road widening and hence, no Action Required.	
C15	11+418	700 PVC	Culvert to remain and be extended as required
C16	12+348	1100 Steel pipe	Culvert to remain and be extended as required

** It has to be noted that the Etobicoke Creek Bridge (C14) at approximately Station 10+653 was recently constructed and the bridge cross section was designed to support 6 lanes width for the road cross section and hence, it was decided that the bridge cross section and profile will not be altered or impacted as a result of the Mayfield Road widening works. Accordingly, it was decided that hydraulic analysis of the existing Etobicoke Creek Bridge and/or flood line assessment of the Etobicoke Creek at Mayfield Road crossing is not required.*

4.2.2 Preliminary Storm Sewer Design

From the railway crossing to approximately 170m west of Hurontario Street, the road cross section will be changed from rural to urban cross section with catch basins and storm sewer networks to collect runoff and discharged to the sewer outlets.

From approximately 170m west of Hurontario Street to Heart Lake Road, the existing road has an urban cross section however, catch basins and manholes will need to be relocated as required to account for the proposed road widening and intersection improvements. Also, the existing storm sewer network will be replaced as it does not have adequate capacity to convey the 10 year design storm event under the proposed road widening conditions.

Table 4-4 provides a summary of the proposed minor system configurations between the railway crossing and Heart Lake Road, while the preliminary hydraulic design of the proposed storm sewer networks under the proposed road conditions is presented in **Appendix D**.

Table 4-4 Summary of Proposed Minor System Configurations for Mayfield Road between the Railway Crossing and Heart Lake Road

Station to Station	Description	Outlet Locations
Sta. 9+300 to Sta. 10+372	Roadway drainage for this section will be collected by catch basins and conveyed by storm sewer network to Outlet 8.	Outlet 8 is located at approximately Station 10+250 and will discharge on the south side of the roadway.
Sta. 10+372 to Sta. 10+630	Roadway drainage for this section will be collected by catch basins and conveyed by storm sewer network to Outlet 9.	Outlet 9 is located at approximately Station 10+617 and will discharge on the north side of the.
Sta. 10+630 to Sta. 11+213	Roadway drainage for this section will be collected by catch basins and conveyed by storm sewer network to Outlet 10.	Outlet 10 is located at approximately Station 10+720 and will discharge on the north side of the roadway.
Sta. 11+213 to Sta. 12+070	Roadway drainage for this section will be collected by catch basins and conveyed by storm sewer network to Outlet 11.	Outlet 11 is located at approximately Station 11+480 and will discharge on the north side of the roadway.
Sta. 12+070 to Sta. 12+740	Roadway drainage for this section will be collected by catch basins and conveyed by storm sewer network to Outlet 12.	Outlet 12 is located at approximately Station 12+640 and will discharge on the south side of the roadway.

5. Surface Drainage and Stormwater Management

5.1 Drainage and Stormwater Management Criteria

5.1.1 General Criteria

The increase in pavement area is expected to have a considerable impact on the overall runoff volumes In accordance with Regional Municipality of Peel, the stormwater management plan should conform to the following documents:

1. Peel Region drainage design standards and criteria.
2. MOE Stormwater Management Practices Planning and Design Manual, March 2003.
3. The Credit Valley Conservation Authority (CVC) SWM Criteria.
4. The Toronto and Region Conservation Authority (TRCA) SWM Criteria

5.1.2 Water Quantity Control Criteria

The road width will increase from 2 or 4 lanes under existing conditions to 6 lanes under future ultimate conditions and hence, the increase in pavement area is expected to have a considerable impact on the overall runoff volumes. According to CVC and TRCA criteria, it is required to control flow values from post to pre-road improvement conditions from 2 year to 100 year storm events.

5.1.3 Water Quality Control Criteria

Both CVC and TRCA require water quality controls commensurate with the maximum downstream habitat type. In this case, the Etobicoke Creek and Fletcher Creek require “Enhanced” protection (Level 1 protection). The minimum requirement is to treat the runoff of the new pavement area.

The MOE Stormwater Management Practices and Planning Manual, March 2003, provides guidance for the selection of appropriate levels of stormwater quality protection for enhanced habitats, based on 80% removal of total suspended solids (TSS).

5.2 Stormwater Management Options

The proposed Mayfield Road widening will increase the pavement area within the study limits. The increase in paved area will increase the quantity of runoff and the amount of pollutants draining to the receiving watercourses.

The list of stormwater management water quality measures that may be considered include:

1. Water Quality Inlets (Oil/Grit Separators)
2. Vegetative Facilities
   - Enhanced grassed swales
   - Filter strips
3. Infiltration Facilities
   - Infiltration basins
   - Infiltration trenches
   - Soak-away pits
4. Detention Facilities:
   - Extended detention wet ponds
   - Extended detention dry ponds
   - Extended detention wetlands

Each of these types of treatment was reviewed for application to this project.

5.2.1 "Do Nothing" Alternative

If nothing is done to mitigate these effects, the receiving watercourses may be negatively impacted with the potential for reduced stream quality, degraded aquatic habitat, and in-stream erosion. Since there are potential negative consequences associated with the "Do Nothing" alternative, it cannot be considered as a reasonable or acceptable course of action. Hence, some form of mitigation measures must be undertaken to manage the stormwater runoff from the proposed roadway improvement.

5.2.2 Water Quality Inlets (Oil/Grit Separators)

Water quality inlets, also known as oil/grit separators, combine storage chambers for sediment trapping and oil separation with drainage inlets or inflow sewers for intercepting or receiving roadway stormwater runoff. Oil/grit separators are capable of removing up to 80% of the annual sediment load when properly applied as a source control for small areas. This type of SWMP was considered feasible for this study.

5.2.3 Vegetative Facilities

Vegetative facilities treat runoff through filtration and sedimentation. With appropriate site conditions, they can provide effective treatment of sediment control. They have limited effectiveness for controlling peak flows and downstream erosion. This option was not considered a feasible option due to the limited area available within the proposed Mayfield Road Right Of Way.

5.2.4 Filter Strips

Filter strips operate through a combination of sedimentation and infiltration. Shallow flows are routed over grassed filter strips which slow down the runoff to enhance both the retention of the particulate matter and the infiltration of the runoff with its dissolved constituents. Filter strips are applicable to a rural road cross section where there are at least several meters of grassed shoulder on the side of the roadway in addition to the standard shoulder and ditch. They may also be applicable where there are highly vegetated embankments at deep valley crossings. Vegetated filter strips were not considered to be a water quality treatment option for Mayfield Road widening, since the roadway will be urbanized.

5.2.5 Enhanced Grassed Swales

Enhanced grassed swales are formed by widening the roadway ditches and installing small, porous check dams to retard the stormwater flow. The check dams slow down and detain the flow, increasing the degree of sedimentation and infiltration that occurs. The enlarged ditches provide additional storage capacity for flow retention and sediment accumulation. Due to the limited storage capacities in the ditches, the degree of flow control may be small; however, they are more effective at controlling runoff from smaller and more frequent events, which results in some erosion control benefit. The sediment storage capacity is also relatively small and may require more frequent cleaning than a detention pond. For the enhanced grassed swales to be effective at providing the desired treatment for runoff, they should be designed with a maximum of flow 0.15m^3/s for the 25mm Chicago type storm distribution and a maximum flow velocity of 0.5m/s. Enhanced grassed ditches can be created with relatively minor modifications to the standard ditches in a rural roadway section. Enhanced grassed swale was not considered to be a feasible water quality treatment option for Mayfield Road, since there is insufficient space to allow for enhanced grassed swales within the proposed road right-of-way limits.

5.2.6 Infiltration Facilities

Infiltration facilities capture runoff for infiltration to groundwater. This reduces the rates of runoff to the streams and provides a high level of treatment through the capture of both particulate and dissolved constituents. These types of facilities reduce water temperature impacts and enhance stream base flows through groundwater recharge. Since the volume of runoff to the receiving streams is reduced, these facilities also contribute to controlling downstream erosion and peak flow rates.

The disadvantage of these types of facilities is that they tend to become clogged by sediment wash-off from the roadway. As a result, the maintenance of an infiltration facility may be more frequent and more costly than other types of stormwater management. A second disadvantage is the need to protect the groundwater from contamination from chlorides and other constituents of road runoff. For these reasons, infiltration facilities were not considered for further review.

5.2.7 Stormwater Management Detention Facilities

Detention facilities operate on the basis of temporary storage of runoff to promote the removal of pollutants through sedimentation. They are generally effective at removing particulate constituents such as sediments and metals but ineffective at removing dissolved constituents such as salt. Extended detention wet ponds and constructed wetlands are considered to be effective at achieving an enhanced level of treatment for roadway runoff. Extended detention dry ponds generally do not provide this level of treatment. Detention facilities are also effective for erosion and flow quantity control. The disadvantage of these facilities is their large land requirement. In case of land constraint to construct detention facilities, super pipes (large diameter pipes) can be incorporated as part of the storm sewer network and can provide flow storage and flow quantity control.

5.3 Existing/Potential SWM Facilities within the Study Area

Within the study limits, there are number of existing/future proposed SWM facilities that can be utilized to provide flow quantity and quality control. The design capacity as well as the design elevations of these facilities should be confirmed during the detail design stage of Mayfield Road widening project.

Between Chinguacousy Road and the railway crossing, according to the “Mayfield West Comprehensive Environmental Impact Study and Management Plan – Part C: Detailed Analysis and Implementation” Study completed by AMEC Environment & Infrastructure for the Town of Caledon, November 2012, it is recommended to install six (6) stormwater management ponds just north of Mayfield Road. The report also stated that the design volumes of the proposed SWM ponds accounted for the future Mayfield Road widening. The proposed road profile and the storm sewer networks were designed to allow for the storm sewer outlets to discharge to these proposed SWM ponds and achieve the water quantity and quality control required as a result of the proposed road widening and the expected increase in flow rates.

Also, between the railway crossing and Heart Lake Road, there are four (4) existing SWM ponds that can be utilized for quantity and quality flow control. These ponds are located north of Mayfield Road on both sides of Etobicoke Creek, on the northeast quadrant of Mayfield Road and Kennedy Road intersection and on the southwest quadrant of Mayfield Road and Heart Lake Road intersection.

5.4 Pavement Areas under Existing and Proposed Road Conditions

The pavement area at each outlet under both existing and proposed road conditions was calculated to assess the impact on both water quantity and quality. **Table 5-1** presents a summary comparison of the Mayfield Road pavement area for both existing and proposed conditions.

Table 5-1 Comparison between Existing and New Paved Areas

Catchment Area ID	From Station	To Station	Length (m)	Existing condition Paved Area (ha)	Proposed condition Paved Area (ha)	Increase in Paved Area (ha)	% Increase in Paved Area Compared to the Proposed Paved Area
Catchment 1	7+208	7+390	182	0.255	0.629	0.374	147%
Catchment 2	7+390	7+900	510	0.607	1.719	1.112	183%
Catchment 3	7+900	8+246	346	0.373	1.090	0.718	193%
Catchment 4	8+246	8+600	354	0.628	1.394	0.765	122%
Catchment 5	8+600	8+920	320	0.481	0.937	0.456	95%
Catchment 6	8+920	9+200	280	0.413	0.853	0.440	107%
Catchment 7	9+200	9+300	100	0.107	0.221	0.114	107%
Catchment 8	9+300	10+370	1,070	2.553	4.448	1.895	74%
Catchment 9	10+370	10+630	260	0.840	1.238	0.398	47%
Catchment 10	10+630	11+213	583	1.870	2.726	0.856	46%
Catchment 11	11+213	12+070	857	2.948	4.585	1.637	56%
Catchment 12	12+070	12+740	670	2.189	2.387	0.198	9%
Total				**13.264**	**22.228**	**35.492**	**99%**

5.5 Preferred SWM Measures

Based on the conducted Stormwater Management analysis of all available facilities and the Mayfield Road site constraints and area limitations, the following SWM measures were selected as the preferred SWM Plan:

- For catchment areas 1 to 7 (Station 7+208 to Station 9+275), it is recommended to discharge runoff to the proposed six (6) stormwater management ponds just north of Mayfield Road between Chinguacousy Road and the railway crossing in accordance with the "Mayfield West Comprehensive Environmental Impact Study and Management Plan – Part C: Detailed Analysis and Implementation" Study.
- For the Mayfield Road section between Stations 9+275 and 9+300, the increase in flow values is not significant as this stretch is only 25 m long and hence, water quantity control for this section of Mayfield Road was not considered and can be compensated by slightly over controlling flow values discharging from proposed six (6) stormwater management ponds between Chinguacousy Road and the railway crossing. Water quality control for the road section between Stations 9+275

and 9+300 will be provided by allowing runoff to discharge to the existing grass swales located on the west side of the railway just south of Mayfield Road.

- For catchment area 8 (Station 9+300 to Station 10+370), an Oil/Grit Separator (OGS) is recommended to be installed for quality control at approximately Station 10+250. As a minimum, the Oil/Grit Separators are designed to achieve Level 1 treatment (80% TSS removal and provide treatment for 90% of the total runoff volume). The recommended OGS unit is STC 9000 (or equivalently approved) and would achieve 80% TSS removal and provide treatment for 90% of the total runoff volume. For flow quantity control of catchment area 8, super pipes with orifice plates will be incorporated as part of the storm sewer network design.

- For catchment area 9 (Station 10+370 to Station 10+630), an Oil/Grit Separator (OGS) is recommended to be installed for quality control at approximately Station 10+620. The recommended OGS unit is STC 4000 (or equivalently approved) and would achieve 85% TSS removal and provide treatment for 94% of the total runoff volume. For flow quantity control of catchment area 9, outlet 9 will be discharged to the existing SWM pond located on the north side of Mayfield Road just west of Etobicoke Creek.

- For catchment area 10 (Station 10+630 to Station 11+213), flow quality and quantity control will be achieved by discharging flow from outlet 10 to the existing SWM pond located on the north side of Mayfield Road just east of Etobicoke Creek.

- For catchment area 11 (Station 11+213 to Station 12+070), runoff will be discharged to the existing SWM pond located at the north east corner of Mayfield Road and Kennedy Road intersection. This SWM pond will provide both water quantity and quality control (control post to pre flow values control and achieve Level 1 Protection for quality control). The “Mayfield Road Development at Kennedy Road Stormwater Management Design Brief, City of Brampton, Town of Caledon” completed by Stantec Consulting Ltd. for the Toronto and Region Conservation Authority, December 2007 was reviewed and it was confirmed that the SWM pond located at the north east corner of Mayfield Road and Kennedy Road intersection was designed to accept runoff from the Mayfield Road under ultimate road widening conditions (6 lanes wide in addition to left and right turning lanes as required).

- For catchment area 12 (Station 12+070 to Station 12+740), runoff will be discharged to the existing SWM pond located at the south west corner of Mayfield Road and Heart Lake Road intersection. This SWM pond will provide both water quantity and quality control (control post to pre flow values control and achieve Level 1 Protection for quality control). The “Mayfield Road Development at Heart Lake Road Stormwater Management Design Brief, City of Brampton, Town of Caledon” completed by Stantec Consulting Ltd. for the Toronto and Region Conservation Authority, November 2007 was reviewed and it was confirmed that the SWM pond located at the south west corner of Mayfield Road and Heart Lake Road intersection was designed to accept runoff from the Mayfield Road under ultimate road widening conditions (6 lanes wide in addition to left and right turning lanes as required).

The preliminary Oil/Grit Separators and super pipe designs are included in **Appendix E**, while the approximate location of the proposed SWM facilities is presented in the drawings included in the Environmental Study Report (ESR).

6. Erosion and Sediment Control Measures during Construction

Erosion and sediment control measures should be implemented and monitored through the construction period. Construction activity should be conducted during periods that are least likely to result in in-stream impacts to downstream fish habitat.

Detailed erosion and sediment control plans will be required as part of the detailed design component for all phases of construction. The erosion and sediment control plans will be subject to review and approval by various external agencies involved in the project. These would include the Region of Peel, CVC and TRCA.

During construction, disturbances to watercourse riparian vegetation should be minimized. If riparian vegetation is removed or disturbed, erosion and sediment control measures such as silt fences, rock flow check dams and sedimentation ponds should be utilized to provide maximum protection of local and downstream aquatic resources. These measures should be maintained during construction and until disturbed areas have been stabilized with seed and mulch. Additionally, topsoil should not be stockpiled close to the watercourses, and water should not be withdrawn from these sensitive streams for construction purposes.

For works in the vicinity of watercourse culverts, standard sediment and erosion control mitigation will be provided. For any in-water works, construction should also adhere to MNR fisheries restrictions.

DFO authorization for works affecting fish and fish habitat will also be required once the detailed design has been finalized.

7. Summary and Conclusions

1. This report provides a preliminary drainage and stormwater management design for the Mayfield Road Class EA Study from Chinguacousy Road to Heart Lake Road, Regional Municipality of Peel.
2. Field investigation was completed for the study area to confirm the drainage scheme and assess conditions of the existing drainage elements.
3. From Chinguacousy Road to approximately 170m west of Hurontario Street, the existing Mayfield Road has a rural cross section consisting of one lane in each direction. From approximately 170m west of Hurontario Street to approximately 600m west of Heart Lake Road, the Mayfield Road has an urban cross section consisting of two lanes in each direction. From approximately 600m west of Heart Lake Road to the east limit of the study area, the Mayfield Road has an urban cross section consisting of three lanes in each direction. Under the future ultimate conditions, the Mayfield Road cross section within the entire study limits will include three lanes in each direction with median and multi-use sidewalks.
4. Based on the information provided by The Municipal Infrastructure Group Ltd. (TMIG), it was concluded that the Fletcher Creek Tributaries located between Chinguacousy Road and the Railway Crossing will be combined north of Mayfield Road and reduced to five (5) crossings, while the remaining existing crossing culverts are recommended to be abandoned.
5. From the railway crossing to Heart Lake Road, it was decided that crossing culvert C11 should be replaced and extended as required, existing crossing culverts C12 and C13 will not be required and should be abandonedand crossing culverts C15 and C16 should only be extended.
6. Preliminary storm sewer design was completed for the study area. Storm sewer networks are designed to convey runoff generated from storms up to 10 year storm event.
7. Stormwater management measures are recommended to achieve quantity and quality flow controls as follows:
    - For catchment areas 1 to 7, it is recommended to discharge runoff to the future six (6) stormwater management ponds just north of Mayfield Road between Chinguacousy Road and the railway crossing.
    - For catchment area 8, an Oil/Grit Separator (STC 9000 or equivalently approved) is recommended for quality control. For flow quantity control, super pipes with orifice plates will be incorporated as part of the storm sewer network design.

- For catchment area 9, an Oil/Grit Separator (STC 4000 or equivalently approved) is recommended for quality control. For flow quantity control, outlet 9 will be discharged to the existing SWM pond located on the north side of Mayfield Road just west of Etobicoke Creek.
- For catchment area 10, flow quality and quantity control will be achieved by discharging flow from outlet 10 to the existing SWM pond located on the north side of Mayfield Road just east of Etobicoke Creek.
- For catchment area 11, flow quality and quantity control will be achieved by discharging flow from outlet 11 to the existing SWM pond located at the north east corner of Mayfield Road and Kennedy Road intersection.
- For catchment area 12, flow quality and quantity control will be achieved by discharging flow from outlet 12 to the existing SWM pond located at the south west corner of Mayfield Road and Heart Lake Road intersection.

8. Detailed erosion and sediment control plans will be required as part of the detailed design component for all phases of the construction. The erosion and sediment control plans will be subject to review and approval by the various external agencies involved in the project. These would include the Region of Peel, CVC and TRCA.

Prepared by

Sherif Iskandar, P. Eng.

Reviewed by

William Heywood, P. Eng.

Appendix A

Existing Drainage Elements and Study Area Photos

Appendix A1

Existing Crossing Culvert Photos

Photo 1: Culvert C1 north end

Photo 2: Culvert C1 south end

Photo 3: Culvert C2 north end

Photo 4: Culvert C2 south end

Photo 5: Culvert C3 north end

Photo 6: Culvert C3 south end

Photo 7: Culvert C4 north end

Photo 8: Culvert C4 south end

Photo 9: Culvert C5 north end

Photo 10: Culvert C5 south end

Photo 11: Culvert C6 north end

Photo 12: Culvert C6 looking inside from the north end

Photo 13: Culvert C6 south end – 100% submerged

Photo 14: Culvert C7 north end

Photo 15: Culvert C7 looking inside from the north end

Photo 16: Culvert C7 south end

Photo 17: Culvert C8 north end

Photo 18: Culvert C8 looking inside from the north end

Photo 19: Culvert C8 south end

Photo 20: Culvert C8 looking inside from the south end

Photo 21: Culvert C9 north end

Photo 22: Culvert C9 looking inside from the north end

Photo 23: Culvert C9 south end

Photo 24: Culvert C9 looking inside from the south end

Photo 25: Culvert C10 north end

Photo 26: Culvert C10 looking inside from the north end

Photo 27: Culvert C10 south end – buried and storm MH exists

Photo 28: Culvert C11 north end

Photo 29: Culvert C11 looking inside from the north end

Photo 30: Culvert C11 south end

Photo 31: Culvert C11 looking inside from the south end

Photo 32: Culvert C12 north end

Photo 33: Culvert C12 looking inside from the north end

Photo 34: Culvert C12 south end

Photo 35: Culvert C13 north end

Photo 36: Culvert C13 looking inside from the north end

Photo 37: Culvert C13 south end

Photo 38: Culvert C13 looking inside from the south end

Photo 39: C14 - Etobicoke Creek Bridge north face

Photo 40: C14 - Etobicoke Creek Bridge south face

Photo 41: Culvert C15 north end

Photo 42: Culvert C15 south end

Photo 43: Culvert C16 north end

Photo 44: Culvert C16 looking inside from the north end

Photo 45: Culvert C16 south end

Photo 46: Culvert C16 looking inside from the south end

Appendix A2

Existing Ditch Inlet Photos

Photo 47: Ditch Inlet DI1

Photo 48: Ditch Inlet DI2

Photo 49: Ditch Inlet DI3

Photo 50: Ditch Inlet DI4

Photo 51: Twin Ditch Inlet DI5

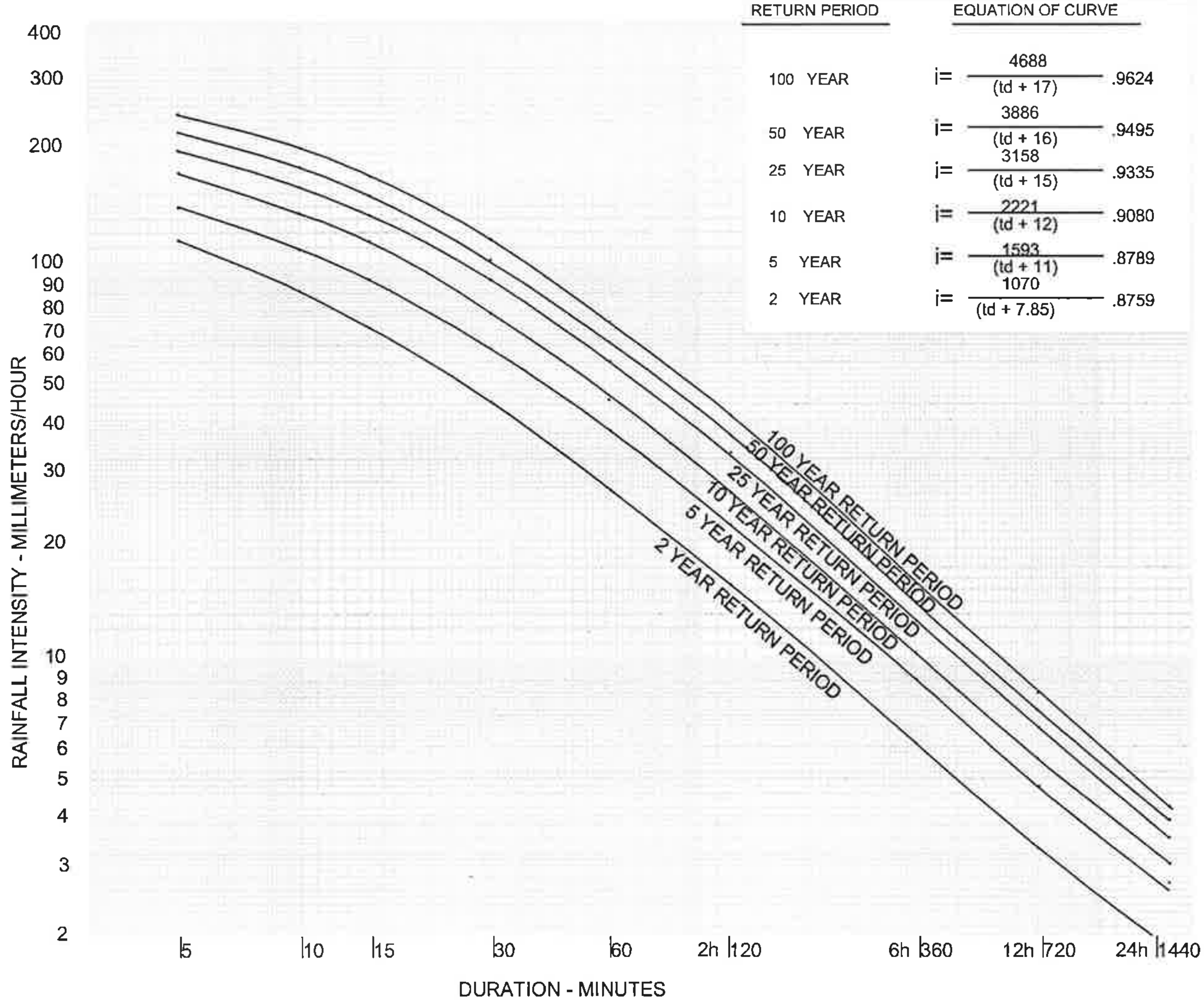
Photo 52: Ditch Inlet DI6

Photo 53: Ditch Inlet DI7

Photo 54: Ditch Inlet DI8

Appendix B

Town of Caledon IDF Curves



RETURN PERIOD	EQUATION OF CURVE
100 YEAR	$i = \dfrac{4688}{(td + 17)^{.9624}}$
50 YEAR	$i = \dfrac{3886}{(td + 16)^{.9495}}$
25 YEAR	$i = \dfrac{3158}{(td + 15)^{.9335}}$
10 YEAR	$i = \dfrac{2221}{(td + 12)^{.9080}}$
5 YEAR	$i = \dfrac{1593}{(td + 11)^{.8789}}$
2 YEAR	$i = \dfrac{1070}{(td + 7.85)^{.8759}}$

INLET TIMES

SUBURBAN RESIDENTIAL	
(ROOF DRAINS UNCONNECTED)	15 min
(ROOF DRAINS CONNECTED)	10 min
SUBURBAN, COMMERCIAL, INDUSTRIAL MULTIPLE FAMILY	10 min
DOWNTOWN COMMERCIAL, HIGH DENSITY APARTMENTS, EXPRESSWAYS	5 min

RUNOFF COEFFICIENT

COMMERCIAL	
- DOWNTOWN & SUBURBAN SHOPPING	0.90
INDUSTRIAL	
- DOWNTOWN	0.90
- SUBURBAN INDUSTRIAL PARKS	0.75
RESIDENTIAL	
- APARTMENTS	0.75
- ROW DWELLINGS	0.70
- DUPLEX DWELLINGS	0.70
- SEMIDETACHED - DOWNTOWN	0.60
- SINGLE FAMILY - DOWNTOWN	0.60
- SEMIDETACHED - SUBURBAN	0.50
- SINGLE FAMILY - SUBURBAN	0.40
SCHOOLS, CHURCHES, HOSPITALS	0.75
PARKS, CEMETERIES, RAIL YARDS	
(OVER 4 Ha)	0.20
(UNDER 4 Ha)	0.25

TOWN OF CALEDON

RAINFALL INTENSITY CURVES

NO.	REVISION	APR'D	DATE
1	STANDARD 112.01 NOW 104		JUNE 08

APR'D: C.C. DATE: FEB 2000

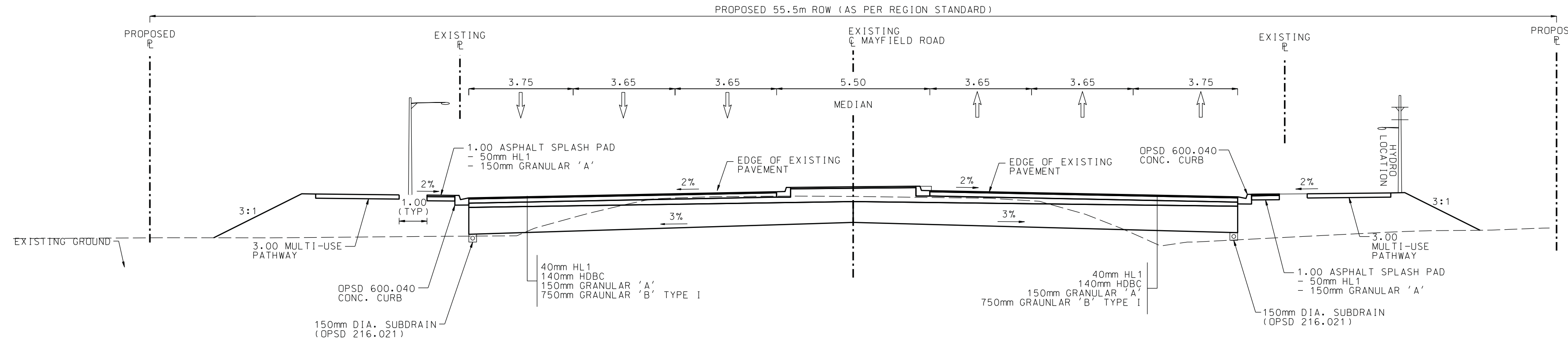
DRAWN: BJM SCALE: N.T.S.

STANDARD No. 104

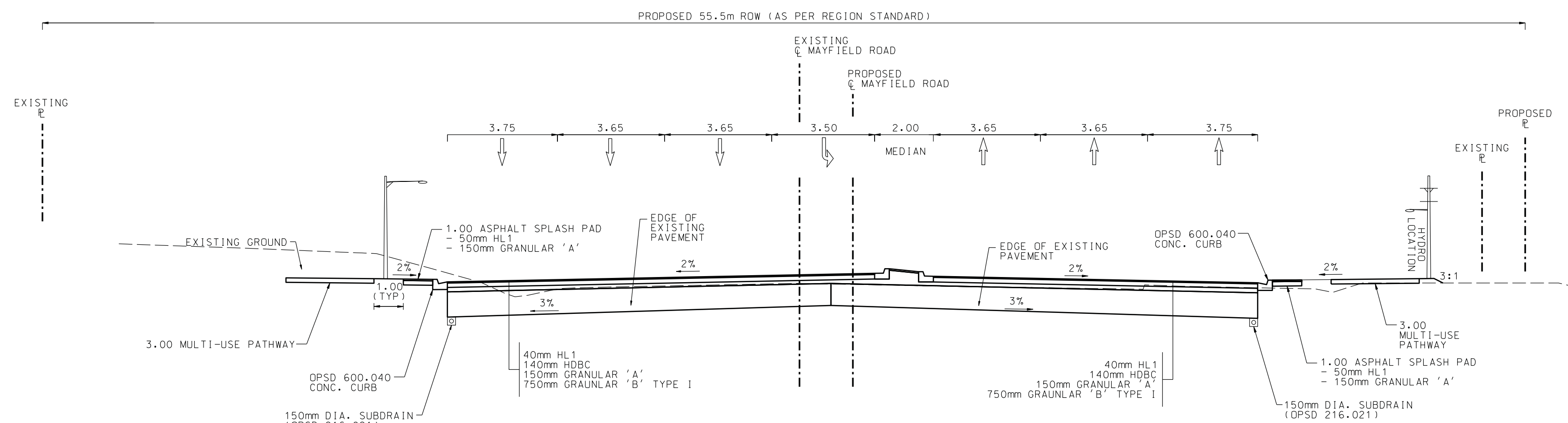
Appendix C

Mayfield Road Typical Proposed Cross Sections

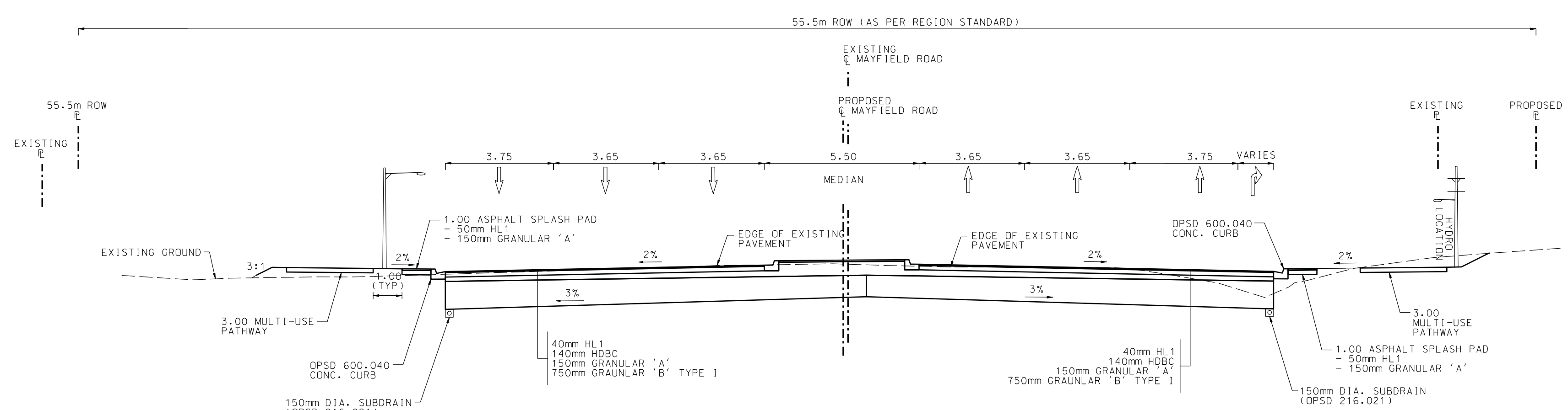
DRAFT



CHINGUACOUSY ROAD TO MCLAUGHLIN ROAD TYPICAL SECTION
STATION 7+900



MCLAUGHLIN ROAD TO ORANGEVILLE RAIL TYPICAL SECTION
STATION 9+000



ORANGEVILLE RAIL TO HURONTARIO STREET TYPICAL SECTION
STATION 9+340

KEY PLAN
(N.T.S.)

NOTES:

1. ALL DIMENSIONS SHOWN ARE IN METRES UNLESS OTHERWISE NOTED.

NTS

WSP

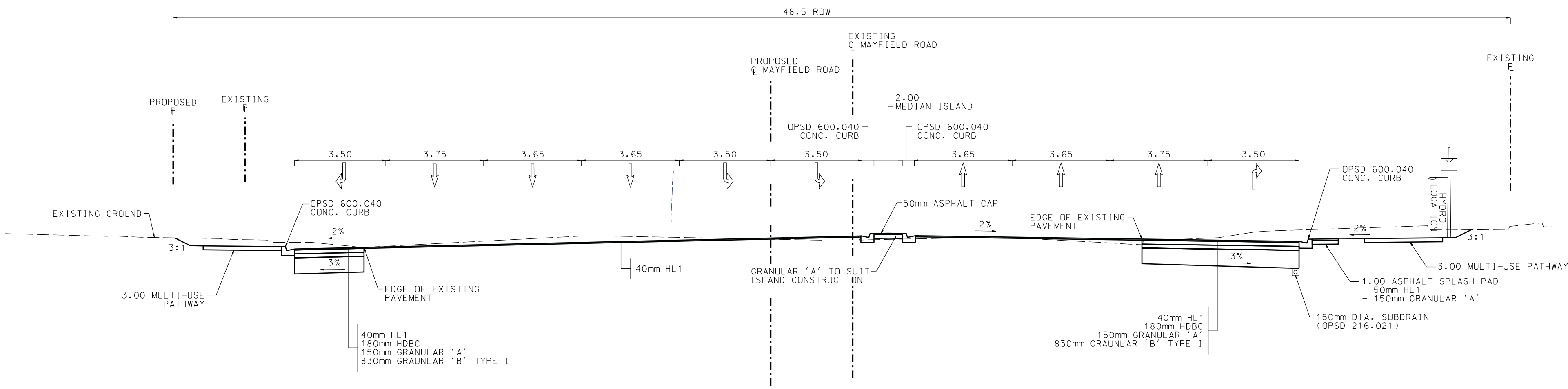
Region of Peel
Working for you

MAYFIELD ROAD

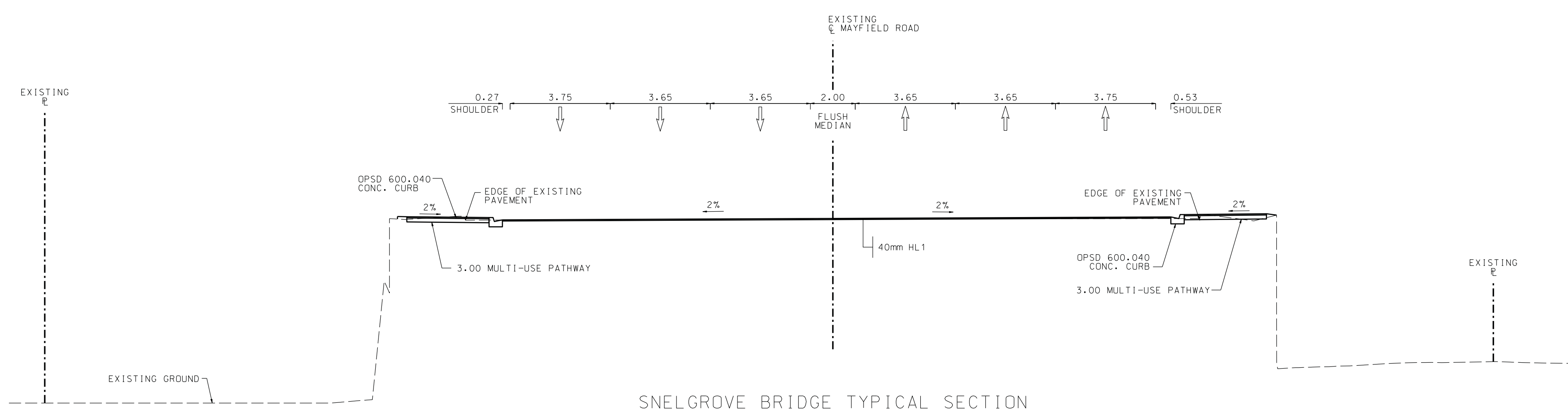
RECOMMENDED DESIGN CONCEPT
CHINGUACOUSY ROAD TO
HURONTARIO STREET

CAD Area	Area	Project No. 101-17262
Checked by V.M.	Drawn by B.F.	
Date APR 2014	Sheet 1 OF 3	FIGURE 5-11

DRAFT



HURONTARIO STREET TO SNELGROVE BRIDGE TYPICAL SECTION
STATION 10+075



SNELGROVE BRIDGE TYPICAL SECTION
STATION 10+665

KEY PLAN
(N.T.S.)

NOTES:

1. ALL DIMENSIONS SHOWN ARE IN METRES UNLESS OTHERWISE NOTED.

NTS

WSP

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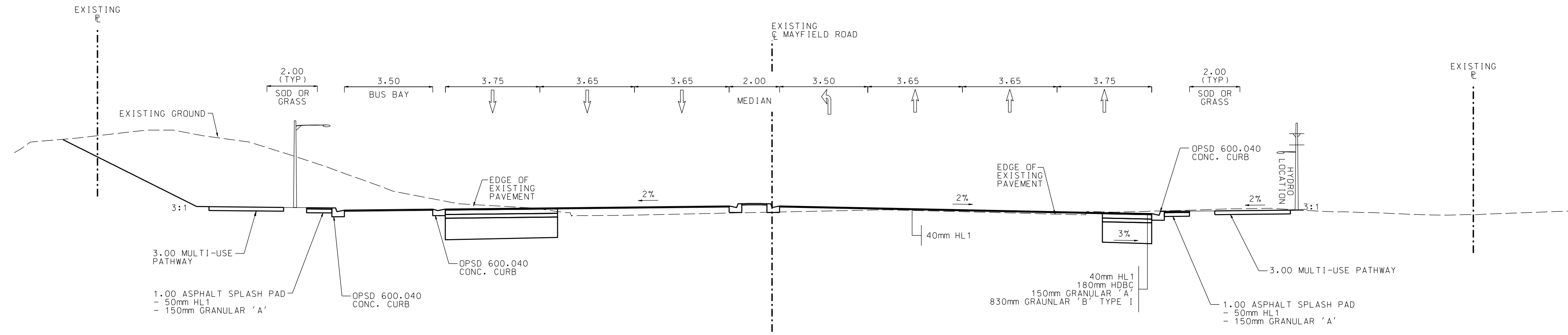
MAYFIELD ROAD

RECOMMENDED DESIGN CONCEPT
HURONTARIO STREET TO KENNEDY ROAD

CAD Area	Area	Project No. 101-17262
Checked by V.M.	Drawn by B.F.	
Date APR 2014	Sheet 2 OF 3	FIGURE 5-12

DRAFT

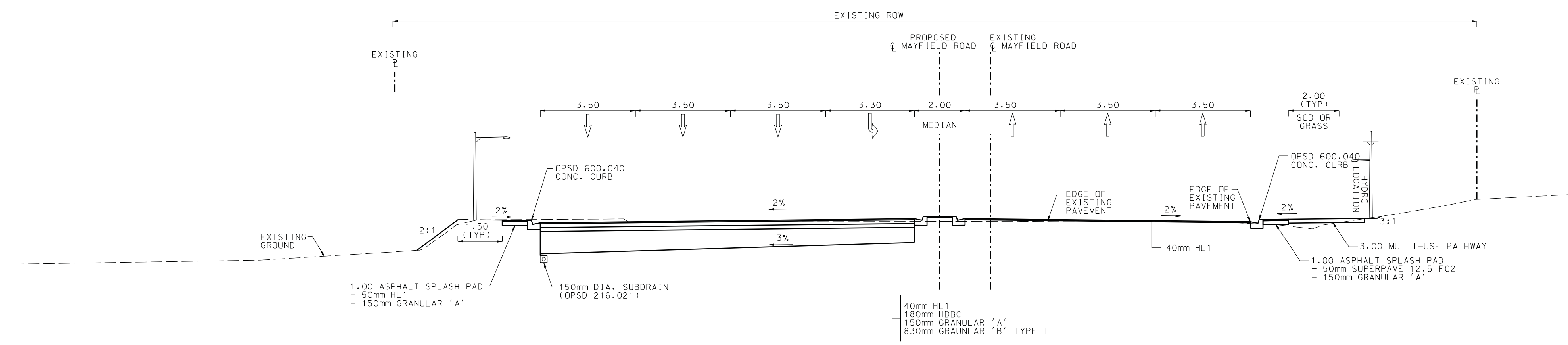


SNELGROVE BRIDGE TO KENNEDY ROAD TYPICAL SECTION
STATION 10+940

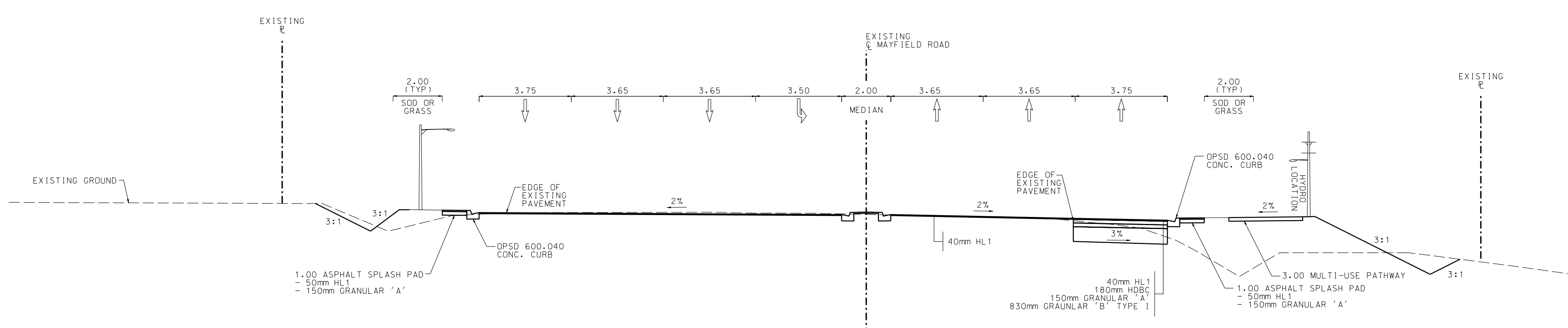
KEY PLAN
(N.T.S.)

NOTES:

1. ALL DIMENSIONS SHOWN ARE IN METRES UNLESS OTHERWISE NOTED.



KENNEDY ROAD TO STONEGATE DRIVE TYPICAL SECTION
STATION 11+564



STONEGATE DRIVE TO HEART LAKE ROAD TYPICAL SECTION
STATION 12+230

NTS

WSP

Region of Peel
Working for you

MAYFIELD ROAD

RECOMMENDED DESIGN CONCEPT
KENNEDY ROAD TO HEART LAKE ROAD

CAD Area	Area	Project No. 101-17262
Checked by V.M.	Drawn by B.F.	
Date APR 2014	Sheet 3 OF 3	FIGURE 5-13

Appendix D

Preliminary Hydraulic Analysis of the Proposed Storm Sewer Networks

Schedule C Class Environmental Assessment Study for Mayfield Road Improvements
from Chinguacousy Road to Heart Lake Road

Town of Caledon & City of Brampton

STORM SEWER ANALYSIS SHEET - PROPOSED DRAINAGE CONDITIONS

Designed by: SI
Reviewed by: WH

Storm Frequency 10 Year/100 Year
IDF Town of Caledon

Date: **Apr-13** **(Revised January 2014)**

Qp (m^3/s) = 0.00278 A I C

A= area (ha)
I= rainfall intensity (mm/hr)
C= runoff coefficient

	10 Yr	100 yr
a	2221	4688
b	12	17
c	0.908	0.9624

From MH/CB	Station	To MH/CB	Station	Prop. Pavement length	Prop. Pavement width	Prop. Pavement total (C= 0.95)	Prop. Grassed length	Prop. Grassed median width	Prop. Grassed width	Prop. Grassed total (C= 0.25)	Avg. C	indiv. 0.00278 A C	Accumulated 0.00278 A C	time of conc. tc (min)	rainfall intensity I (mm/hr)	Peak Flow Qp (m^3/s)	U/S Surface EL.	U/S Inv. EL.	D/S Inv. EL.	Sewer data dia. (mm)	n	slope (%)	length (m)	capacity (m^3/s)	velocity (m/s)	area (m^2)	Sec. Time (min)	$Q_p/Q_{capacity}$ %	U/S Cover m
MH1	7253	MH2	7320	30	31.6	0.1868	30	3.5	9	0.027	0.86	0.00051	0.00051	10.00	134.2	0.069	256.47	254.60	254.39	375	0.013	0.30	67	0.096	0.87	0.11	1.28	72%	1.50
MH2	**7320**	**Outlet 1**	**7320**	140	31.6	0.4424	140	3.5	9	0.126	0.79	0.00126	0.00177	11.28	187.9	0.332	256.38	254.36	254.01	525	0.013	1.00	35	0.430	1.99	0.22	0.29	77%	1.50
MH3	7460	MH4	7580	130	31.6	0.4108	130	3.5	9	0.117	0.79	0.00117	0.00117	10.00	134.2	0.156	257.12	255.17	254.81	450	0.013	0.30	120	0.156	0.98	0.16	2.04	100%	1.50
MH4	7580	MH5	7705	140	31.6	0.4424	140	3.5	9	0.126	0.79	0.00126	0.00242	12.04	123.8	0.300	256.75	254.65	254.28	600	0.013	0.30	125	0.336	1.19	0.28	1.75	89%	1.50
MH5	7705	CBMH6	7705	50	31.6	0.25	50	3.5	9	0.045	0.84	0.00069	0.00311	13.79	116.1	0.362	256.51	254.41	254.33	600	0.013	0.40	19	0.388	1.37	0.28	0.23	93%	1.50
CBMH6	7705	CBMH7	7760										0.00311	14.02	115.2	0.359	256.51	254.33	254.14	600	0.013	0.35	55	0.363	1.28	0.28	0.71	99%	1.58
CB8	7835	CBMH7	7760	65	31.6	0.2054	65	3.5	9	0.0585	0.79	0.00058	0.00058	10.00	134.2	0.078	257.08	255.21	254.98	375	0.013	0.30	75	0.096	0.87	0.11	1.44	81%	1.50
CBMH7	**7760**	**Outlet 2**	**7770**	130	31.6	0.4108	130	3.5	9	0.117	0.79	0.00117	0.00486	14.73	168.2	0.818	256.72	254.14	253.99	675	0.013	1.00	15	0.841	2.35	0.36	0.11	97%	1.90
MH9	7970	MH10	8090	140	31.6	0.4424	140	3.5	9	0.126	0.79	0.00126	0.00126	10.00	134.2	0.169	257.76	255.81	255.33	450	0.013	0.40	120	0.180	1.13	0.16	1.76	93%	1.50
MH12	8190	MH10	8090	75	31.6	0.237	75	3.5	9	0.0675	0.79	0.00067	0.00067	10.00	134.2	0.090	257.95	256.08	255.78	375	0.013	0.30	100	0.096	0.87	0.11	1.92	94%	1.50
MH10	8090	CBMH11	8100										0.00193	11.92	184.0	0.355	257.67	255.33	255.23	600	0.013	0.50	20	0.434	1.54	0.28	0.22	82%	1.74
CBMH11	**8100**	**Outlet 3**	**8120**	130	31.6	0.4108	130	3.5	9	0.117	0.79	0.00117	0.00310	12.13	182.7	0.565	257.67	255.23	255.03	600	0.013	1.00	20	0.614	2.17	0.28	0.15	92%	1.84
MH13	8320	MH14	8440	130	31.6	0.4108	130	3.5	9	0.117	0.79	0.00117	0.00117	10.00	134.2	0.156	257.88	255.93	255.57	450	0.013	0.30	120	0.156	0.98	0.16	2.04	100%	1.50
MH14	8440	MH15	8560	120	31.6	0.3792	120	3.5	9	0.108	0.79	0.00108	0.00224	12.04	123.8	0.278	257.30	255.20	254.60	600	0.013	0.50	120	0.434	1.54	0.28	1.30	64%	1.50
MH15	8560	MH16	8600	60	31.6	0.1896	60	3.5	9	0.054	0.79	0.00054	0.00278	13.34	118.0	0.328	256.70	254.60	254.40	600	0.013	0.50	40	0.434	1.54	0.28	0.43	76%	1.50
MH16	8600	CBMH17	8600	60	31.6	0.1896	60	3.5	9	0.054	0.79	0.00054	0.00332	13.77	116.2	0.386	256.50	254.40	254.30	600	0.013	0.50	20	0.434	1.54	0.28	0.22	89%	1.50
CBMH17	**8600**	**Outlet 4**	**8600**	60	31.6	0.2246	60	3.5	9	0.054	0.81	0.00063	0.00395	13.99	115.3	0.456	256.50	254.30	254.16	600	0.013	0.70	20	0.514	1.82	0.28	0.18	89%	1.60
MH18	8645	MH19	8760	60	31.6	0.2421	60	3.5	23.4	0.1404	0.69	0.00074	0.00074	10.00	134.2	0.099	256.27	254.32	253.98	450	0.013	0.30	115	0.156	0.98	0.16	1.95	63%	1.50

From MH/CB	Station	To MH/CB	Station	Prop. Pavement length	Prop. Pavement width (C= 0.95)	Prop. Pavement total	Prop. Grassed length	Prop. Grassed median width (C= 0.25)	Prop. Grassed width	Prop. Grassed total	Avg. Avg. C	indiv. 0.00278 A C	Accumulated 0.00278 A C	time of conc. tc (min)	rainfall intensity I (mm/hr)	Peak Flow Qp (m^3/s)	U/S Surface EL.	U/S Inv. EL.	D/S Inv. EL.	Sewer data dia. (mm)	n	slope (%)	length (m)	capacity (m^3/s)	velocity (m/s)	area (m^2)	Sec. Time (min)	$Q_p/Q_{capacity}$ %	U/S Cover m
MH20	8880	MH19	8760	100	31.6	0.316	100	3.5	23.4	0.234	0.65	0.00100	0.00100	10.00	134.2	0.134	256.21	254.26	253.60	450	0.013	0.55	120	0.211	1.33	0.16	1.50	63%	1.50
MH19	8760	CBMH21	8760	120	31.6	0.3792	120	3.5	23.4	0.2808	0.65	0.00120	0.00293	11.50	186.5	0.547	255.79	253.60	253.50	675	0.013	0.50	20	0.594	1.66	0.36	0.20	92%	1.51
CBMH21	**8760**	**Outlet 5**	**8760**									0.00000	0.00293	11.71	185.3	0.543	255.79	253.50	253.40	675	0.013	0.50	20	0.594	1.66	0.36	0.20	91%	1.61
MH22	8955	MH23	9070	90	31.6	0.2844	90	3.5	18.4	0.1656	0.69	0.00087	0.00087	10.00	134.2	0.116	256.33	254.46	253.80	375	0.013	0.57	115	0.132	1.20	0.11	1.60	88%	1.50
MH23	9070	MH24	9190	120	31.6	0.3792	120	3.5	18.4	0.2208	0.69	0.00115	0.00202	11.60	125.9	0.254	256.20	254.18	253.49	525	0.013	0.57	120	0.325	1.50	0.22	1.33	78%	1.50
MH24	9190	CBMH25	9200	60	31.6	0.1896	60	3.5	18.4	0.1104	0.69	0.00058	0.00260	12.93	119.8	0.311	255.55	253.45	253.38	600	0.013	0.30	22	0.336	1.19	0.28	0.31	93%	1.50
CBMH25	**9200**	**Outlet 6**	**9200**									0.00000	0.00260	13.24	118.4	0.308	255.55	253.38	253.32	600	0.013	0.30	20	0.336	1.19	0.28	0.28	92%	1.57
CBMH26	**9270**	**Outlet 7**	**9270**	70	31.6	0.2212	70	3.5	18.4	0.1288	0.69	0.00067	0.00067	10.00	134.2	0.090	255.31	253.44	253.34	375	0.013	0.50	20	0.124	1.12	0.11	0.30	73%	1.50
MH27	9380	MH28	9500	130	31.6	0.4108	130	3.5	11.85	0.15405	0.76	0.00119	0.00119	10.00	134.2	0.160	255.12	253.17	252.79	450	0.013	0.32	120	0.161	1.01	0.16	1.97	99%	1.50
MH28	9500	MH29	9620	100	31.6	0.316	100	3.5	11.85	0.1185	0.76	0.00092	0.00211	11.97	124.1	0.262	254.90	252.80	252.44	600	0.013	0.30	120	0.336	1.19	0.28	1.68	78%	1.50
MH29	9620	MH30	9740	140	31.6	0.4424	140	3.5	11.85	0.1659	0.76	0.00128	0.00339	13.65	116.7	0.396	254.69	252.52	252.16	675	0.013	0.30	120	0.460	1.29	0.36	1.55	86%	1.50
MH30	9740	MH31	9860	120	31.6	0.3792	120	3.5	11.85	0.1422	0.76	0.00110	0.00449	15.21	110.6	0.497	254.47	252.22	251.86	750	0.013	0.30	120	0.610	1.38	0.44	1.45	82%	1.50
MH31	9860	MH32	9980	120	31.6	0.3792	120	3.5	11.85	0.1422	0.76	0.00110	0.00559	16.66	105.5	0.590	254.26	251.86	251.50	750	0.013	0.30	120	0.610	1.38	0.44	1.45	97%	1.65
MH32	9980	MH33	10100	100	31.6	0.8755	100	3.5	11.85	0.385	0.74	0.00258	0.00817	18.11	100.9	0.825	254.03	251.50	251.14	900	0.013	0.30	120	0.992	1.56	0.64	1.28	83%	1.63
MH33	10100	MH34	10250	140	47	0.658	140	0	8	0.112	0.85	0.00182	0.00999	19.39	147.5	1.473	253.55	251.14	250.39	975	0.013	0.50	150	1.585	2.12	0.75	1.18	93%	1.44
MH35	10300	MH34	10250	70	47	0.329	70	0	8	0.056	0.85	0.00091	0.00091	10.00	196.5	0.178	252.90	250.95	250.55	450	0.013	0.80	50	0.255	1.60	0.16	0.52	70%	1.50
MH34	**10250**	**Outlet 8**	**10250**	140	47	0.658	140	0	8	0.112	0.85	0.00182	0.01271	20.57	143.0	1.818	252.64	250.09	250.04	1050	0.013	0.50	10	1.931	2.23	0.87	0.07	94%	1.50
MH36	10440	MH37	10560	130	47	0.627	130	0	8	0.112	0.84	0.00173	0.00173	10.00	134.2	0.233	252.31	250.44	246.84	375	0.013	3.00	120	0.304	2.75	0.11	0.73	77%	1.50
MH37	10560	MH38	10615	60	47	0.282	60	0	8	0.048	0.85	0.00078	0.00251	10.73	130.3	0.327	248.88	246.84	245.24	450	0.013	2.90	55	0.486	3.05	0.16	0.30	67%	1.60
MH38	**10615**	**Outlet 9 (STC 2000)**	**10615**	70	47	0.329	70	0	8	0.056	0.85	0.00091	0.00342	11.03	128.7	0.440	247.28	245.26	245.12	525	0.013	1.20	11	0.471	2.18	0.22	0.08	93%	1.50
MH43	11140	MH42	11070	70	47	0.329	70	0	8	0.056	0.85	0.00091	0.00091	10.00	134.2	0.122	257.90	256.10	254.70	300	0.013	2.00	70	0.137	1.93	0.07	0.60	89%	1.50
MH42	11070	MH41	10960	70	47	0.329	70	0	8	0.056	0.85	0.00091	0.00182	10.60	130.9	0.238	256.76	254.89	251.26	375	0.013	3.30	110	0.319	2.88	0.11	0.64	75%	1.50
MH41	10960	MH40	10860	150	47	0.705	150	0	8	0.12	0.85	0.00195	0.00376	11.24	127.7	0.480	253.34	251.39	247.39	450	0.013	4.00	100	0.570	3.59	0.16	0.46	84%	1.50
MH40	10860	MH39	10720	140	47	0.658	140	0	8	0.112	0.85	0.00182	0.00558	11.70	125.4	0.699	249.06	246.96	244.16	600	0.013	2.00	140	0.868	3.07	0.28	0.76	81%	1.50
MH39	**10720**	**Outlet 10**	**10720**	150	47	0.705	150	0	8	0.12	0.85	0.00195	0.00752	12.46	180.7	1.359	246.22	243.97	243.72	750	0.013	1.70	15	1.452	3.29	0.44	0.08	94%	1.50

From MH/CB	Station	To MH/CB	Station	Prop. Pavement length	Prop. Pavement width	Prop. Pavement total	Prop. Grassed length	Prop. Grassed median width	Prop. Grassed width	Prop. Grassed total	Avg. Avg. C	indiv. 0.00278 A C	Accumulated 0.00278 A C	time of conc. tc (min)	rainfall intensity I (mm/hr)	Peak Flow Qp (m^3/s)	U/S Surface EL.	U/S Inv. EL.	D/S Inv. EL.	Sewer data dia. (mm)	n	slope (%)	length (m)	capacity (m^3/s)	velocity (m/s)	area (m^2)	Sec. Time (min)	$Q_p/Q_{capacity}$ %	U/S Cover m
				C= 0.95			C= 0.25																						
		(STC4000)																											
MH50	11990	MH49	11860	130	45	0.585	130	0	8	0.104	0.84	0.00162	0.00162	10.00	134.2	0.217	268.90	267.03	263.94	375	0.013	2.37	130	0.270	2.44	0.11	0.89	80%	1.50
MH49	11860	MH48	11740	140	45	0.63	140	0	8	0.112	0.84	0.00174	0.00336	10.89	129.4	0.435	265.84	263.89	258.85	450	0.013	4.20	120	0.584	3.67	0.16	0.54	74%	1.50
MH48	11740	MH47	11620	120	45	0.54	120	0	8	0.096	0.84	0.00149	0.00485	11.43	126.7	0.615	260.77	258.75	255.82	525	0.013	2.44	120	0.672	3.10	0.22	0.64	92%	1.50
MH47	11620	MH46	11480	130	45	0.585	130	0	8	0.104	0.84	0.00162	0.00647	12.08	183.0	1.184	258.02	255.77	254.09	750	0.013	1.20	140	1.220	2.76	0.44	0.85	97%	1.50
MH44	11290	MH45	11410	150	45	0.675	150	0	8	0.12	0.84	0.00187	0.00187	10.00	134.2	0.250	257.80	255.78	255.18	525	0.013	0.50	120	0.304	1.40	0.22	1.42	82%	1.50
MH45	11410	MH46	11480	120	45	0.94	120	0	8	0.296	0.78	0.00269	0.00455	11.42	187.1	0.852	257.19	254.80	253.40	600	0.013	2.00	70	0.868	3.07	0.28	0.38	98%	1.79
MH46	**11480**	**Outlet 11**	**11480**	140	45	0.63	140	0	8	0.112	0.84	0.00174	0.01277	12.92	178.0	2.273	257.18	253.40	253.07	975	0.013	1.10	30	2.350	3.15	0.75	0.16	97%	2.80
		(Exist Pond)																											
MH51	12140	MH52	12260	130	35.1	0.4563	130	0	5.5	0.0715	0.86	0.00125	0.00125	10.00	134.2	0.168	268.96	267.09	264.33	375	0.013	2.30	120	0.266	2.41	0.11	0.83	63%	1.50
MH52	12260	MH53	12380	120	35.1	0.4212	120	0	5.5	0.066	0.86	0.00116	0.00241	10.83	129.7	0.313	266.30	264.35	261.23	450	0.013	2.60	120	0.460	2.89	0.16	0.69	68%	1.50
MH53	12380	MH54	12510	120	35.1	0.4212	120	0	5.5	0.066	0.86	0.00116	0.00357	11.52	126.3	0.451	263.03	260.93	259.89	600	0.013	0.80	130	0.549	1.94	0.28	1.12	82%	1.50
MH54	12510	MH55	12640	120	35.1	0.4212	120	0	5.5	0.066	0.86	0.00116	0.00473	12.64	179.7	0.850	262.33	260.01	259.49	825	0.013	0.40	130	0.908	1.70	0.53	1.28	94%	1.50
MH56	12730	MH55	12640	20	35.1	0.0702	20	0	5.5	0.011	0.86	0.00019	0.00019	10.00	196.5	0.038	262.09	260.29	259.84	300	0.013	0.50	90	0.068	0.97	0.07	1.55	55%	1.50
MH55	**12640**	**Outlet 12**	**12640**	170	35.1	0.5967	170	0	5.5	0.0935	0.86	0.00164	0.00656	13.91	172.5	1.132	261.81	259.49	259.34	900	0.013	0.50	30	1.280	2.01	0.64	0.25	88%	1.43
		(Exist Pond)																											

Appendix E

Preliminary Design of the Proposed Oil/Grit Separators and Super Pipes

Appendix E1

Preliminary Design of the Proposed Oil/Grit Separators

Stormceptor®

Stormceptor Design Summary

PCSWMM for Stormceptor

Project Information

Date	4/8/2013
Project Name	Mayfield Road Widening Class EA - Region of Peel
Project Number	101-17262-00
Location	Outlet 8 at Station10+260

Designer Information

Company	GENIVAR Inc
Contact	Sherif Iskandar

Notes

N/A

Drainage Area

Total Area (ha)	5.84
Imperviousness (%)	76

The Stormceptor System model STC 9000 achieves the water quality objective removing 80% TSS for a OK-110 (sand only) particle size distribution and 90% runoff volume.

Rainfall

Name	TORONTO CENTRAL
State	ON
ID	100
Years of Records	1982 to 1999
Latitude	45°30'N
Longitude	90°30'W

Water Quality Objective

TSS Removal (%)	80
Runoff Volume (%)	90

Upstream Storage

Storage (ha-m)	Discharge (L/s)
0	0

Stormceptor Sizing Summary

Stormceptor Model	TSS Removal %	Runoff Volume %
STC 300	41	32
STC 750	53	53
STC 1000	53	53
STC 1500	54	53
STC 2000	62	67
STC 3000	63	67
STC 4000	69	79
STC 5000	70	79
STC 6000	74	85
STC 9000	**80**	**90**
STC 10000	79	90
STC 14000	84	93

Particle Size Distribution

Removing silt particles from runoff ensures that the majority of the pollutants, such as hydrocarbons and heavy metals that adhere to fine particles, are not discharged into our natural water courses. The table below lists the particle size distribution used to define the annual TSS removal.

OK-110 (sand only)

Particle Size µm	Distribution %	Specific Gravity	Settling Velocity m/s		Particle Size µm	Distribution %	Specific Gravity	Settling Velocity m/s
1	0	2.65	0.0004					
53	3	2.65	0.0025					
75	15	2.65	0.0040					
88	25	2.65	0.0055					
106	40.8	2.65	0.0077					
125	15	2.65	0.0105					
150	1	2.65	0.0145					

Stormceptor Design Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor version 1.0
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal.
- Only the STC 300 is adaptable to function with a catch basin inlet and/or inline pipes.
- Only the Stormceptor models STC 750 to STC 6000 may accommodate multiple inlet pipes.
- Inlet and outlet invert elevation differences are as follows:

Inlet and Outlet Pipe Invert Elevations Differences

Inlet Pipe Configuration	STC 300	STC 750 to STC 6000	STC 9000 to STC 14000
Single inlet pipe	75 mm	25 mm	75 mm
Multiple inlet pipes	75 mm	75 mm	Only one inlet pipe.

- Design estimates are based on stable site conditions only, after construction is completed.
- Design estimates assume that the storm drain is not submerged during zero flows. For submerged applications, please contact your local Stormceptor representative.
- Design estimates may be modified for specific spills controls. Please contact your local Stormceptor representative for further assistance.
- For pricing inquiries or assistance, please contact Imbrium Systems Inc., 1-800-565-4801.

Stormceptor Design Summary
PCSWMM for Stormceptor

Project Information

Date	4/8/2013
Project Name	Mayfield Road Widening Class EA - Region of Peel
Project Number	101-17262-00
Location	Outlet 9 at Station 10+620

Designer Information

Company	GENIVAR Inc
Contact	Sherif Iskandar

Notes

N/A

Drainage Area

Total Area (ha)	1.454
Imperviousness (%)	85

The Stormceptor System model STC 4000 achieves the water quality objective removing 85% TSS for a OK-110 (sand only) particle size distribution and 94% runoff volume.

Rainfall

Name	TORONTO CENTRAL
State	ON
ID	100
Years of Records	1982 to 1999
Latitude	45°30'N
Longitude	90°30'W

Water Quality Objective

TSS Removal (%)	80
Runoff Volume (%)	90

Upstream Storage

Storage (ha-m)	Discharge (L/s)
0	0

Stormceptor Sizing Summary

Stormceptor Model	TSS Removal %	Runoff Volume %
STC 300	62	64
STC 750	73	82
STC 1000	73	82
STC 1500	74	82
STC 2000	80	89
STC 3000	81	89
STC 4000	**85**	**94**
STC 5000	85	94
STC 6000	88	96
STC 9000	91	98
STC 10000	91	98
STC 14000	93	99

Stormceptor®

Particle Size Distribution

Removing silt particles from runoff ensures that the majority of the pollutants, such as hydrocarbons and heavy metals that adhere to fine particles, are not discharged into our natural water courses. The table below lists the particle size distribution used to define the annual TSS removal.

OK-110 (sand only)

Particle Size μm	Distribution %	Specific Gravity	Settling Velocity m/s		Particle Size μm	Distribution %	Specific Gravity	Settling Velocity m/s
1	0	2.65	0.0004					
53	3	2.65	0.0025					
75	15	2.65	0.0040					
88	25	2.65	0.0055					
106	40.8	2.65	0.0077					
125	15	2.65	0.0105					
150	1	2.65	0.0145					

Stormceptor Design Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor version 1.0
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal.
- Only the STC 300 is adaptable to function with a catch basin inlet and/or inline pipes.
- Only the Stormceptor models STC 750 to STC 6000 may accommodate multiple inlet pipes.
- Inlet and outlet invert elevation differences are as follows:

Inlet and Outlet Pipe Invert Elevations Differences

Inlet Pipe Configuration	STC 300	STC 750 to STC 6000	STC 9000 to STC 14000
Single inlet pipe	75 mm	25 mm	75 mm
Multiple inlet pipes	75 mm	75 mm	Only one inlet pipe.

- Design estimates are based on stable site conditions only, after construction is completed.
- Design estimates assume that the storm drain is not submerged during zero flows. For submerged applications, please contact your local Stormceptor representative.
- Design estimates may be modified for specific spills controls. Please contact your local Stormceptor representative for further assistance.
- For pricing inquiries or assistance, please contact Imbrium Systems Inc., 1-800-565-4801.

Appendix E2

Preliminary Design of the Proposed Super Pipes

Project No.:	101-17262-00
Project:	Mayfield
Description:	Orifice Release Rate

Catchment ID =	2					
Orifice Location =	Outlet of MH 34	**Outlet of MH 34**				
Orifice Type =	Vertical					
Invert Elevation =	250.15	m				
Min. Ground Elevation =	252.50	m (minimum CB grate elevation)				
Tailwater Elevation		m				
Diameter of Orifice =	533	mm				
Area of Orifice (A)=	0.223	m^2				
Orifice Coefficient (C_d) =	0.64					
	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
Ponding Depth[a] =	-0.4	-0.35	-0.3	At Ground	At Ground	At Ground
Water Elevation =	252.10	252.15	252.20	252.50	252.50	252.50
Upstream Head[b], H =	1.683	1.733	1.783	2.083	2.083	2.083
	$Q_o = C_d A (2 g h)^{1/2}$					
Total Discharge, Q_o=	0.824	0.836	0.848	0.917	0.917	0.917
Discharge Vel.[c], V=	3.691	3.745	3.799	4.106	4.106	4.106

Storage Available:	305
	Storage Require
2 Year	0
5 Year	58
10 Year	246
25 Year	351
50 Year	586
100 Year	660

[a]Ponding depth is relative to ground elevation
[b]Head is based on depth of water above orifice midpoint
[c]Velocity based on orifice area @ orifice face not Vena Contracta

S:\MA\10 after Jul19-10\101-17262 Mayfield EA\Stormwater Management\[Super Pipe Calcs.xls]MH 34

Project No.:	101-17262-00
Project:	Mayfield
Description:	Modified Rational Storage Calculations

Available Storage =	305	m^3
Excess (shortage) of Storage =	304.972	m^3
MH 30 Release Rate	0.275	
Required 2 year Orifice Release Rate =	0.549	m^3/sec

Note: The required release rate used to calculate storage requirements accounts for controlled flow contributions from upstream catchments 102, 103, 104 & R-102

2 Year

Catchment ID =	2	
Time of Concentration (t_c) =	20.57	minutes
Time Step (t_1) =	5	minutes
Runoff Coefficient (C) =		
Catchment Area (A) =		ha

Cumulative CA: 2.96

Goal Release Rate

0.515

Target Release Rate (Q_o) =	0.549	m^3/s
5 Year Storage Required =		m^3

Time	Intensity	Runoff	Storage Rate	Required Storage
$t = t_c + t_1$	**$I=a/(t_c+b)^c$**	**Q=CIA**	**$Q_s = Q - Q_o$**	**$V = Q_s t$**
(min.)	**(mm/hr)**	**(m^3/s)**	**(m^3/s)**	**(m^3)**
20.57	57	0.469		
25.57	49	0.407		
30.57	44	0.360		
35.57	39	0.324		
40.57	36	0.294		
45.57	33	0.270		
50.57	30	0.249		
55.57	28	0.232		
60.57	26	0.217		
65.57	25	0.204		
70.57	23	0.193		
75.57	22	0.183		
80.57	21	0.174		
85.57	20	0.165		
90.57	19	0.158		
95.57	18	0.151		
100.57	18	0.145		
105.57	17	0.140		
110.57	16	0.134		
115.57	16	0.130		
120.57	15	0.125		
125.57	15	0.121		
130.57	14	0.117		
135.57	14	0.114		
140.57	13	0.110		
145.57	13	0.107		
150.57	13	0.104		
155.57	12	0.101		
160.57	12	0.099		
165.57	12	0.096		
170.57	11	0.094		
175.57	11	0.092		
180.57	11	0.089		
185.57	11	0.087		
190.57	10	0.085		
195.57	10	0.084		
200.57	10	0.082		
205.57	10	0.080		

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Project No.:	101-17262-00
Project:	Mayfield
Description:	Modified Rational Storage Calculations

5 Year

Available Storage =	305	m^3
Excess (shortage) of Storage =	247.122	m^3
MH 30 Release Rate	0.253	
Required 2 year Orifice Release Rate =	0.583	m^3/sec

Catchment ID =	2	
Time of Concentration (t_c) =	20.57	minutes
Time Step (t_1) =	5	minutes
Runoff Coefficient (C) =		
Catchment Area (A) =	1.22	ha

Cumulative CA: 2.96

Goal Release Rate
0.692

Target Release Rate (Q_o) =	0.583	m^3/s
5 Year Storage Required =	58	m^3

Time	Intensity	Runoff	Storage Rate	Required Storage
$t = t_c + t_1$	$I=a/(t_c+b)^c$	Q=CIA	$Q_s = Q - Q_o$	$V = Q_s\ t$
(min.)	(mm/hr)	(m^3/s)	(m^3/s)	(m^3)
20.57	77	0.630	0.047	58
25.57	67	0.554	0.005	8
30.57	60	0.495		
35.57	54	0.448		
40.57	50	0.409		
45.57	46	0.377		
50.57	43	0.350		
55.57	40	0.327		
60.57	37	0.307		
65.57	35	0.289		
70.57	33	0.274		
75.57	32	0.260		
80.57	30	0.247		
85.57	29	0.236		
90.57	27	0.226		
95.57	26	0.216		
100.57	25	0.208		
105.57	24	0.200		
110.57	23	0.193		
115.57	23	0.186		
120.57	22	0.180		
125.57	21	0.174		
130.57	20	0.169		
135.57	20	0.163		
140.57	19	0.159		
145.57	19	0.154		
150.57	18	0.150		
155.57	18	0.146		
160.57	17	0.142		
165.57	17	0.139		
170.57	16	0.135		
175.57	16	0.132		
180.57	16	0.129		
185.57	15	0.126		
190.57	15	0.124		
195.57	15	0.121		
200.57	14	0.118		
205.57	14	0.116		

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Project No.:	101-17262-00
Project:	Mayfield
Description:	Modified Rational Storage Calculations

10 Year

Available Storage =	305	m^3
Excess (shortage) of Storage =	58.590	m^3
MH 30 Release Rate	0.275	
Required 10 year Orifice Release Rate =	0.573	m^3/sec

Catchment ID =	2	
Time of Concentration (t_c) =	20.57	minutes
Time Step (t_1) =	5	minutes
Runoff Coefficient (C) =		
Catchment Area (A) =	1.22	ha

Cumulative CA: 2.96

Goal Release Rate	**Total Discharge**
0.848	0.848

Target Release Rate (Q_o) =	0.573	m^3/s
10 Year Storage Required =	246	m^3

Time	**Intensity**	**Runoff**	**Storage Rate**	**Required Storage**
$t = t_c + t_1$	**$I=a/(t_c+b)^c$**	**Q=CIA**	**$Q_s = Q - Q_o$**	**$V = Q_s\ t$**
(min.)	**(mm/hr)**	**(m^3/s)**	**(m^3/s)**	**(m^3)**
20.57	94	0.773	0.200	246
25.57	83	0.679	0.106	162
30.57	74	0.606	0.033	60
35.57	67	0.548		
40.57	61	0.500		
45.57	56	0.461		
50.57	52	0.427		
55.57	48	0.398		
60.57	45	0.373		
65.57	43	0.351		
70.57	40	0.332		
75.57	38	0.315		
80.57	36	0.299		
85.57	35	0.285		
90.57	33	0.273		
95.57	32	0.261		
100.57	30	0.251		
105.57	29	0.241		
110.57	28	0.232		
115.57	27	0.224		
120.57	26	0.216		
125.57	25	0.209		
130.57	25	0.202		
135.57	24	0.196		
140.57	23	0.190		
145.57	22	0.185		
150.57	22	0.179		
155.57	21	0.175		
160.57	21	0.170		
165.57	20	0.166		
170.57	20	0.161		
175.57	19	0.158		
180.57	19	0.154		
185.57	18	0.150		
190.57	18	0.147		
195.57	17	0.144		
200.57	17	0.141		
205.57	17	0.138		

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Project No.:	101-17262-00
Project:	Mayfield
Description:	Modified Rational Storage Calculations

25 Year

Available Storage =	305	m^3
Excess (shortage) of Storage =	-45.867	m^3
MH 30 Release Rate	0.275	
Required 10 year Orifice Release Rate =	0.641	m^3/sec

Catchment ID =	2	
Time of Concentration (t_c) =	20.57	minutes
Time Step (t_1) =	5	minutes
Runoff Coefficient (C) =		
Catchment Area (A) =	1.22	ha

Cumulative CA: 2.96

Goal Release Rate	**Total Discharge**
1.016	0.917

Target Release Rate (Q_o) =	0.641	m^3/s
25 Year Storage Required =	351	m^3

Time	**Intensity**	**Runoff**	**Storage Rate**	**Required Storage**
$t = t_c + t_1$	**$I=a/(t_c+b)^c$**	**Q=CIA**	**$Q_s = Q - Q_o$**	**$V = Q_s t$**
(min.)	**(mm/hr)**	**(m^3/s)**	**(m^3/s)**	**(m^3)**
20.57	113	0.926	0.284	351
25.57	100	0.819	0.177	272
30.57	89	0.735	0.093	171
35.57	81	0.667	0.025	54
40.57	74	0.610		
45.57	68	0.563		
50.57	64	0.523		
55.57	59	0.488		
60.57	56	0.458		
65.57	52	0.432		
70.57	50	0.408		
75.57	47	0.387		
80.57	45	0.368		
85.57	43	0.351		
90.57	41	0.335		
95.57	39	0.321		
100.57	37	0.308		
105.57	36	0.296		
110.57	35	0.285		
115.57	33	0.275		
120.57	32	0.265		
125.57	31	0.257		
130.57	30	0.248		
135.57	29	0.241		
140.57	28	0.233		
145.57	28	0.227		
150.57	27	0.220		
155.57	26	0.214		
160.57	25	0.209		
165.57	25	0.203		
170.57	24	0.198		
175.57	23	0.193		
180.57	23	0.189		
185.57	22	0.184		
190.57	22	0.180		
195.57	21	0.176		
200.57	21	0.172		
205.57	20	0.169		

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Project No.:	101-17262-00
Project:	Mayfield
Description:	Modified Rational Storage Calculations

50 Year

Available Storage =	305	m^3
Excess (shortage) of Storage =	-281.263	m^3
MH 30 Release Rate	0.275	
Required 10 year Orifice Release Rate =	0.641	m^3/sec

Catchment ID =	2	
Time of Concentration (t_c) =	20.57	minutes
Time Step (t_1) =	5	minutes
Runoff Coefficient (C) =		
Catchment Area (A) =	1.22	ha

Cumulative CA: 2.96

Goal Release Rate	**Total Discharge**
1.15	0.917

Target Release Rate (Q_o) =	0.641	m^3/s
50 Year Storage Required =	586	m^3

Time	Intensity	Runoff	Storage Rate	Required Storage
$t = t_c + t_1$	$I=a/(t_c+b)^c$	Q=CIA	$Q_s = Q - Q_o$	$V = Q_s\ t$
(min.)	(mm/hr)	(m^3/s)	(m^3/s)	(m^3)
20.57	127	1.048	0.475	586
25.57	113	0.928	0.355	545
30.57	101	0.833	0.260	477
35.57	92	0.756	0.183	391
40.57	84	0.692	0.120	291
45.57	78	0.639	0.066	181
50.57	72	0.593	0.020	62
55.57	67	0.554		
60.57	63	0.519		
65.57	59	0.489		
70.57	56	0.462		
75.57	53	0.438		
80.57	51	0.417		
85.57	48	0.397		
90.57	46	0.380		
95.57	44	0.363		
100.57	42	0.349		
105.57	41	0.335		
110.57	39	0.322		
115.57	38	0.311		
120.57	36	0.300		
125.57	35	0.290		
130.57	34	0.280		
135.57	33	0.272		
140.57	32	0.263		
145.57	31	0.256		
150.57	30	0.248		
155.57	29	0.241		
160.57	29	0.235		
165.57	28	0.229		
170.57	27	0.223		
175.57	26	0.217		
180.57	26	0.212		
185.57	25	0.207		
190.57	25	0.202		
195.57	24	0.198		
200.57	24	0.194		
205.57	23	0.189		

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Project No.:	101-17262-00
Project:	Mayfield
Description:	Modified Rational Storage Calculations

100 Year

Available Storage =	305	m^3
Excess (shortage) of Storage =	-354.609	m^3
MH 30 Release Rate	0.275	
Required 10 year Orifice Release Rate =	0.641	m^3/sec

Goal Release Rate	Total Discharge
1.291	0.917

Catchment ID =	2	
Time of Concentration (t_c) =	20.57	minutes
Time Step (t_1) =	5	minutes
Runoff Coefficient (C) =		
Catchment Area (A) =	1.22	ha

Cumulative CA: 2.96

Target Release Rate (Q_o) =	0.641	m^3/s
100 Year Storage Required =	660	m^3

Time	Intensity	Runoff	Storage Rate	Required Storage
$t = t_c + t_1$	$I=a/(t_c+b)^c$	Q=CIA	$Q_s = Q - Q_o$	$V = Q_s t$
(min.)	(mm/hr)	(m^3/s)	(m^3/s)	(m^3)
20.57	143	1.176	0.534	660
25.57	127	1.043	0.401	616
30.57	114	0.937	0.296	542
35.57	104	0.851	0.210	447
40.57	95	0.780	0.138	337
45.57	88	0.720	0.078	214
50.57	81	0.668	0.027	82
55.57	76	0.624		
60.57	71	0.585		
65.57	67	0.551		
70.57	63	0.521		
75.57	60	0.494		
80.57	57	0.469		
85.57	54	0.447		
90.57	52	0.427		
95.57	50	0.409		
100.57	48	0.392		
105.57	46	0.377		
110.57	44	0.363		
115.57	42	0.349		
120.57	41	0.337		
125.57	40	0.326		
130.57	38	0.315		
135.57	37	0.305		
140.57	36	0.296		
145.57	35	0.287		
150.57	34	0.279		
155.57	33	0.271		
160.57	32	0.264		
165.57	31	0.257		
170.57	30	0.250		
175.57	30	0.244		
180.57	29	0.238		
185.57	28	0.232		
190.57	28	0.227		
195.57	27	0.222		
200.57	26	0.217		
205.57	26	0.212		

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Project No.:	101-17262-00
Project:	Mayfield
Description:	Modified Rational Storage Calculations

100 Year

Available Storage =	305	m^3
Excess (shortage) of Storage =	-354.609	m^3
MH 30 Release Rate	0.275	
Required 10 year Orifice Release Rate =	0.641	m^3/sec

Goal Release Rate	Total Discharge
1.291	0.917

Catchment ID =	2	
Time of Concentration (t_c) =	20.57	minutes
Time Step (t_1) =	5	minutes
Runoff Coefficient (C) =		
Catchment Area (A) =	1.22	ha

Cumulative CA: 2.96

Target Release Rate (Q_o) =	0.641	m^3/s
100 Year Storage Required =	660	m^3

Time	Intensity	Runoff	Storage Rate	Required Storage
$t = t_c + t_1$	$I=a/(t_c+b)^c$	Q=CIA	$Q_s = Q - Q_o$	$V = Q_s\ t$
(min.)	(mm/hr)	(m^3/s)	(m^3/s)	(m^3)
20.57	143	1.176	0.534	660
25.57	127	1.043	0.401	616
30.57	114	0.937	0.296	542
35.57	104	0.851	0.210	447
40.57	95	0.780	0.138	337
45.57	88	0.720	0.078	214
50.57	81	0.668	0.027	82
55.57	76	0.624		
60.57	71	0.585		
65.57	67	0.551		
70.57	63	0.521		
75.57	60	0.494		
80.57	57	0.469		
85.57	54	0.447		
90.57	52	0.427		
95.57	50	0.409		
100.57	48	0.392		
105.57	46	0.377		
110.57	44	0.363		
115.57	42	0.349		
120.57	41	0.337		
125.57	40	0.326		
130.57	38	0.315		
135.57	37	0.305		
140.57	36	0.296		
145.57	35	0.287		
150.57	34	0.279		
155.57	33	0.271		
160.57	32	0.264		
165.57	31	0.257		
170.57	30	0.250		
175.57	30	0.244		
180.57	29	0.238		
185.57	28	0.232		
190.57	28	0.227		
195.57	27	0.222		
200.57	26	0.217		
205.57	26	0.212		

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