Mississauga Road (Regional Road 1)

From North of Queen Street West (Reg. Rd. 6)
to South of Bovaird Drive
Stormwater Management Report
Addendum to Municipal Class Environmental Assessment

Mississauga Road (Regional Road 1)
From Financial Drive to Queen Street West (Regional Road 6)
to South of Bovaird Drive
Municipal Class Environmental Assessment
Stormwater Management Report

Addendum to Municipal Class Environmental Assessment

Submitted to:

Regional Municipality of Peel
Public Work Department
10 Peel Centre Drive, Suite B
Brampton, ON L6T 4B9

Submitted by:

Wood Environment & Infrastructure Solutions
a Division of Wood Canada Limited
3450 Harvester Road, Suite 100
Burlington, ON L7N 3W5

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1.0 Introduction

The Regional Municipality of Peel (Region) is proposing roadway improvements to approximately 3.0 km of Mississauga Road between Queen Street West and approximately 100 m south of Bovaird Drive, within the City of Brampton (ref. Figure 1.1). The Region of Peel's Long Range Transportation Plan has identified the need for capacity improvements along this section of Mississauga Road.

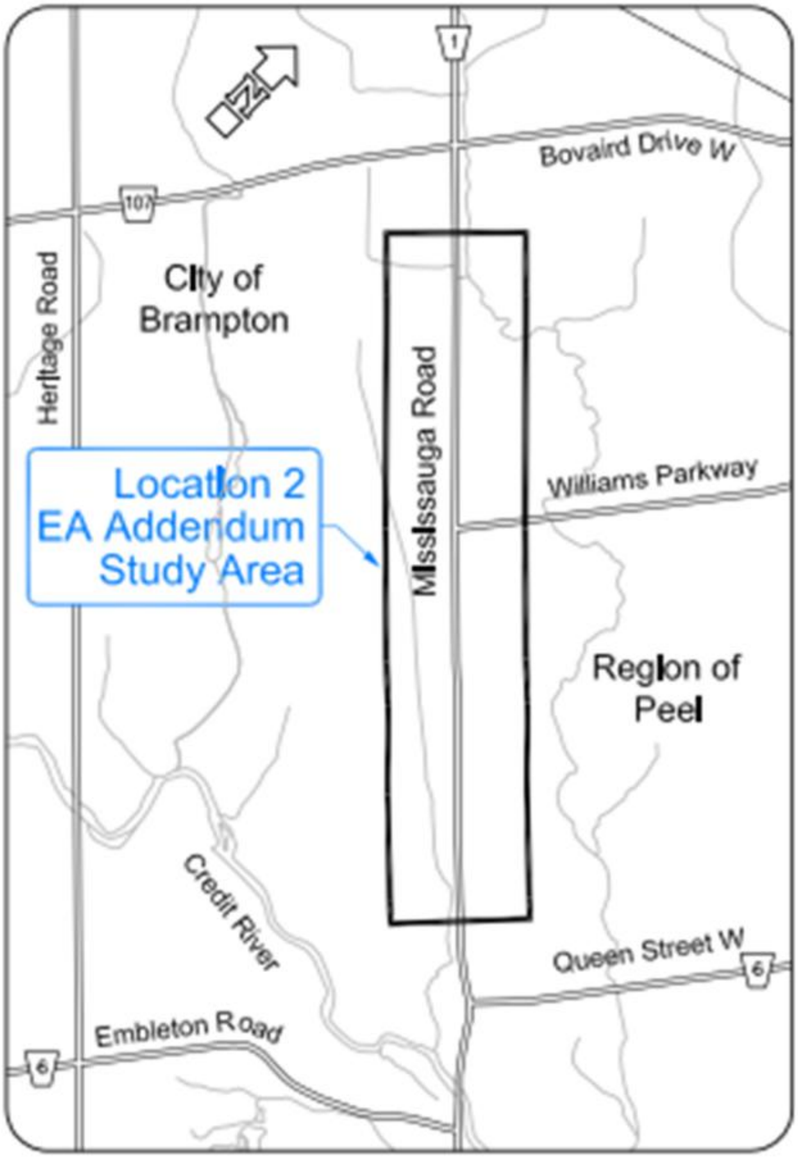


Figure 1.1 Key Plan

1.1 Project Description

Wood has been retained by the Region to undertake the technical studies required for an Addendum to a previously approved Schedule 'C' Municipal Class Environmental Assessment (Class EA) completed for this section of Mississauga Road. The original Class EA, completed by Trow Associates Inc. in November 2006, recommended a 5 lane right-of-way (R.O.W.) be constructed between Queen Street West and Bovaird Drive. The Addendum will revise the recommendation of a 5 lane R.O.W. to a 6 lane R.O.W. This stormwater management report will facilitate the preparation of the Addendum.

The proposed road improvements will include urbanization, widening and intersection improvements. This section of Mississauga Road, in its current 2017 condition, includes various states of urbanization. Between Queen Street West to approximately 160 m north of Ostrander Boulevard, the R.O.W. is urbanized with curb and gutter on both sides of the R.O.W. Between 160 m north of Ostrander Boulevard to 500 m north of Williams Parkway, the R.O.W. is partially urbanized with curb and gutter along the east side of Mississauga Road, and a rural roadside ditch system along the west. The remaining stretch of Mississauga Road, between 500 m north of Williams Parkway to Bovaird Drive has a rural R.O.W. with ditches on both sides.

Construction of "Contract 3" of Mississauga Road is currently on-going. The Contract 3 area stretches from approximately 150 m north of Williams Parkway to approximately 300 m north of Bovaird Drive, and includes improvements to the intersection of Mississauga Road and Bovaird Drive. The detailed design of the Contract 3 area has proposed to increase the number of lanes within Mississauga Road as well as partially urbanize the R.O.W., as per the original Class EA completed by Trow Associates Inc. When Contract 3 construction is complete, the Mississauga Road R.O.W. will have curb and gutter along the east side of the R.O.W. and ditches along the west, and will be 5 lanes wide. This report has been prepared assuming the construction of the Contract 3 area is complete (i.e. existing condition).

The road improvements proposed by the Addendum will increase the number of lanes from 5 to 6 within the Mississauga Road R.O.W. from north of Queen Street West to south of Bovaird Drive, with a fully urbanized R.O.W. (i.e. curb and gutter on both sides).

1.2 Background Information Collection and Review

The project limits, herein referred to as the Study Area, include approximately 3.0 km of Mississauga Road. The Study Area is a major north-south arterial road, located within the Credit River watershed. The Study Area contributes drainage to two (2) subwatersheds, namely the Huttonville Creek subwatershed, and the Norval to Port Credit.

To assess the existing drainage systems and associated hydraulic crossings for the Study Area, previously completed reports, mapping, drawings and other documents have been obtained and reviewed. Summaries of the background information has been provided with this report as noted.

1.2.1 Reports

The following reports have been reviewed for background use in the drainage system assessment and analysis. Reports have been provided by the Region, TMIG, and Aquafor Beech Ltd.

Design Brief, Region of Peel and Credit Valley Conservation Low Impact Development Design for Mississauga Road, Project 1: Mississauga Road (Credit River to Williams Parkway), Aquafor Beech Ltd., October 2016

The Design Brief outlines the detailed Low Impact Development (LID) design completed for Mississauga Road (Credit River to Williams Parkway). The Design Brief was prepared to address the need for quality controls for this section of Mississauga Road under its current condition. The current condition consists of a 4 lane R.O.W. with a semi-urban cross-section.

The LID design is a combination of six (6) enhanced swales and one (1) bioswale, located within the center median adjacent to Stormwater Management (SWM) Facility W1. The LIDs receive runoff from a 25 mm storm event, collected and conveyed by the storm sewer within Mississauga Road. A flow splitter manhole is located at the intersection of Adamsville Road and Mississauga Road which directs the 25 mm peak flow to a storm sewer dedicated to the LIDs. The storm sewer conveys flows through an OGS unit prior to discharging to an enhanced swale. The enhanced swales are connected in series, and are configured to allow flows to cascade from one to the next, and finally cascade to the bioswale. The LIDs are comprised of engineered soils media that promotes infiltration and evapotranspiration. Any runoff that filters through the entire series of LIDs is collected by an underdrain connected back to the Mississauga Road storm sewer, and conveyed to SWM Facility W1. The Design Brief also provides groundwater elevations along Mississauga Road between Queen Street and Bovaird Drive.

Contract 3 – Stormwater Management Report, Mississauga Road Improvement Project from Williams Parkway to Bovaird Drive, Bovaird Drive at Mississauga Road Intersection, The Municipal Infrastructure Group, November 2015

The stormwater management report outlines the design of the stormwater management solution for a section of Mississauga Road identified as 'Contract 3'. The Contract 3 area extends from just north of Williams Parkway to approximately 360 m north of Bovaird Drive, as well as the Bovaird Drive & Mississauga Road intersection. The report was prepared as part of an earlier Class EA completed to expand the Contract 3 section of Mississauga Road from a rural R.O.W. to a semi-urban R.O.W. The report provides assessments of existing and proposed drainage conditions, as well as recommended methods of stormwater quality and quantity treatment.

The stormwater management solution recommended in the report provides 10 year post to 10 year pre-development stormwater quantity control by the use of orifice plates and flood storage within storm sewers. Quality control is provided by oil/grit separator (OGS) units and various LID BMPs. Erosion control is not provided. Several culverts were identified in the report, some of which were identified for removal, others to be extended, and another to be relocated.

Stormwater Management Implementation Report, Draft Plan 21T-10020B, Four X Development Inc. Rand Engineering Corporation, September 2015.

The stormwater management report was prepared for the detailed design of two SWM facilities located within the Four X residential development located west of Mississauga Road and north of Queen Street. The SWM facilities were sized to provide quantity controls for the 2-100 year and Regional Storm events, and Enhanced (Level 1) water quality control for drainage from the Four X development. Erosion control is provided to meet extended detention criteria. The design of the SWM facilities does not account for drainage from the Mississauga Road R.O.W, that said, prior to development the existing natural drainage outlet for a section of the Mississauga R.O.W. was through the Four X development site.

Design Brief, Region of Peel and Credit Valley Conservation Low Impact Development Design for Mississauga Road, Project 2: Mississauga Road (Williams Parkway to Bovaird Drive), Aquafor Beech Ltd., August 2015

The Design Brief outlines the detailed LID BMP design completed for the Contract 3 area of Mississauga Road (Williams Parkway to Bovaird Drive). The Design Brief was prepared in combination with the Contract 3 SWM report prepared by TMIG (November 2015) and addresses two (2) conditions for the Mississauga Road R.O.W.; interim and ultimate. The interim condition consists of a 4 lane R.O.W. with a semi-urban cross-section, and the ultimate condition consists of a 6 lane R.O.W. with a fully urban cross-section.

Under a 4 lane R.O.W. with a semi-urban cross-section where one side of the R.O.W. contains curb/gutter, and the opposite side contains a typical rural ditch, the LID BMP design is a combination of infiltration trenches and enhanced swales. Under a 6 lane fully urbanized R.O.W. the infiltration trenches would remain in-place and the enhanced swale would be replaced with a bioswale located within the boulevard. The Design Brief also provides groundwater elevations along Mississauga Road between Queen Street and Bovaird Drive.

Stormwater Management Report, Bluegrass South Ltd. & Bluegrass Valley Properties Ltd., City of Brampton, Schaeffers Consulting Engineers, September 2013

The stormwater management report was prepared for the detailed design of three SWM facilities located within the Bluegrass South residential development, located east of Mississauga Road, on the north and south sides of Williams Parkway. One SWM facility of importance is SWM Facility H3, located south of Williams Parkway along Royal West Drive.

SWM Facility H3 was sized to provide quantity controls for the 2-100 year storm events, and Enhanced (Level 1) water quality control for drainage from the Bluegrass South residential development. Erosion control is provided to meet target outflow rates established based on erosion thresholds in the receiving watercourse. SWM Facility H3 outlets to Huttonville Creek. Hydrologic modelling was conducted using Visual OTTHYMO2 (VO2).

The design of SWM Facility H3 accounted for storm drainage from a 1.04 ha area for the Mississauga Road R.O.W., between Williams Parkway and the drainage divide north of Williams

Parkway, at an imperviousness of 100%. The future Mississauga Road R.O.W. drainage area to SWM Facility H3 will be approximately 0.73 ha, at an imperviousness of 86% (impervious area = 0.63 ha). It is noted that the actual impervious area draining to SWM Facility H3 from the Mississauga Road R.O.W. (0.63 ha) is less than the impervious area accounted for in the design (0.73 ha).

Hydrogeological Study, Mississauga Road Improvements Project, AES International Environmental Consultants Inc., November 2010

The Hydrogeological Study was completed to support dewatering requirements associated with the installation of a 1200 mm diameter watermain along Mississauga Road. The study included the advancement of three boreholes, as well as the review of several other borehole logs along Mississauga Road between Williams Parkway and Bovaird Drive. The borehole logs show that the soils beneath Mississauga Road is fill consisting of silty clay, underlain by various substrates consisting of silty clay, clay till, silty sand, and fine to medium sand. The study outlined the existence of a sand plain located between 300 m and 550 m north of Williams Parkway. The study also provided groundwater levels within the boreholes. The groundwater levels are noted to match those reported in the Design Briefs completed by Aquafor Beech.

Contract 2 – Stormwater Management Report, Mississauga Road Improvement Project from Credit River Bridge to Williams Parkway, Queen Street from Royal West to Mississauga Road, The Municipal Infrastructure Group, July 2010

The stormwater management report outlines the design of the stormwater management solution for a section of Mississauga Road identified as 'Contract 2'. The Contract 2 area extends from the Mississauga Road crossing of the Credit River to just north of Williams Parkway, as well as a portion of Queen Street West between Mississauga Road and Royal West Drive. The report was prepared as part of an earlier Class EA completed to expand the Contract 2 section of Mississauga Road from a rural R.O.W. to an urban R.O.W. between the Credit River Crossing and Ostrander Boulevard, and a semi-urban R.O.W. between Ostrander Boulevard and just north of Williams Parkway. The report provides assessments of existing and proposed conditions, as well as recommended methods of stormwater quality and quantity treatment.

The stormwater management solution recommended in the report provides 10 year post-development to 10 year pre-development stormwater quantity control by the use of orifice plates and flood storage via storm sewers within the Mississauga Road R.O.W., as well as by utilizing adjacent stormwater management facilities W1 and H3, located east of the Mississauga Road R.O.W. Quality control is provided by OGS units and the SWM facilities. Erosion control is provided for the sections of Mississauga Road that drain to the SWM facilities. Multiple culverts were identified in the report, two of which were identified for replacement, and the rest identified for removal.

Stormwater Management Report, SWM Pond W1 (Regional Control), Valdor Engineering Inc., December 2009

The stormwater management report was prepared for the detailed design of SWM Facility W1, located at the northeast corner of Mississauga Road and Queen Street West. SWM Facility W1 was sized to provide quantity controls for the 2-100 year and Regional Storm events, and Enhanced (Level 1) water quality control for drainage from the Chariot Subdivision. Erosion control is provided to meet target outflow rates established based on erosion thresholds in the receiving watercourse. SWM Facility W1 outlets to a tributary of the Credit River, located west of Mississauga Road. Hydrologic modelling for the development area and SWM Facility W1 was conducted in Visual OTTHYMO2 (VO2).

The design of SWM Facility W1 accounted for storm drainage from a 7.25 ha area for the Mississauga Road R.O.W. between Queen Street West and Williams Parkway, at an imperviousness of 100%. The future Mississauga Road R.O.W. drainage area to SWM Facility W1 will be approximately 7.40 ha, at an imperviousness of 82% (impervious area = 6.10 ha). It is noted that the actual impervious area draining to SWM Facility W1 from the Mississauga Road R.O.W. (6.10 ha) is less than the impervious area accounted for in the design (7.25 ha).

Stormwater Management Study, Mississauga Road, Class Environmental Assessment, Bovaird Drive to Queen Street, Trow Associates Inc., November 2006

The stormwater management report outlines the design of the stormwater management solution for a section of Mississauga Road between Bovaird Drive and Queen Street West. The report was prepared as part of an Class EA, to support the urbanization of Mississauga Road, in which the existing rural R.O.W. would be expanded and converted to a semi-urban R.O.W. The report provides assessments of existing and proposed conditions, as well as recommended methods of stormwater quality and quantity treatment.

The report concluded that no stormwater quantity control would be required for the proposed road as the associated works would not adversely impact the receiving watercourses. The report concluded that enhanced level stormwater quality control is to be provided by use of oil/grit separators and an enhanced swale.

Credit Valley Subwatershed Study, Huttonville Creek (7), Springbrook Creek (8a), Churchville Tributary (8b), draft Appendices, Totten Sims Hubicki Associates, January 2004

The subwatershed study evaluated the impacts of development within an area bounded by Highway 7 and the CNR Tracks to the north, Chinguacousy Road and the CPR Tracks to the east, Steeles Avenue to the south, and Mississauga Road and the Credit River to the west, which cover the Study Area associated with this EA Addendum. The subwatershed study evaluated the effects of development on the receiving watercourses, and provided recommendations for the stormwater management strategy for the development lands. The hydrologic evaluation of the development was completed using the 24-hour SCS storm event. The stormwater management strategies recommended in the Subwatershed are reflected in the stormwater management criteria in Section 3.1.2.

1.2.2 Mapping, Drawings, and Documents

The following mapping, drawings and other documents have been reviewed for background use in the assessment and analysis of this study.

Credit Valley Conservation Authority (CVC)

- Subwatershed Maps; and
- CVC, Stormwater Management Criteria (August 2012).

Regional Municipality of Peel

- Guidelines for the Preparation of Stormwater Management Reports in Support of Municipal Class Environmental Assessment, Region of Peel, June 2014; and
- Various as-Constructed Plan and Profiles for Mississauga Road, prepared by MMM & TMIG (May 2013).

TMIG

- Mississauga Road Reconstruction (From Ostrander Blvd to Queen St) LID Drainage & Centre Median Design, Phase 2 LID Works, prepared by Aquafor Beech Ltd. (July 2016) – Issued for 90% Review;
- Terraslope and LID Drainage Design Drawings, Part A: Terraslope RSS Slope, prepared by Terrafix Geosynthetics Inc. (August 2015); and
- Terraslope and LID Drainage Design Drawings, Part B: LID Drainage Design, prepared by Aquafor Beech Ltd. (August 2015).

Ministry of the Environment and Climate Change (MOECC)

Amended ECA #2123-A8AR5D (May 7, 2016) for construction of stormwater infrastructure related to the retrofit of medians on Mississauga Road from Adamsville Road to Queen Street, in the City of Brampton.

1.3 Background Review Findings

Review of the background material listed in Section 1.2 produced multiple items worthy of noting due to their implications to the SWM assessment and recommendations of this EA Addendum. The items are explained below, organized by background report.

Contract 3 – Stormwater Management Report, TMIG, November 2015

- The SWM Report outlines the detailed design for the quantity control solution for the section of Mississauga Road discharging to Culvert C4 (between Bovaird Drive and the drainage divide north of Williams Parkway);

- The SWM assessment completed for this report was done for a four (4) lane configuration only. Mississauga Road will have an ultimate six (6) lane configuration;
- The SWM solution services only the 2 – 10 year storm events. The quantity control criteria outlined in Section 3.1.2 for lands draining to Huttonville Creek requires control of the 2 – 100 year storm events;
- The existing quantity control system is not expected to achieve quantity control targets for the ultimate lane configuration, therefore the performance of the existing system must be assessed for the ultimate condition;
- To assess the performance of the existing system, the ultimate conditions peak flows must be compared to conditions prior to the current four (4) lane widening works (i.e. pre-development conditions);
- Pre-development peak flows, for drainage to Culvert C4, were not established in the SWM Report and must be established at this time.

Design Brief, Project 2: Mississauga Road (Williams Parkway to Bovaird Drive), Aquafor Beech Ltd., August 2015

- The Design Brief outlines the detailed design of an infiltration trench system that receivers and treats drainage from the east half of Mississauga Road (3 lanes), north of Culvert C4, for a 25 mm storm event. No infiltration system was proposed for drainage from the east half of Mississauga Road, south of Culvert C4;
- Subsequent meetings and discussions with the Region has concluded that infiltration of drainage for the east half of Mississauga Road, south of Culvert C4, is required to the extent possible up to 25 mm capture;
- The Region does not intend to disturb the east half of Mississauga Road following the current on-going four (4) lane widening construction;
- The infiltration requirements for the east half of Mississauga Road, south of Culvert C4, will be added into the requirements for the west half of Mississauga Road (infiltration criteria explained in Section 3.1.5 under Ministry of Environment and Climate Changes).

Design Brief, Project 1: Mississauga Road (Credit River to Williams Parkway), Aquafor Beech Ltd., October 2016

- The design brief outlines the detailed design of a series of enhanced swales and one bioswale that treats drainage from a 25 mm storm event from the existing lane configuration of Mississauga Road from Adamsville Road to the drainage divide north of Williams Parkway;
- The LID BMP system contains an impermeable lined base, thus restricting infiltration, and allowing only for filtration & evapotranspiration;
- The LID BMP system cannot be considered to meet the infiltration requirements outlined in Section 3.1.5, and an infiltration system should be investigated to meet the requirements.

2.0 EXISTING CONDITIONS

2.1 Existing Conditions Storm Drainage

The existing roadway drainage is split between three (3) watercourses: Huttonville Creek, the Credit River, and a tributary to the Credit River. As outlined in Section 1.1, the existing Mississauga Road encompasses a series of storm sewers conveying minor system flows, and a series of urban and semi-urban R.O.W.s conveying major system flows. The minor system conveys storm events up to the 10 year storm event, and the major system conveys storm events greater than the 10 year, up to the 100 year storm event. The overall existing drainage boundaries are shown on Figure 3.1, and the minor and major systems drainage patterns, as well as storm sewers and LIDs are represented on Figures 3.1 – 3.4. A description of the storm drainage systems, split between watercourses, is provided below.

Huttonville Creek

Approximately 5.14 ha of the existing Mississauga Road R.O.W. is conveyed to Huttonville Creek.

As shown on Figure 3.2, drainage from Subcatchments M122 – M132 (0.88 ha) and Subcatchment EXT-GAS (0.48 ha) is conveyed to Outlet 6, which discharges directly to Huttonville Creek. Most of the drainage from Subcatchment 101 includes a portion of Bovaird Drive. The Mississauga Road and Bovaird Drive intersection is urbanized, and drainage is directed to catchbasin manholes located along the curb/gutter. The catchbasin manholes are connected to a 300 mm diameter storm sewer, which conveys minor system flows to Outlet 6. As per the "Contract 3 – Stormwater Management Report" (TMIG, November 2015) described in Section 1.2.1, the minor system (10 year) peak flow rates generated from Subcatchments M125A – M132 and Subcatchment EXT-GAS are detained within the storm sewer system by a 296 mm diameter orifice plate located on the southwest side of Control Manhole 136. Stormwater storage is provided within the storm sewer system. Approximately 20 m^3 of stormwater storage is required and is provided within the storm sewer (TMIG, November 2015). Subcatchments M122 and M123 are conveyed uncontrolled through Control Manhole 136, to Outlet 6. Prior to discharging to Huttonville Creek, storm drainage conveyed by the storm sewer is treated by an Oil/Grit Separator (OGS) unit (CDS PMSU20_25_5) sized to provide 80% TSS removal. The major system is conveyed by the semi-urban R.O.W. toward Culvert C4. The east half of the R.O.W. collects at a low point between Subcatchments M111A and M111B. The west half of the R.O.W. is conveyed by the existing roadside ditch to Culvert C4. The minor and major systems drainage eventually combine downstream of Culvert C4.

Drainage from Subcatchments M110 – M117, and M120 and M120A (1.05 ha) is conveyed to Outlet 5N. Drainage from this section of Mississauga Road is directed toward catchbasin manholes located along the curb/gutter of the urbanized R.O.W. Flows captured by the catchbasin manholes are initially directed to an infiltration trench located along the east side of the Mississauga Road R.O.W. A flow splitter located within the catchbasin manholes directs flows to the infiltration trenches. As per the "Design Brief, Region of Peel and Credit Valley Conservation Low Impact

Development Design for Mississauga Road, Project 2: Mississauga Road (Williams Parkway to Bovaird Drive)" (Aquafor Beech Ltd., August 2015), the infiltration trenches were designed to provide Enhanced (Level 1) water quality treatment (80% TSS removal) for the area draining to it, as well as provide an erosion control benefit to the system by infiltrating the first 25 mm of rainfall. When flows exceed the capacity of the infiltration trench/flow splitter, drainage spills to the storm sewer system. Appendix A provides a plan and cross-section details of the infiltration trench and storm sewer system. The storm sewer system, ranging in size from 300 mm to 675 mm diameter, conveys the minor system to Outlet 5N, located immediately north of Culvert C4, and immediately adjacent to Huttonville Creek. The minor system peak flow rates generated by this portion of Mississauga Road are detained within the storm sewer system by a 198 mm diameter orifice plate located on the north side of Control Manhole 116. Approximately 62 m^3 of stormwater storage is required and is provided within the storm sewer (TMIG, November 2015). The major system is conveyed by the R.O.W. to the low point between Subcatchments M111A and M111B at a double catchbasin. When runoff rates exceed the capacity of the double catchbasin, flows will spill east, over the boulevard and retaining wall, toward Huttonville Creek, where it combines with the minor system drainage.

Drainage from Subcatchments M118 – M119B, including Subcatchments M118EXT and Swale127 (1.68 ha) is also conveyed to Outlet 5N. Drainage from Subcatchments M119A and M119B is directed toward catchbasins located along the curb/gutter of the urbanized R.O.W. Flows captured by the catchbasin manholes are directed to the storm sewer system. Drainage from Subcatchments M118 and M118EXT is directed toward the roadside ditch (Subcatchment Swale127) along the west side of the R.O.W. Subcatchment Swale127 is comprised of an enhanced swale designed to provide Enhanced (Level 1) water quality treatment (80% TSS removal) for the area draining to it, as well as provide an erosion control benefit (Aquafor Beech Ltd., August 2015). Appendix A provides typical cross-section details of the enhanced swale. Drainage in Subcatchment Swale127 is directed toward an inlet pipe connecting to the storm sewer system. The storm sewer system, ranging in size from 300 mm to 600 mm diameter, conveys the minor system to Outlet 5N. The minor system peak flow rates generated by this portion of Mississauga Road are detained within the storm sewer system by a 209 mm diameter orifice plate located on the west side of Control Manhole 116. Approximately 45 m^3 of stormwater storage is required and is provided within the storm sewer (TMIG, November 2015). The major system is conveyed by the roadside ditch to Culvert C4, and combines with the minor system in Huttonville Creek. Prior to discharging to Huttonville Creek, storm drainage conveyed to Outlet 5N receives additional quality control treatment from an OGS unit (CDS PMSU30_20_6) sized to provide 80% TSS removal.

Drainage from Subcatchments M88 – M106, and EXT-94B (1.66 ha, ref. Figures 3.1 and 3.2) is conveyed to Outlet 5S. Drainage from this section of Mississauga Road is directed toward catchbasin manholes located along the curb/gutter of the urbanized R.O.W. Flows captured by the catchbasin manholes are directed to the storm sewer system. The storm sewer system, ranging in size from 300 mm to 525 mm diameter, conveys the minor system to Outlet 5S, located immediately south of Culvert C4, and immediately adjacent to Huttonville Creek. The minor system peak flow rates generated by this portion of Mississauga Road are detained within the storm sewer system by a 216 mm diameter orifice plate located on the south side of Control Manhole 107. Approximately 62 m^3 of stormwater storage is required and is provided within the storm sewer (TMIG, November 2015). The major system is conveyed by the R.O.W. to the low point between Subcatchments M111A and M111B at the double catchbasin. When runoff rates exceed the capacity of the double catchbasin, flows will spill east, over the boulevard and retaining wall, toward Huttonville Creek, where it combines with the minor system drainage.

Drainage from Subcatchments M86 – M87, M107 – M109A, and M107EXT – M109EXT (6.47 ha) is directed toward the roadside ditch (Subcatchments Swale109, Swale111, and Swale113 – 0.03 ha) along the west side of the R.O.W. Subcatchments Swale109, Swale111, and Swale113 are comprised of an enhanced swale designed to provide Enhanced (Level 1) water quality treatment (80% TSS removal) for the area draining to it, as well as provide an erosion control benefit (Aquafor Beech Ltd., August 2015). Appendix 'A' provides typical cross-section details of the enhanced swale. Drainage in Subcatchments Swale109, Swale111, and Swale113 is directed toward an inlet pipes connecting to the storm sewer system. The storm sewer system, ranging in size from 300 mm to 600 mm diameter, conveys the minor system to Outlet 5S. The minor system peak flow rates generated by this portion of Mississauga Road are detained within the storm sewer system by a 195 mm diameter orifice plate located on the west side of Control Manhole 107. Approximately 92 m^3 of stormwater storage is required and is provided within the storm sewer (TMIG, November 2015). The major system is conveyed by the roadside ditch to Culvert C4, and combines with the minor system in Huttonville Creek. Prior to discharging to Huttonville Creek, storm drainage conveyed to Outlet 5S receives additional quality control treatment from an OGS unit (CDS PMSU20_25_6) sized to provide 80% TSS removal.

Drainage from Subcatchments M109A and M108 A (0.24 ha) is directed toward the roadside ditch (Subcatchments Swale114 and Swale126 – 0.014 ha) along the west side of the R.O.W. Subcatchments Swale114 and Swale126 are comprised of an enhanced swale designed to provide Enhanced (Level 1) water quality treatment (80% TSS removal) for the area draining to it, as well as provide an erosion control benefit (Aquafor Beech Ltd., August 2015). Drainage within Subcatchments Swale 114 and Swale 126 are directed toward the upstream side of Culvert C4. Subcatchment EXT-C4 (36.13 ha) is also directed toward Culvert C4. Culvert C4 conveys the runoff from these Subcatchments to Huttonville creek, where they combine with the previously described major and minor system drainage.

Drainage from Subcatchments S80 – S85 (0.72 ha) undergoes a major/minor system split. The drainage from the east half of the R.O.W. is directed toward catchbasins located along the curb/gutter of the urbanized R.O.W. Flows captured by the catchbasin manholes are directed to the storm sewer system. The drainage from the west half of the R.O.W. is conveyed within the roadside ditch, and directed toward inlet pipes connecting to the storm sewer system. The storm sewer system, 300 mm in size, is conveyed by a storm sewer network through Mississauga Road, Williams Parkway, and Royal West Drive to SWM Facility H3 located along Royal West Drive, south of Williams Parkway. SWM Facility H3 outlets directly to Huttonville Creek and provides stormwater quantity, quality, and erosion control for the minor system drainage from Subcatchments S80 – S85, as well minor and major system drainage from the Bluegrass South residential development (Subcatchment SWMP-H3 – 43.95 ha) located on the northeast corner of the Williams Parkway and Mississauga Road intersection (ref. Figure 3.1). As per the "Stormwater Management Report, Bluegrass South Ltd. & Bluegrass Valley Properties Ltd" (Schaeffers Consulting Engineers, September 2013), SWM Facility H3 is sized to treat 1.04 ha of drainage from the Mississauga Road R.O.W. at 100 % imperviousness. The major system drainage from Subcatchments S80 – S85 is conveyed by the semi-urban Mississauga Road R.O.W. to the Credit River Crossing, located south of Queen Street West (ref Figure 3.4).

Tributary to Credit River

Approximately 6.89 ha of the existing Mississauga Road R.O.W. is conveyed to the Tributary of the Credit River. As shown on Figures 3.2 – 3.4, drainage from Subcatchments S19 – S79 is conveyed south along Mississauga Road. Drainage on the east side of the R.O.W. is directed toward catchbasin manholes located along the curb/gutter of the urbanized R.O.W. Drainage from the west side of the R.O.W. is directed toward a roadside ditch which conveys major and minor system flows to inlet pipes located within Subcatchments S44 – S51. South of Subcatchment S44, the Mississauga Road R.O.W. becomes fully urbanized and drainage from both sides of the R.O.W. are directed toward catchbasins located along the curb/gutter. Drainage collected within the storm sewers north of Subcatchments S29 and S40 is conveyed to a flow splitter manhole located at the southeast corner of the Mississauga Road and Adamsville Road intersection (ref. Figure 3.4). As per the "Design Brief, Region of Peel and Credit Valley Conservation Low Impact Development Design for Mississauga Road, Project 1: Mississauga Road (Credit River to Williams Parkway)" (Aquafor Beech Ltd., October 2016), the flow splitter manhole splits the minor system flows, directing flows from the first 25 mm of rainfall to an OGS and a series of enhanced swales and one (1) bioswale located within the center median of the Mississauga Road R.O.W. Flows in excess of the first 25 mm of rainfall are directed to a storm sewer located within the Adamsville R.O.W. The Adamsville storm sewer drains through a storm sewer network within the Chariot Subdivision residential development and outlets to the east forebay of SWM Facility W1, located at the northeast corner of Mississauga Road and Queen Street West (ref. Figure 3.5).

The enhanced swales and bioswale located within the center median of the R.O.W. receive flows from a storm sewer designated for the 25 mm peak flows diverted by the flow splitter manhole (ref. Figure 3.4). Flows entering the enhanced swales receives pre-treatment from an OGS unit (STC 6000) sized to provide 80% TSS removal. The storm sewer outlets to the surface of the first enhanced swale. The enhanced swales are oriented in series and spill in a cascading manner from one to the next, while the last enhanced swale spills to the bioswale. The bioswale contains an underdrain that collects any stormwater not absorbed by the media, and connects to the storm sewer within Mississauga Road, where drainage is conveyed to the west forebay of SWM Facility W1. The infiltration trenches were designed to provide Enhanced (Level 1) water quality treatment (80% TSS removal) for the area draining to it, as well as provide an erosion control benefit to the system by infiltrating the first 25 mm of rainfall (Aquafor Beech Ltd., October 2016). See Appendix A for plan and cross-section details of the enhanced swales and bioswales.

Drainage south of Subcatchments S41 and S52 is directed toward catchbasins located along the curb/gutter of the urbanized R.O.W. Flows captured by the catchbasin manholes are directed to the storm sewer system, and conveyed to the west forebay of SWM Facility W1 (ref. Figure 3.4). Flows within the storm sewer combine with flows from the bioswale collected by the underdrain.

SWM Facility W1 provides stormwater quantity, quality and erosion control for the minor system drainage from Subcatchments S19 – S79, as well as minor and major system drainage from the Chariot Subdivision residential development (Subcatchment SWMP-W1 – 39.82 ha) located along the east side of Mississauga Road (ref. Figure 3.1). As per the "Stormwater Management Report, Chariot Subdivision (Valdor Engineering Inc., December 2009)", SWM Facility W1 is sized to treat 7.25 ha of drainage from the Mississauga Road R.O.W. at 100% imperviousness. SWM Facility W1 outlets to the tributary of the Credit River by draining through a 1500 mm diameter storm sewer crossing beneath Mississauga Road, and through a headwall located on the west side of Mississauga Road (ref. Figure 3.4). The major system drainage from Subcatchments S19 – S79 is conveyed by the Mississauga Road R.O.W. to the Credit River Crossing.

Credit River

Drainage from 9.06 ha of the Mississauga Road R.O.W. is conveyed to the Credit River. Drainage from Subcatchments S1 – S18 (1.49 ha) is conveyed south along the Mississauga Road R.O.W. toward the Credit River Crossing (ref. Figure 3.4). Drainage from Subcatchments S103 – S116 (1.87 ha) is conveyed west along the Queen Street West R.O.W. toward Mississauga Road (ref. Figure 3.5). Minor and major system drainage Queen Street West combines with minor and major system drainage from Mississauga Road within the intersection. Minor system drainage within the Mississauga Road storm sewer is conveyed to Outlet 1, located immediately downstream of the Credit River Crossing (ref. Figure 3.4). Major system drainage from the Mississauga Road R.O.W. is conveyed within the R.O.W. to the low point of Mississauga Road, approximately 250 m east of the Credit River Crossing.

As this EA Addendum has been prepared for the Mississauga Road widening starting from north of Queen Street West and ending south of Bovaird Drive, the storm drainage for Subcatchments S1 – S18 and S103 – S116 will not be discussed in further detail in this report. A Schedule 'C' Class EA is being prepared simultaneously with this EA Addendum, for a section of Mississauga Road between north of Financial Drive and north of Queen Street West. As most of the drainage from Subcatchments S1 – S18 and S103 – S116 is located within the limits of the Schedule 'C; Class EA, the drainage will be discussed in detail in the Class EA SWM Report.

2.2 Hydraulic Crossings

As shown on Figure 3.1, two (2) crossings exist within the Study Area. Culvert C4 is a 0.9 m x 1.8 m concrete box culvert that conveys runoff from a 36.13 ha external drainage area west of Mississauga Road to Huttonville Creek. The culvert has the capacity to convey a peak flow of 5.9 m^3/s, generated by a Regional Storm event (TMIG, November 2015).

Crossing C10 is a 14.6 m x 3.6 m open span Concast™ structure, 72 m in length that conveys Huttonville Creek. The crossing has the capacity to convey a peak flow of 86.2 m^3/s, generated by a Regional Storm event.

The existing Huttonville Creek Regional floodline is represented on Figure 2.2. As shown, the Regional Storm floodline is contained along the east side of the Mississauga Road R.O.W.

2.3 Soils and Groundwater

The soils beneath the Mississauga Road R.O.W. between Queen Street West and Bovaird Drive are fill material. Between Queen Street West and Williams Parkway, the fill material consists primarily of silty fine sand (saturated hydraulic conductivity = 6.3 mm/hr, Aquafor Beech Ltd., October 2016). As per "Hydrogeological Study, Mississauga Road Improvements Project" (AES International Environmental Consultants Inc., November 2010), the fill material between Williams Parkway and Bovaird Drive consists primarily of silty clay (saturated hydraulic conductivity = 0.5 mm/hr). The depth of the fill materials range from 0.5 m – 3.5 m. The fill material is underlain predominately by silty clay, ranging in depth from 0.5 m – 5.0 m, with traces of gravel, sand, silty sand, silty clay, and clay material throughout. Beneath the silty clay material is weathered shale and shale. A sand plain, consisting of medium to coarse sand and gravel, is located between approximately 300 mm and 550 m north of Williams Parkway at a depth of 3.5 m – 9.5 m below ground (AES, November 2010).

Soils within the Bluegrass South and Chariot Subdivision residential developments are noted to be silty clay and clayey silt (Schaeffers Consulting Engineers, September 2013 & Valdor Engineering Inc., December 2009).

Borehole log information provided in the Design Brief, Project 1 (Aquafor Beech Ltd., October 2016) indicates that groundwater was not encountered in any boreholes between Queen Street West and approximately 140 m north of Williams Parkway, with the exception of BH110, located approximately 150 m south of Williams Parkway, where groundwater was encountered at 4.2 m below the existing road grade. Borehole depths in this section of Mississauga Road range from 3.8 m to 5.7 m. Between 140 m north of Williams Parkway to Bovaird Drive, groundwater was encountered in all boreholes, ranging in depths of 1.4 m – 4.4 m below the existing road grade. Appendix 'A' provides the soil stratigraphy and groundwater information provided in the Design Brief, Project 1 (Aquafor Beech Ltd., October 2016) and Hydrogeological Study (AES, November 2010).

2.4 Pre-Development Conditions

As discussed in Section 1.3, the existing SWM controls for storm drainage to Culvert C4 were sized to service the 2-10 year storm events. As the quantity control criteria, outlined in Section 3.1.2 requires post-to-pre control for the 2 – 100 year storm events, it is unlikely that the existing SWM controls for this section of Mississauga Road will provide appropriate SWM control for the 25 – 100 year storm events. Furthermore, the post-to-pre controls developed for the existing conditions (4 lane) were determined on an individual storm sewer basis, and did not consider the overall release rates to Huttonville Creek. To ensure that the storm drainage for the ultimate condition (6 lane) of this section of Mississauga Road is appropriately developed, a SWM assessment must be completed for the storm drainage within the Study Area that drains to Huttonville Creek, immediately downstream, of Culvert C4. The SWM assessment will require appropriate target peak flows rates for the 2 – 100 year storm events, for the condition of Mississauga Road prior to the current on-going four (4) lane widening works (i.e. pre-development). As such, the pre-development condition of a two (2) lane rural road cross-section has been reviewed and assessed. Pre-development drainage information was obtained from the "Contract 3 – Stormwater Management Report" (TMIG, November 2015).

2.4.1 Pre-Development Conditions Storm Drainage

Figure 2.1 represents the drainage conditions for the pre-development condition. As shown, three (3) culvert existing under pre-development conditions, namely Culvert C4 (1200 mm dia. CSP), Culvert C5 (450 mm dia. CSP), and Culvert C6 (600 mm dia. CSP). Culvert C6 conveys drainage from Subcatchment C6W (1.21 ha), consisting of Mississauga Road, Bovaird Drive, and the existing gas station. Flows conveyed through Culvert C6 combine with drainage from Subcatchment C6E (0.30 ha) within Huttonville Creek. Subcatchment C6E consist of drainage from Mississauga Road and Bovaird Drive.

Culvert C5 conveys drainage from Subcatchment C5W (1.08 ha), consisting mainly of grassed lands, and a small pond used to service the adjacent driving range property. Flows conveyed through Culvert C5 combine with drainage from Subcatchment C5E (0.25 ha) within Huttonville Creek.

Culvert C4 conveys drainage from Subcatchments C4SW and C4NW (2.20 ha), consisting of drainage from the west side of the Mississauga Road R.O.W., as well as drainage form Subcatchment EXT-C4 (41.68 ha), consisting of drainage from the adjacent driving range property, Bovaird Drive, and vacant land north of Bovaird Drive. Flows conveyed through Culvert C4 combine with drainage from Subcatchments C4SE and C4NE (2.52 ha) within Huttonville Creek, as well as drainage from the subcatchments upstream.

2.4.2 Pre-Development Conditions Target Flows

A hydrologic model has been developed in PCSWMM Version 7.0 to model the existing conditions drainage described above, and establish target rate peak flows within Huttonville Creek. It is noted that, although a large area upstream of Bovaird Drive contributes drainage to the section of Huttonville Creek draining through the Study Area, the upstream drainage area has not been modelled in PCSWMM. The target rate peaks flows established within Huttonville Creek are a representation of the pre-development drainage described herein.

In keeping with the "Credit Valley Subwatershed study, Huttonville Creek (7), Springbrook Creek (8a), Churchville Tributary (8b), draft Appendices" (Totten Sims Hubicki Associates, January 2004) the 24-hour SCS storm event has been modelled using Visual OTTHYMO2 (VO2). Parameterization of the model incorporates the soils information described in Section 2.3.

Table 2.1 below provides the pre-development target rates in Huttonville Creek, immediately downstream of Culvert C4.

Table 2.1. Pre-Development Peak Flows in Huttonville Creek at Culvert C4 (m^3/s)

Storm Event	Peak Flow
2 year	0.83
5 year	1.63
10 year	1.95
25 year	3.18
50 year	4.08
100 year	5.53

The peak flow rates provided in Table 2.1 have been taken as the target rates for land within the Study Area drainage to Huttonville Creek, immediately downstream of Culvert C4.

The PCSWMM hydrologic model of pre-development conditions has been provided digitally with this report.

2.4.3 Target Flows for SWM Facilities H3 and W1

The pre-development conditions for lands draining to SWM Facilities H3 and W1 were not modelled as target flows rates were provided in the respective SWM reports. Target flows rate were determined based on unitary flow rates established within the 2004 Subwatershed Study (TSH, January 2004) and as part of the development planning of the Springbrook Community Lands. The target flow rates for SWM Facilities H3 and W1 are provided in Table 2.2 below.

Table 2.2. Target Flow Rates for SWM Facilities H3 & W1 (m^3/s)

Storm Event	SWM Facility H3	SWM Facility W1
2 year	0.16	0.18
5 year	0.29	0.31
10 year	0.34	0.35
25 year	0.51	0.52
50 year	0.61	0.61
100 year	0.72	0.72
Regional	N/A	1.98

2.5 Existing Conditions Hydrology

A hydrologic model of the existing conditions of the Mississauga Road R.O.W., described in Section 2.1, has been developed in PCSWMM Version 7.0. The PCSWMM model developed as part of the Design Brief, Project 1 (Aquafor Beech Ltd., October 2016) by CHI was built upon to include the drainage to SWM Facilities H3 and W1, as well as the drainage to Huttonville Creek immediately downstream of Culvert C4. A review of the PCSWMM model developed by CHI has been completed, and the following items in relation to the selected parameters are important to note:

Subcatchments

- The Manning's 'n' value assigned to impervious surfaces is 0.012. Typical industry standard for this parameter is 0.013;
- The Manning's 'n' value assigned to pervious surfaces is 0.24. Given the type of pervious surfaces being modelled (i.e. manicured grass), typical industry standard for this parameter is 0.025;
- The depression storage assigned to impervious surfaces is 2.5 mm. Typical industry standard for this parameter is between 1 mm – 2 mm; and
- The initial deficit fraction assigned is 0.315. Based upon review of Table 24.2 within the User's guide to SWMM5, 13th Edition, the initial deficit fraction for soils described in the Design Brief, Project 1 (Aquafor Beech Ltd., October 2016) would be 0.217.

Although the manning's 'n' and depression storage values assigned are not per industry standard they are within a reasonable range and have been kept in the model. In keeping with these values, the subcatchments added to the PCSWMM model have been also assigned these values. The initial deficit fraction has been changed to match Table 24.2 of the User's guide to SWMM5 for soils within this section of Mississauga Road. Subcatchments added to the PCSWMM model were assigned values from Table 24.2 corresponding to their respective subsurface soils conditions described in Section 2.3.

Storm Sewers

- The entrance and exit loss coefficients assigned to storm sewers are 0.2 and 0.4 respectively. Typical industry standards for these parameters ranges from 0.15 – 1;
- The Manning's 'n' value assigned to road surfaces is 0.014. Typical industry standard for this parameter is 0.013; and
- The Manning's 'n' value assigned to ditches is 0.03. Typical industry standard for this parameter is 0.25.

Although the entrance and exit loss coefficients and manning's 'n' values assigned to road surfaces are not per industry standard they are still within a reasonable range and have been kept in the model. In keeping with these values, the storm sewers and road surfaces added to the PCSWMM model were also assigned these values. Roadside ditches were not added to the PCSWMM model.

The PCSWMM model developed for the existing conditions, models the drainage boundaries shown on Figures 3.0 – 3.4. the PCSWMM model also incorporates SWM Facility W1 (Valdor Engineering Inc., December 2009), the enhanced swales and bioswale located within the center median (Aquafor Beech Ltd., October 2016), SWM Facility H3 (Schaeffers Consulting Engineers, September 2013), the SWM controls on the storm sewer for drainage to Huttonville Creek at Culvert C4 (TMIG, November 2015), and the infiltration trenches and enhanced swales draining to Huttonville Creek (Aquafor Beech Ltd., August 2015). The results of the existing conditions peak flows in Huttonville Creek at Culvert C4 are presented below in Table 2.3, with a comparison to the target flow rates.

Table 2.3. Existing Conditions Peak Flows in Huttonville Creek at Culvert C4 (m^3/s)

Storm Event	Target Flow Rates	Existing Conditions Peak Flows	% Difference
2 year	0.83	1.13	36%
5 year	1.63	2.13	30%
10 year	1.95	2.47	26%
25 year	3.18	3.74	18%
50 year	4.08	4.61	13%
100 year	5.53	5.58	1%

Peak flow results presented in Table 2.3. indicate that the existing conditions peak flows exceed the target rates in Huttonville Creek for all storm events. As expected, the 25 – 100 year storm event targets are not being met. More interestingly, the 2 – 10 year storm event targets are not being met either, and with a larger relative increase than the 25 – 100 year storm events. Other noteworthy findings from the review of the PCSWMM model are as follows:

- The 10 year head depth of the storm sewer system within Subcatchments M88 – M106 is higher than the elevation of the catchbasin in Subcatchment M105, resulting in spill onto the roadway surface. The significant head depth is noted to be caused by the 216 mm diameter orifice plate located in control manhole 107;

- The 100 year head depth for storm sewers within Subcatchments M88 – M106 and M110 – M117 is higher than the elevation of the catchbasins, resulting in flooding of the roadway. The significant head depth is noted to be caused by the 195 mm and 216 mm diameter orifice plates located in control manholes 116 and 107; and
- The ponding depth at the low point between Subcatchments M111A and M111B is approximately 26 cm above the road elevation, resulting in a spill over the boulevard and retaining wall, toward Huttonville Creek.

The results of the existing conditions peak flows from SWM Facility H3 are presented below in Table 2.4, with a comparison to the target flow rates.

Table 2.4. Existing Conditions Peak Flows from SWM Facility H3 (m^3/s)

Storm Event	Target Flow Rates	Existing Conditions Peak Flows	% Difference
2 year	0.16	0.16	0%
5 year	0.29	0.27	-7%
10 year	0.34	0.40	16%
25 year	0.51	0.54	5%
50 year	0.61	0.56	-8%
100 year	0.72	0.59	-18%

Peak flow results presented in Table 2.4. indicate that the existing conditions peak flows are equal to or less than the target rates for the 2 year, 5 year, 50 year, and 100 year storm events. The 10 year and 25 year storm events exceed the target rates, although the magnitude of the exceedance is relatively small (0.06 m^3/s and 0.03 m^3/s respectively). It should be noted that the target flow rates were established using Visual OTTHYMO (VO2), while the current analysis is being completed using PCSWMM. As the two modelling programs operate on different engines and the models have different discretizations, it can be expected that different results will be produced. Understanding that SWM Facility H3 was designed to meet post-to-pre-development peak flow targets for the 2 – 100 year storm events (Schaeffers Consulting Engineers, September 2013), there is no cause for concern that the 10 year and 25 year peak flow targets are exceeded as presented in Table 2.4. There are no other noteworthy findings from the review of the PCSWMM model.

The results of the existing conditions peak flows from SWM Facility W1 are presented below in Table 2.5, with a comparison to the target flow rates.

Table 2.5. Existing Conditions Peak Flows from SWM Facility W1 (m^3/s)

Storm Event	Target Flow Rates	Existing Conditions Peak Flows	% Difference
2 year	0.18	0.19	4%
5 year	0.31	0.22	-29%
10 year	0.35	0.23	-34%
25 year	0.52	0.53	2%
50 year	0.61	0.62	1%
100 year	0.72	0.72	0%
Regional	1.98	1.91	-3%

Peak flow results presented in Table 2.5. indicate that the existing conditions peak flows are equal to or less that the target rates for the 5 year, 10 year, 100 year, and Regional Storm events. The 2 year, 25 year, and 50 year storm events exceed the target rates, although the magnitude of the exceedance is relatively small (0.01 m^3/s). As discussed above, it should be noted that the target flow rates were established using VO2, while the current analysis has been conducted using PCSWMM. As the two modelling programs operate on different engines and the models have different discretizations, it can be expected that different results will be produced. Understanding that SWM Facility W1 was designed to meet post-to-pre-development peak flow targets for the 2 – 100 year storm events (Valdor Engineering Inc., December 2009), there is no cause for concern that the 2 year, 25 year, and 50 year peak flow targets are exceeded as presented in Table 2.5.

One noteworthy finding from the review of the PCSWMM model is as follows:

- The ponding depth adjacent to SWM Pond W1 within Subcatchment S33 is approximately 28 cm above the road elevation.

The PCSWMM hydrologic model of existing conditions has been provided digitally with this report.

3.0 STORMWATER OBJECTIVES

3.1 Stormwater Management Design Criteria

The stormwater management analyses of the Mississauga Road widening will consider stormwater management design criteria from several agencies including; the Region, the City of Brampton (City), the Credit Valley Conservation Authority (CVC), the Ministry of Transportation (MTO), the Ministry of Natural Resources and Forestry (MNRF), and the Ministry of Environment and Climate Change (MOECC). The stormwater management criteria relevant to the Mississauga Road widening is outlined below.

3.1.1 The Region of Peel

- Minor System: Storm sewers are to convey the 10 year storm event, and are to be designed using local municipality (Brampton) IDF information;
- Major System: Regional road R.O.W.s, including both urban and rural, are to convey flows generated by the R.O.W. itself, up to the 100 year storm event;
- External lands should not drain to the Region's storm sewer system; and
- No overtopping of the roadway to occur during the Regional Storm event at cross culverts.

3.1.2 The Credit Valley Conservation Authority

Huttonville Creek & Unnamed Tributary

- Quantity Control: Post-to-pre-development for 2 – 100 year storm events is required;
- Quality Control: MOE Enhanced Level (Level 1) Water Quality Control. A treatment train solution is to be implemented;
- Water Balance: Minimum infiltration of 3 mm is required.
- Erosion Control: Minimum infiltration of 5 mm is required (inclusive of water balance).

Credit River – Norval to Port Credit

- Quantity Control: No control is required for all storm events;
- Quality Control: MOE Enhanced Level (Level 1) Water Quality Control. A treatment train solution is to be implemented;
- Water Balance: Minimum infiltration of 3 mm is required.
- Erosion Control: Minimum infiltration of 5 mm is required.

3.1.3 The Ministry of Transportation

- Culverts crossing beneath roads classified as Urban Arterial, with a span less than 6.0 m, are to convey the peak flow generated from a 50 year storm event; and

- Culverts crossing beneath roads classified as Urban Arterial, with a span greater than 6.0 m, are to convey the peak flow generated from a 100 year storm event.

3.1.4 The Ministry of Natural Resources and Forestry

- Huttonville Creek supports Redside Dace habitat, and as such, thermal mitigation of stormwater discharging to Huttonville Creek is required.

3.1.5 The Ministry of Environment and Climate Change

The Region has requested that the SWM assessment completed as part of this EA Addendum incorporate the forthcoming MOECC criteria which is anticipated as being applicable at the time of detailed design and when an Environmental Compliance Approval (ECA) is required. The draft criteria, provided by the Region, is as follows:

- **Linear Development Volume Control**
  New linear projects without restrictions and subject to the approved Source Protection Plan, that results in the creation of impervious surface(s) and/or fully reconstructs the existing impervious surfaces, shall control per the mandatory control hierarchy the larger of the following:
  - The runoff generated from the geographically specific **90th percentile rainfall event from the new and/or fully reconstructed impervious surfaces on the site,** <u>or</u>
  - The runoff generated from the geographically specific **90th percentile rainfall event from the net increase in impervious area(s) on the site.**
- The site shall be required to maintain the pre-development water balance.

3.2 Other Stormwater Objectives

- As noted in Section 1.3, an infiltration system is not currently provided along the east side of the Mississauga Road R.O.W. between Culvert C4 and the drainage divide north of Williams Parkway. As discussed with the Region, infiltration of runoff for this section of the R.O.W. is to be provided, to the extent possible, for the geographically specific 90th percentile rainfall event, as per the pending MOECC LID Guidance document. As the Region does not intend to disturb the east half of the R.O.W. during the proposed widening construction, the infiltration requirements for this section of the R.O.W. are to be added to the infiltration requirements for the west side of the R.O.W.
- As outlined in Section 4.1 below, the existing storm sewer controls at Culvert C4 result in significant flooding of the R.O.W. in the 100 year storm event. Furthermore, the 100 year ponding at the low point between Subcatchments M111A and M111B is high enough to spill east, over the boulevard and retaining wall, toward Huttonville Creek. The proposed SWM solution for this outlet should eliminate 100 year flooding of the R.O.W. resulting from the existing SWM controls, and eliminate spill over the retaining wall.

4.0 FUTURE CONDITIONS

4.1 Future Conditions Storm Drainage

Future conditions storm drainage boundaries are shown on Figure 4.1. Under future conditions, the Mississauga Road R.O.W. will be widened to a six (6) lane R.O.W., including additional turning lanes where required. The widening works will take place entirely on the west side of the R.OW., between Ostrander Boulevard and Bovaird Drive. The east half of the R.O.W. will remain unchanged from its existing condition and drainage conditions will not change. The west half of the R.O.W., currently in a rural condition with a roadside ditch, will be modified to add the two (2) additional lanes, and a boulevard. The result of the widening works will create a fully urbanized cross-section along the entire Study Area. The impacts to the drainage patterns described in Section 2.1 will be minimal. Subcatchments along the west side of the R.O.W. will now be directed to catchbasin manholes located along the curb/gutter instead of the roadside ditches, as the roadside ditches will be removed. The enhanced swale located within Subcatchments Swale109 – Swale127 will be removed to allow for the widening. Culvert C4 will be extended to accommodate the widening width. The existing storm sewer system has been aligned along the west curb line of the future R.O.W. to minimize changes to the storm sewer during the widening. Inlet pipes collecting drainage from roadside ditches will be removed and select manhole lids will be replaced for catchbasin type grates (ref. Figure 4.1).

Table 4.1 below provides a comparison of the impervious coverage of the Mississauga Road R.O.W. for the three land use conditions, as well as the area of the R.O.W. accounted for in the design of SWM Facilities H3 & W1. The table is organized by storm drainage outlet location.

Table 4.1. Impervious Coverage by Storm Drainage Outlet (ha)

Scenario	Outlet					
	Culvert C4		SWM Facility H3		SWM Facility W1	
	Total Area	Impervious Area	Total Area	Impervious Area	Total Area	Impervious Area
Pre-Development	48.66	2.48	-	-	-	-
Existing	48.66	4.61	0.71	0.43	6.89	4.76
Future	48.66	5.65	0.73	0.63	7.40	6.10
Design	-	-	1.04	1.04	7.25	7.25

To determine the impacts of the widening works, the PCSWMM model developed for the existing conditions has been modified to model the future conditions storm drainage. Tables 4.2 – 4.4 below presents the impacts to peak flows at each outlet without any additional SWM controls added. The results of the future conditions peak flows in Huttonville Creek at Culvert C4 are presented in Table 4.2, with a comparison to the target flow rates.

Table 4.2. Future Conditions Peak Flows in Huttonville Creek at Culvert C4 (m^3/s)			
Storm Event	**Target Flow Rates**	**Future Conditions Peak Flows**	**% Difference**
2 year	0.83	1.08	30%
5 year	1.63	1.96	20%
10 year	1.95	2.28	17%
25 year	3.18	3.61	14%
50 year	4.08	4.59	12%
100 year	5.53	5.85	6%

As expected, peak flow results presented in Table 4.2. indicate that the future conditions peak flows exceed the target rates in Huttonville Creek for all storm events. In comparison to the existing conditions peak flows presented in Table 2.3, the 2 – 50 year storm event peak flows are less than existing conditions. The magnitude of the differences between future and existing peak flows is small relative to the peak flows themselves, with the largest difference being 0.19 m^3/s in the 10 year storm event. This is attributed to the effects of the urbanized R.O.W. facilitating more runoff to enter the storm sewer system and be detained by the existing SWM controls, than what was previously captured by the inlet pipes in the roadside ditches. Other noteworthy findings from the review of the PCSWMM model are as follows:

- The 10 year head depth of all storm sewer systems is higher than the elevation of the catchbasins, resulting in spill onto the roadway surface. The significant head depth results from the orifice plates located in Control Manholes 116 and 107;
- The 100 year head depth of all storm sewer systems is higher than the elevation of the catchbasins, resulting in flooding of the roadway. The significant head depth results from the orifice plates located in Control Manholes 116 and 107; and; and
- The ponding depth at the low point between Subcatchments M111A and M111B is approximately 28 cm, resulting in a spill easterly over the boulevard and retaining wall, toward Huttonville Creek.

The results indicate the requirement for additional SWM controls to be implemented within this section of the Mississauga Road R.O.W. to achieve the quantity control criteria outlined in Section 3.1.2. Furthermore, the easterly spill over the retaining wall should be eliminated. A review of SWM alternatives is provided in Section 5.0.

The results of the future conditions peak flows from SWM Facility H3 are presented in Table 4.3, with a comparison to the target peak flow rates.

Table 4.3. Future Conditions Peak Flows from SWM Facility H3 (m^3/s)

Storm Event	Target Flow Rates	Future Conditions Peak Flows	% Difference
2 year	0.16	0.16	0%
5 year	0.29	0.27	-6%
10 year	0.34	0.40	17%
25 year	0.51	0.54	5%
50 year	0.61	0.56	-8%
100 year	0.72	0.59	-18%

Peak flow results presented in Table 4.3. indicate that the future conditions peak flows are equal to or less than the target rates for the 2 year, 5 year, 50 year, and 100 year storm events. The 10 year and 25 year storm events exceed the target rates, although the magnitude of the exceedance is relatively small (0.06 m^3/s and 0.03 m^3/s respectively). As discussed in Section 2.5, the exceedance in the 10 year and 25 year storm events is attributable to the different modelling platforms and discretization's used. Despite the differences noted, SWM controls are not required as the impervious area of the Mississauga Road R.O.W. accounted for in the design of SWM Facility H3 (1.04 ha) is larger than the actual impervious area draining to SWM Facility H3 (0.63 ha) under future conditions.

In comparison to the existing conditions peak flows presented in Table 2.4, the future conditions peak flows are equal to the existing conditions peak flows. This indicates that proposed road works would have no impact on the receiving watercourse (i.e. Huttonville Creek). This is to be expected as the area of Mississauga Road draining to SWM Facility H3 is relatively small compared to the overall drainage area to SWM Facility H3 (1.7% of drainage area to SWM Facility H3). Also, only the minor system from this section of Mississauga Road drains to SWM Facility H3. There are no other noteworthy findings from the review of the PCSWMM model.

The results of the future conditions peak flows from SWM Facility W1 are presented in Table 4.4, with a comparison to the target flow rates.

Table 4.4. Future Conditions Peak Flows from SWM Facility W1 (m^3/s)

Storm Event	Target Flow Rates	Future Conditions Peak Flows	% Difference
2 year	0.18	0.19	6%
5 year	0.31	0.22	-28%
10 year	0.35	0.23	-33%
25 year	0.52	0.54	5%
50 year	0.61	0.62	2%
100 year	0.72	0.82	14%
Regional	1.98	1.92	-3%

Peak flow results presented in Table 4.4. indicate that the future conditions peak flows are equal to or less than the target rates for the 5 year, 10 year, and Regional Storm events. The 2 year, 25 year, and 50 year storm events exceed the target rates with relatively small magnitudes (0.01 m^3/s and 0.02 m^3/s). As discussed in Section 2.5, the exceedance in the 2 year, 25 year, and 50 year storm events is attributable to the different modelling programs and model discretizations used.

The 100 year storm event exceeds the target rate by 0.10 m^3/s. This result is expected as the impervious area of the R.O.W. has increased.

In comparison to the existing conditions peak flows presented in Table 2.5, the 25 year, 100 year, and Regional Storm event peak flows have increased under future conditions, while all other storm event peak flows are equal to the existing conditions peak flows. Despite the peak flow increases shown, SWM controls are not required as the impervious area of the Mississauga Road R.O.W. accounted for in the design of SWM Facility W1 (7.25 ha) is larger than the actual impervious area draining to SWM Facility W1 (6.10 ha) under future conditions.

One noteworthy finding from the review of the PCSWMM model is as follows:

- The ponding depth adjacent to SWM Pond W1 within Subcatchment S33 is approximately 28 cm (same as existing conditions).

The following Section 5.0 provides a review of the SWM opportunities for the Mississauga Road R.O.W. to achieve all SWM objectives outlined in Section 3.0.

5.0 STORMWATER MANAGEMENT OPPORTUNITIES

5.1 General Stormwater Management Opportunities

Stormwater Management Practices (SWMPs) for the management of roadway runoff generally fall into two categories: those that address water quantity and those that manage quality of surface runoff, apart from Low Impact Development (LID) best management practices (BMPs) which provide water quality treatment and quantity control for frequent storm events (i.e. 27 mm storm event).

Water quantity management issues relate to properly sizing the conveyance of roadway runoff along the roadway corridor for minor and major storm events. In addition, water quantity management strategies can include the need for facilities to address downstream flood and erosion potential from the expansion of the right-of-way. Water quantity objectives have been provided within Section 3, and can be divided between the drainage discharging to Huttonville Creek (Culverts C4, C6), discharging to SWM Facility H3/ Huttonville Creek and discharging to SWM Facility W1/ Credit River Tributary.

In terms of water quality, the SWMPs relate to the treatment of new pavement and where possible, the treatment of existing pavement; however, current legislation solely relates to the former. Typically, the treatment level is related to the standards defined in a watershed or subwatershed planning study, which are dependent on the quality and sensitivity of the receiving stream system (i.e. Type 1, Type 2, etc.). Mississauga Road drainage discharges require an Enhanced (Level 1) water quality level of control.

Pending MOECC Guidelines will require capture of the 90th percentile storm event (27 mm for the current study) and infiltration practices to be assessed. Based on discussions with the Region of Peel, in addition to the pending MOECC Guidelines, additional infiltration is to be implemented along the roadway if possible to; first compensate for road sections that under existing conditions do not have infiltration systems, and secondly to reduce runoff volumes being conveyed to SWM Facilities H3 and W1.

Various Best Management Practices or Stormwater Management practices are available to address both the quantity and quality of runoff from roadways. Due to the linear nature of roadway corridors, however, the full spectrum of stormwater management practices is typically not appropriate.

5.1.1 Alternative Stormwater Management Practices

Quantity Management (Flood and Erosion Control)

Flood and erosion impacts due to increased runoff from expanded paved surfaces can be mitigated by on-site storage techniques and/or off-site mitigation measures, such as flood proofing, regulation or stream stabilization.

Quality Management

There are numerous stormwater management practices, which can be used to treat contaminated stormwater runoff from roadway surfaces. These include the following:

i. Wet ponds/wetlands/hybrids (generally linear facilities)
ii. Enhanced grass swales
iii. Filter strips
iv. Oil and grit separators
v. Off-site stormwater management facilities (existing, retrofitted and/or proposed)
vi. LID BMPs – (Bioretention systems and other infiltration systems)

The respective characteristics, advantages and disadvantages of the foregoing have been well documented in previous municipal and provincial literature and hence this information has not been repeated within this document. Some brief advantages and disadvantages, though, are discussed in the following.

5.1.2 General Assessment

The advantages and disadvantages of the various Best Management Practices associated with both quantity and quality control measures are as follows:

Quantity and Erosion Control

Controlling runoff in stormwater management facilities requires land and future management/maintenance by municipal staff. The advantages relate to maintaining existing sizing of drainage infrastructure or smaller infrastructure across the roadway, as well as downstream. Disadvantages include the cost of land, infrastructure and maintenance. Increasing the size of drainage infrastructure, while somewhat more costly to the municipality, reduces the need for future maintenance and eliminates the need for the dedication of stand-alone land for surface controls. Inter-subcatchment diversions can be effective on a minor scale in optimizing and/or reducing the number of crossings and are typically followed to address both major and minor runoff conditions.

For flood and erosion control, on-site measures to reduce peak flow impacts can be highly constraining due to the general lack of properly configured land. Roadway corridors, due to their inherent linear nature, can only effectively manage relatively small volumes of increased runoff (peak flows), in the absence of stand-alone land acquisition. Combination of measures to mitigate impacts through some on-site storage, along with off-site upgrades as necessary, is often the 'best' approach, where impacts exceed allowable minimums, that said, Mississauga Road currently drains to SWM Facilities H3 and W1, where capacity may be available within the SWM facilities under their existing condition, or perhaps retrofitted to provide quantity controls for the less frequent storm events. That said, the major system drainage from the Mississauga Road R.O.W., for the road sections draining to the existing SWM facilities, drains directly to the Credit River which does not require quantity controls.

The following quantity and erosion controls have been screened from further consideration due to the reason provided herein:

i. Wet ponds/wetlands/hybrids

Constructing a new wet pond, wetland or hybrid pond is not feasible within the Mississauga Road R.O.W. based on space constraints, as such this alternative has not been considered further.

ii. Super Pipe Storage

Super pipe storage would require upgrading the existing, just constructed, 10 year storm sewer to a size capable of storing additional runoff to meet the erosion and quantity control targets. Through discussions with the Region of Peel it was determined that upgrading the existing storm sewer system is not practical as it would require disturbing the recently constructed road and infrastructure. The existing storm sewer system, based on review, would require manholes to be replaced, storm sewer sections to be upgraded and the road to be repaved. The project would also extend the current lane restrictions and traffic congestion. In addition, super pipe storage is one of the costliest methods of providing underground storage. As such this method of erosion and quantity control has been screened from further consideration.

iii. Conventional Underground Storage

Conventional underground storage for Mississauga Road would require multiple concrete tanks connected by equalization pipes, sized to provide the storage volumes required to meet peak flow targets. The concrete tanks would be connected to the downstream end of the existing/ proposed storm sewers to maximize the contributing drainage area to the storage elements. Underground concrete tanks are considered costly to implement. In addition, conventional underground tanks do not filter or infiltrate captured runoff, and would therefore have to be used in conjunction with a quality control LID BMP. As such conventional underground storage (concrete tanks) have been screened from further consideration. This does not preclude the use of unconventional underground storage systems or cellular tank systems such as Brentwood™, Cultec™ or Triton™ systems, which would facilitate storage and infiltration.

Quality Control

i. Wet ponds, Wetlands, Hybrids

These systems generally require the dedication of land that most often is not available in linear corridors for roadway projects. Most often when applied to roadway runoff, these SWMP's are located adjacent to creek crossings. Typically, these systems provide an excellent level of treatment, and as end-of-pipe systems, the management and performance is more visible and therefore less prone to failure. For Mississauga Road, this particular opportunity is considered impractical as new facilities would be required at multiple locations to manage runoff to the multiple storm drainage outlets. Costs associated with the construction and maintenance of the multiple new facilities would be expected to be high. There is also a lack of available land for the sections of Mississauga Road drainage to SWM Facilities H3 & W1. In addition, the Region of Peel is trying to reduce the use of traditional end-of-pipe SWM facilities, and reduce the runoff from Regional property discharging to end-of-pipe SWM facilities.

ii. Enhanced Grassed Swales

Grassed swales designed with a trapezoidal geometry and flat longitudinal profiles with largely un-maintained turf can provide excellent filtration and treatment for storm runoff from roadways. It is generally conceded that treatment levels are at a minimum (Normal (formerly Level 2) water quality treatment), however when combined with other practices can provide Enhanced (Level 1) water quality treatment. Their application in linear corridors is also particularly appropriate and can be further enhanced through the introduction of check dams to provide additional on-line storage. The application in urbanized roadway cross-sections (i.e. curb and gutter) often requires alternative grading and roadway configurations which can compromise the function of the roadway itself, and are therefore typically not preferred. Notwithstanding, gutter outlets along outside lanes have functioned effectively in the past where the R.O.W. can accommodate the design. That said, should the Region consider it beneficial and economically viable during the detailed design stage, enhanced grassed swales could be added to an infiltrative LID BMP at specific locations.

iii. Filter Strips

Filter strips typically are designed for small drainage areas less than 2 ha, and are applied as part of a treatment train. Filter strips require flat areas with slopes ranging from 1 to 5% and are usually in the range of 10 to 20 m in length in the direction of flow. Flow leaving filter strips should be a maximum of 0.10 m in depth, based on a 10 mm storm event. Based on the limited space within the Mississauga Road R.O.W., filter strips are not considered a practical stormwater quality solution.

iv. Oil and Grit Separators

These systems tend to serve limited drainage areas and provide levels of water quality treatment (less than Enhanced, formerly Level 1). Disadvantages include the need for frequent maintenance, as well as relatively high capital costs and the ability to serve small drainage areas. As a pre-treatment approach to infiltrative LID BMPs, oil and grit separators can be implemented as part of the "treatment train" approach. That said, road surface drainage would have to be conveyed to an oil and grit separator via the proposed storm sewer system prior to discharging to an LID BMP. Due to the typical depth of oil and grit separators, LID BMPs are forced to be deeper in the ground when utilizing an oil and grit separator as a pre-treatment device. The groundwater levels within parts of the study area are noted to be relatively high (ref. Appendix A), and as such, restrict the ability to implement deep LID BMPs. Therefore, the use of oil and grit separators as a pre-treatment device is considered impractical for Mississauga Road.

v. Off-Site Stormwater Management Facilities

While facilities can often not be constructed within roadway R.O.W. lands, roadway runoff can be directed towards existing and proposed subdivisions, which would have their runoff managed by existing or future stormwater management facilities. As discussed, sections of the Mississauga Road minor system are connected to existing SWM Facilities H3 and W1, with the same road sections conveying major system drainage to the Credit River.

SWM Facility H3 for the ultimate road condition would receive drainage from approximately 0.73 ha of the Mississauga Road R.O.W., at an imperviousness of 86% (impervious area = 0.63 ha). It is noted that the design of SWM Facility H3 accounted for a 1.04 ha drainage area from the Mississauga Road R.O.W. at 100% impervious. Therefore, SWM Facility H3 is considered to provide the required level of quality control within the permanent pool. It is noted that based on the requirement to infiltrate the 27 mm storm event runoff from the proposed additional two (2) road lanes, per Section 3.1.5, SWM Facility H3 would act as supplemental quality control.

SWM Facility W1 for the ultimate road condition would receive drainage from approximately 7.40 ha of the Mississauga Road R.O.W., at an imperviousness of 82% (impervious area = 6.10 ha). It is noted that the design of SWM Facility W1 accounted for a 7.25 ha drainage area from the Mississauga Road R.O.W. at 100% impervious. Therefore, SWM Facility W1 is also considered to provide the required level of quality control within the permanent pool. Again, it is noted that based on the requirement to infiltrate the 27 mm storm event runoff from the proposed additional two (2) road lanes, per Section 3.1.5, SWM Facility W1 would act as supplemental quality control.

vi. Low Impact Development Best Management Practices

Low Impact Development represents the application of a suite of BMPs normally related to source and conveyance storm water management controls to promote infiltration and pollutant removal on a local site by site basis. These measures rely on eliminating the direct connection between impervious surfaces such as roads and the storm drainage system, as well as the promotion of infiltration of road drainage. General design guidelines and considerations for source and conveyance controls have been advanced since the early 1990's as part of the Ministry of Municipal Affairs and Housing (MMAH) "Making Choices" and in 1994 as part of the Ministry of the original Environment Best Management Practices Guidelines.

Subsequent to the 1994 MOE Guidelines, technologies and standards have been developed further for the application of source and conveyance controls. These have evolved into a class of Best Management Practices (BMPs) referred to as Low Impact Development (LID) practices, which have advanced as an integrated form of site planning and storm servicing to maintain water balance and providing storm water quality control for urban developments. Initial results from studies in other settings have demonstrated that LID practices provide benefits by way of reducing the erosion potential within receiving watercourses and thereby reducing the total volume of end-of-pipe storm water erosion control requirements. In addition, due to volumetric controls afforded by LID BMP's, water quality is also improved through a reduction in mass loading. The benefits from LID storm water management practices are generally focused on the more frequent storm events (e.g. 2 year storm) of lower volumes as opposed to the less frequent storm events (e.g. 100 year storm) with higher volumes. It is also recognized that the forms of LID practices which promote infiltration or filtration through a granular medium provide thermal mitigation for storm runoff.

Guidelines regarding the application of LID practices and techniques have been developed within various jurisdictions in the United States and Canada. The Toronto and Region Conservation Authority and Credit Valley Conservation have produced the 2010 Low Impact Development Stormwater Management Manual, for the design and application of LID measures. Various LID techniques, as well as their function that are applicable to road projects, are summarized in Table 5.1, not including grassed swales which have already been screened as an appropriate SWM measure for Mississauga Road.

Table 5.1. LID Source And Conveyance Controls

Technique	Function
Bio-retention Cell	• Vegetated technique for filtration of storm runoff • Storm water quality control provided through filtration of runoff through soil medium and vegetation • Infiltration/ evapotranspiration/ water balance maintenance and additional erosion control may be achieved if no subdrain provided
Infiltration Trenches	• Infiltration technique to provide storm water quality control and maintain water balance • Erosion controls may be achieved depending upon soil conditions
Permeable Pavers/Pavement	• Infiltration technique to reduce surface runoff volume • Benefits to storm water quality and erosion control are informal
Pervious Pipes	• Technique to reduce storm runoff through the implementation of perforated pipes within storm sewers • Promotion of infiltration maintains water balance and provides storm water quality and erosion control benefits

Further discussion is provided on LID BMPs below:

Bioretention Systems

Bioretention systems provide effective removal of pollutants by sedimentation, filtering, soil adsorption, microbial processes and plant uptake. Bioretention systems should be approximately 10 to 20% in size of the contributing drainage area, with typical drainage areas of 0.50 ha and a maximum drainage area of 0.8 ha. Slopes within bioretention systems are typically 1 % to 5 %. Bioretention systems are preferred in areas that have reasonable infiltration properties (15 mm/ hr, $1x10^{-6}$ cm/s), but can be implemented in all soil types as long as the water quality event can be temporarily stored (typical depths 0.15 m to 0.25 m) before infiltrating and an underdrain is provided.

Based on ultimate six (6) lane R.O.W. configuration, and more pertinently the west side configuration, there is a 1 m +/- wide landscape strip, then a 3 m wide multiuse path and then up to a 1 m wide space to the R.O.W. limit. The multiuse path could be reset to the west R.O.W. limit which would provide up to a 2 m width for bioretention systems. It is noted that a significant length of the R.O.W. would have less than 2 m width available, that said should the Region consider it beneficial and economically viable during the detailed design stage, bioretention systems could be added to an infiltrative LID BMP at specific locations. The bioretention systems should have forebays for a form of surface water pre-treatment. Catchbasins fitted with goss traps should also direct runoff to the infiltrative component of the bioretention system.

Infiltrative Trenches

Infiltrative Trenches could be implemented as they are similar to bioretention systems but could be positioned not only with the 2 m wide landscaped areas but under the proposed 3 m wide multiuse pathway. All catchbasins should be fitted with goss traps. The infiltration trench would be designed to capture the 27 m storm event with no discharge by setting the overflow to the storm sewer system above the 27 mm storm event capture storage depth.

Permeable Pavers/ Pavement

The Region of Peel has used permeable pavement as pilot projects within the last five (5) years (e.g. Dixie Road project incorporated pervious concrete as a pilot project). Permeable pavement could be used for entirety or sections of the proposed westerly 3 m wide multiuse pathway. As a standalone LID BMP, a multiuse permeable paved multiuse path would not meet either stormwater quality and/or quantity targets but it would reduce the runoff volume from paved surfaces within the urban road R.O.W. This LID BMP would have to be selected by the Region to complement other SWM measures during the detailed design stage.

Pervious Pipes

Pervious pipes could be used in combination with either bioretention systems or infiltration trenches. As a standalone SWM measure, pervious pipes would not provide adequate storage to satisfy stormwater quantity control requirements to meet peak flows targets based on the SWM objectives.

6.0 SHORT-LISTED STORMWATER MANAGEMENT ALTERNATIVES ASSESSMENT

Stormwater management alternatives for both quantity and quality control have been assessed as per the following:

6.1 Huttonville Creek at Culvert C4

Due to the requirements to provide 100 year post-to-pre control, and the current stormwater management controls servicing only up to the 10 year storm event, the storage volumes required to reduce ultimate conditions peak flows down to the target rates is expected to be significant. Upon preliminary review, the storage volumes are known to be too large to be accommodated in an upsized storm sewer. Furthermore, the current orifice plate configuration within Control Manholes 116 and 107 are noted to be producing significant head elevations resulting in flooding within the roadway surface. As such, the existing orifice plates would need to be removed and replaced with a single orifice plate located on the downstream side of each control manhole, in an effort to reduce the head elevation to below to roadway surface.

In discussion with the Region of Peel, two (2) options have been assessed to achieve all applicable quantity, quality, erosion, water balance, and pending MOECC criteria. The first option assesses a combination of unconventional underground cellular storage tanks (Brentwood™ or approved equivalent) and infiltration trenches. The underground storage tanks have been selected to be assessed to achieve the applicable quantity control criteria, and the infiltration trenches have been selected to be assessed to achieve the quality, erosion, water balance, and pending MOECC criteria. The infiltration trenches are required to capture and infiltrate the runoff resulting from the additional impervious surfaces during a 27 mm storm event.

Through discussion with the Region at the December 6, 2017 meeting, it was established that a second assessment should be completed with an emphasis on the Region's preference for maximizing infiltration. As such, the second option assesses the applicability of an infiltration only type solution. For this assessment, an infiltration trench has been selected to be assessed to achieve all applicable quantity, quality, erosion, water balance, and pending MOECC criteria.

6.1.1 Option 1 – Underground Storage and Infiltration Trenches

The PCSWMM model of the future conditions has been modified to include the underground storage, orifice plates, and infiltration trenches. The combination of the SWM alternatives has been assessed to determine to impact to peak flow targets in Huttonville Creek. The results of the assessment are presented below in Table 6.1, with a comparison to the target flow rates. The future conditions drainage boundaries for Option 1 are represented on Figures 4.1 – 4.3.

Table 6.1. Future Conditions with SWM Peak Flows in Huttonville Creek at Culvert C4 – Option 1 (m^3/s)			
Storm Event	**Target Flow Rates**	**Future Conditions Peak Flows**	**% Difference**
2 year	0.83	0.68	-18%
5 year	1.63	1.63	0%
10 year	1.95	1.93	-1%
25 year	3.18	3.16	-1%
50 year	4.08	3.93	-4%
100 year	5.53	4.69	-15%

The results presented in Table 6.1 indicate that the selected SWM alternatives could reduce future conditions peak flows down to the target release rates in Huttonville Creek. Storage tanks would be located within the west boulevard on both the north and south side of Culvert C4. The storage tanks could be accommodated within the boulevard area, however will be restricted in width as the infiltration trench must also fit within the boulevard space (ref. Figure 5.1). The underground storage tanks could be connected to the adjacent manholes to allow for a hydraulic connection with the storm sewer system. The underground storage tank north of Culvert C4 is restricted in height due to the low road profile point located between Subcatchments M111A and M111B. Preliminary storage volume requirements for the north and south tanks are 1000 m^3 and 1800 m^3 respectively. These storage volumes could be accommodated in double-stacked Brentwood™ StormTanks, approximately 1.4 m in height. Due to groundwater constraints, sections of the underground storage tanks would likely require an impermeable liner. Where groundwater depths permit, the underground storage tanks would not require an impermeable liner and could allow for infiltration of the stormwater detained within the underground storage tanks.

The orifice plates proposed on the downstream sides of Control Manholes 116 and 107 should be sized to reduce the peak flows discharging through Outlets 5N and 5S. Preliminary sizing of the orifice plates requires a 200 mm diameter plate within Control Manhole 116 and a 75 mm diameter plate in Control Manhole 107. Sizing the quantity controls as such would reduce the head elevation to below to road surface for the 100 year storm event. It is important to note that the limitation of implementing only one (1) orifice on each control manhole results in significant overcontrol in the 100 year storm event.

In order to reduce the ponding elevations at the low point between Subcatchments M111A and M111B, several double catchbasin grates would likely be required to capture flows upstream of the low point (ref. Figure 4.2). By incorporating double catchbasin grates on the manholes noted on Figure 4.2, the ponding elevation can be reduced to 23 cm, and spill over the retaining wall would no longer occur.

Infiltration trenches have been preliminarily sized to capture the additional runoff volume from a 27 mm storm event resulting from the additional impervious surfaces added to the R.O.W. Preliminary volume requirements are provided below in Table 6.2.

Table 6.2. Preliminary Infiltration Trench Volume Requirements for Culvert C4 Outlet – Option 1 (m^3)				
Storm Event	**Existing/Pre-Development Runoff Volumes from R.O.W.***	**Future Runoff Volumes from R.O.W.**	**Infiltration Volume Required**	**Preliminary Infiltration Volume Provided**
27 mm	512	875	362	581

*As outlined in Section 3.2, infiltration from the east half of the R.O.W., south of Culvert C4 is required, based on differences between the future and pre-development road conditions.

Flow splitting devices could be retrofitted into the catchbasins and catchbasin manholes to divert the required 27 mm infiltration volumes to infiltrations trenches. Pipes connecting from the catchbasins can convey the diverted flow to the infiltration trenches within the boulevard area. A typical detail of the underground storage and infiltration trench configuration is provided on Figure 5.1.

Similar to the thermal mitigation of stormwater runoff provided by the infiltration trench on the east side of the R.O.W., north of Culvert C4 (Aquafor Beech Ltd., August 2015), infiltration trenches implemented along the west side of the R.O.W. will provide thermal mitigation as well, thus satisfying the criteria outlined in Section 3.1.4.

6.1.2 Option 2 – Infiltration Trenches

The PCSWMM model of the future conditions has been modified to include the infiltration trench and orifice plates. The SWM alternative has been assessed to determine the impact to peak flow targets in Huttonville Creek. The results of the assessment are presented below in Table 6.3, with a comparison to the target flow rates. The future conditions drainage boundaries for Option 2 are represented on Figures 4.4 – 4.6.

Table 6.3. Future Conditions with SWM Peak Flows in Huttonville Creek at Culvert C4 – Option 2 (m^3/s)			
Storm Event	**Target Flow Rates**	**Future Conditions Peak Flows**	**% Difference**
2 year	0.83	0.69	-16%
5 year	1.63	1.58	-3%
10 year	1.95	1.90	-3%
25 year	3.18	3.11	-2%
50 year	4.08	3.96	-3%
100 year	5.53	4.86	-12%

The results presented in Table 6.3 indicate that the selected SWM alternative could reduce future conditions peak flows down to the target release rates in Huttonville Creek. Infiltration trenches would be located within the west boulevard on both the north and south side of Culvert C4. It should be noted that the infiltration trenches cannot be accommodated within the current boulevard boundaries. This is a result of three (3) factors:

- High groundwater elevations encountered in the area restricting the depths of the infiltration trenches;
- The magnitude of the stormwater detention volume required to meet quantity control peak flow targets (re. Table 6.4), and
- The stone infiltration trench will have a void ratio of approximately 0.40.

Due to the void ratio associated with stone infiltration trenches, the storage capacity is relatively inefficient and requires a significant area when sized to infiltrate large volumes of stormwater. To accommodate the quantity control volume, the infiltration trench located north of Culvert C4 will require a width of approximately 10 m, and the infiltration trench located south of Culvert C4 will require a width of approximately 9 m. In order to implement the infiltration trenches, the Region will require additional R.O.W. width and area along the west boundary of the current R.O.W. limits. The additional R.O.W. width required north of Culvert C4 is 6.5 m (0.22 ha), and the additional R.O.W. width required south of Culvert C4 is 5.5 m (0.29 ha). The additional R.O.W. width accommodates a 0.5 m separation between the edge of the infiltration trench and the limit of the R.O.W.

Flow splitting devices would be retrofitted into the catchbasins and catchbasin manholes to divert the required 100 year runoff volumes to the infiltration trenches. Pipes connecting from the catchbasins and catchbasin manholes would convey the diverted flow to the infiltration trenches within the expanded boulevard areas. A typical cross-section detail of the infiltration trench configuration is provided on Figure 5.2.

The quantity control volume would be provided within the voids of the stone infiltration trench. An overflow system would be provided above the stone, to convey flows toward the outlet, should the volume provided within the stone voids ever be exceed. The overflow system also provides temporary storage volume that has been accounted for in the modelling. This assessment incorporated Cultec™ Contactor® 100 HD units (or approved equivalent) as the overflow system. Due to the steepness of Mississauga Road, the infiltration trenches would likely not be installed as one consecutive trench, but rather a series of trenches organized in a cascading manner. Figure 5.3 provides a typical profile view of the infiltration trenches. As shown on the figure, pipes connecting from the catchbasins and catchbasin manholes would connect to the Cultec™ system and percolate into the stone trench. Each individual stone trench would contain an impermeable liner located at the downstream end of the trench to prevent interaction between adjacent trenches and promote infiltration. The Cultec™ systems would be connected by a pipe to allow overflows to flow toward the outlet. The infiltration trenches are restricted in depth due to the high groundwater levels encountered in the area. As a best practice, a minimum separation of 1.0 m should be provided between the bottom of the infiltration trench and the high groundwater level, however for this assessment, a minimum separation of 0.5 m was applied in areas where groundwater levels did not allow the implementation of the infiltration trench while maintaining a 1.0 m separation.

The orifice plates proposed on the downstream sides of Control Manholes 116 and 107 should be sized to reduce the peak flows discharging through Outlets 5N and 5S. Preliminary sizing of the orifice plates requires a 250 mm diameter plate within Control Manhole 116 and a 220 mm diameter plate in Control Manhole 107. Sizing the quantity controls as such would reduce the head elevation to below to road surface for the 100 year storm event. It is important to note that the limitation of implementing only one (1) orifice on each control manhole results in significant overcontrol in the 100 year storm event.

To reduce the ponding elevations at the low point between Subcatchments M111A and M111B, several double catchbasin grates would likely be required to capture flows upstream of the low point (ref. Figure 4.5). By incorporating double catchbasin grates on the manholes noted on Figure 4.5, the ponding elevation can be reduced to 23 cm, and as such there would no longer be a spill over the retaining wall.

Preliminary infiltration trench volumes are provided in Table 6.4.

Table 6.4. Preliminary Infiltration Trench Volume Requirements for Culvert C4 Outlet – Option 2 (m^3)

Storm Event	Total Volume Required	
	North of Culvert C4	South of Culvert C4
2 year	652	437
5 year	1044	692
10 year	1173	799
25 year	1239	1198
50 year	1274	1350
100 year	1281	1448

By infiltrating the quantity control volume requirement, the quality control, water balance, erosion, and pending MOECC criteria requirements are achieved.

The thermal mitigation requirement per the MNRF criteria would be achieved by the infiltration trenches implemented along the west side of the R.O.W., similar to the thermal mitigation provided by the infiltration trench on the east side of the R.O.W., north of Culvert C4 (Aquafor Beech Ltd., August 2015),

6.1.3 Recommended Option for Huttonville Creek at Culvert C4

Sections 6.11 and 6.1.2 demonstrated two different options that could be implemented to satisfy the applicable quantity, quality, erosion, water balance, and pending MOECC criteria for storm drainage to Culvert C4. Option 1 utilizes a combination of unconventional underground cellular storage tanks (Brentwood™ or approved equivalent) and infiltration trenches, while Option 2 utilizes only an infiltration trench.

As outlined in Section 6.1.2, Option 2 would require additional lands beyond the ultimate right-of-way (approximately 0.51 ha) to be obtained by the Region. Through discussions and email correspondence with the Region subsequent to the December 6, 2017 meeting (ref. Zois-Smith), it was determined that Option 2, while it aligns with the Region's preference for maximizing infiltration practices, would result in concerns over the viability of land acquisition and potentially the option not being feasible. As such, Option 2 is not considered a viable solution for storm drainage to Culvert C4. Therefore, Option 1 is the preferred solution.

6.2 SWM Facility H3

As discussed in Sections 4.1 and 5.1.2, additional SWM quantity and quality controls are not required. Therefore, the only SWM criteria to be achieved are water balance and erosion infiltration volumes, and the pending MOECC criteria.

Infiltration trenches have been selected and incorporated in the PCSWMM model. The results of the future conditions peak flows from SWM Facility H3 with infiltration trenches are presented in Table 6.5, with a comparison to the target flow rates and existing conditions peak flow rates.

Table 6.5. Future Conditions with LID Peak Flows from SWM Facility H3 (m^3/s)

Storm Event	Target Flow Rates	Existing Conditions Peak Flows	Future Conditions with Infiltration Trenches	% Difference (Future vs. Target Flow Rates)
2 year	0.16	0.16	0.16	0%
5 year	0.29	0.27	0.27	-6%
10 year	0.34	0.40	0.40	17%
25 year	0.51	0.54	0.54	5%
50 year	0.61	0.56	0.56	-8%
100 year	0.72	0.59	0.59	-18%

As shown by Table 6.5, future conditions with infiltration trenches in place produces the same peak flows as existing conditions. It is also noted that the future conditions with infiltration trenches in place produces the same peak flows as future conditions without infiltration trenches in place (ref. Table 4.3). Despite the infiltration trenches capturing runoff volume from the Mississauga Road R.O.W. during the 27 mm storm event, these results can be expected as the Mississauga Road R.O.W. accounts for only 1.7% of the total drainage area to SWM Facility H3.

In comparison to the target flow rates, and as previously discussed, the future conditions with infiltration trenches scenarios produce peak flows equal to or less than the target rates for the 2 year, 5 year, 50 year, and 100 year storm events. The 10 year and 25 year storm events exceed the target rates, although the magnitude of the exceedance is relatively small (0.06 m^3/s and 0.03 m^3/s respectively). As discussed in Section 2.5, the exceedance in the 10 year and 25 year storm events is attributable to the different modelling platforms and model discretizations used. Furthermore, as outlined in Section 5.1.2, the ultimate condition impervious area draining to SWM Facility H3 from the Mississauga Road R.O.W. (0.63 ha) is less than the impervious area accounted for in the design (0.73 ha). As such, it is concluded that there is no impact to the receiving watercourse (Huttonville Creek) resulting from the proposed road widening works.

The infiltration trench volumes have been sized and configured as previously discussed. Preliminary volume requirements are provided in Table 6.6.

Table 6.6. Preliminary Infiltration Trench Volume Requirements for SWM Facility H3 Outlet (m^3)

Storm Event	Existing Runoff Volumes from R.O.W.*	Future Runoff Volumes from R.O.W.	Infiltration Volume Required	Preliminary Infiltration Volume Provided
27 mm	20	83	63	52

The results presented in Table 6.6 indicate that the provided infiltration trench volume is less than the required volume. This is noted to be a result of the capture capacity of the catchbasins within this section of Mississauga Road. The existing manholes, 1200 mm in diameter, are to be retrofitted with catchbasin grates, however can only accommodate a single catchbasin grate. Upon review of the PCSWMM model, it is noted that the single catchbasin grates do not provide the sufficient inlet capacity to capture the required runoff volume. Fortunately, the short-comings of the infiltration trench volume provided by this section of Mississauga Road (11 m^3) can be accommodated downstream in the infiltration trench system for the section of the Mississauga Road R.O.W. draining to SWM Facility W1.

By infiltrating the volume requirement of the pending MOECC criteria, the quality control, water balance and erosion criteria requirements are achieved.

6.3 SWM Facility W1

As discussed in Sections 4.1 and 5.1.2, additional SWM quantity and quality controls are not required as the design of SWM Facility W1 accounted for an impervious area greater than the actual ultimate condition impervious area. Therefore, the only SWM criteria to be achieved are water balance and erosion infiltration volumes, and the pending MOECC criteria.

In keeping with the other sections of the Mississauga Road R.O.W., infiltration trenches have been selected and incorporated in the PCSWMM model. The results of the future conditions peak flows from SWM Facility W1 with infiltration trenches are presented in Table 6.7, with a comparison to the target flow rates and existing conditions peak flow rates.

Table 6.7. Future Conditions with LID Peak Flows from SWM Facility W1 (m^3/s)

Storm Event	Target Flow Rates	Existing Conditions Peak Flows	Future Conditions with Infiltration Trenches	% Difference (Future vs. Target Flow Rates)
2 year	0.18	0.19	0.19	4%
5 year	0.31	0.22	0.22	-29%
10 year	0.35	0.23	0.23	-34%
25 year	0.52	0.53	0.53	2%
50 year	0.61	0.62	0.62	1%
100 year	0.72	0.72	0.77	6%
Regional	1.98	1.91	1.92	-3%

As shown by Table 6.7, future conditions with infiltration trenches in place produces the same peak flows as existing conditions, with the exception of the 100 year and Regional Storm events. The magnitudes of the increases are noted the be relatively small (0.05 m^3/s and 0.01 m^3/s respectively). It is also noted that the future conditions with infiltration trenches in place produces peak flows that are either equal to or lower than peak flows produced by the future conditions without infiltration trenches in place (ref. Table 4.4).

In comparison to the target flow rates, and as previously discussed, the future conditions with infiltration trenches scenarios produces peak flows equal to or less than the target rates for the 5 year, 10 year, and Regional Storm events. The 2 year, 25 year, and 50 year storm events exceed the target rates with relatively small magnitudes (0.01 m^3/s). The 100 year storm event exceeds the target rate by 0.05 m^3/s. This result is expected as the impervious area of the R.O.W. has increased. As discussed in Sections 2.5 and 4.1, the exceedances can be attributed to the different modelling programs used. Furthermore, as outlined in Section 5.1.2, the actual impervious area draining to SWM Facility W1 from the Mississauga Road R.O.W. (6.10 ha) is less than the impervious area accounted for in the design (7.25 ha). As such, it is concluded that there is no impact to the receiving watercourse (Credit River Tributary) resulting from the proposed road widening works.

The infiltration trench volumes are sized and configured as previously discussed. Preliminary volume requirements are provided below in Table 6.8.

Table 6.8. Preliminary Infiltration Trench Volume Requirements for SWM Facility W1 Outlet (m^3)

Storm Event	Existing Runoff Volumes from R.O.W.*	Future Runoff Volumes from R.O.W.	Infiltration Volume Required	Preliminary Infiltration Volume Provided
27 mm	222	646	424	543

The results presented in Table 6.8 indicate that the infiltration trenches can provide an infiltration volume sufficient to meet the requirements for this section of Mississauga Road, as well as the short-comings of the infiltration trenches provided for the section of R.O.W. draining to SWM Facility H3. A typical detail of the underground storage and infiltration trench configuration is provided on Figure 5.3.

By infiltrating the volume requirement of the pending MOECC criteria, the quality control, water balance and erosion criteria requirements are achieved.

7.0 CONCLUSIONS

Based on the results presented and discussed in this Stormwater Management Report, the following conclusions can be made:

i. The existing SWM infrastructure providing quantity control for the section of Mississauga Road draining to Huttonville Creek, immediately downstream of Culvert C4, is insufficient in providing reduction of existing and future conditions peak flows to pre-development target rates for the 2 – 100 year storm events under the ultimate 6 lane R.O.W. configuration.

ii. To mitigate the lack of quantity control available at Culvert C4, two (2) underground storage tanks will be required to provide storm water detention storage, and can be located within the west boulevard area of the ultimate R.O.W. Orifice plates located on the control manholes adjacent to Culvert C4 must be reconfigured to reduce future conditions peak flows to pre-development target rates, as well as eliminate surface ponding caused by the existing orifice plates.

iii. To meet the water quality control, water balance, erosion infiltration, and the pending MOECC infiltration criteria, LID BMPs must be implemented within the ultimate R.O.W. A preliminary review of the site constraints has determined that infiltration trenches, located within the west boulevard area of the ultimate R.O.W. can accommodate the volume requirements of the criteria. The infiltration trenches will be located along the length of the proposed R.O.W. widening limits, from approximately Ostrander Boulevard to Bovaird Drive.

iv. To assist in the implementation of the detailed design of the recommended infiltration trenches, monitoring wells should be installed along the length of the study to obtain the current seasonally high groundwater levels.

v. Flow splitter devices must be implemented within the catchbasins and catchbasin manholes to divert the required runoff volumes to the infiltration trenches during a 27 mm storm event.

vi. The existing SWM Facility H3 is sufficiently sized to provide quantity control for the section of Mississauga Road draining to it, under the ultimate 6 lane R.O.W. configuration, with no impacts to Huttonville Creek.

vii. The existing SWM Facility W1 is sufficiently sized to provide quantity control for the section of Mississauga Road draining to it, under the ultimate 6 lane R.O.W. configuration, with no impacts to the Credit River Tributary.

8.0 APPROVAL AND REVIEW REQUIREMENTS

The aforementioned SWM recommendations are subject to the review and approval of the Region of Peel, Credit Valley Conservation, Ministry of Natural Resources and Forestry, and the City of Brampton.

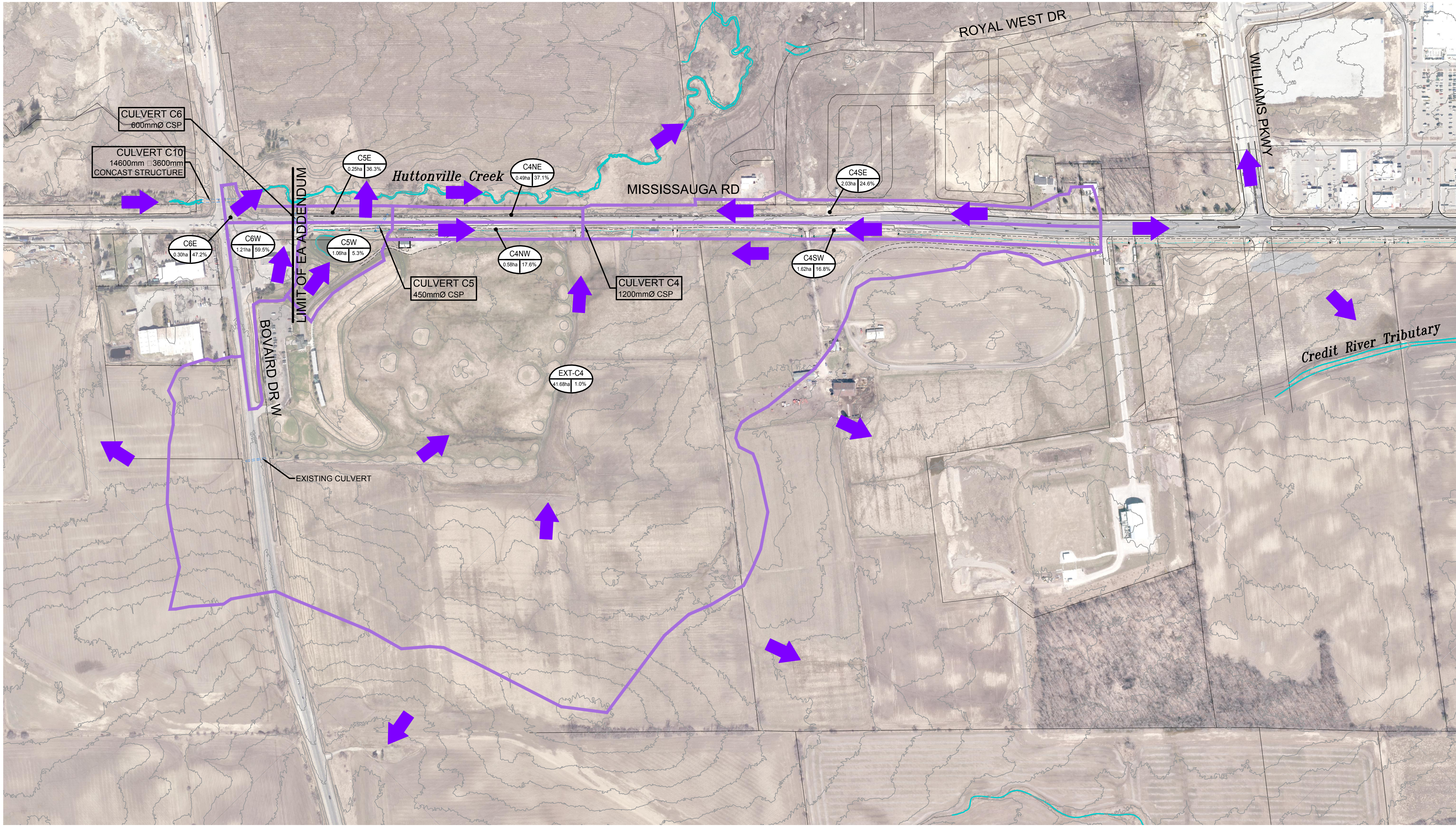
LICENSED PROFESSIONAL ENGINEER
S. CHIPPS
PROVINCE OF ONTARIO

Sincerely,

Wood Environment & Infrastructure Solutions
a Division of Wood Canada Limited

Per: Matt Britton, EIT
Water Resources Engineering Intern

Per: Steve Chipps, P.Eng.
Senior Associate, Water Resources



LEGEND

PROPERTY BOUNDARY

WATERCOURSE

CONTOUR (1m)

EXISTING CULVERT

SUBCATCHMENT BOUNDARY

M114 — SUBCATCHMENT ID#

0.75ha — SUBCATCHMENT AREA

73.4% — PERCENTAGE OF IMPERVIOUS AREA

MAJOR SYSTEM FLOW DIRECTION

MISSISSAUGA ROAD
EA ADDENDUM

REGION OF PEEL

OVERALL STORM DRAINAGE BOUNDARIES
(PREDEVELOPMENT CONDITION FOR C4, C5 & C6 CULVERTS)

wood.

SCALE VALID ONLY FOR 24"x36" VERSION

Scale 1:2500
0 25 50 100

Consultant File No. TP115085

Figure No. 2.1

Path: P:\Work\TP115085\Water\dwg\2018-06 (Bovaird EA)\Fig2-1 PreDev-Overall.dwg

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Plotted: 2018-06-07
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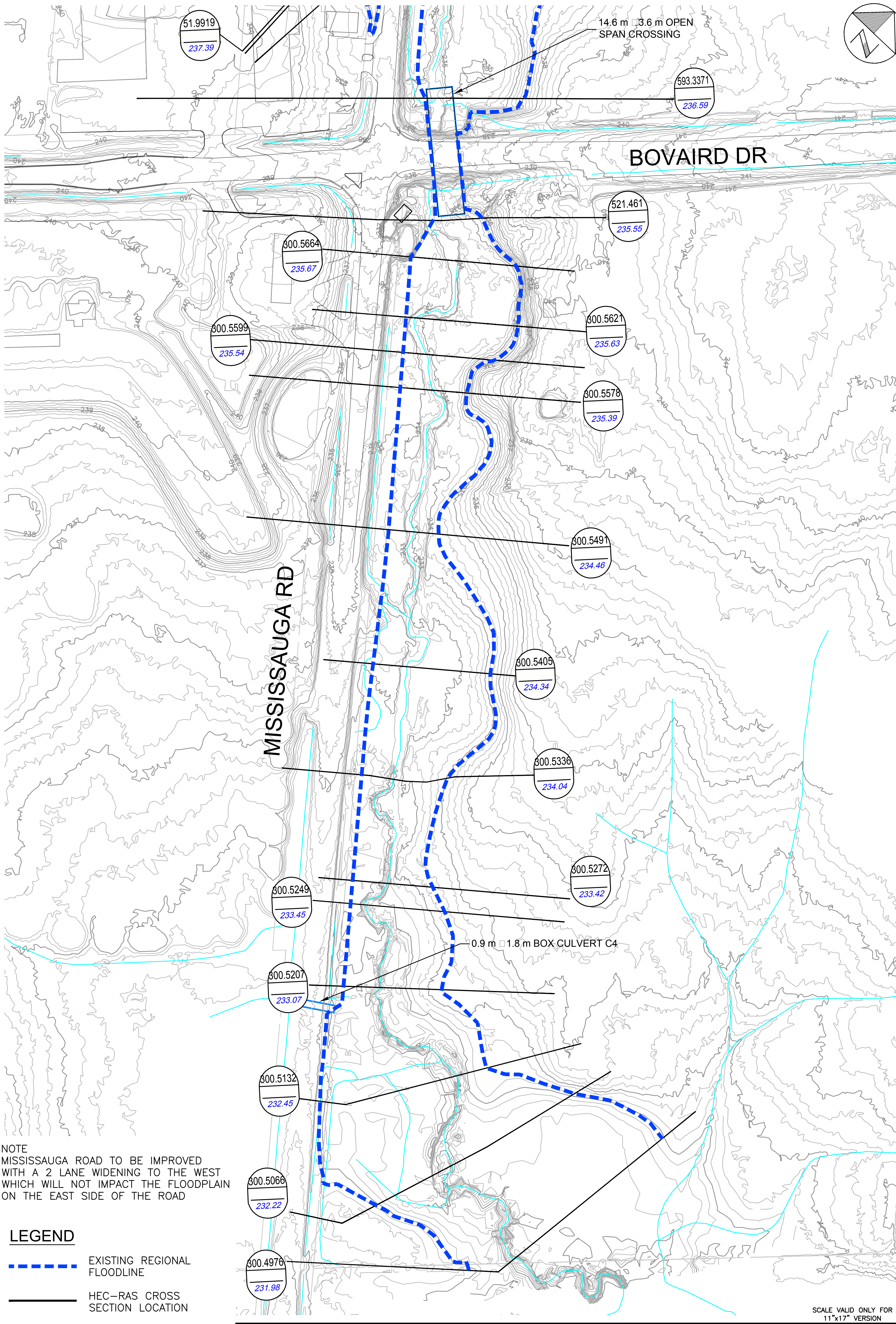

NOTE
MISSISSAUGA ROAD TO BE IMPROVED WITH A 2 LANE WIDENING TO THE WEST WHICH WILL NOT IMPACT THE FLOODPLAIN ON THE EAST SIDE OF THE ROAD

LEGEND

EXISTING REGIONAL FLOODLINE

HEC-RAS CROSS SECTION LOCATION

100.069 / 238.08 — HEC-RAS CROSS SECTION REFERENCE ID; EXISTING REGIONAL WATER SURFACE ELEV.

SCALE VALID ONLY FOR 11"x17" VERSION

MISSISSAGA ROAD EA ADDENDUM REGION OF PEEL	HUTTONVILLE CREEK FLOODPLAIN LIMITS	wood.	Scale 1:2000 (0 10 20 40) Consultant File No. TP115085 Figure No. 2.2

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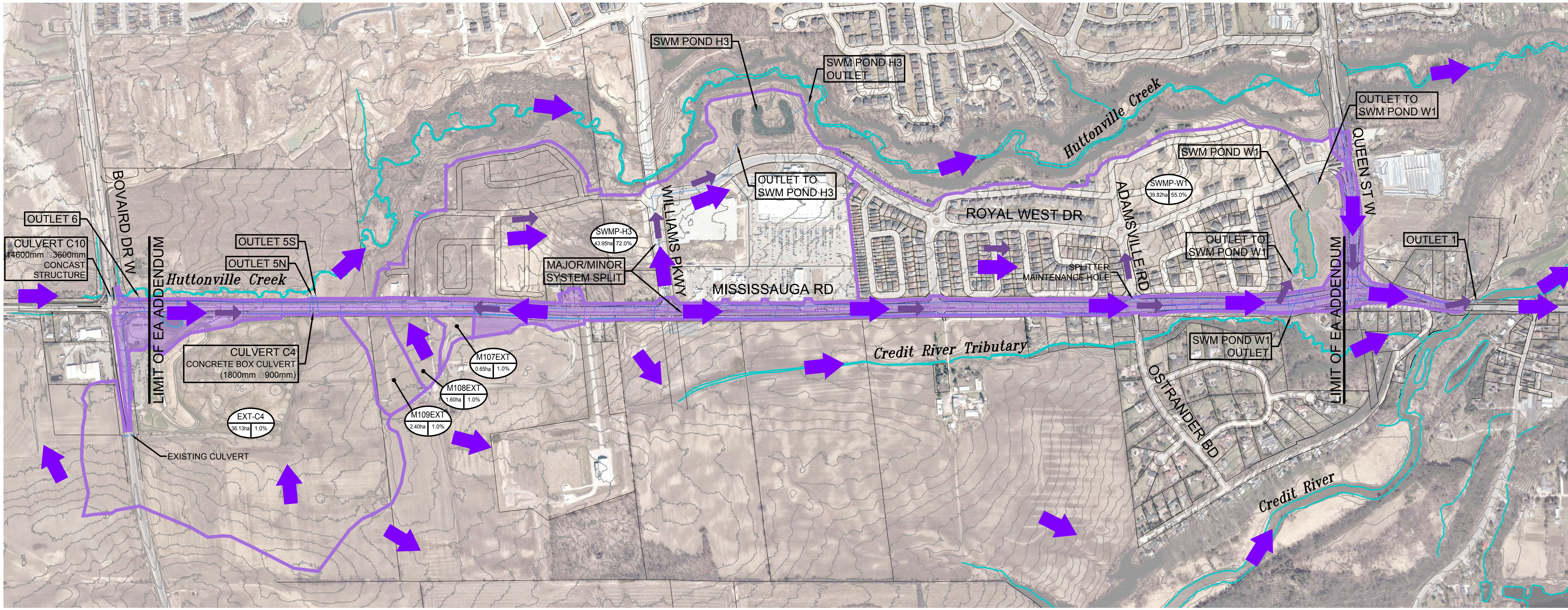

LEGEND

PROPERTY BOUNDARY	SUBCATCHMENT BOUNDARY
WATERCOURSE	M114 / 0.75ha / 73.4% — SUBCATCHMENT ID#; PERCENTAGE OF IMPERVIOUS AREA; SUBCATCHMENT AREA
CONTOUR (1m)	MAJOR SYSTEM FLOW DIRECTION
EXISTING STORM SEWER	MINOR SYSTEM FLOW DIRECTION
EXISTING CULVERT	REFER TO MISSISSAUGA ROAD DRAINAGE BOUNDARY PLANS (FIG. 3.1–3.4)

MISSISSAUGA ROAD
EA ADDENDUM
REGION OF PEEL

OVERALL STORM
DRAINAGE BOUNDARIES
(EXISTING CONDITION)

wood.

SCALE VALID ONLY FOR 24"x36" VERSION
Scale 1:5000
0 50 100 200

Consultant File No. TP115085

Figure No. 3.1

Path: P:\Work\TP115085\Water\dwg\2018-06 (Bovaird EA)\Fig3-1 Existing-Overall.dwg

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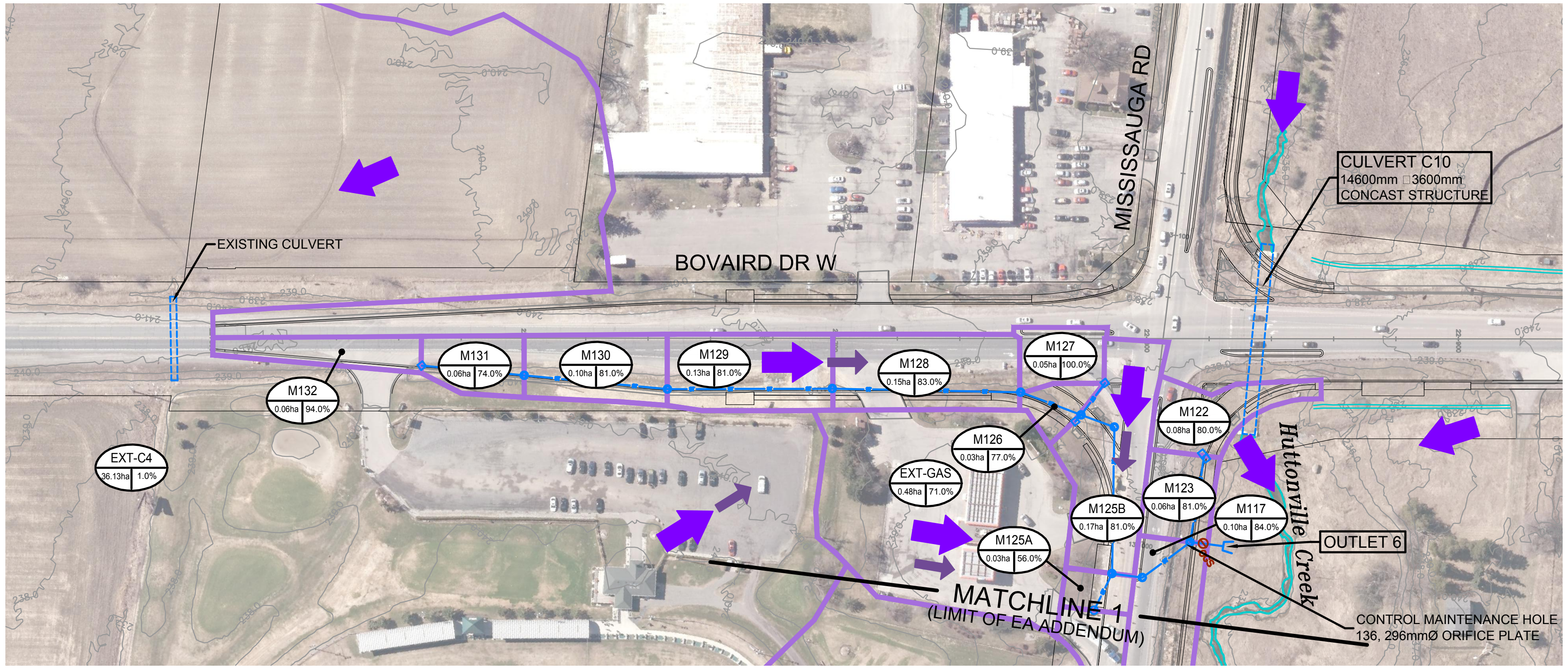

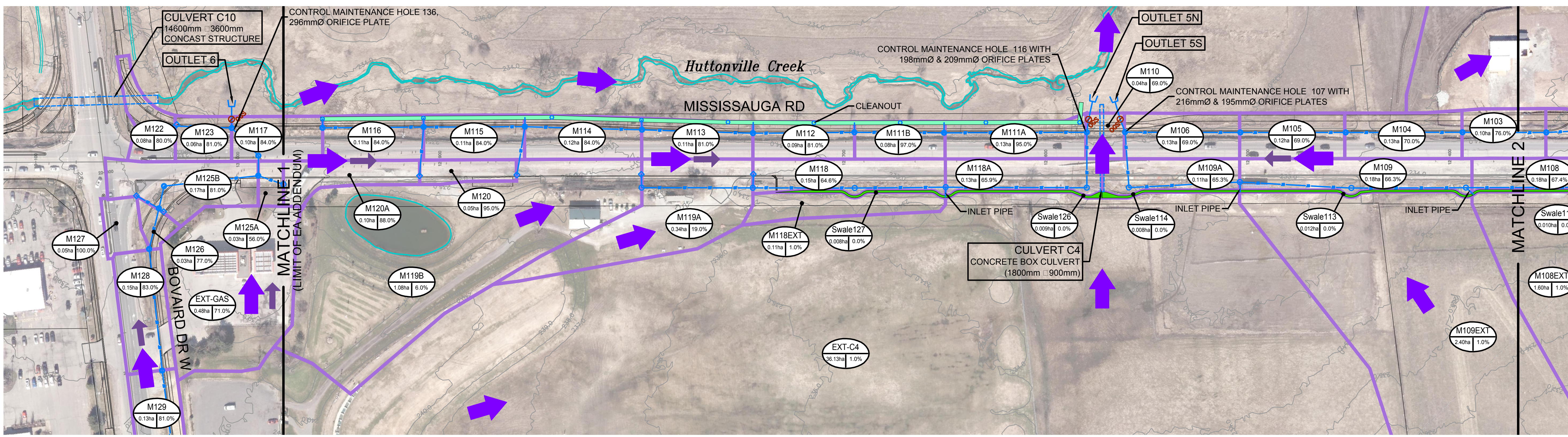

LEGEND

PROPERTY BOUNDARY	EXISTING CULVERT	SUBCATCHMENT BOUNDARY
WATERCOURSE	EXISTING CLEANOUT	SUBCATCHMENT ID#
CONTOUR (1m)	EXISTING OIL/GRIT SEPARATOR	PERCENTAGE OF IMPERVIOUS AREA
EXISTING INFILTRATION TRENCH	EXISTING STORM SEWER SYSTEM	SUBCATCHMENT AREA
EXISTING ENHANCED SWALE	MAJOR SYSTEM FLOW DIRECTION	
EXISTING BIOSWALE	MINOR SYSTEM FLOW DIRECTION	

M114 0.75ha 73.4%

MISSISSAUGA ROAD EA ADDENDUM

REGION OF PEEL

STORM DRAINAGE BOUNDARIES (EXISTING CONDITION)

wood.

SCALE VALID ONLY FOR 24"x36" VERSION

Scale 1:1000

Consultant File No. TP115085

Figure No. 3.2

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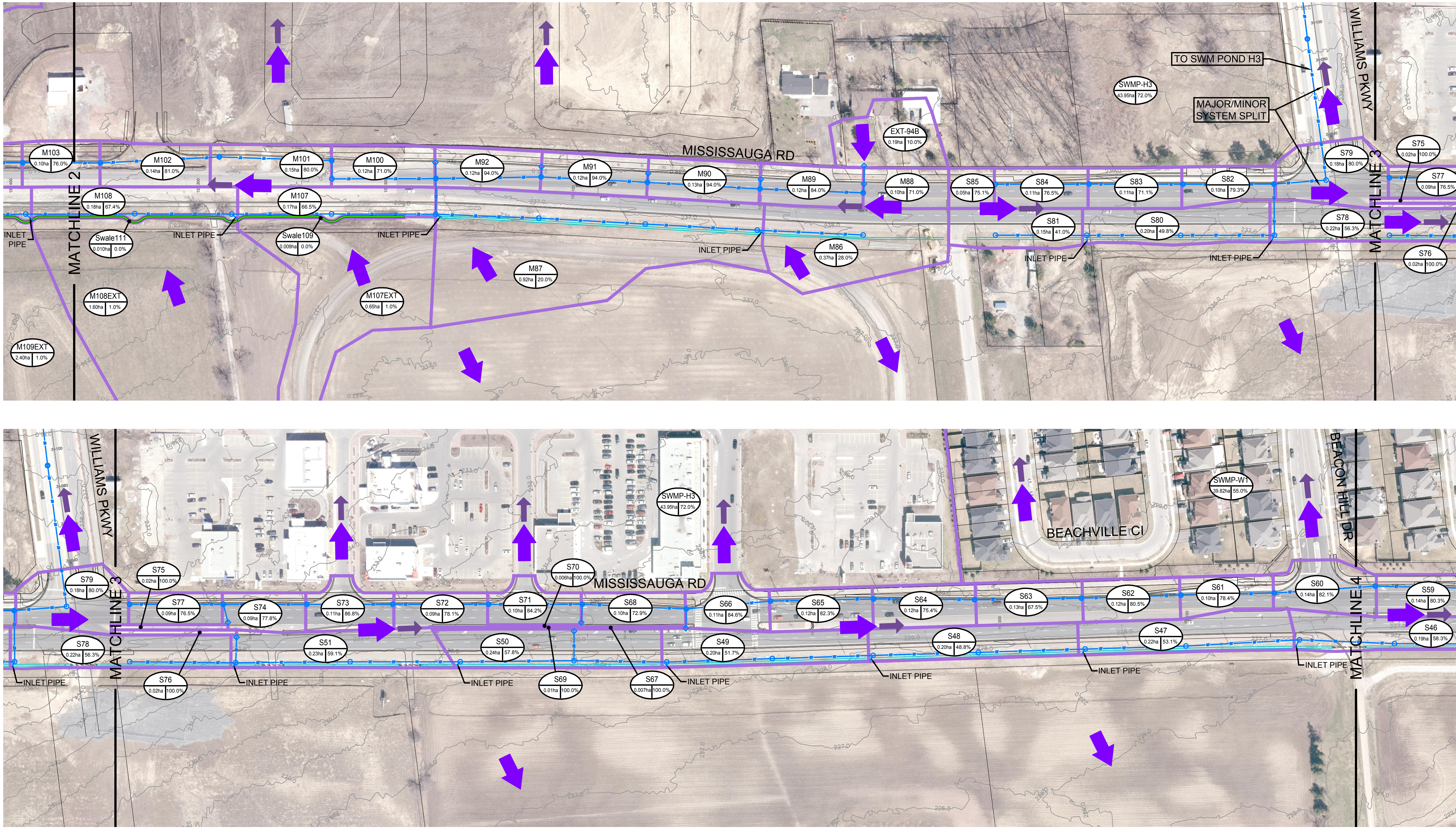

LEGEND

PROPERTY BOUNDARY
WATERCOURSE
CONTOUR (1m)
EXISTING INFILTRATION TRENCH
EXISTING ENHANCED SWALE
EXISTING BIOSWALE
EXISTING CULVERT
EXISTING CLEANOUT
EXISTING OIL/GRIT SEPARATOR
EXISTING STORM SEWER SYSTEM
MAJOR SYSTEM FLOW DIRECTION
MINOR SYSTEM FLOW DIRECTION
SUBCATCHMENT BOUNDARY
M114 0.75ha 73.4%
SUBCATCHMENT ID#
PERCENTAGE OF IMPERVIOUS AREA
SUBCATCHMENT AREA

MISSISSAUGA ROAD EA ADDENDUM
REGION OF PEEL

STORM DRAINAGE BOUNDARIES (EXISTING CONDITION)

wood.

SCALE VALID ONLY FOR 24"x36" VERSION

Scale 1:1000
0 10 20 40

Consultant File No. TP115085

Figure No. 3.3

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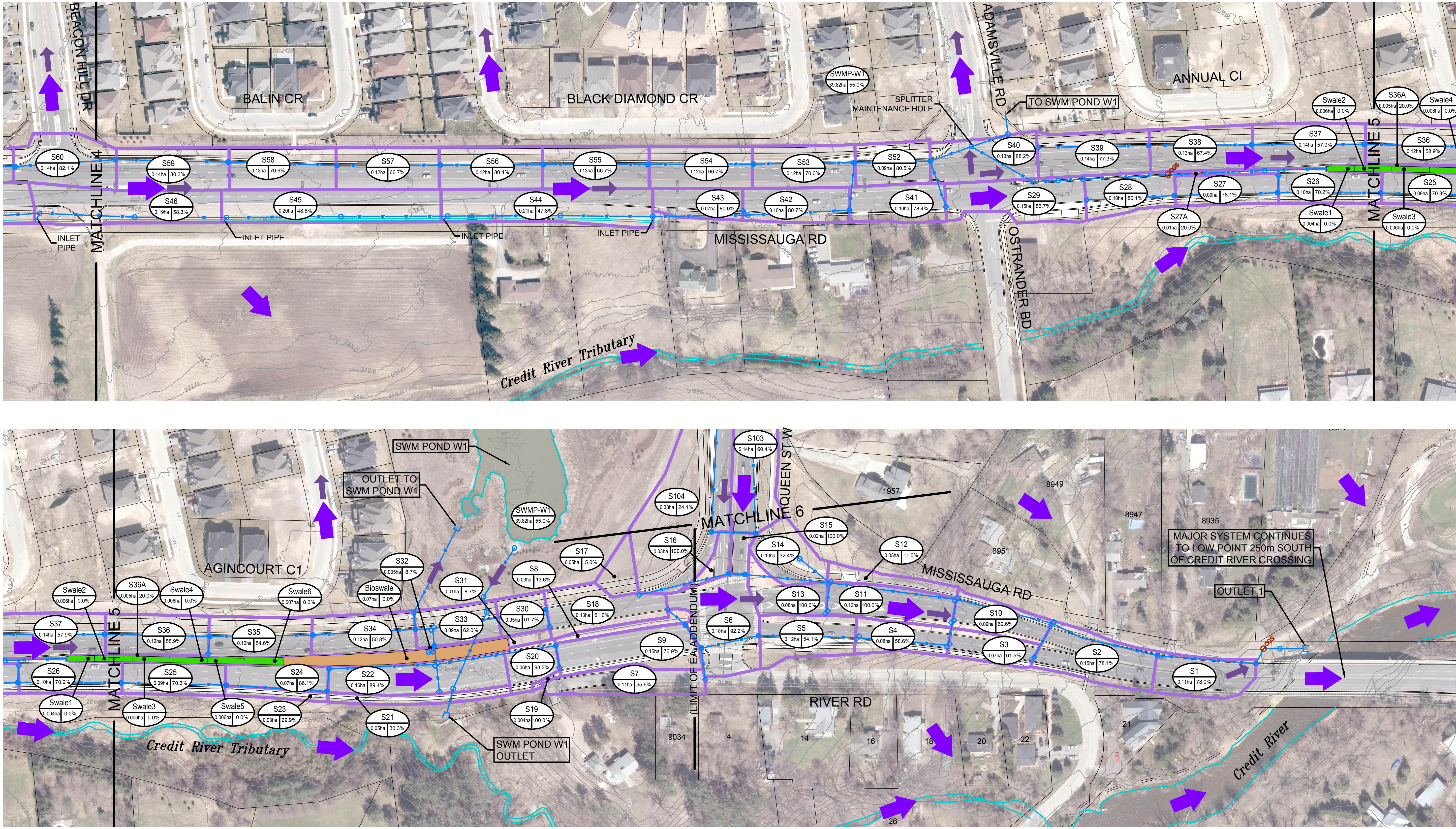

LEGEND

PROPERTY BOUNDARY	EXISTING CULVERT	SUBCATCHMENT BOUNDARY	
WATERCOURSE	EXISTING CLEANOUT	SUBCATCHMENT ID#	M114
CONTOUR (1m)	EXISTING OIL/GRIT SEPARATOR (OGS)	PERCENTAGE OF IMPERVIOUS AREA	73.4%
EXISTING INFILTRATION TRENCH	EXISTING STORM SEWER SYSTEM	SUBCATCHMENT AREA	0.75ha
EXISTING ENHANCED SWALE	MAJOR SYSTEM FLOW DIRECTION		
EXISTING BIOSWALE	MINOR SYSTEM FLOW DIRECTION		

MISSISSAUGA ROAD EA ADDENDUM
REGION OF PEEL

STORM DRAINAGE BOUNDARIES (EXISTING CONDITION)

wood.

SCALE VALID ONLY FOR 24"x36" VERSION
Scale 1:1000 (0 10 20 40)
Consultant File No. TP115085
Figure No. 3.4

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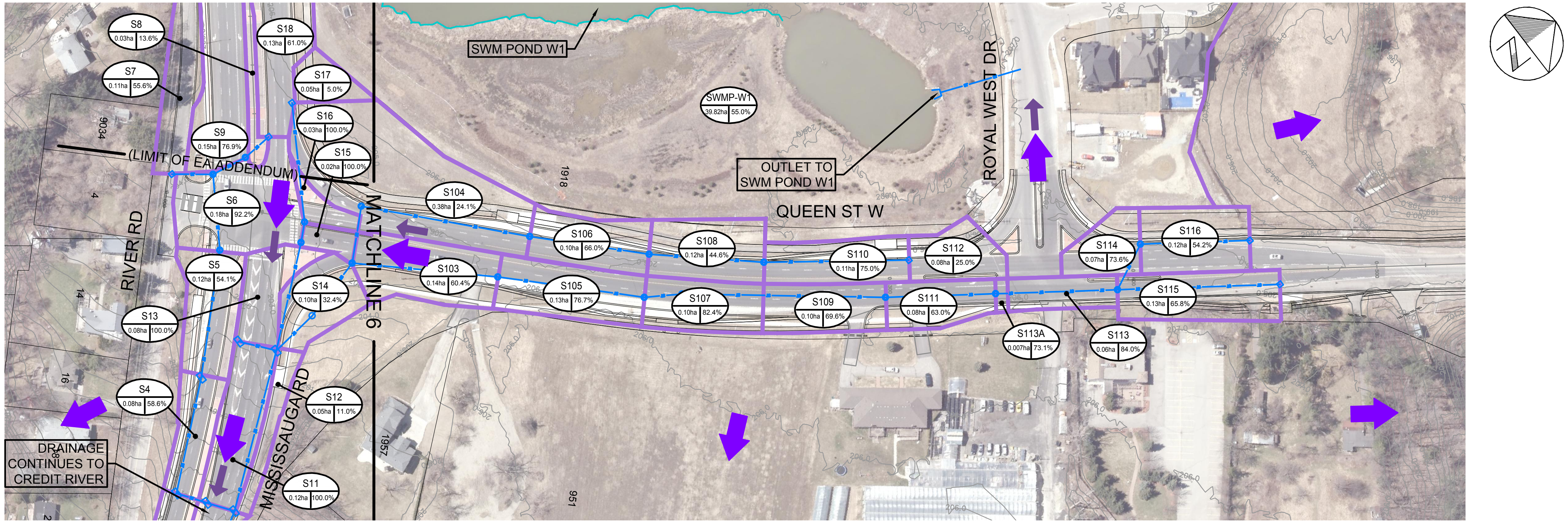

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LEGEND

PROPERTY BOUNDARY	EXISTING CULVERT
WATERCOURSE	EXISTING CLEANOUT
CONTOUR (1m)	EXISTING OIL/GRIT SEPARATOR
EXISTING INFILTRATION TRENCH	EXISTING STORM SEWER SYSTEM
EXISTING ENHANCED SWALE	MAJOR SYSTEM FLOW DIRECTION
EXISTING BIOSWALE	MINOR SYSTEM FLOW DIRECTION

SUBCATCHMENT BOUNDARY

M114 0.75ha 73.4%
- SUBCATCHMENT ID#
- PERCENTAGE OF IMPERVIOUS AREA
- SUBCATCHMENT AREA

SCALE VALID ONLY FOR 24"x36" VERSION

MISSISSAUGA ROAD
EA ADDENDUM
REGION OF PEEL

STORM DRAINAGE
BOUNDARIES
(EXISTING CONDITION)

wood.

Scale 1:1000
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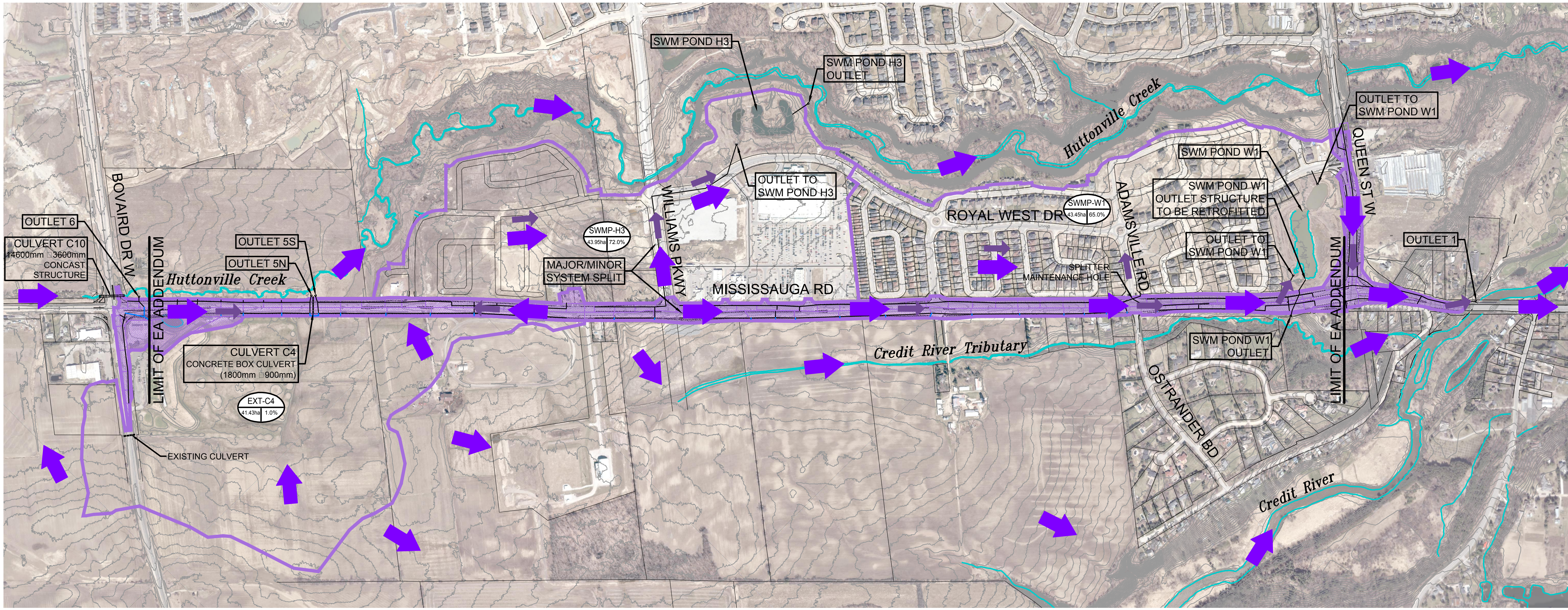
Consultant File No. TP115085

Figure No. 3.5



LEGEND

PROPERTY BOUNDARY	SUBCATCHMENT BOUNDARY
WATERCOURSE	SUBCATCHMENT ID#
CONTOUR (1m)	PERCENTAGE OF IMPERVIOUS AREA
EXISTING CULVERT	SUBCATCHMENT AREA
EXISTING STORM SEWER SYSTEM	MAJOR SYSTEM FLOW DIRECTION
FUTURE STORM SEWER SYSTEM	MINOR SYSTEM FLOW DIRECTION

M114
0.75ha
73.4%

REFER TO MISSISSAUGA ROAD DRAINAGE BOUNDARY PLANS (FIG. 4.1–4.4)

MISSISSAUGA ROAD
EA ADDENDUM
REGION OF PEEL

OVERALL STORM DRAINAGE BOUNDARIES
(FUTURE CONDITION - OPTION 1)

wood.

SCALE VALID ONLY FOR 24"x36" VERSION

Scale 1:5000
0 50 100 200

Consultant File No. TP115085

Figure No. 4.1

Path: P:\Work\TP115085\Water\dwg\2018-06 (Bovaird EA)\Fig4-1 Future-Overall (OPTION 1).dwg

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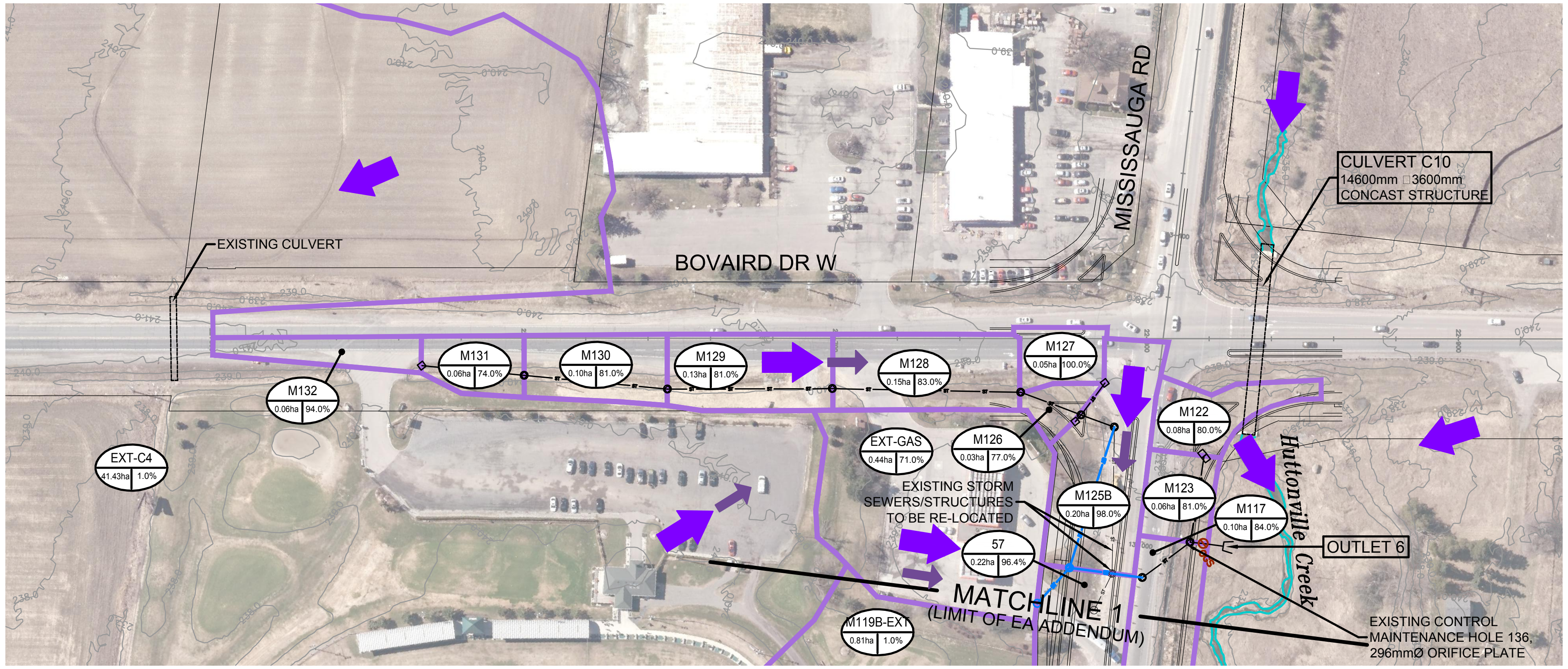

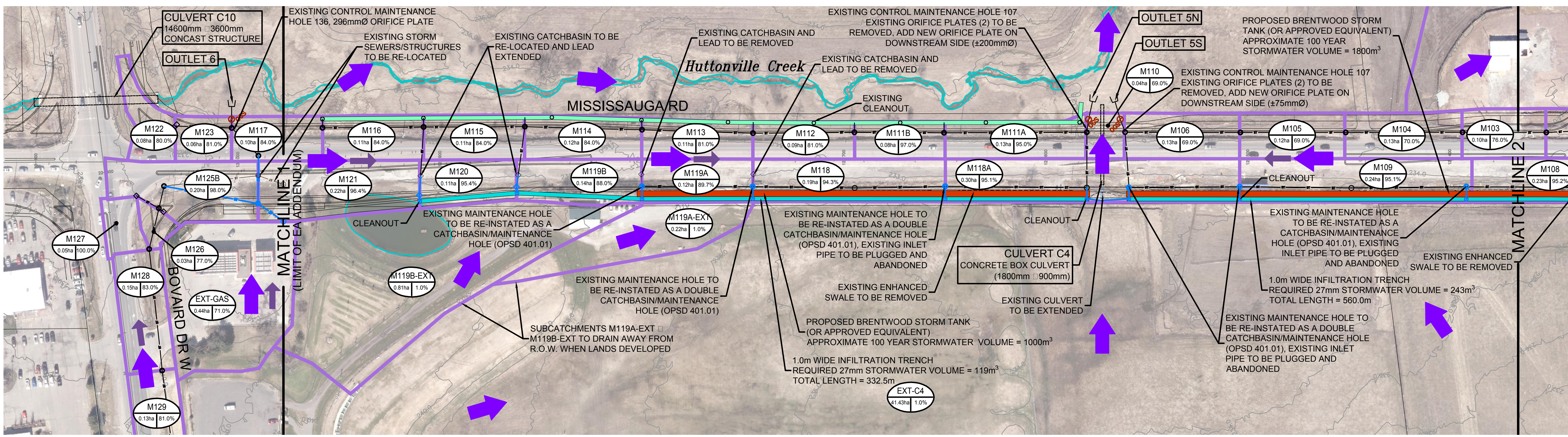

LEGEND

PROPERTY BOUNDARY	PROPOSED UNDERGROUND STORAGE TANK	SUBCATCHMENT BOUNDARY	
WATERCOURSE	EXISTING CULVERT	SUBCATCHMENT ID#	M114
CONTOUR (1m)	EXISTING CLEANOUT	PERCENTAGE OF IMPERVIOUS AREA	73.4%
EXISTING INFILTRATION TRENCH	EXISTING OIL/GRIT SEPARATOR (OGS)	SUBCATCHMENT AREA	0.75ha
EXISTING ENHANCED SWALE	EXISTING STORM SEWER SYSTEM	MAJOR SYSTEM FLOW DIRECTION	
EXISTING BIOSWALE	FUTURE CLEANOUT	MINOR SYSTEM FLOW DIRECTION	
PROPOSED INFILTRATION TRENCH	FUTURE STORM SEWER SYSTEM		

MISSISSAUGA ROAD
EA ADDENDUM
REGION OF PEEL

STORM DRAINAGE
BOUNDARIES
(FUTURE CONDITION - OPTION 1)

wood.

SCALE VALID ONLY FOR 24"x36" VERSION

Scale 1:1000 (0 10 20 40)

Consultant File No. TP115085

Figure No. 4.2

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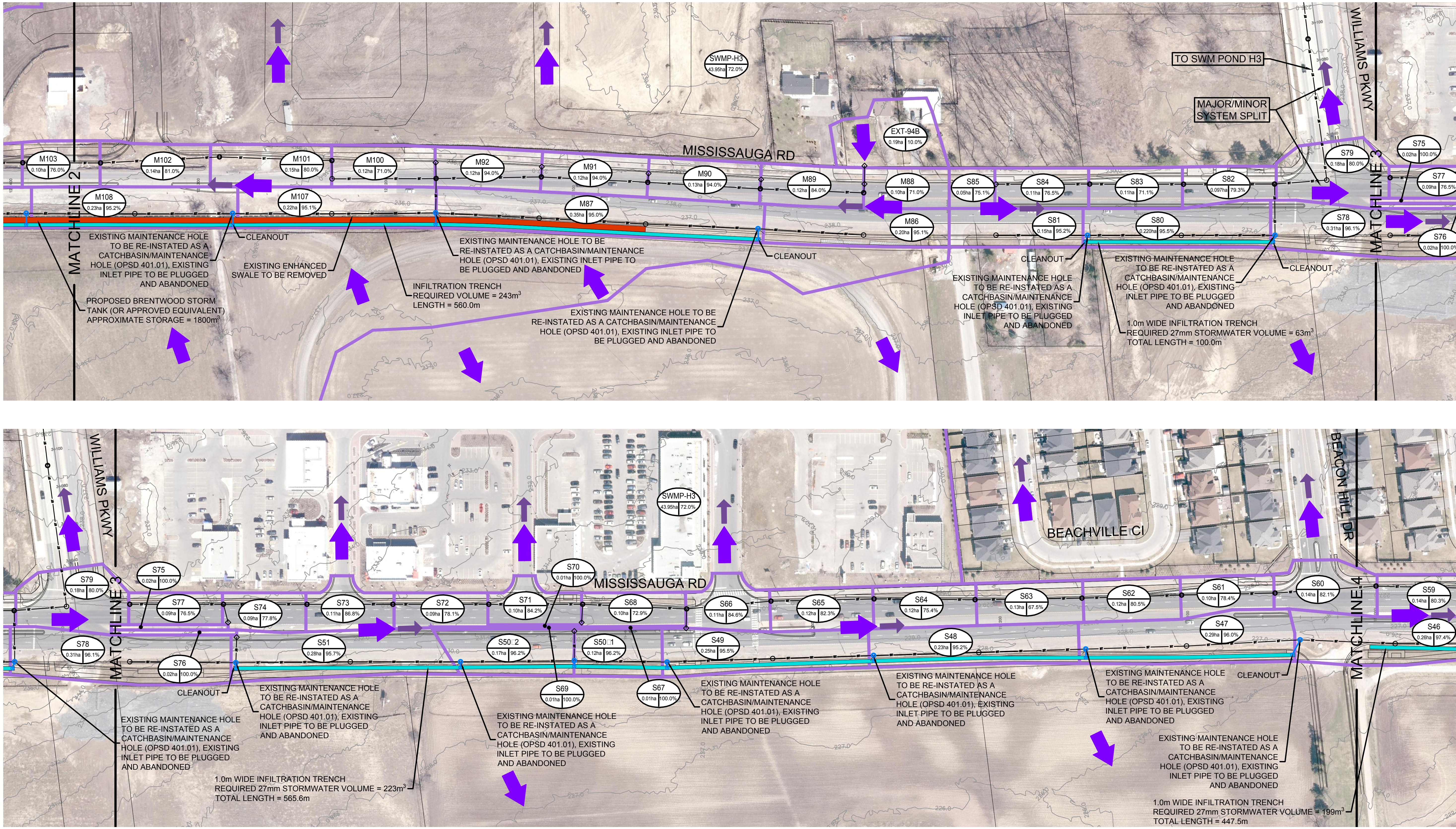


LEGEND

PROPERTY BOUNDARY	PROPOSED UNDERGROUND STORAGE TANK
WATERCOURSE	EXISTING CULVERT
CONTOUR (1m)	EXISTING CLEANOUT
EXISTING INFILTRATION TRENCH	EXISTING OIL/GRIT SEPARATOR
EXISTING ENHANCED SWALE	EXISTING STORM SEWER SYSTEM
EXISTING BIOSWALE	FUTURE CLEANOUT
PROPOSED INFILTRATION TRENCH	FUTURE STORM SEWER SYSTEM

SUBCATCHMENT BOUNDARY

M114 0.75ha 73.4%
- SUBCATCHMENT ID#
- PERCENTAGE OF IMPERVIOUS AREA
- SUBCATCHMENT AREA

MAJOR SYSTEM FLOW DIRECTION

MINOR SYSTEM FLOW DIRECTION

MISSISSAUGA ROAD EA ADDENDUM

REGION OF PEEL

STORM DRAINAGE BOUNDARIES (FUTURE CONDITION - OPTION 1)

wood.

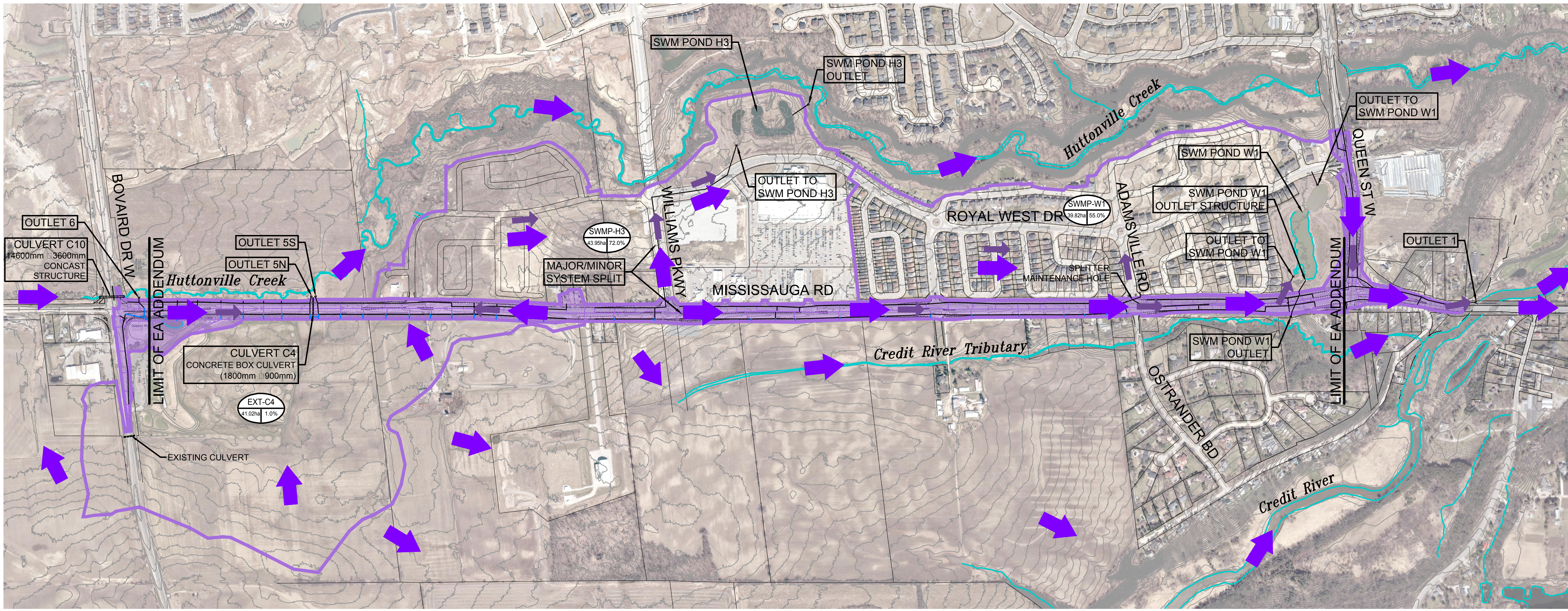
SCALE VALID ONLY FOR 24"x36" VERSION

Scale 1:1000

Consultant File No. TP115085

Figure No. 4.3

Path: P:\Work\TP115085\Water\dwg\2018-06 (Bovaird EA)\Fig4-2,4-5 Future-Plates (OPTION 1).dwg
Plotted By: matthew.britton
Last Saved By: matthew.britton
Plotted: 2018-06-07
Last Saved: 2018-06-07



Path: P:\Work\TP115085\Water\dwg\2018-06 (Bovaird EA)\Fig4-4 Future-Overall (OPTION 2).dwg

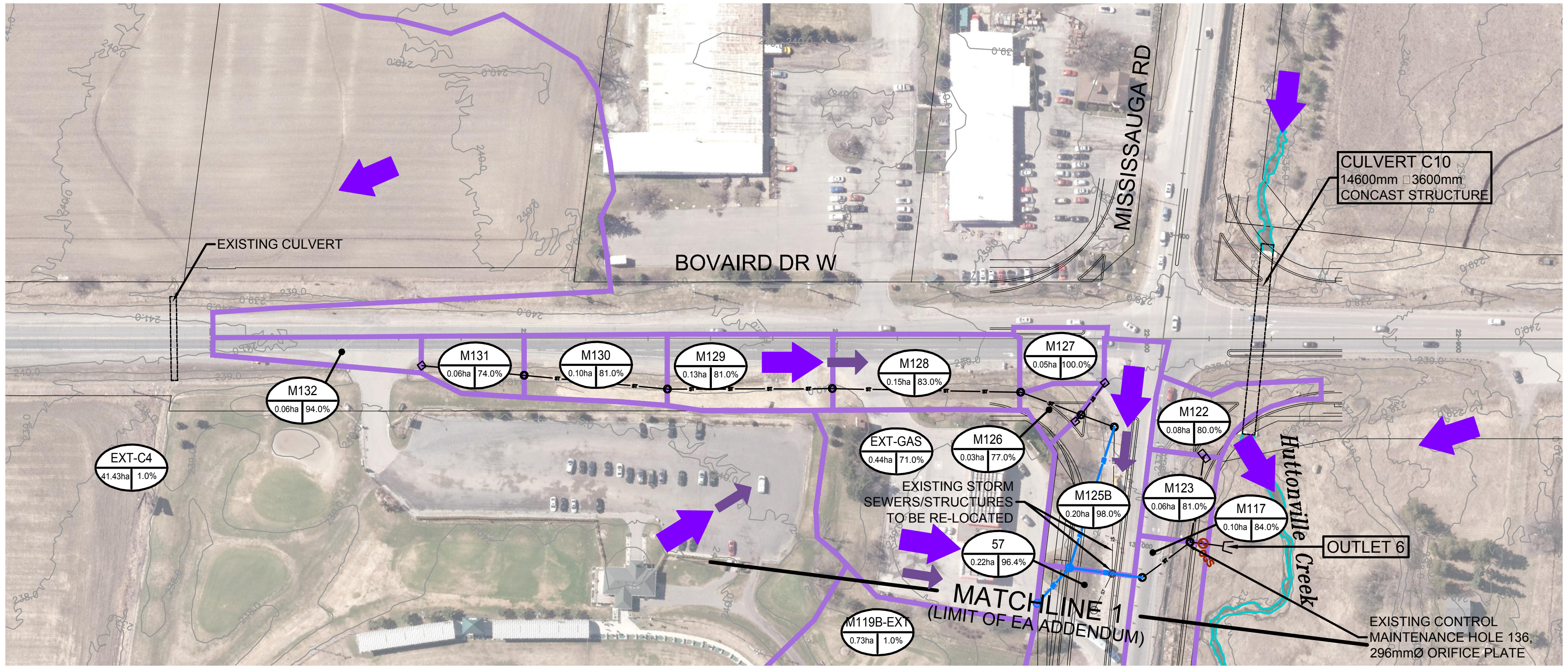
Plotted By: mike.loncar
Last Saved By: mike.loncar
Plotted: 2018-06-07
Last Saved: 2018-06-06

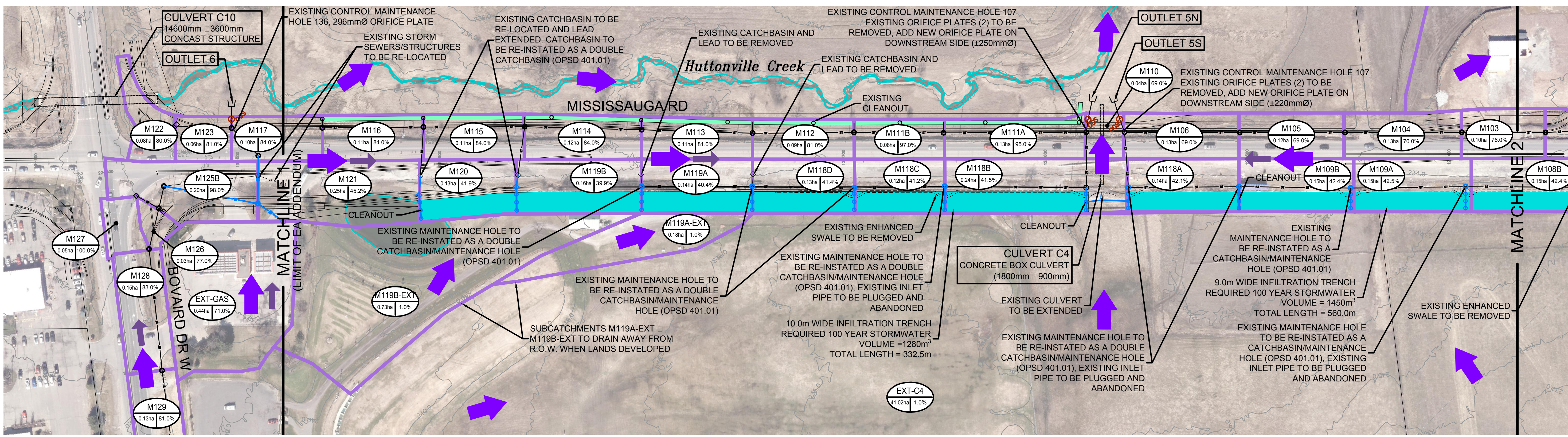
LEGEND

- PROPERTY BOUNDARY
- WATERCOURSE
- CONTOUR (1m)
- EXISTING CULVERT
- EXISTING STORM SEWER SYSTEM
- FUTURE STORM SEWER SYSTEM
- SUBCATCHMENT BOUNDARY
- M114 / 0.75ha / 73.4% — SUBCATCHMENT ID#; PERCENTAGE OF IMPERVIOUS AREA; SUBCATCHMENT AREA
- MAJOR SYSTEM FLOW DIRECTION
- MINOR SYSTEM FLOW DIRECTION
- REFER TO MISSISSAUGA ROAD DRAINAGE BOUNDARY PLANS (FIG. 4.1–4.4)

SCALE VALID ONLY FOR 24"x36" VERSION

MISSISSAUGA ROAD EA ADDENDUM REGION OF PEEL	OVERALL STORM DRAINAGE BOUNDARIES (FUTURE CONDITION - OPTION 2)	wood.	Scale 1:5000 (0 50 100 200) Consultant File No. TP115085 Figure No. 4.4





LEGEND

PROPERTY BOUNDARY	EXISTING CULVERT
WATERCOURSE	EXISTING CLEANOUT
CONTOUR (1m)	EXISTING OIL/GRIT SEPARATOR
EXISTING INFILTRATION TRENCH	EXISTING STORM SEWER SYSTEM
EXISTING ENHANCED SWALE	FUTURE CLEANOUT
EXISTING BIOSWALE	FUTURE STORM SEWER SYSTEM
PROPOSED INFILTRATION TRENCH	

SUBCATCHMENT BOUNDARY

M114 0.75ha 73.4%
- SUBCATCHMENT ID#
- PERCENTAGE OF IMPERVIOUS AREA
- SUBCATCHMENT AREA

MAJOR SYSTEM FLOW DIRECTION

MINOR SYSTEM FLOW DIRECTION

MISSISSAUGA ROAD EA ADDENDUM

REGION OF PEEL

STORM DRAINAGE BOUNDARIES (FUTURE CONDITION - OPTION 2)

wood.

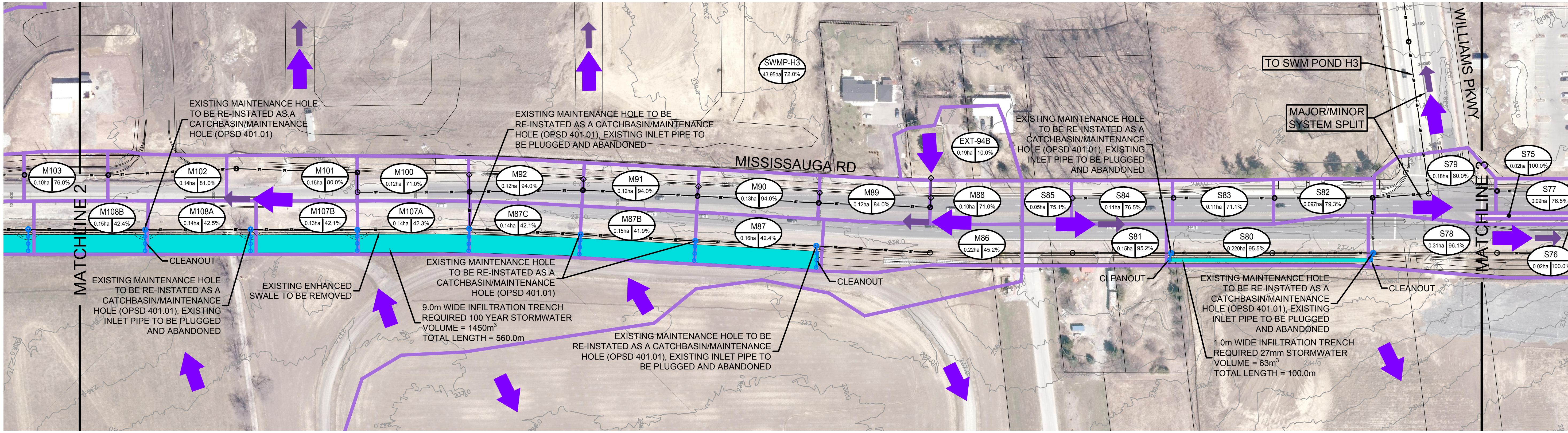
SCALE VALID ONLY FOR 24"x36" VERSION

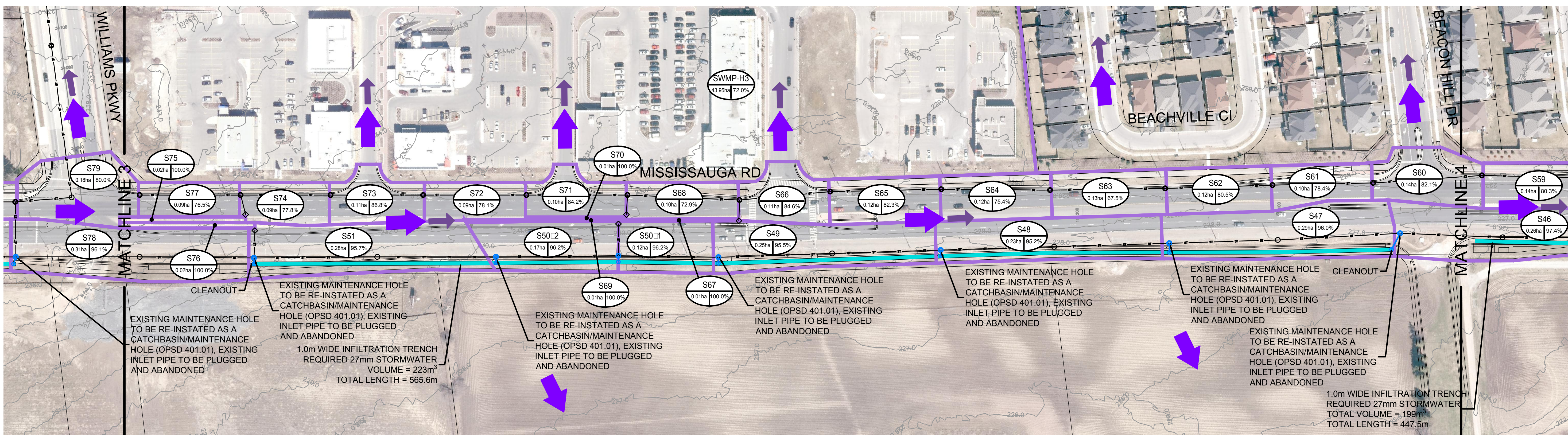
Scale 1:1000 (0 10 20 40)

Consultant File No. TP115085

Figure No. 4.5

Path: P:\Work\TP115085\Water\dwg\2018-06 (Bovaird EA)\Fig4-5_4-8 Future-Plates (OPTION 2).dwg
Plotted By: mike.loncar
Last Saved By: mike.loncar
Plotted: 2018-06-07
Last Saved: 2018-06-06





LEGEND

PROPERTY BOUNDARY	EXISTING CULVERT
WATERCOURSE	EXISTING CLEANOUT
CONTOUR (1m)	EXISTING OIL/GRIT SEPARATOR
EXISTING INFILTRATION TRENCH	EXISTING STORM SEWER SYSTEM
EXISTING ENHANCED SWALE	FUTURE CLEANOUT
EXISTING BIOSWALE	FUTURE STORM SEWER SYSTEM
PROPOSED INFILTRATION TRENCH	

SUBCATCHMENT BOUNDARY

M114 0.75ha 73.4%
- SUBCATCHMENT ID#
- PERCENTAGE OF IMPERVIOUS AREA
- SUBCATCHMENT AREA

MAJOR SYSTEM FLOW DIRECTION

MINOR SYSTEM FLOW DIRECTION

Path: P:\Work\TP115085\Water\dwg\2018-06 (Bovaird EA)\Fig4-5_4-8 Future-Plates (OPTION 2).dwg

Plotted By: matthew.britton
Last Saved By: matthew.britton
Plotted: 2018-06-07
Last Saved: 2018-06-07

MISSISSAUGA ROAD EA ADDENDUM

REGION OF PEEL

STORM DRAINAGE BOUNDARIES (FUTURE CONDITION - OPTION 2)

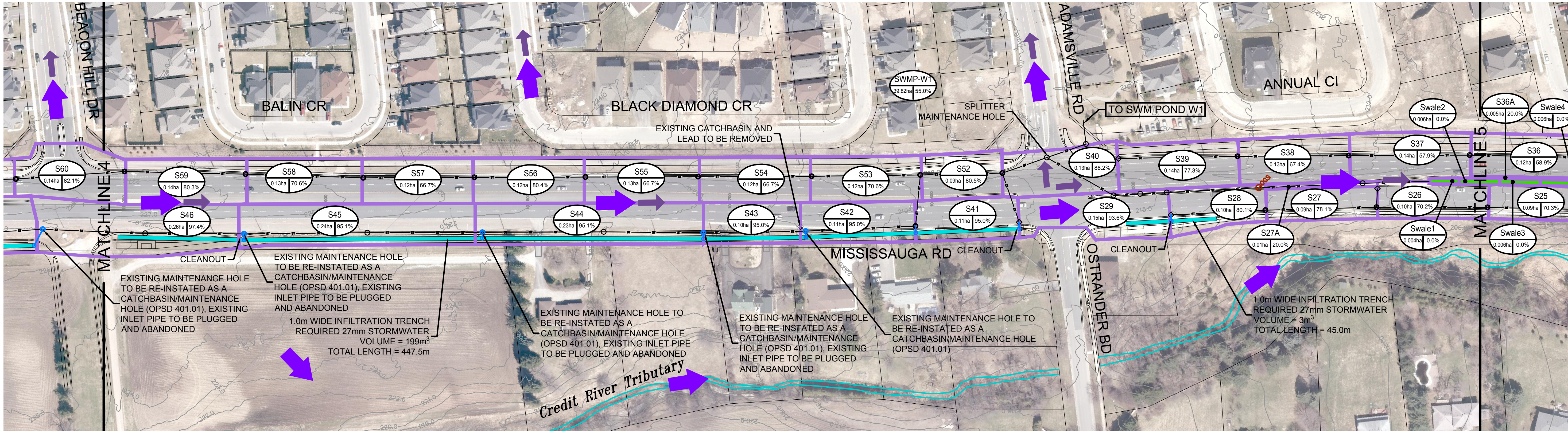
wood.

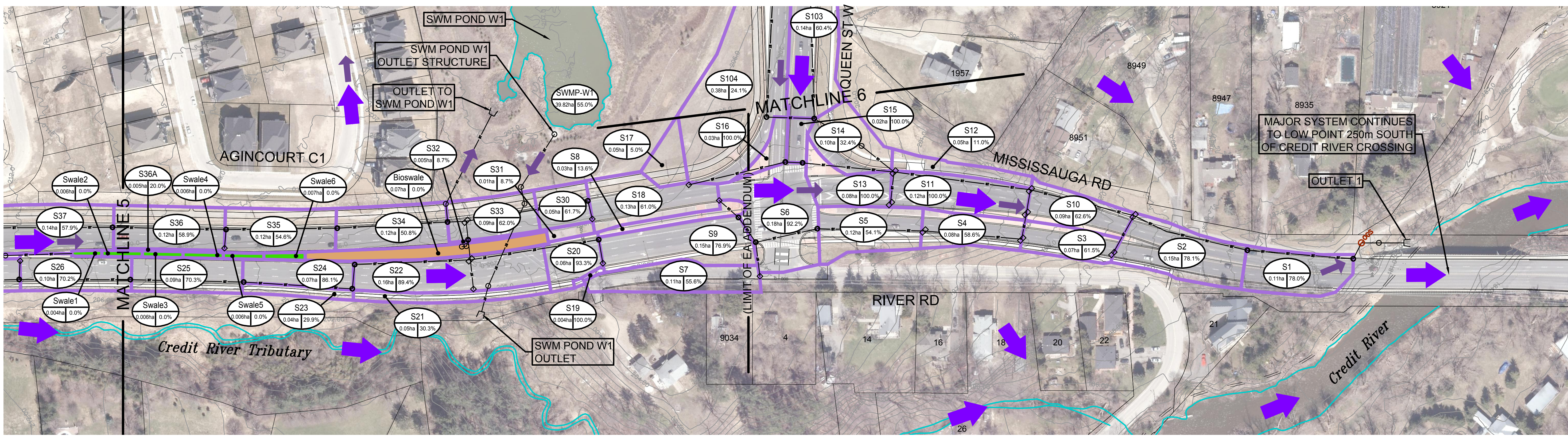
SCALE VALID ONLY FOR 24"x36" VERSION

Scale 1:1000
0 10 20 40

Consultant File No. TP115085

Figure No. 4.6





LEGEND

PROPERTY BOUNDARY
WATERCOURSE
CONTOUR (1m)
EXISTING INFILTRATION TRENCH
EXISTING ENHANCED SWALE
EXISTING BIOSWALE
PROPOSED INFILTRATION TRENCH
EXISTING CULVERT
EXISTING CLEANOUT
OGS EXISTING OIL/GRIT SEPARATOR
EXISTING STORM SEWER SYSTEM
FUTURE CLEANOUT
FUTURE STORM SEWER SYSTEM
SUBCATCHMENT BOUNDARY
M114 0.75ha 73.4%
SUBCATCHMENT ID#
PERCENTAGE OF IMPERVIOUS AREA
SUBCATCHMENT AREA
MAJOR SYSTEM FLOW DIRECTION
MINOR SYSTEM FLOW DIRECTION

MISSISSAUGA ROAD EA ADDENDUM

REGION OF PEEL

STORM DRAINAGE BOUNDARIES (FUTURE CONDITION)

wood.

SCALE VALID ONLY FOR 24"x36" VERSION

Scale 1:1000
0 10 20 40

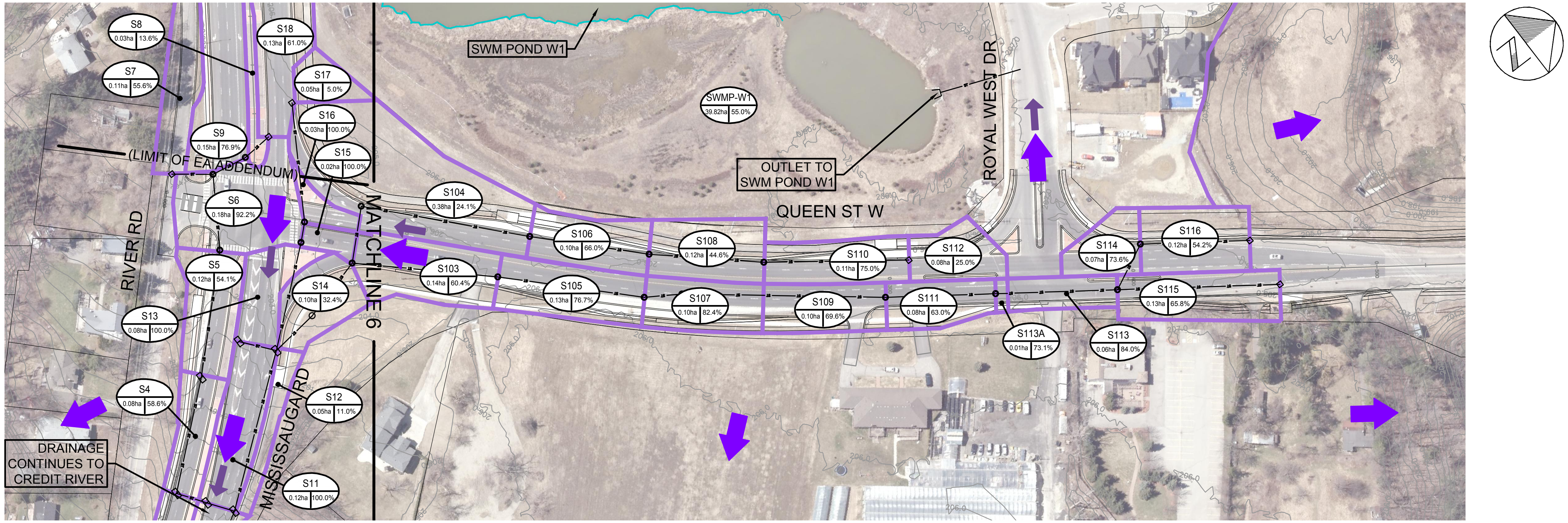
Consultant File No. TP115085

Figure No. 4.7

Path: P:\Work\TP115085\Water\dwg\2018-06 (Bovaird EA)\Fig4-5_4-8 Future-Plates (OPTION 2).dwg

Plotted By: matthew.britton
Last Saved By: matthew.britton

Plotted: 2018-06-07
Last Saved: 2018-06-07



LEGEND

PROPERTY BOUNDARY	EXISTING CULVERT
WATERCOURSE	EXISTING CLEANOUT
CONTOUR (1m)	EXISTING OIL/GRIT SEPARATOR (OGS)
EXISTING INFILTRATION TRENCH	EXISTING STORM SEWER SYSTEM
EXISTING ENHANCED SWALE	FUTURE CLEANOUT
EXISTING BIOSWALE	FUTURE STORM SEWER SYSTEM
PROPOSED INFILTRATION TRENCH	

SUBCATCHMENT BOUNDARY

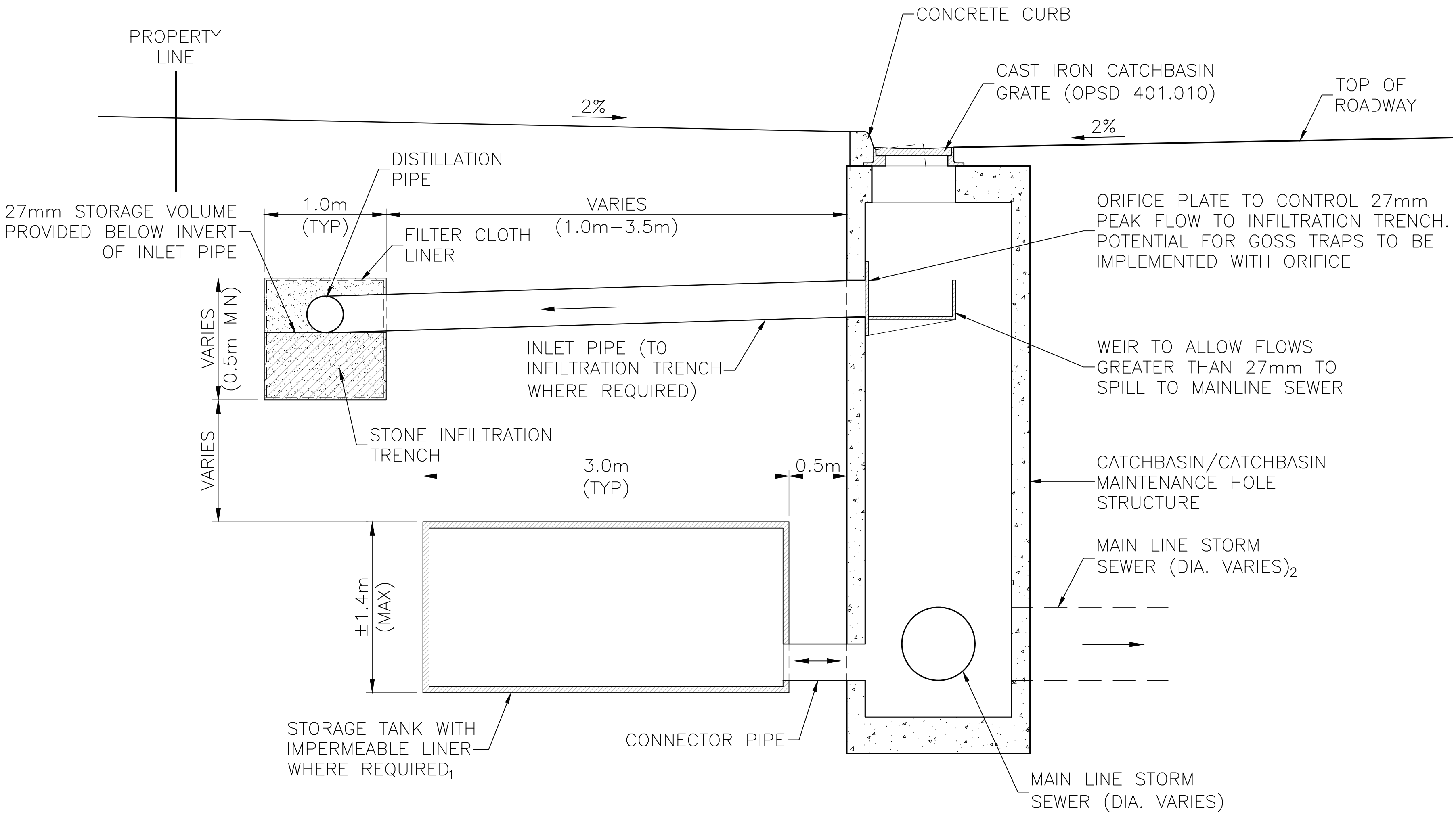
M114 0.75ha 73.4%
- SUBCATCHMENT ID#
- PERCENTAGE OF IMPERVIOUS AREA
- SUBCATCHMENT AREA

MAJOR SYSTEM FLOW DIRECTION

MINOR SYSTEM FLOW DIRECTION

SCALE VALID ONLY FOR 24"x36" VERSION

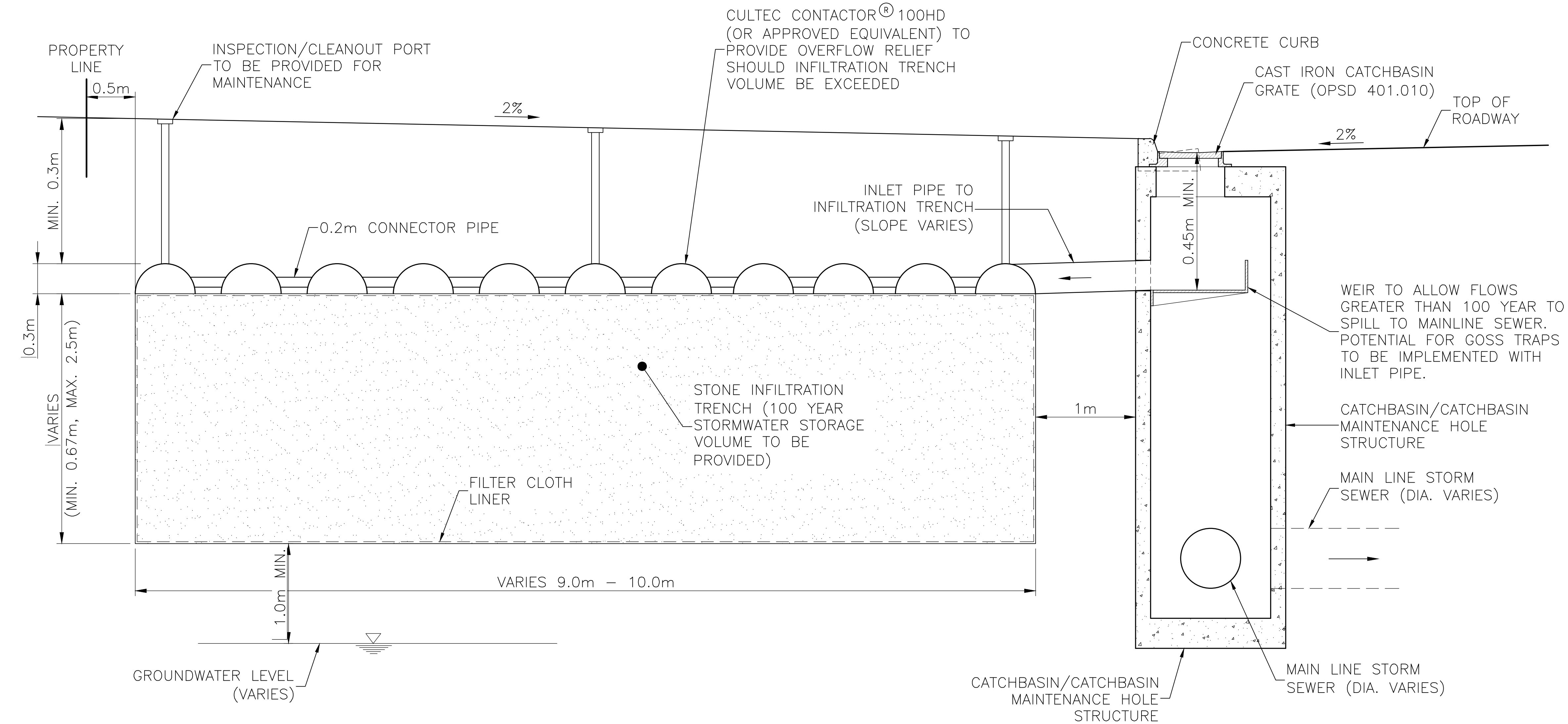
MISSISSAUGA ROAD EA ADDENDUM REGION OF PEEL	STORM DRAINAGE BOUNDARIES (FUTURE CONDITION)	wood.	Scale 1:1000 (0 10 20 40) Consultant File No. TP115085 Figure No. 4.8



NOTE:

1. IMPERMEABLE LINER REQUIRED WHERE GROUNDWATER LEVELS ARE <1.0m BELOW UNDERSIDE OF TANK.
2. DOWNSTREAM ORIFICE PLATE BACKS-UP STORMWATER INTO STORAGE TANK.

MISSISSAUGA ROAD EA ADDENDUM REGION OF PEEL	INFILTRATION TRENCH AND UNDERGROUND STORAGE TANK CONFIGURATION -OPTION 1	wood.	Scale 1:50 Consultant File No. TP115085 Figure No. 5.1



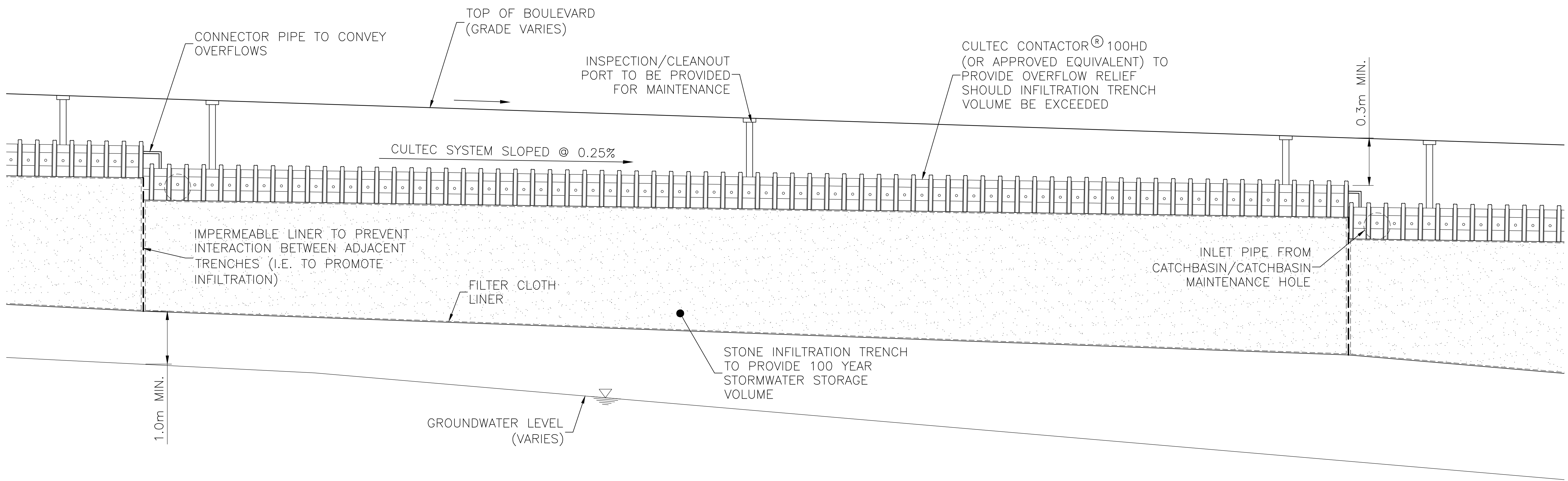
NOTE:

1. DOWNSTREAM ORIFICE PLATE BACKS–UP STORMWATER INTO STORAGE TANK.

Path: P:\Work\TP115085\Water\dwg\2018-06 (Bovaird EA)\Fig5-2 Storage (OPTION 2).dwg
Plotted: 2018-06-06 Plotted By: mike.loncar
Last Saved: 2018-06-05 Last Saved By: mike.loncar

SCALE VALID ONLY FOR 11"x17" VERSION

MISSISSAUGA ROAD EA ADDENDUM REGION OF PEEL	INFILTRATION STORAGE TRENCH - OPTION 2 TYPICAL CROSS-SECTION CONFIGURATION	wood.	Scale 1:50 Consultant File No. TP115085 Figure No. 5.2



SCALE VALID ONLY FOR 11"x17" VERSION

MISSISSAUGA ROAD EA ADDENDUM REGION OF PEEL	INFILTRATION STORAGE TRENCH - OPTION 2 TYPICAL PROFILE CONFIGURATION	wood.	Scale: 1:200 Consultant File No.: TP115085 Figure No.: 5.3

Path: P:\Work\TP115085\Water\dwg\2018-06 (Bovaird EA)\Fig5-3 Storage (OPTION 2).dwg
Plotted By: mike.loncar
Last Saved By: mike.loncar
Plotted: 2018-06-06
Last Saved: 2018-06-06

Appendix A:
Background Information

Submitted to:

The Region of Peel and Credit Valley Conservation

DESIGN BRIEF

REGION OF PEEL AND CREDIT VALLEY CONSERVATION LOW IMPACT DEVELOPMENT DESIGN FOR MISSISSAUGA ROAD

PROJECT 2: MISSISSAUGA ROAD (WILLIAMS PARKWAY TO BOVAIRD DRIVE)

Aquafor Beech Ltd.

August, 2015

Contact:
Chris Denich, M.Sc., P.Eng
Aquafor Beech Ltd.
denich.c@aquaforbeech.com

Mississauga, Ontario.
2600 Shymark Ave, Bld 6,
Unit 202 , L4W 5B2

MISSISSAUGA ROAD WIDENING
(FROM WILLIAMS PARKWAY TO BOVAIRD DRIVE)

LID DRAINAGE DESIGN

100% DRAWING SUBMISSION
REISSUED FOR APPROVAL

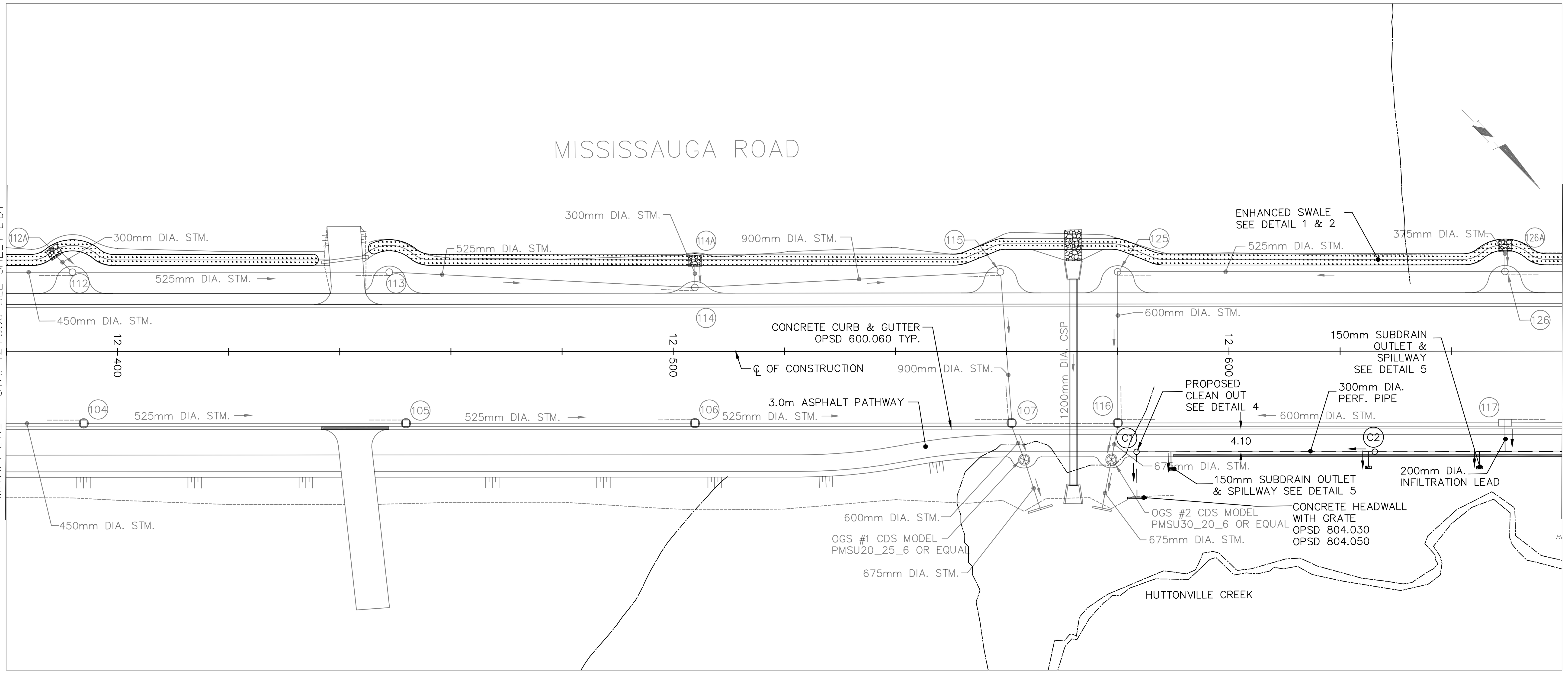
PART B: LID DRAINAGE DESIGN (AQUAFOR BEECH LTD)

Aquafor Beech Limited
#6-202-2600 SKYMARK Ave,
MISSISSAUGA, ONTARIO, L4W 5B2
PHONE: (905) 629-0099
FAX: (905) 629-0089

55 REGAL ROAD, UNIT 3
GUELPH, ONTARIO, N1K 1B6
PHONE: (519) 224-3740
FAX: (519) 224-3750

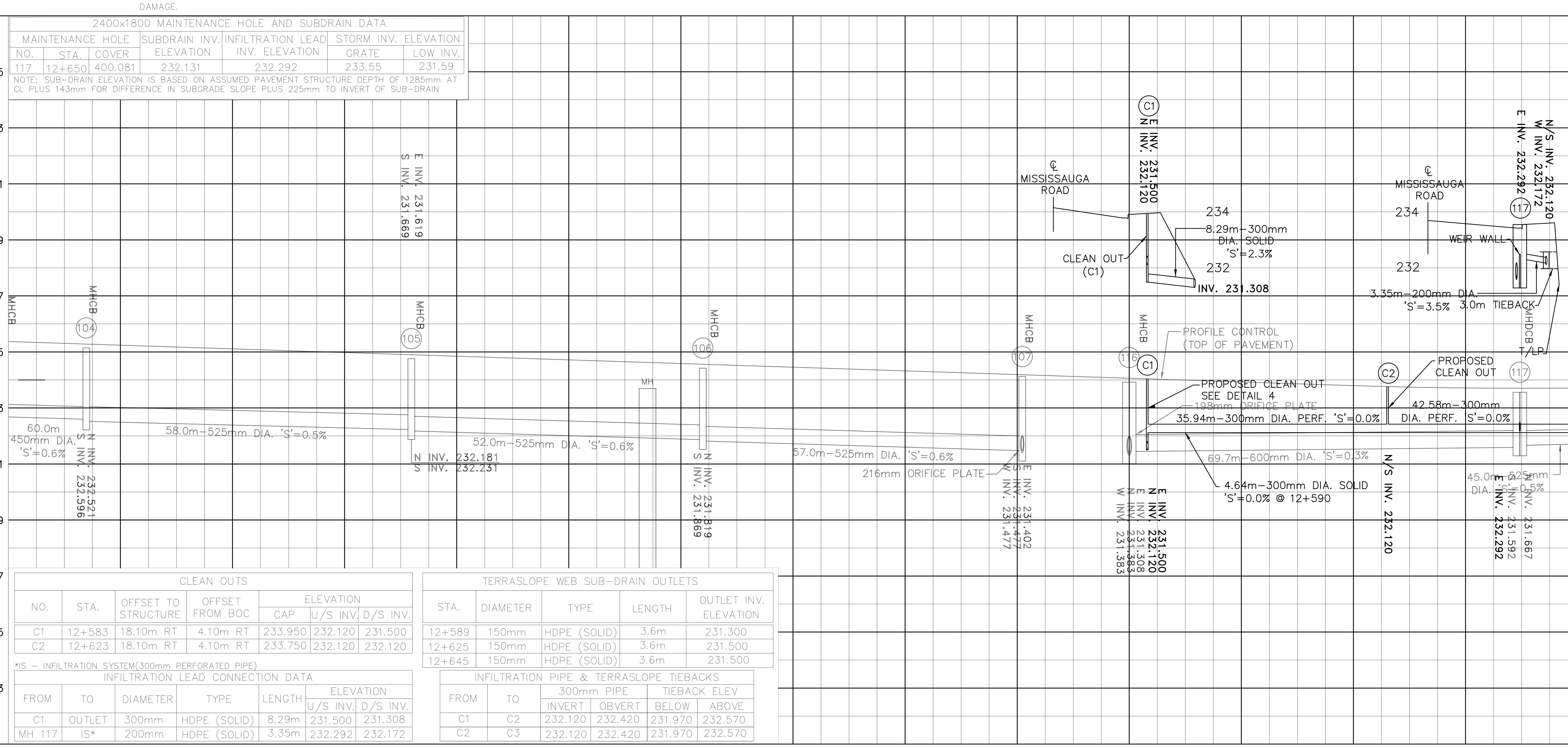
terrafix geosynthetics inc.

Region of Peel
Working for you



THESE DESIGN DOCUMENTS ARE PREPARED SOLELY FOR THE USE BY THE PARTY WITH WHOM THE DESIGN PROFESSIONAL HAS ENTERED INTO A CONTRACT AND THERE ARE NO REPRESENTATIONS OF ANY KIND MADE BY THE DESIGN PROFESSIONAL TO ANY PARTY WITH WHOM THE DESIGN PROFESSIONAL HAS NOT ENTERED INTO A CONTRACT.

THE LOCATION OF UTILITIES IS APPROXIMATE ONLY AND THE EXACT LOCATION SHOULD BE DETERMINED BY CONSULTING THE MUNICIPAL AUTHORITIES AND UTILITY COMPANIES CONCERNED. THE CONTRACTOR SHALL PROVE THE LOCATION OF UTILITIES AND SHALL BE RESPONSIBLE FOR ADEQUATE PROTECTION FROM DAMAGE.



2400x1800 MAINTENANCE HOLE AND SUBDRAIN DATA						
MAINTENANCE HOLE			SUBDRAIN INV. ELEVATION	INFILTRATION LEAD INV. ELEVATION	STORM INV. ELEVATION	
NO.	STA.	COVER			GRATE	LOW INV.
117	12+650	400.081	232.131	232.292	233.55	231.59

NOTE: SUB-DRAIN ELEVATION IS BASED ON ASSUMED PAVEMENT STRUCTURE DEPTH OF 1285mm AT CL PLUS 143mm FOR DIFFERENCE IN SUBGRADE SLOPE PLUS 225mm TO INVERT OF SUB-DRAIN

CLEAN OUTS						
NO.	STA.	OFFSET TO STRUCTURE	OFFSET FROM BOC	ELEVATION		
				CAP	U/S INV.	D/S INV.
C1	12+583	18.10m RT	4.10m RT	233.950	232.120	231.500
C2	12+623	18.10m RT	4.10m RT	233.750	232.120	232.120

TERRASLOPE WEB SUB-DRAIN OUTLETS				
STA.	DIAMETER	TYPE	LENGTH	OUTLET INV. ELEVATION
12+589	150mm	HDPE (SOLID)	3.6m	231.300
12+625	150mm	HDPE (SOLID)	3.6m	231.500
12+645	150mm	HDPE (SOLID)	3.6m	231.500

*IS – INFILTRATION SYSTEM(300mm PERFORATED PIPE)

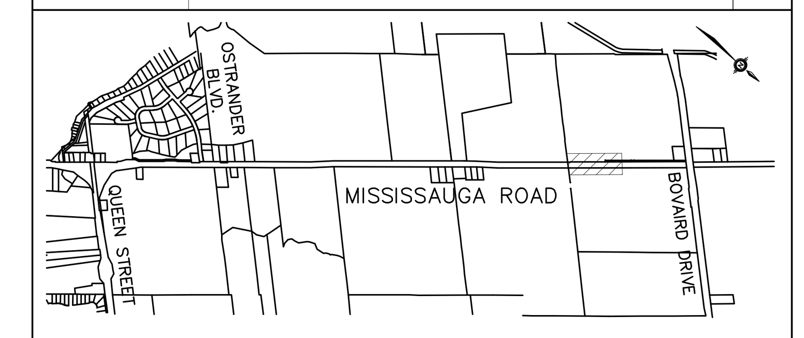
INFILTRATION LEAD CONNECTION DATA						
FROM	TO	DIAMETER	TYPE	LENGTH	ELEVATION	
					U/S INV.	D/S INV.
C1	OUTLET	300mm	HDPE (SOLID)	8.29m	231.500	231.308
MH 117	IS*	200mm	HDPE (SOLID)	3.35m	232.292	232.172

INFILTRATION PIPE & TERRASLOPE TIEBACKS					
FROM	TO	300mm PIPE		TIEBACK ELEV	
		INVERT	OBVERT	BELOW	ABOVE
C1	C2	232.120	232.420	231.970	232.570
C2	C3	232.120	232.420	231.970	232.570

BOT.EL. OF WM.															
SEWER INVERT															
EX. ROAD ELEV.															
ROAD CHAINAGE	12+380	12+400	12+420	12+440	12+460	12+480	12+500	12+520	12+540	12+560	12+580	12+600	12+620	12+640	12+660

SERVICE DATA					
SERVICE	DATE	INIT.	SERVICE	DATE	INIT.
SAN SEWERS			GAS MAINS		
STORM SEWERS			BELL U/G CABLE		
WATERMAINS			HYDRO U/G CABLE		
TRANSIT			HYDRO ONE		
PARKS & REC.			CTV		
ONT. CLEAN WATER			COMMUNIC. CABLES		

REVISIONS		
DATE	DETAILS	INIT.
05/12/2014	60% DESIGN SUBMISSION	W.C
17/02/2015	90% DESIGN SUBMISSION	W.C
08/05/2015	90% DESIGN SUBMISSION – RESUBMISSION	W.C
28/05/2015	90% DESIGN SUBMISSION – 2nd RESUBMISSION	W.C
08/06/2015	100% DESIGN SUBMISSION – ISSUED FOR APPROVAL	W.C
14/08/2015	100% DESIGN SUBMISSION – REISSUED FOR APPROVAL	W.C



KEY PLAN (N.T.S.)

100% SUBMISSION
AUG, 2015

General Notes

- All Driveways ASPHALT Unless Otherwise Noted.
- All Service Locations Are Approximate And Must Be Located Accurately In The Field
- Denotes Building – Not Located
- Denotes Building Located
- Type 'B' Bedding Unless Otherwise Noted (SAN)

B.M. No. Elev.

The Contractor Is Responsible For Locating And Protecting All Existing Utilities Prior To And During Construction Location of Existing Utilities Approximate Only, To Be Verified In Field By Contractor. For final layout approval prior to installation, please contact Tahar Singh at 905-874-2750 ext 2397 or Chris Lafleur ext 2358.

LICENSED PROFESSIONAL ENGINEER W.S.R. COWLIN 100148707 PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER C.J. DENICH 100134582 PROVINCE OF ONTARIO

Designed by
WILL COWLIN, P.E.
Chkd.

Approved by
CHRIS DENICH, P.E.

Aquafor Beech Limited

#6-202-2600 SKYMARK Ave,
MISSISSAUGA, ONTARIO, L4W 5B2
PHONE: (905) 629-0099
FAX: (905) 629-0089

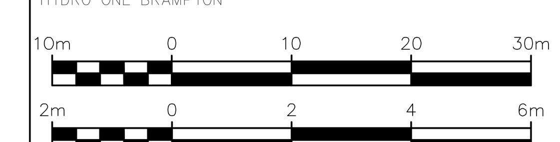
55 REGAL ROAD, UNIT 3
GUELPH, ONTARIO, N1K 1B6
PHONE: (519) 224-3740
FAX: (519) 224-3750

NOTICE TO CONTRACTOR

48 HOURS PRIOR TO COMMENCING WORK NOTIFY THE FOLLOWING

THE REGIONAL MUNICIPALITY OF PEEL
CITY OF MISSISSAUGA WORKS DEPT.
CITY OF BRAMPTON WORKS DEPT.
TOWN OF CALEDON WORKS DEPT.
BELL CANADA
ENBRIDGE INCORPORATED–GAS DISTRIBUTION
ONTARIO MINISTRY OF TRANSPORTATION
ONTARIO CLEAN WATER AGENCY
HYDRO ONE NETWORKS
ENERSOURCE, HYDRO MISSISSAUGA
HYDRO ONE BRAMPTON

CABLE TELEVISION/FIBREOPTIC PROVIDERS:
BELL CANADA
ENERSOURCE TELECOM
HYDRO ONE TELECOM
ROGERS CABLE
ALLSTREAM
PSN (PUBLIC SECTOR NETWORK)
FUTUREWAY (FCI BROADBAND)



HORIZONTAL SCALE
VERTICAL SCALE

Region of Peel
Working for you

MISSISSAUGA ROAD

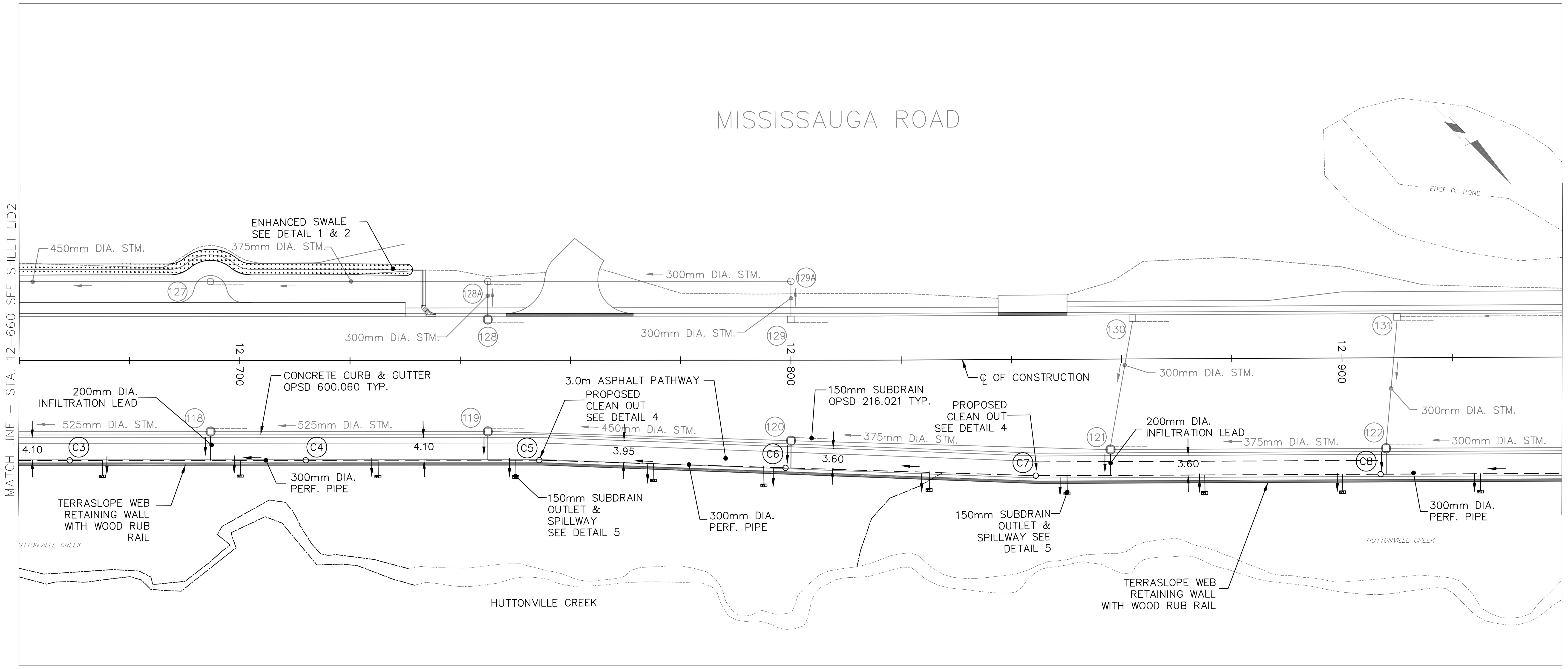
(FROM WILLIAMS PARKWAY TO BOVAIRD DRIVE)

L.I.D – PLAN AND PROFILE 2

STA. 12+380 TO STA. 12+660

CAD Area	Area	Project No.	
Checked by	Drawn by WC		
Date 08/06/15	Sheet 2 of 9	Plan No.	LID 2

File : C:\Users\ChrisD\Desktop\ABL_MISS ROAD PHASE II - DETAILED DESIGN (100% SUBMISSION)_V10ht.dwg, Layout : GENERAL PLAN 2 Date :Aug 17, 2015 - 1:12pm, Edit By : ChrisD



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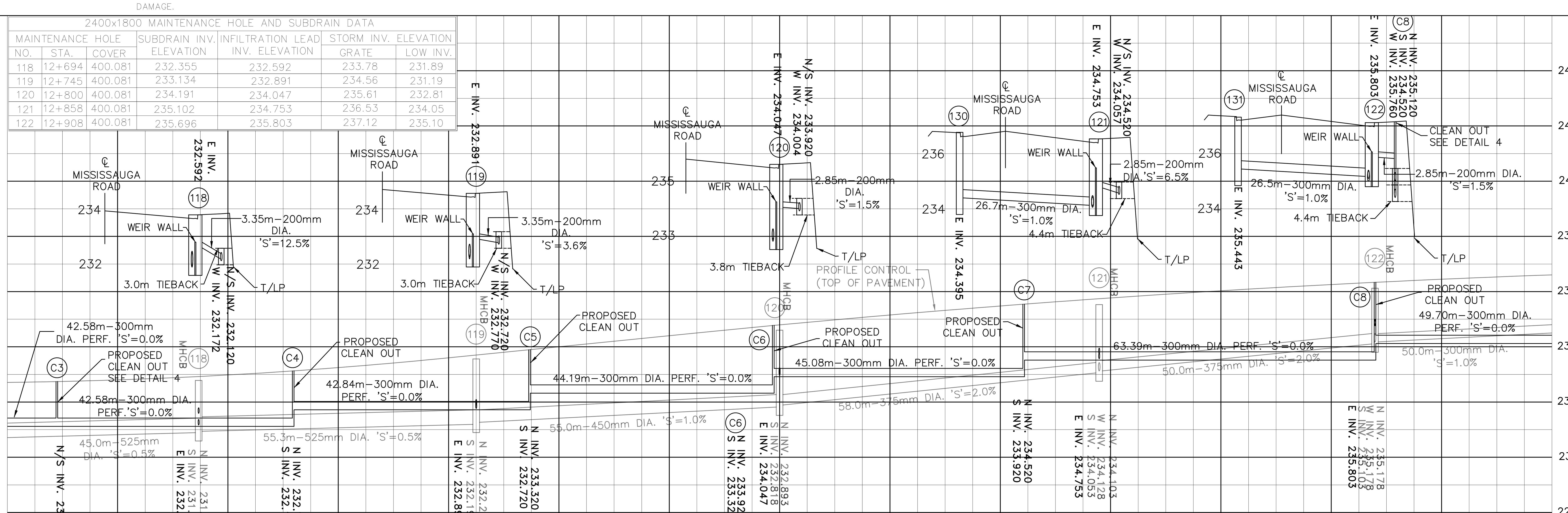
NOTE: SUB-DRAIN ELEVATION IS BASED ON ASSUMED PAVEMENT STRUCTURE DEPTH OF 1285mm AT CL PLUS 14mm FOR DIFFERENCE IN SUBGRADE SLOPE PLUS 225mm TO INVERT OF SUB-DRAIN

2400x1800 MAINTENANCE HOLE AND SUBDRAIN DATA

MAINTENANCE HOLE			SUBDRAIN INV. ELEVATION	INFILTRATION LEAD INV. ELEVATION	STORM INV. ELEVATION	
NO.	STA.	COVER			GRATE	LOW INV.
118	12+694	400.081	232.355	232.592	233.78	231.89
119	12+745	400.081	233.134	232.891	234.56	231.19
120	12+800	400.081	234.191	234.047	235.61	232.81
121	12+858	400.081	235.102	234.753	236.53	234.05
122	12+908	400.081	235.696	235.803	237.12	235.10



CLEAN OUTS						
NO.	STA.	OFFSET TO STRUCTURE	OFFSET FROM BOC	ELEVATION		
				CAP	U/S INV.	D/S INV.
C3	12+669	18.10m RT	4.10m RT	233.750	232.120	232.120
C4	12+711	18.10m RT	4.10m RT	234.130	232.720	232.120
C5	12+754	18.10m RT	4.10m RT	234.900	233.320	232.720
C6	12+799	19.51m RT	3.85m RT	235.780	233.920	233.320
C7	12+844	21.08m RT	3.60m RT	236.550	234.520	233.920
C8	12+907	21.10m RT	3.60m RT	237.340	235.120	234.520

INFILTRATION LEAD CONNECTION DATA						
FROM	TO*	DIAMETER	TYPE	LENGTH	ELEVATION	
					U/S INV.	D/S INV.
MH 118	IS	200mm	HDPE (SOLID)	3.35m	232.592	232.172
MH 119	IS	200mm	HDPE (SOLID)	3.35m	232.891	232.770
MH 120	IS	200mm	HDPE (SOLID)	2.85m	234.047	234.004
MH 121	IS	200mm	HDPE (SOLID)	2.85m	234.753	234.570
MH 122	IS	200mm	HDPE (SOLID)	2.85m	235.803	235.760

*IS – INFILTRATION SYSTEM(300mm PERFORATED PIPE)

TERRASLOPE WEB SUB-DRAIN OUTLETS				
STA.	DIAMETER	TYPE	LENGTH	OUTLET INV. ELEVATION
12+675	150mm	HDPE (SOLID)	3.6m	231.700
12+700	150mm	HDPE (SOLID)	3.6m	231.700
12+725	150mm	HDPE (SOLID)	3.6m	231.700
12+750	150mm	HDPE (SOLID)	4.3m	231.900
12+775	150mm	HDPE (SOLID)	4.3m	232.000
12+795	150mm	HDPE (SOLID)	4.3m	232.100
12+825	150mm	HDPE (SOLID)	4.9m	232.300
12+850	150mm	HDPE (SOLID)	4.9m	232.500
12+875	150mm	HDPE (SOLID)	4.9m	232.700
12+900	150mm	HDPE (SOLID)	4.9m	232.900
12+925	150mm	HDPE (SOLID)	4.9m	233.200

INFILTRATION PIPE & TERRASLOPE TIEBACKS					
FROM	TO	300mm PIPE		TIEBACK ELEV	
		INVERT	OBVERT	BELOW	ABOVE
C2	C3	232.120	232.420	231.970	232.570
C3	C4	232.120	232.420	231.970*	232.570
C4	C5	232.720	233.020	232.570	233.170
C5	C6	233.320	233.620	233.170	233.770
C6	C7	233.920	234.220	233.770	234.370
C7	C8	234.520	234.820	234.370	234.970
C8	C9	235.120	235.420	234.970	235.570

*FROM STATION 12+688.41 TO C4 TIEBACK BELOW "IS" TO BE ADJUSTED: ADJUSTED TIEBACK FROM 232.17 TO 231.97, SUCH THAT GEOGRID DIPS BELOW INFILTRATION SYSTEM. GEOGRID TO REMAIN AT 232.17 ON EITHER SIDE OF THE INFILTRATION SYSTEM

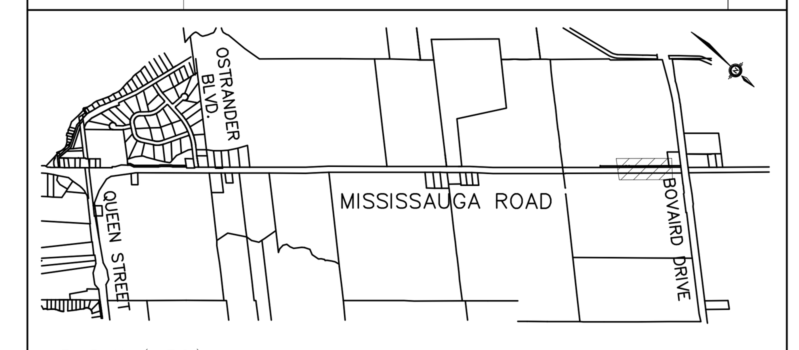
															BOT.EL. OF WM.
															SEWER INVERT
															EX. ROAD ELEV.
12+660	12+680	12+700	12+720	12+740	12+760	12+780	12+800	12+820	12+840	12+860	12+880	12+900	12+920	12+940	ROAD CHAINAGE

SERVICE DATA

SERVICE	DATE	INIT.	SERVICE	DATE	INIT.
SAN SEWERS			GAS MAINS		
STORM SEWERS			BELL U/G CABLE		
WATERMAINS			HYDRO U/G CABLE		
TRANSIT			HYDRO ONE		
PARKS & REC.			CTV		
ONT. CLEAN WATER			COMMUNIC. CABLES		

REVISIONS

DATE	DETAILS	INIT.
05/12/2014	60% DESIGN SUBMISSION	W.C
17/02/2015	90% DESIGN SUBMISSION	W.C
08/05/2015	90% DESIGN SUBMISSION – RESUBMISSION	W.C
28/05/2015	90% DESIGN SUBMISSION – 2nd RESUBMISSION	W.C
08/06/2015	100% DESIGN SUBMISSION – ISSUED FOR APPROVAL	W.C
14/08/2015	100% DESIGN SUBMISSION – REISSUED FOR APPROVAL	W.C



KEY PLAN (N.T.S.)

100% SUBMISSION
AUG, 2015

General Notes

All Driveways ASPHALT Unless Otherwise Noted.
All Service Locations Are Approximate And Must Be Located Accurately In The Field
Denotes Building – Not Located
Denotes Building Located
Type 'B' Bedding Unless Otherwise Noted (SAN)

B.M. No. Elev.

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LICENSED PROFESSIONAL ENGINEER W.S.R. COWLIN 100148707 08/06/15 PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER C.J. DENICH 100134582 08/06/15 PROVINCE OF ONTARIO

Designed by WILL COWLIN, P.E Chkd.

Approved by CHRIS DENICH, P.E

Aquafor Beech Limited

#6-202-2600 SKYMARK Ave, MISSISSAUGA, ONTARIO, L4W 5B2 PHONE: (905) 629-0099 FAX: (905) 629-0089

55 REGAL ROAD, UNIT 3 GUELPH, ONTARIO, N1K 1B6 PHONE: (519) 224-3740 FAX: (519) 224-3750

NOTICE TO CONTRACTOR

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CITY OF BRAMPTON WORKS DEPT.
TOWN OF CALEDON WORKS DEPT.
BELL CANADA
ENBRIDGE INCORPORATED-GAS DISTRIBUTION
ONTARIO MINISTRY OF TRANSPORTATION
ONTARIO CLEAN WATER AGENCY
HYDRO ONE NETWORKS
ENERSOURCE, HYDRO MISSISSAUGA
HYDRO ONE BRAMPTON

CABLE TELEVISION/FIBREOPTIC PROVIDERS:
BELL CANADA
ENERSOURCE TELECOM
HYDRO ONE TELECOM
ROGERS CABLE
ALLSTREAM
PSN (PUBLIC SECTOR NETWORK)
FUTUREWAY (FCI BROADBAND)

10m 0 10 20 30m HORIZONTAL SCALE

2m 0 2 4 6m VERTICAL SCALE

Region of Peel
Working for you

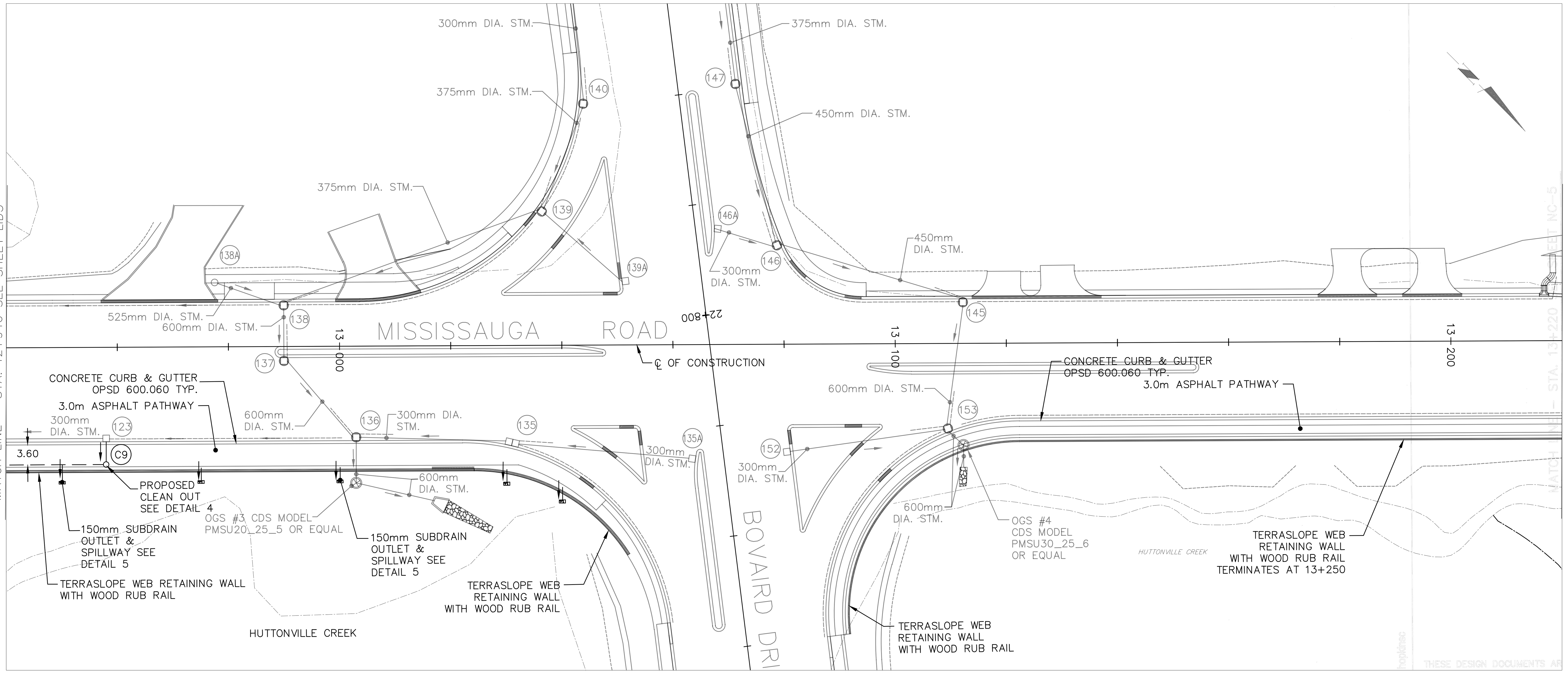
MISSISSAUGA ROAD

(FROM WILLIAMS PARKWAY TO BOVAIRD DRIVE)

L.I.D – PLAN AND PROFILE 3

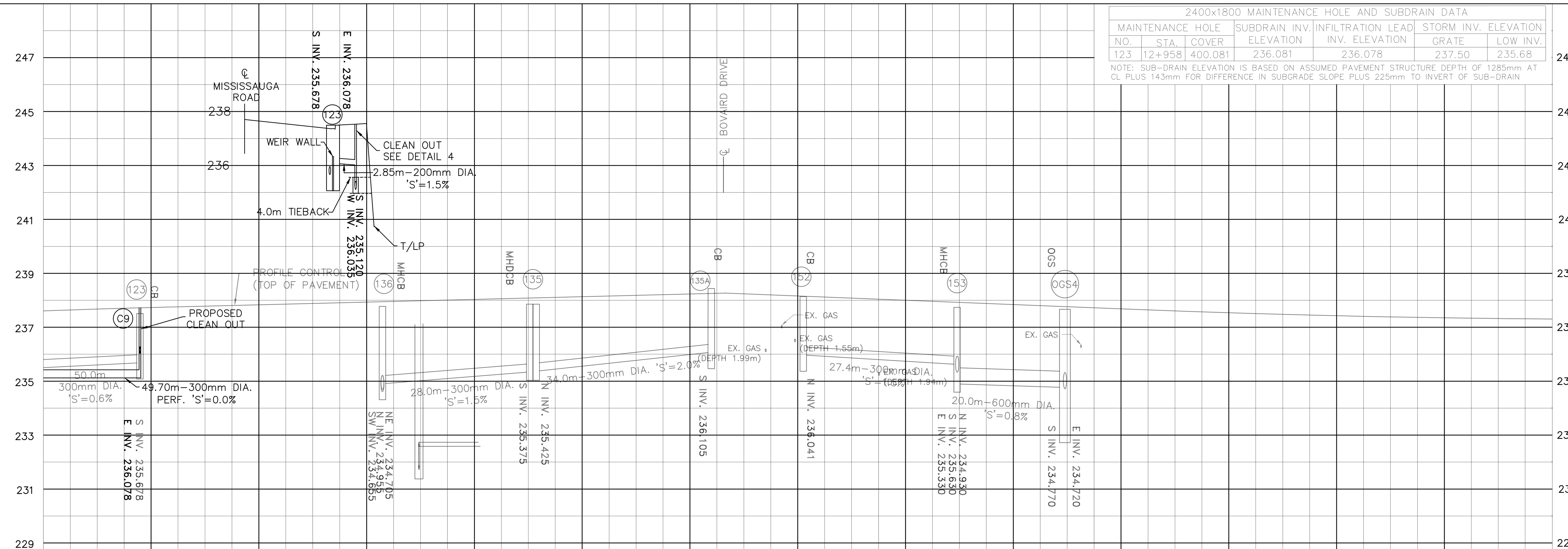
STA. 12+660 TO STA. 12+940

CAD Area	Area	Project No.
Checked by	Drawn by WC	
Date 08/06/15	Sheet 3 of 9	Plan No. LID 3



THESE DESIGN DOCUMENTS ARE PREPARED SOLELY FOR THE USE BY THE PARTY WITH WHOM THE DESIGN PROFESSIONAL HAS ENTERED INTO A CONTRACT AND THERE ARE NO REPRESENTATIONS OF ANY KIND MADE BY THE DESIGN PROFESSIONAL TO ANY PARTY WITH WHOM THE DESIGN PROFESSIONAL HAS NOT ENTERED INTO A CONTRACT.

THE LOCATION OF UTILITIES IS APPROXIMATE ONLY AND THE EXACT LOCATION SHOULD BE DETERMINED BY CONSULTING THE MUNICIPAL AUTHORITIES AND UTILITY COMPANIES CONCERNED. THE CONTRACTOR SHALL PROVE THE LOCATION OF UTILITIES AND SHALL BE RESPONSIBLE FOR ADEQUATE PROTECTION FROM DAMAGE.



2400x1800 MAINTENANCE HOLE AND SUBDRAIN DATA						
MAINTENANCE HOLE			SUBDRAIN INV. ELEVATION	INFILTRATION LEAD INV. ELEVATION	STORM INV. ELEVATION	
NO.	STA.	COVER			GRATE	LOW INV.
123	12+958	400.081	236.081	236.078	237.50	235.68

NOTE: SUB–DRAIN ELEVATION IS BASED ON ASSUMED PAVEMENT STRUCTURE DEPTH OF 1285mm AT CL PLUS 143mm FOR DIFFERENCE IN SUBGRADE SLOPE PLUS 225mm TO INVERT OF SUB–DRAIN

CLEAN OUTS						
NO.	STA.	OFFSET TO STRUCTURE	OFFSET FROM BOC	ELEVATION		
				CAP	U/S INV.	D/S INV.
C9	12+958	21.10m RT	3.60m RT	237.720	–	235.120

INFILTRATION LEAD CONNECTION DATA						
FROM	TO	DIAMETER	TYPE	LENGTH	ELEVATION	
					U/S INV.	D/S INV.
MH 123	C9	200mm	HDPE (SOLID)	2.85m	236.078	236.035

TERRASLOPE WEB SUB–DRAIN OUTLETS				
STA.	DIAMETER	TYPE	LENGTH	OUTLET INV. ELEVATION
12+950	150mm	HDPE (SOLID)	4.5m	233.300
12+975	150mm	HDPE (SOLID)	4.5m	233.700
13+000	150mm	HDPE (SOLID)	4.5m	234.000
13+030	150mm	HDPE (SOLID)	4.5m	234.400
13+040	150mm	HDPE (SOLID)	4.5m	234.500

INFILTRATION PIPE & TERRASLOPE TIEBACKS					
FROM	TO	300mm PIPE		TIEBACK ELEV	
		INVERT	OBVERT	BELOW	ABOVE
C8	C9	235.120	235.420	234.970	235.570

File : C:\Users\ChrisD\Desktop\ABL_MISS ROAD PHASE II - DETAILED DESIGN (100% SUBMISSION)_V10nt.dwg, Layout : GENERAL PLAN 4 Date :Aug 17, 2015 - 1:13pm, Edit By : ChrisD

SERVICE DATA					
SERVICE	DATE	INIT.	SERVICE	DATE	INIT.
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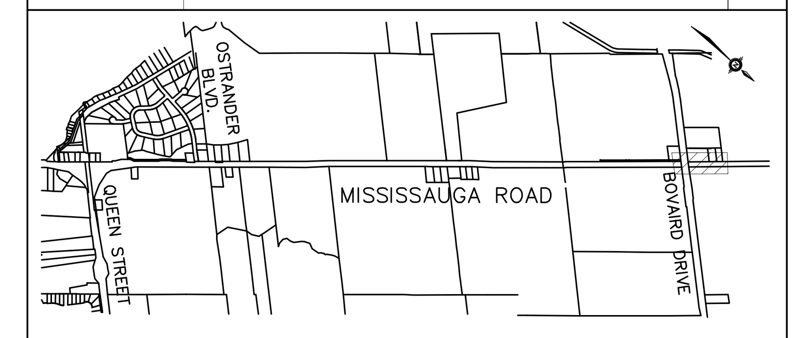

KEY PLAN (N.T.S.)

100% SUBMISSION
AUG, 2015

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Approved by CHRIS DENICH, P.Eng.

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Region of Peel
Working for you

MISSISSAUGA ROAD

(FROM WILLIAMS PARKWAY TO BOVAIRD DRIVE)

L.I.D – PLAN AND PROFILE 4

STA. 12+940 TO STA. 13+220

CAD Area	Area	Project No.
Checked by	Drawn by WC	
Date 08/06/15	Sheet 4 of 9	Plan No. LID 4

REVISIONS

DATE	DETAILS	INIT.
FEB 17, 2015	90% SUBMISSION	WC
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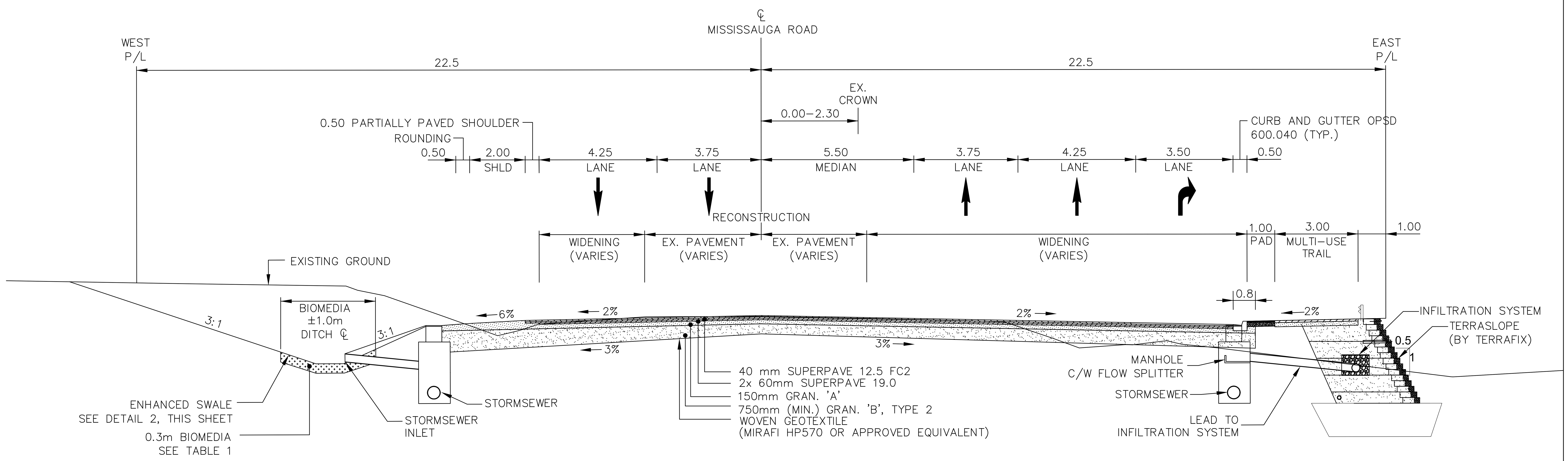
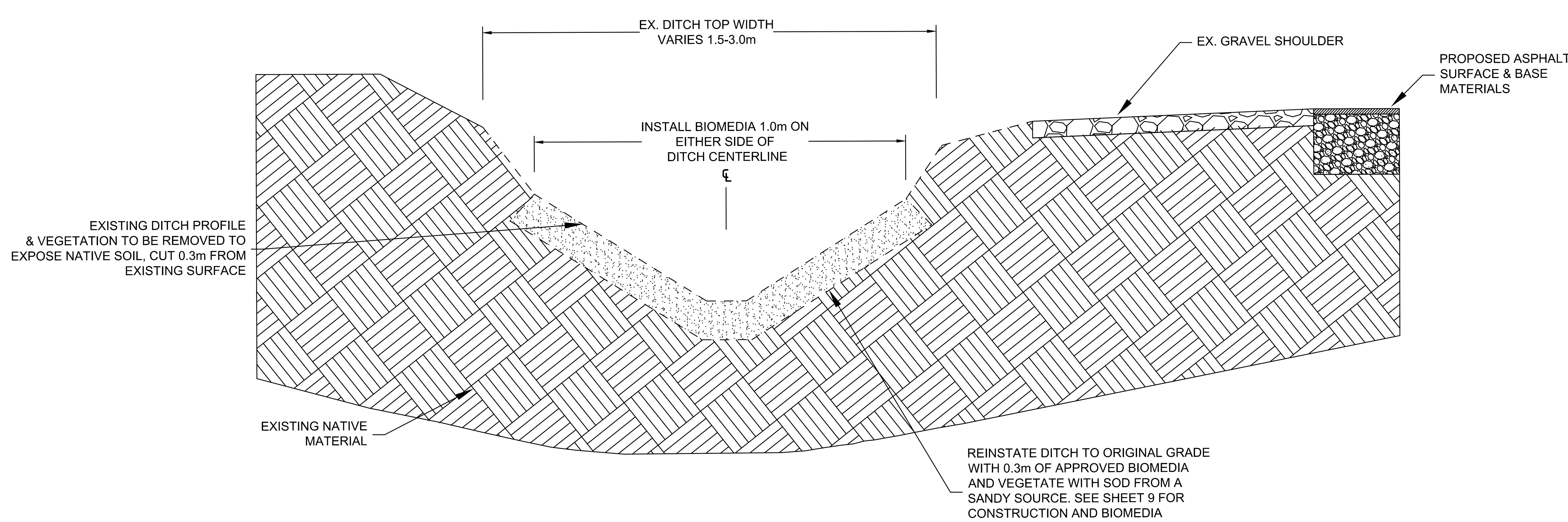


DETAIL 1
INTERIM 4 LANE CONFIGURATION
ENHANCED SWALE - SEMI RURAL CROSS-SECTION
N.T.S.



DETAIL 2
ENHANCED SWALE DETAIL
4 LANE CONFIGURATION
N.T.S.

Aquafor Beech
Limited

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W. S. R. COWLIN
100148707
08/06/15
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
C. J. DENICH
100134582
08/06/15
PROVINCE OF ONTARIO

Desi[illegible]ed [illegible] WILL COWLIN, P.E[illegible] Ch[illegible]d.

A[illegible]ro[illegible]ed [illegible] CHRIS DENICH, P.E[illegible]

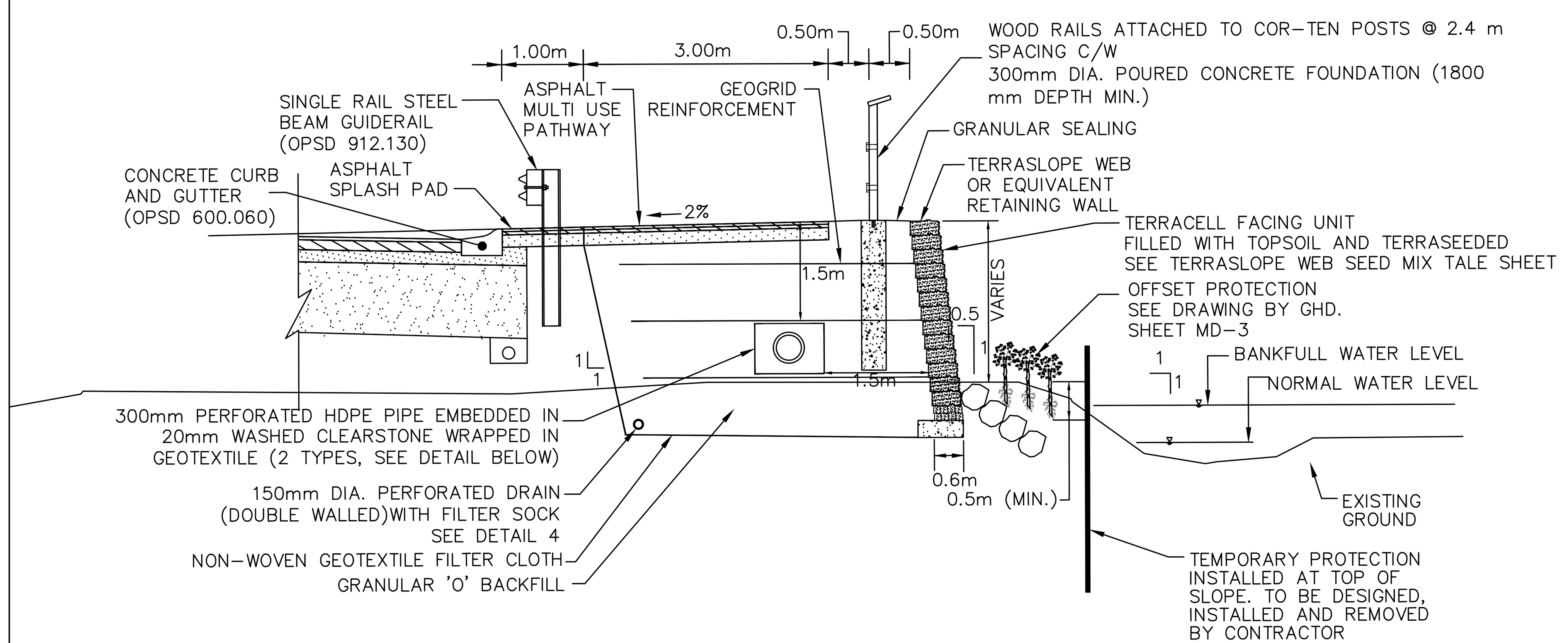
Region of Peel
Working for you

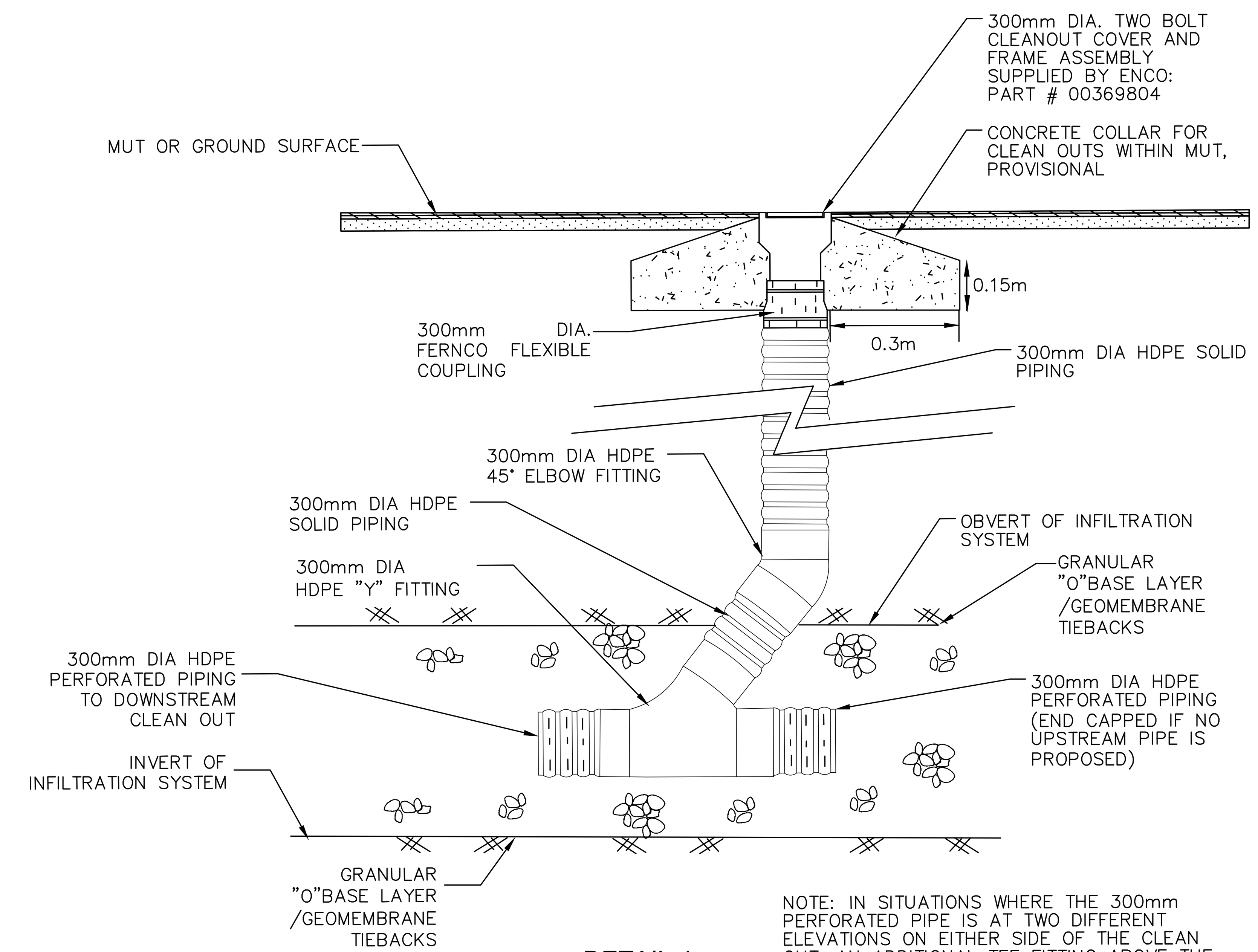
MISSISSAUGA ROAD

(FROM WILLIAMS PARKWAY TO BOVAIRD DRIVE

(TERRASLOPE AND LID DRAINAGE)

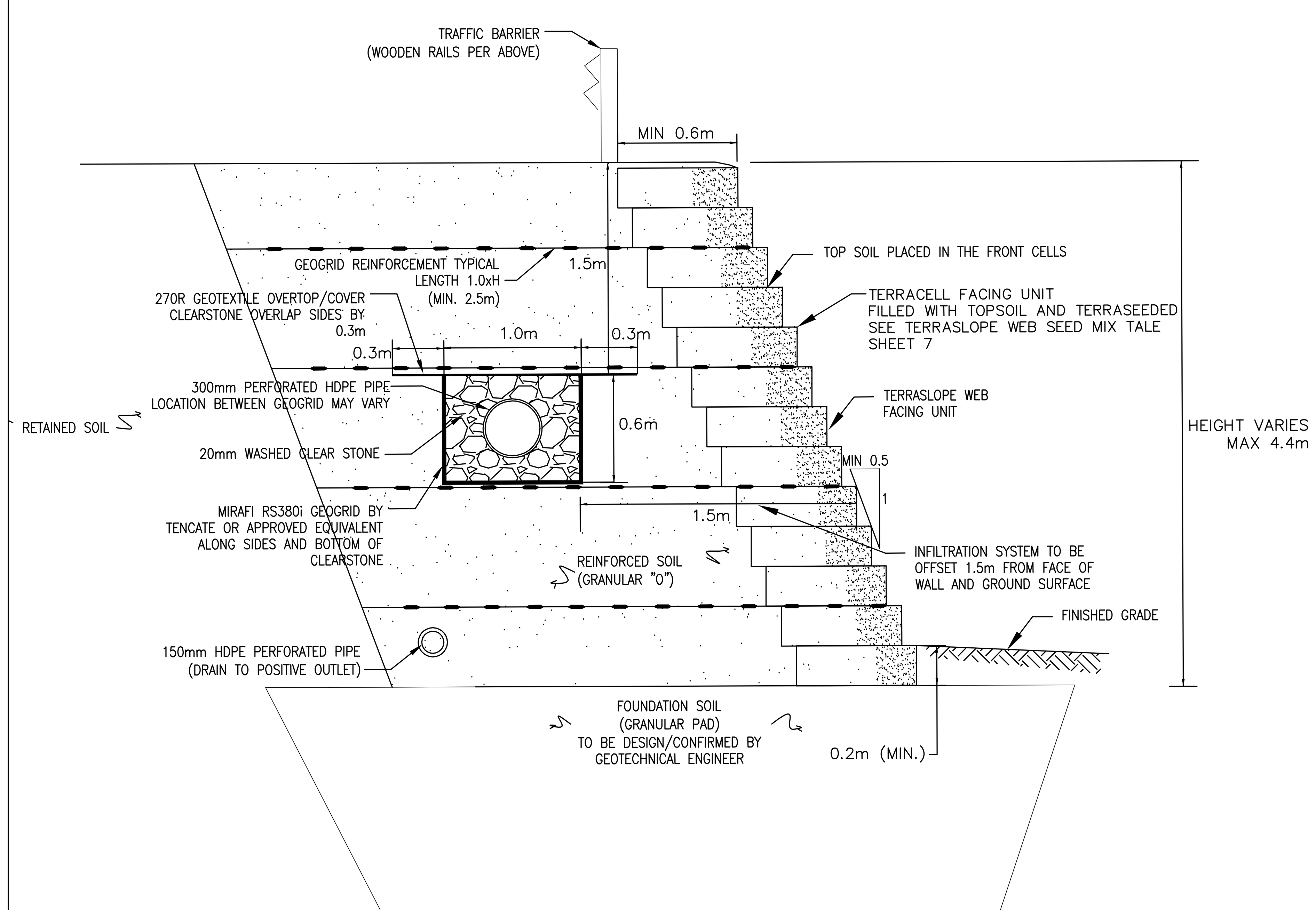
CAD Area	Area	Pro[illegible]e[illegible]No.
Che[illegible]ed [illegible]	Draw[illegible] WC	Pla[illegible]No.
Da[illegible]e JUNE 2015	Shee[illegible] 5 OF 9	



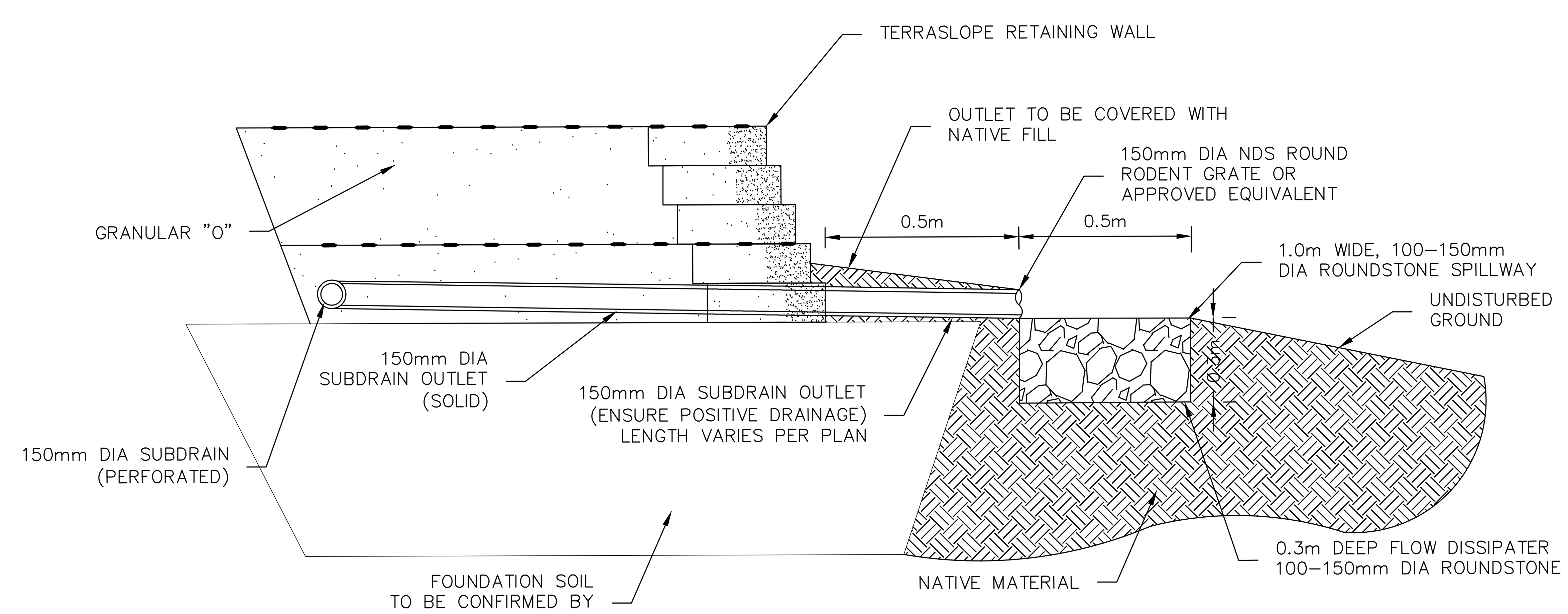


NOTE: IN SITUATIONS WHERE THE 300mm PERFORATED PIPE IS AT TWO DIFFERENT ELEVATIONS ON EITHER SIDE OF THE CLEAN OUT, AN ADDITIONAL TEE FITTING ABOVE THE 45° ELBOW SHALL BE REQUIRED.

DETAIL 4
CLEAN OUT DETAIL
N.T.S.



DETAIL 3
INFILTRATION DISTRIBUTION SYSTEM TERRASLOPE WEB DETAIL
N.T.S.



DETAIL 5
TERRASLOPE RETAINING WALL
UNDERDRAIN OUTLET DETAIL
N.T.S.

REVISIONS

DATE	DETAILS	INIT.
FEB 17, 2015	90% SUBMISSION	WC
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Desi ed
WILL COWLIN, P.E
Ch d.

A ro ed
CHRIS DENICH, P.E

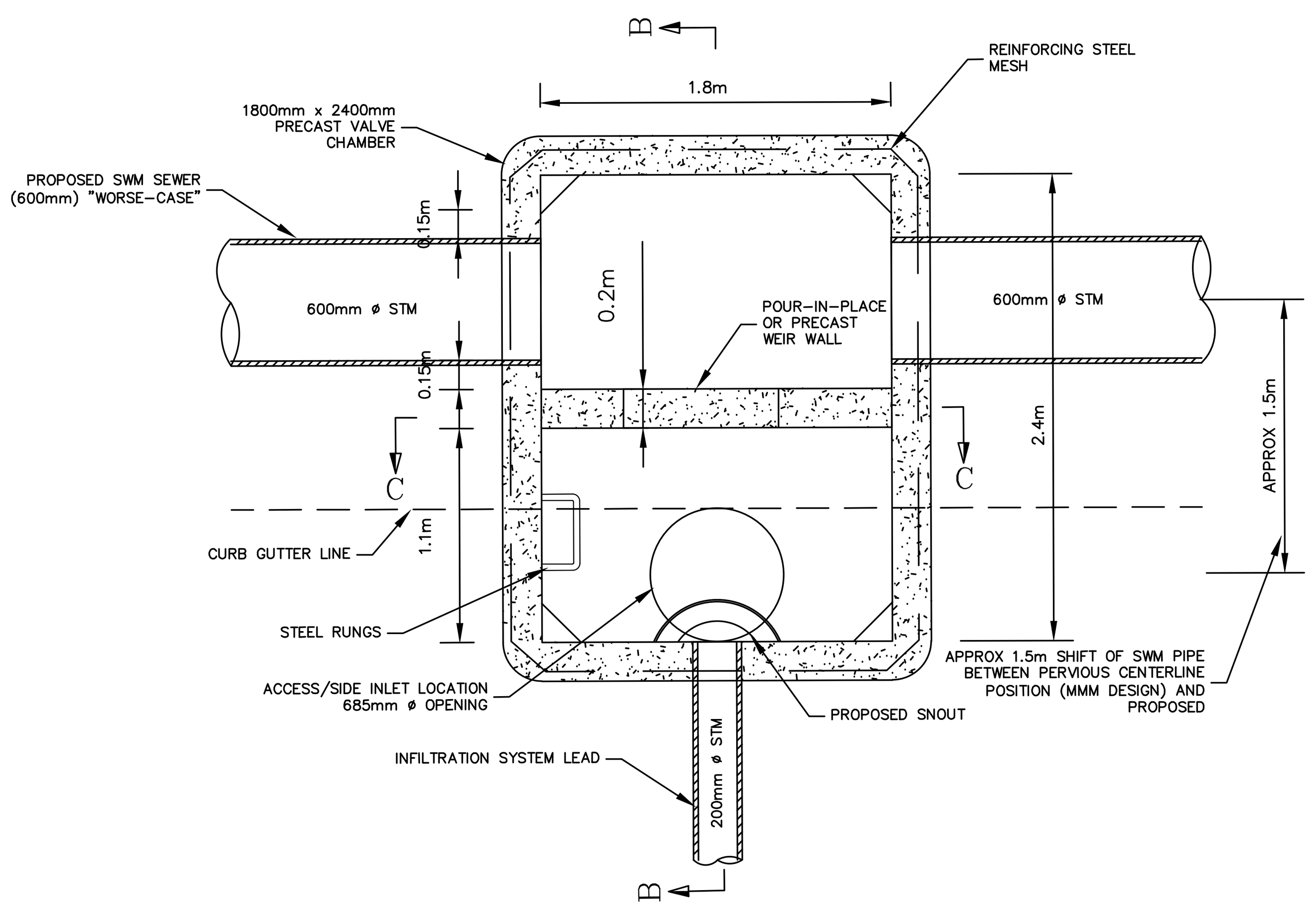
Region of Peel
Working for you

MISSISSAUGA ROAD

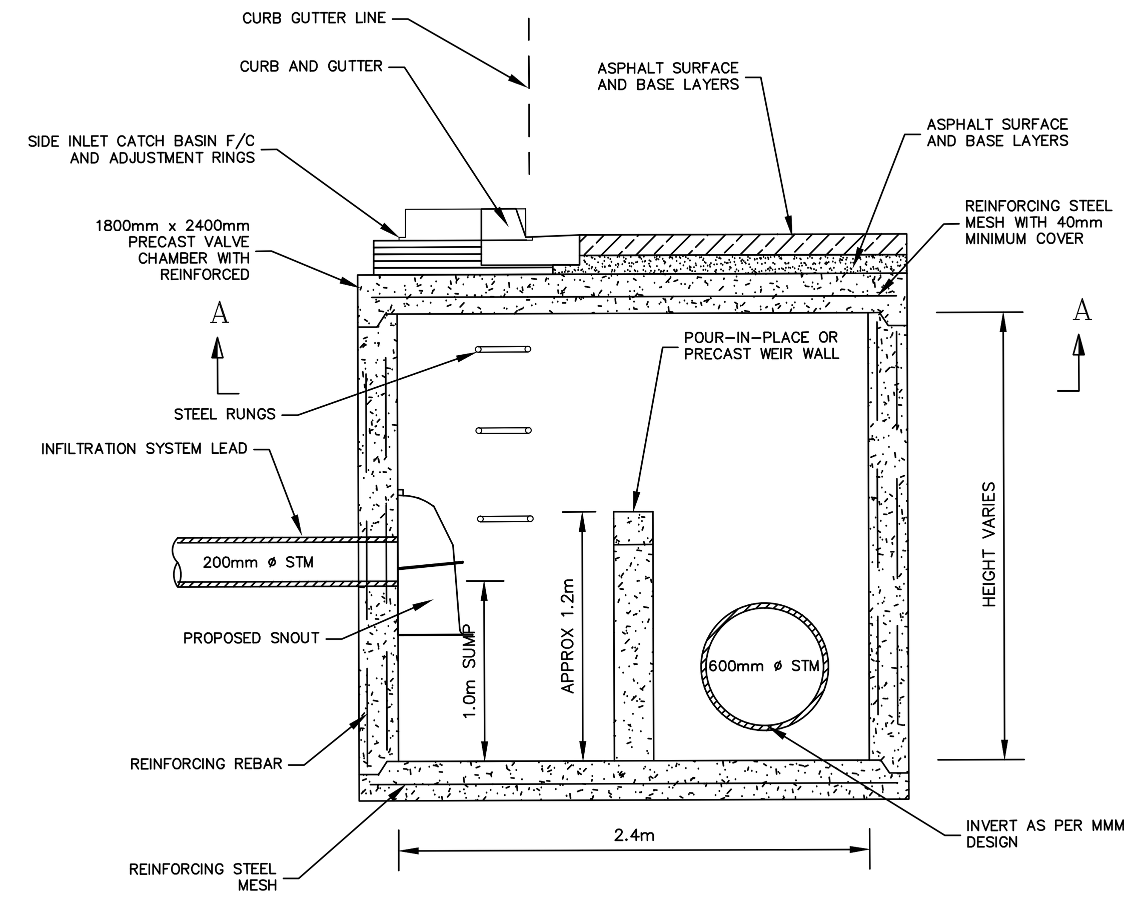
(FROM WILLIAMS PARKWAY TO BOVAIRD DRIVE)

(TERRASLOPE AND LID DRAINAGE)

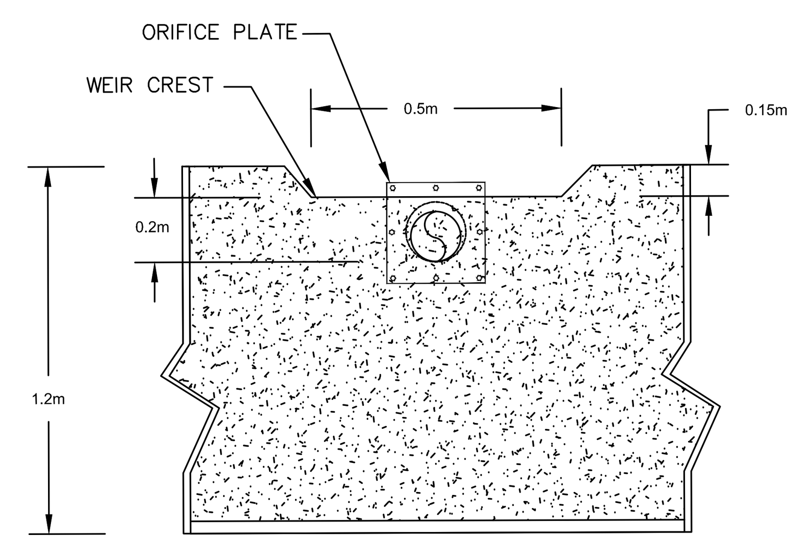
CAD Area	Area	Pro e No.	
Che ed	Draw WC		
Da e JUNE 2015	Shee 6 OF 9	Pla No.	



CROSS SECTION A : PLAN VIEW



CROSS SECTION B: SIDE VIEW

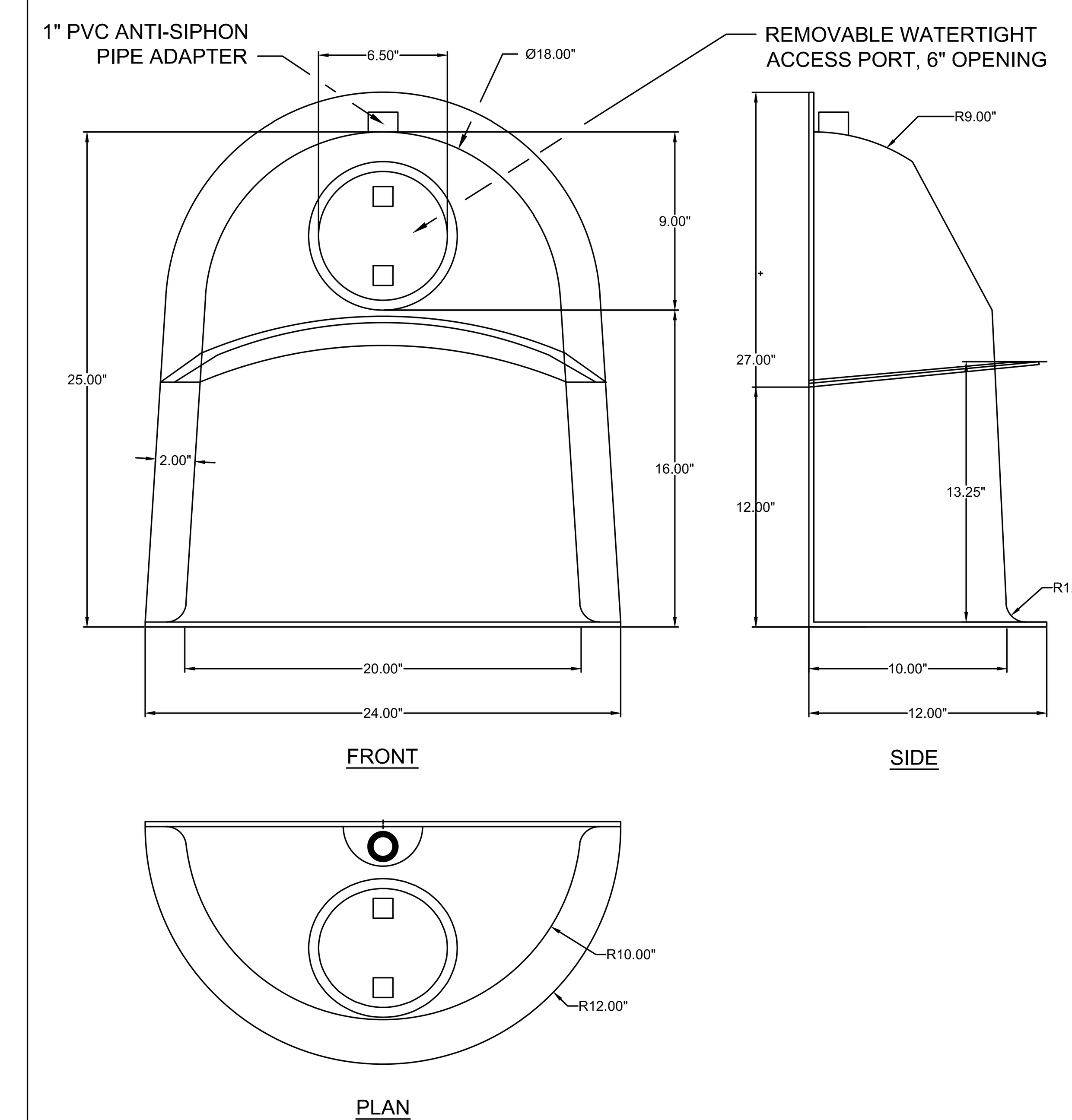


CROSS SECTION C: SIDE VIEW PROFILE OF WEIR WALL

NOTES:

1. DESIGNED TO OHBD CODE AND CSA SPECIFICATIONS.
2. CONCRETE STRENGTH - 30MPa
3. WELDED DEFORMED STEEL WORE FABRIC: CSA G.30.15.
4. REINFORCING STEEL GRADE: 400MPa CSA G.30.12 CSA g.30.16
5. ALL MESH HAS 40 mm ± 5mm MINIMUM COVER. ALL REBAR HAS 25mm MIN - 39 mm MAX COVER.
6. DESIGN DEPTH SHOWN IS 10m FOR CAP BASE AND TRANSITION SLAB.
7. ALL DIMENSIONS ARE IN MILLIMETERS, UNLESS OTHERWISE SHOWN

DETAIL 6
2400 X 1800mm PRE-CAST
CONCRETE MAINTENANCE HOLE/ FLOW CONTROL STRUCTURE



US PATENT #6126817 ADDITIONAL PATENTS PENDING

BMP, INC.
53 MT. ARCHER ROAD, LYME, CT. 06371
(800) 504-8008 FAX: (860)434-3195

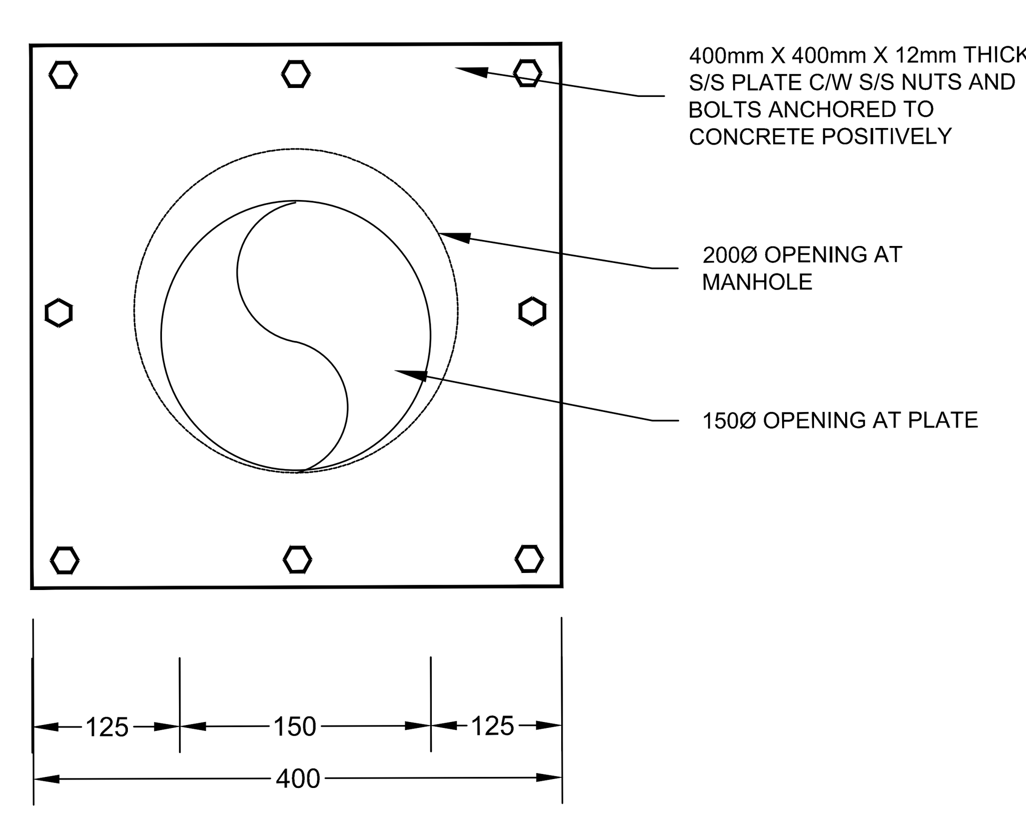
DESCRIPTION	DATE	SCALE
18F SNOUT OIL & DEBRIS STOP	09/14/99	NONE
	DRAWING NUMBER 18F	

DETAIL 9
BMP INC. SNOUT DETAIL
N.T.S.

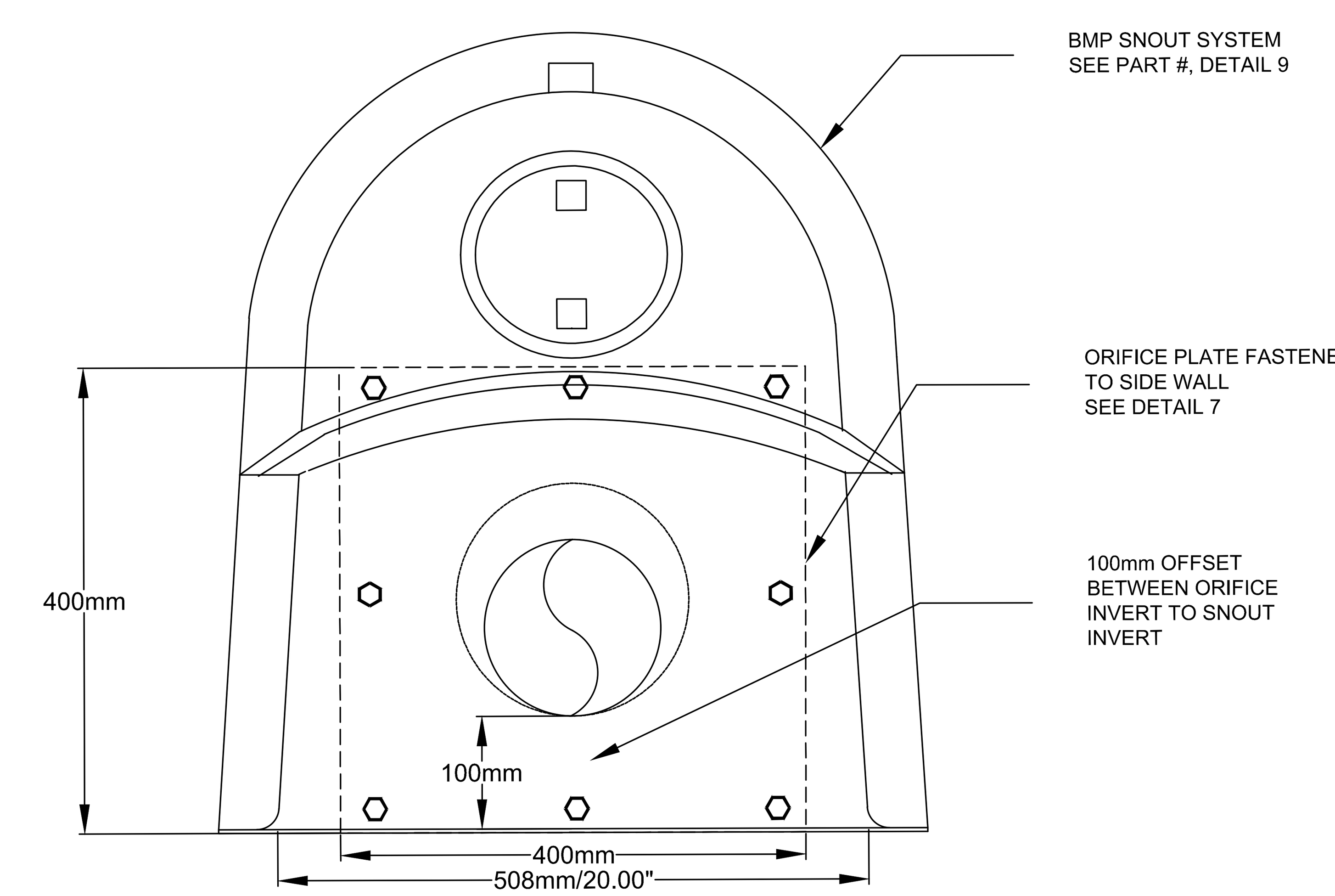
TERRESLOPE WEB SEED MIX

Species Name	Common Name	%	Application Rate
Agrostis scabra	Rough Hair Grass	6	25 kg/ha
Anemone virginiana	Thimbleweed	5	
Apocynum cannabinum	Hemp Dogbane	2	
Aquilegia canadensis	Wild Columbine	2	
Asclepias syriaca	Common Milkweed	4	
Aster cordifolius	Heart-leaved Aster	2	
Aster ericoides	Heath Aster	4	
Aster lateriflorus	Calico Aster	2	
Aster novae-anglae	New England Aster	3	
Danthonia spicata	Poverty Oat Grass	7	
Euthamia graminifolia	Grass-leaved Goldenrod	1	
Fragaria virginiana	Wild Strawberry	3	
Geum canadense	White Avens	2	
Juncus tenuis	Path Rush	2	
Monarda fistulosa	Wild Bergamot	3	
Oenothera biennis	Evening Primrose	4	
Penstemon digitalis	Foxglove Beardtongue	3	
Rudbeckia hirta	Black-eyed Susans	5	
Schizachyrium scoparium	Little Bluestem	10	
Solidago canadensis	Canada Goldenrod	5	
Solidago juncea	Early Goldenrod	2	
Solidago nemoralis	Gray Goldenrod	9	
Sporobolus cryptandrus	Sand Dropseed	10	
Verbena urticifolia	White Vervain	4	
	TOTAL	*100*	
Avena sativa	Nurse crop - annual oats	40	22 kg/ha
Panicum capillare	Nurse crop - ticklegrass	60	
	TOTAL	*100*	

NOTE: The following seed mix was developed in consultation with the CVC. In recognition of the uniqueness of this one-off pilot project, a limited number of locally rare species were included in the seed mix. Many of these species will attract pollinating syrphid flies, which are eaten by Redside and other fish.



DETAIL 7
ORIFICE DETAIL
N.T.S.



DETAIL 8
ORIFICE SNOUT DETAIL
N.T.S.

REVISIONS

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Approved
CHRIS DENICH, P.E.

Region of Peel
Working for you

MISSISSAUGA ROAD
(FROM WILLIAMS PARKWAY TO BOVAIRD DRIVE)
(TERRASLOPE AND LID DRAINAGE)

CAD Area	Area	Project No.
Checked	Drawn WC	Plan No.
Date JUNE 2015	Sheet 7 OF 9	

REVISIONS		
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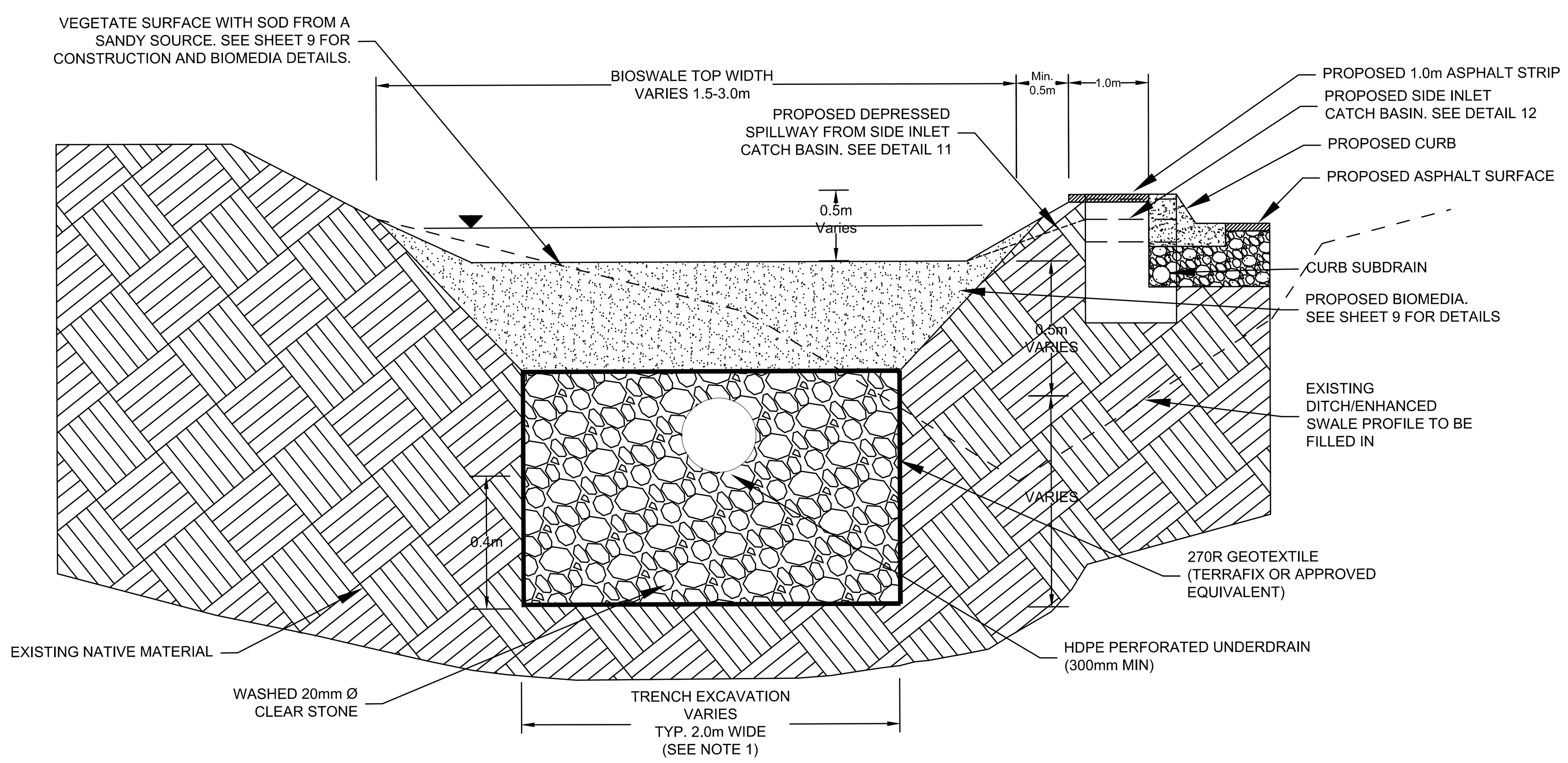
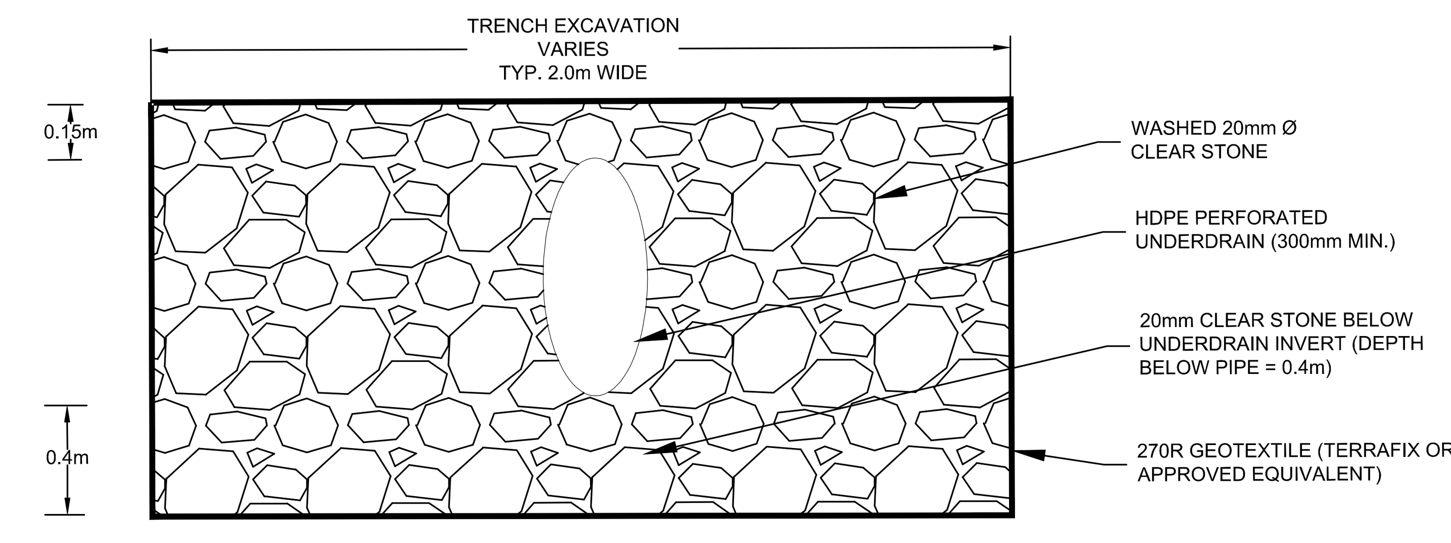


BIOSWALE CONSTRUCTION DETAIL
6 LANE CONFIGURATION
N.T.S.

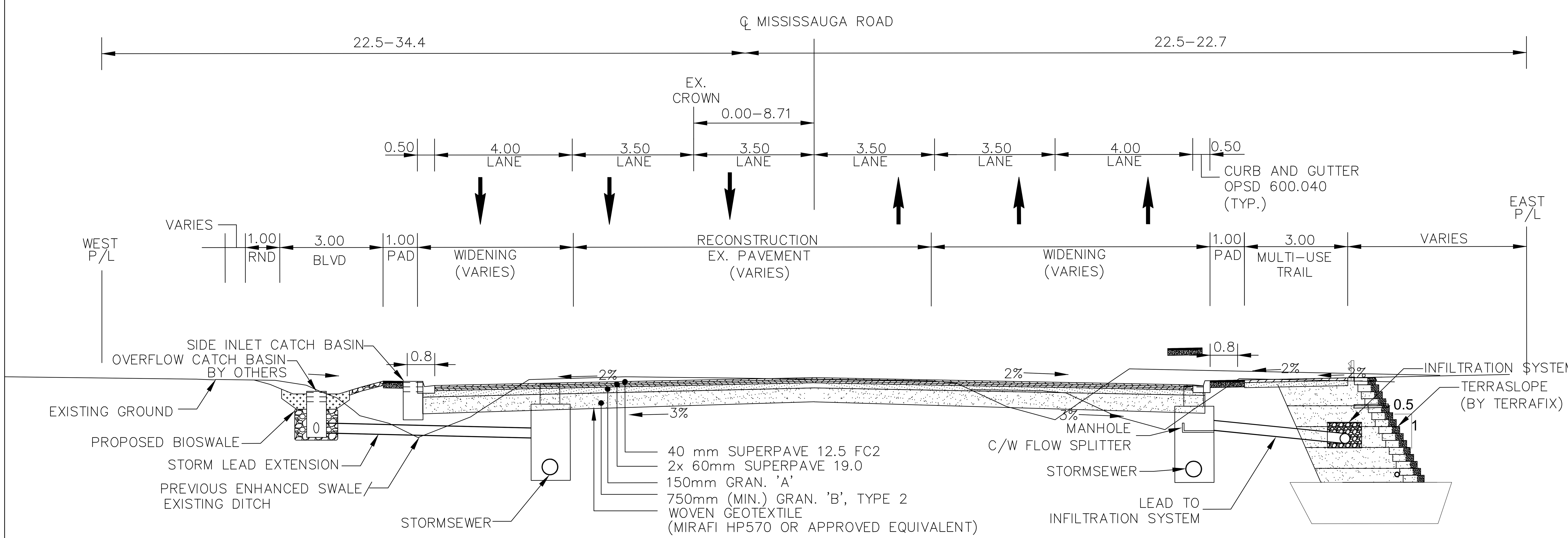


BIOSWALE UNDERDRAIN DETAIL
N.T.S.

Notes:

1. TRENCH WIDTH SHALL BE TYPICALLY 2.0m WIDTH EXCEPT WHERE UTILITIES ARE ENCOUNTERED. TRENCH WITH MAY BE DECREASED, AS APPROVED BY THE FIRLED ENGINEER, TO A MINIMUM EXCAVATION WIDTH OF 1.0m IN ORDER TO AVOID UTILITIES OR OTHER OBSTRUCTION ENCOUNTERED DURING EXCAVATION.
2. PIPE CONFIGURATION DETAILED ON THE PLAN MAY BE ALTERED IN THE FIELD AS APPROVED BY THE FIELD ENGINEER IN ORDER TO AVOID UTILITIES OR OBSTRUCTIONS.

DETAIL 10
BIOSWALE DETAIL
6 LANE CONFIGURATION
N.T.S.



DETAIL 11
FINAL 6 LANE CONFIGURATION
BIOSWALE - URBAN CROSS-SECTION
N.T.S.

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FAX: (519) 224–3750

LICENSED PROFESSIONAL ENGINEER W. S. R. COWLIN 100148707 08/06/15 PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER C. J. DENICH 100134582 08/06/15 PROVINCE OF ONTARIO

Designed: WILL COWLIN, P.Eng. Chkd.

Approved: CHRIS DENICH, P.Eng.

Region of Peel
Working for you

MISSISSAUGA ROAD

(FROM WILLIAMS PARKWAY TO BOVAIRD DRIVE

(TERRASLOPE AND LID DRAINAGE)

CAD Area	Area	Project No.
Checked	Drawn WC	Plan No.
Date JUNE 2015	Sheet 8 OF 9	

Submitted to:

The Region of Peel and Credit Valley Conservation

DESIGN BRIEF

REGION OF PEEL AND CREDIT VALLEY CONSERVATION LOW IMPACT DEVELOPMENT DESIGN FOR MISSISSAUGA ROAD

PROJECT 1: MISSISSAUGA ROAD (CREDIT RIVER TO WILLIAMS PARKWAY)

APPENDIX B

Geotechnical Investigation Summary

Mississauga Road - Project 1 and Project 2
Geotechnical Review and Summary

		Station	Asphalt/ Shoulder		Strat 1		Strat 2		Strat 3		WT	Proposed Road CL	Offset to WL
					Silty Sand		Sand and gravel		n/a				
	BH 101	9-811	191	188	188	186.5	186.5	183.5			187.4	192.3	4.9
					Silty Fine Sand		Clay bound Sand & Gravel		n/a				
	BH 102	9-918	200	198.5	198.5	195	195	EB			Dry	195	-
					Fill		Hard Silty Clay		W. Shale				
	BH 103	10-182	205	204	204	201.7	201.7	200.4	200.4	189.8	Dry	205.5	-
					Fill		Hard Silty Clay		W. Shale				
	BH 104	10-355	210.4	208	208	207.5	207.5	206	206	EB	Dry	210.2	-
					Fill		Hard Silty Clay		Shale				
Project 1	BH 105	10-588	218.2	217.5	217.5	217.2	217.2	216.3	216.3	EB	Cave @ 4.9 BGS	219	-
					Fill		Stiff Silty Clay/ Shaly Clay		Shale				
	BH 106	10-851	225	224.3	224.3	223.6	223.6	222.7	222.7	220.5	Dry	225.8	-
					Fill		Stiff Silty Clay/ Shaly Clay		n/a				
	BH 107	10-957	225.8	225.9	225.9	225	225	222.9			Dry	227.5	-
					Fill		Stiff Silty Clay/ Shaly Clay		W. Shale				
	BH 108	11-155	228.8	228.1	228.1	227	227	225.7	225.7	223.9	Dry	229.2	-
					Fill		Stiff Silty Clay/ Shaly Clay		W. Shale				
	BH 109	11-359	230.3	229.6	229.6	227.8	227.8	227.2	227.2	226.5	Dry	230.9	-
					Fill		Fine Silty Sand		H. Silty Clay				
	BH 110	11-597	233.5	232.8	232.8	231.3	231.3	229.1	229.1	227.8	229.8	234.1	4.3
					Silty Clay		Silt & fine Sand		Sand w Silt				
	BH 111	11-810	239	238.2	238.2	237.8	237.8	236.1	236.1	233.9	Dry	239.6	-
					Fill/ Silty Clay		Silty Sand		Sand & Gravel				
	BH 112	12-054	238.4	237.6	237.6	236.4	236.4	234.7	234.7	230.5	235.9	238.9	3
					Fill		Fine Sand & silt		Dense Fine Sand & silt				
	BH 113	12-282	236	235	235	234.5	234.5	230	230	229.4	234.4	236	1.6
					Fill		Sandy Silty Clay		Silt & fine Sand				
	BH 114	12-400	234.3	233.6	233.6	232.8	232.8	232.1	232.1	231.3	232.7	235.3	2.6

Project 2

				Fill		Sandy Silty Clay		Weak Silty Sand				
BH 115	12-571	233.2	232.5	232.5	231.5	231.5	231	231	228.2	229.8	234.2	4.4
				Fill		Silty Sand		Shaly Clay				
BH 116	12-706	233.7	232.7	232.7	231.6	231.6	229.4	229.4	227.5	232.1	236.7	4.6
				Fill		Sandy Silty Clay		Shale				
BH 117	12-812	235.1	234.3	234.3	233.5	233.5	229.5	229.5	EB	232.1	235.2	3.1
				Fill		Silty Sand		Shaly Clay				
BH 118	12-917	235.6	235	235	233.2	233.2	232.1	232.1	EB	233.5	235.9	2.4
				Fill		Silty Clay - Silty Sand		W. Shale				
BH 119	13-175	237.1	23.6.5	23.6.5	234.4	234.4	231.3	231.3	EB	234.2	237.3	3.1

MISSISSAUGA ROAD
(FROM OSTRANDER BLVD TO QUEEN ST)
LID DRAINAGE CENTRE MEDIAN DESIGN

90% DRAWING SUBMISSION

Aquafor Beech Limited

#6-202-2600 SKYMARK Ave,
MISSISSAUGA, ONTARIO, L4W 5B2
PHONE: (905) 629-0099
FAX: (905) 629-0089

55 REGAL ROAD, UNIT 3
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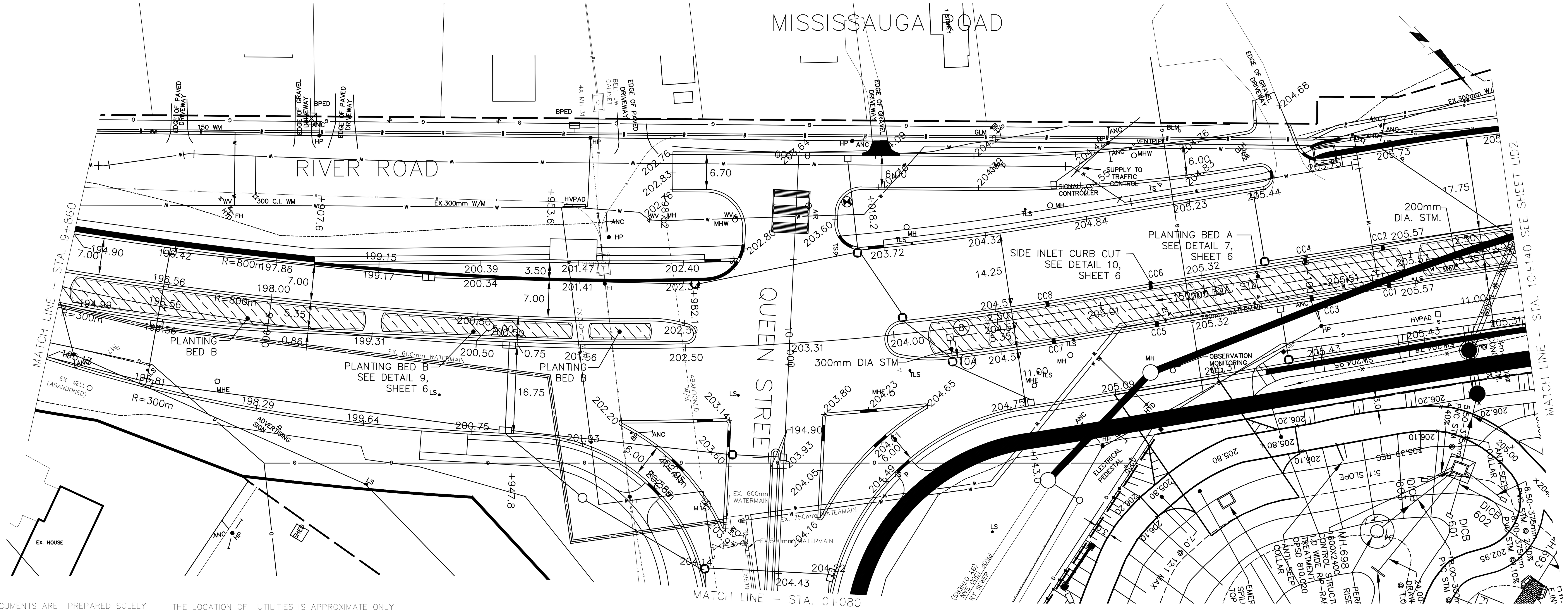
PHONE: (519) 224-3740
FAX: (519) 224-3750

Region of Peel
Working for you



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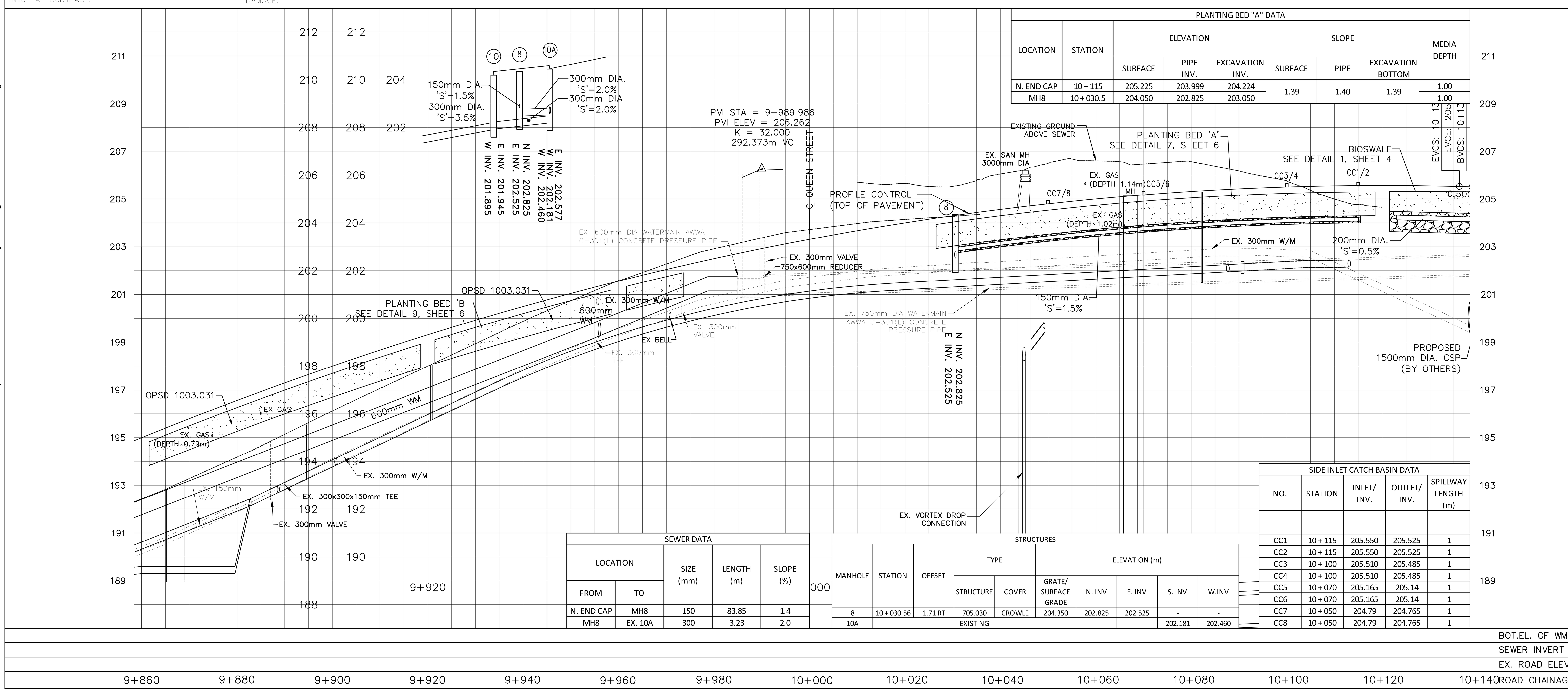


PLANTING BED "A" DATA

LOCATION	STATION	ELEVATION			SLOPE			MEDIA DEPTH
		SURFACE	PIPE INV.	EXCAVATION INV.	SURFACE	PIPE	EXCAVATION BOTTOM	
N. END CAP	10+115	205.225	203.999	204.224	1.39	1.40	1.39	1.00
MH8	10+030.5	204.050	202.825	203.050				1.00

SEWER DATA

LOCATION		SIZE (mm)	LENGTH (m)	SLOPE (%)
FROM	TO			
N. END CAP	MH8	150	83.85	1.4
MH8	EX. 10A	300	3.23	2.0

STRUCTURES

MANHOLE	STATION	OFFSET	TYPE		ELEVATION (m)				
			STRUCTURE	COVER	GRATE/SURFACE GRADE	N. INV	E. INV	S. INV	W.INV
8	10+030.56	1.71 RT	705.030	CROWLE	204.350	202.825	202.525	-	-
10A			EXISTING			-	-	202.181	202.460

SIDE INLET CATCH BASIN DATA

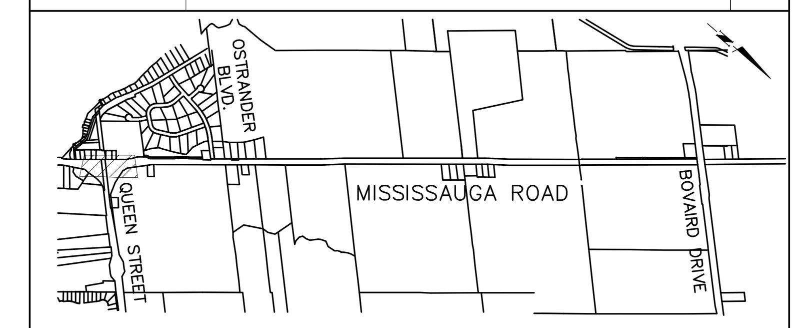
NO.	STATION	INLET/INV.	OUTLET/INV.	SPILLWAY LENGTH (m)
CC1	10+115	205.550	205.525	1
CC2	10+115	205.550	205.525	1
CC3	10+100	205.510	205.485	1
CC4	10+100	205.510	205.485	1
CC5	10+070	205.165	205.14	1
CC6	10+070	205.165	205.14	1
CC7	10+050	204.79	204.765	1
CC8	10+050	204.79	204.765	1

SERVICE DATA

SERVICE	DATE	INIT.	SERVICE	DATE	INIT.
SAN SEWERS			GAS MAINS		
STORM SEWERS			BELL U/G CABLE		
WATERMAINS			HYDRO U/G CABLE		
TRANSIT			HYDRO ONE		
PARKS & REC.			CTV		
ONT. CLEAN WATER			COMMUNIC. CABLES		

REVISIONS

DATE	DETAILS	INIT.
05/12/2014	60% DESIGN SUBMISSION	W.C



KEY PLAN (N.T.S.)

LEGEND

- Proposed Solid Pipe
- Proposed Perforated Pipe
- W1 Proposed Flow Control Weir
- Proposed Armourstone
- Proposed Bioswale Area
- Proposed Enhanced Swale Area
- Proposed Planting Bed Areas
- 227.82 Ex. Road Grade
- CC1 Proposed Curb Cut

General Notes

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FUTUREWAY (FCI BROADBAND)

10m 0 10 20 30m HORIZONTAL SCALE

2m 0 2 4 6m VERTICAL SCALE

Region of Peel
Working for you

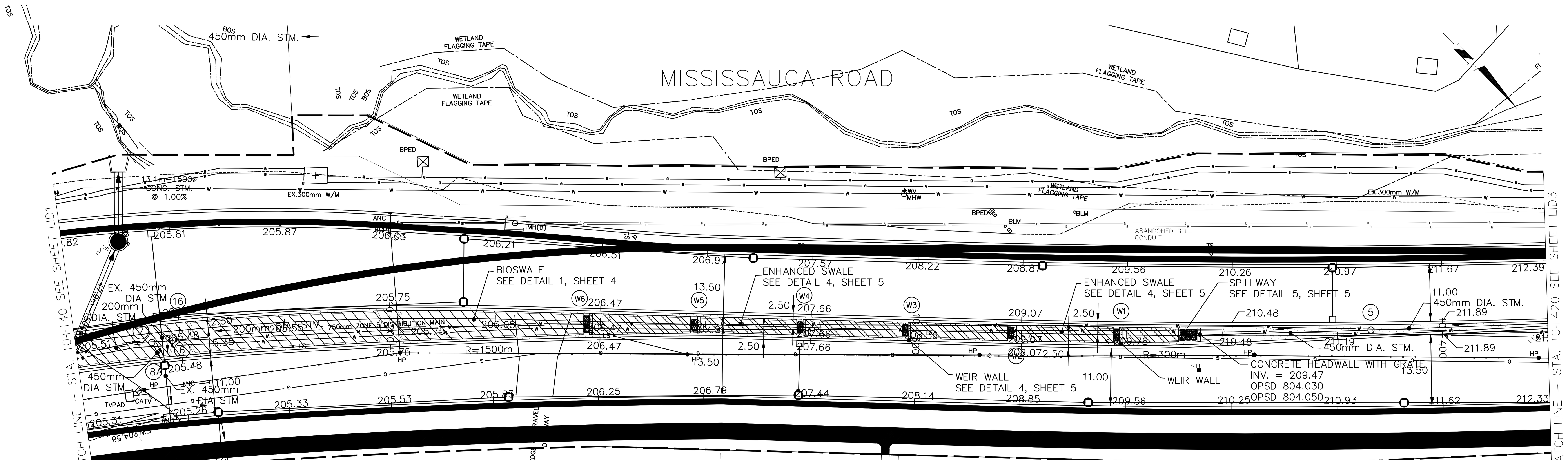
MISSISSAUGA ROAD

(FROM QUEEN STREET TO BOVAIRD DRIVE)

L.I.D – PLAN AND PROFILE 1

STA. 9+860 TO STA. 10+140

CAD Area	Area	Project No.
Checked by	Drawn by HT	
Date 04/12/14	Sheet 1 of 6	Plan No. LID 1



BIOSWALE DATA											
LOCATION	STATION	ELEVATION				SLOPE			DEPTH		
		SURFACE GRADE	PIPE INV.	EXCAVATION INV.	TOP OF GRAVEL	SURFACE GRADE	PIPE	EXCAVATION	MEDIA	CLEAR STONE	TOTAL
W6	10 + 238.16	205.981	-	204.237	205.087	0.85	-	0.99	0.894	0.850	1.744
N. END CAP	10 + 236.39	205.881	204.712	204.212	205.062		1.0		0.819	0.850	1.669
MH 6	10 + 158.50	205.300	203.950	203.450	204.300	-	-	-	1.000	0.850	1.850
S. END CAP	10 + 122.93	205.320	204.131	203.631	204.481	0.056	0.5	0.51	0.839	0.850	1.689

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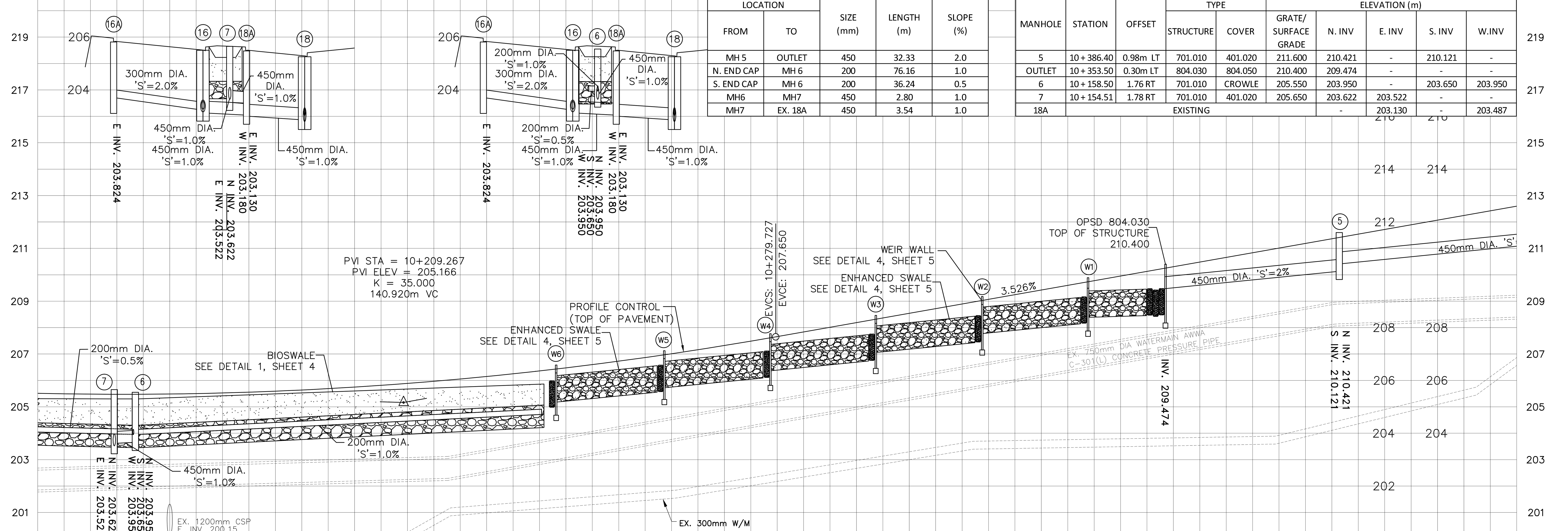
SEWER DATA				
LOCATION		SIZE (mm)	LENGTH (m)	SLOPE (%)
FROM	TO			
MH 5	OUTLET	450	32.33	2.0
N. END CAP	MH 6	200	76.16	1.0
S. END CAP	MH 6	200	36.24	0.5
MH6	MH7	450	2.80	1.0
MH7	EX. 18A	450	3.54	1.0

STRUCTURES									
MANHOLE	STATION	OFFSET	TYPE		ELEVATION (m)				
			STRUCTURE	COVER	GRATE/ SURFACE GRADE	N. INV	E. INV	S. INV	W.INV
5	10 + 386.40	0.98m LT	701.010	401.020	211.600	210.421	-	210.121	-
OUTLET	10 + 353.50	0.30m LT	804.030	804.050	210.400	209.474	-	-	-
6	10 + 158.50	1.76 RT	701.010	CROWLE	205.550	203.950	-	203.650	203.950
7	10 + 154.51	1.78 RT	701.010	401.020	205.650	203.622	203.522	-	-
18A	EXISTING					-	203.130	-	203.487



ENHANCED SWALE DATA								
NO.	LENGTH (m)	SLOPE (%)	SURFACE ELEVATION		U/S SWALE INV. BELOW U/S WEIR CREST (m)	SWALE DEPTH U/S (m)	SWALE DEPTH D/S (m)	AVG. SWALE DEPTH (m)
			U/S	D/S				
1	14.39	0.59	209.474	209.389	0.00	0.926	0.500	0.713
2	19.52	2.00	209.168	208.778	0.32	0.721	0.400	0.560
3	19.64	2.00	208.456	208.063	0.42	0.722	0.400	0.561
4	19.46	2.00	207.757	207.368	0.41	0.706	0.400	0.553
5	19.57	2.00	207.114	206.723	0.35	0.654	0.400	0.527
6	19.94	2.00	206.580	206.181	0.24	0.543	0.400	0.472

WEIR DATA								
NO.	STATION	OFFSET	ELEVATION			TOTAL SPAN (m)	CREST WIDTH (m)	CREST HEIGHT (m)
			TOP	CREST	WEEP HOLE INV.			
W 1	10 + 338.84	0	209.889	209.489	208.789	3.0	2.0	0.400
W 2	10 + 318.81	0	209.178	208.878	208.178	3.0	2.0	0.300
W 3	10 + 298.66	0	208.463	208.163	207.463	3.0	2.0	0.300
W 4	10 + 278.71	0	207.768	207.468	206.768	3.0	2.0	0.300
W 5	10 + 258.63	0.10 RT	207.123	206.823	206.123	3.2	2.0	0.300
W 6	10 + 238.16	0.5m RT	206.581	206.281	205.581	4.0	3.0	0.300

BOT.EL. OF WM.
SEWER INVERT
EX. ROAD ELEV.
ROAD CHAINAGE: 10+140 10+160 10+180 10+200 10+220 10+240 10+260 10+280 10+300 10+320 10+340 10+360 10+380 10+400 10+420

File : C:\Users\Will\WORK PROJECTS\CVC\65567 - Miss Road LID Retrofit\Project 1 Retrofit - Credit to Williams Pkwy\ASB Design CAD\ABL_MissABL Mississauga Rd_Phase 1_90%_DESIGN_V6(FEB 19, 2015).dwg, Layout : LID 2 Date :Feb 23, 2015 - 10:19am, Edit By : Will

SERVICE DATA

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SAN. SEWERS			GAS MAINS		
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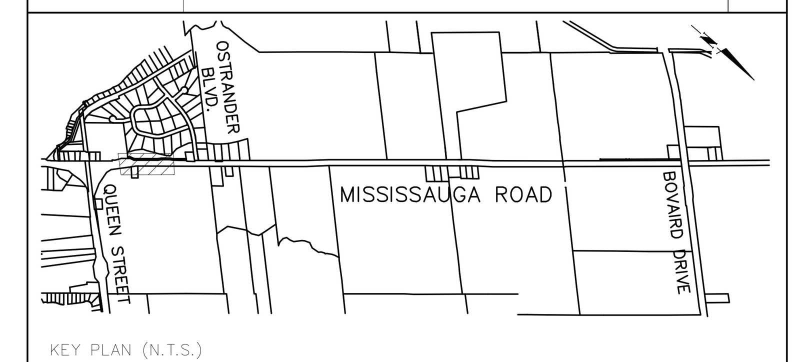
WATERMAINS			HYDRO U/G CABLE		
TRANSIT			HYDRO ONE		
PARKS & REC.			CTV		
ONT. CLEAN WATER			COMMUNIC. CABLES		

REVISIONS

DATE	DETAILS	INIT.
05/12/2014	60% DESIGN SUBMISSION	W.C.



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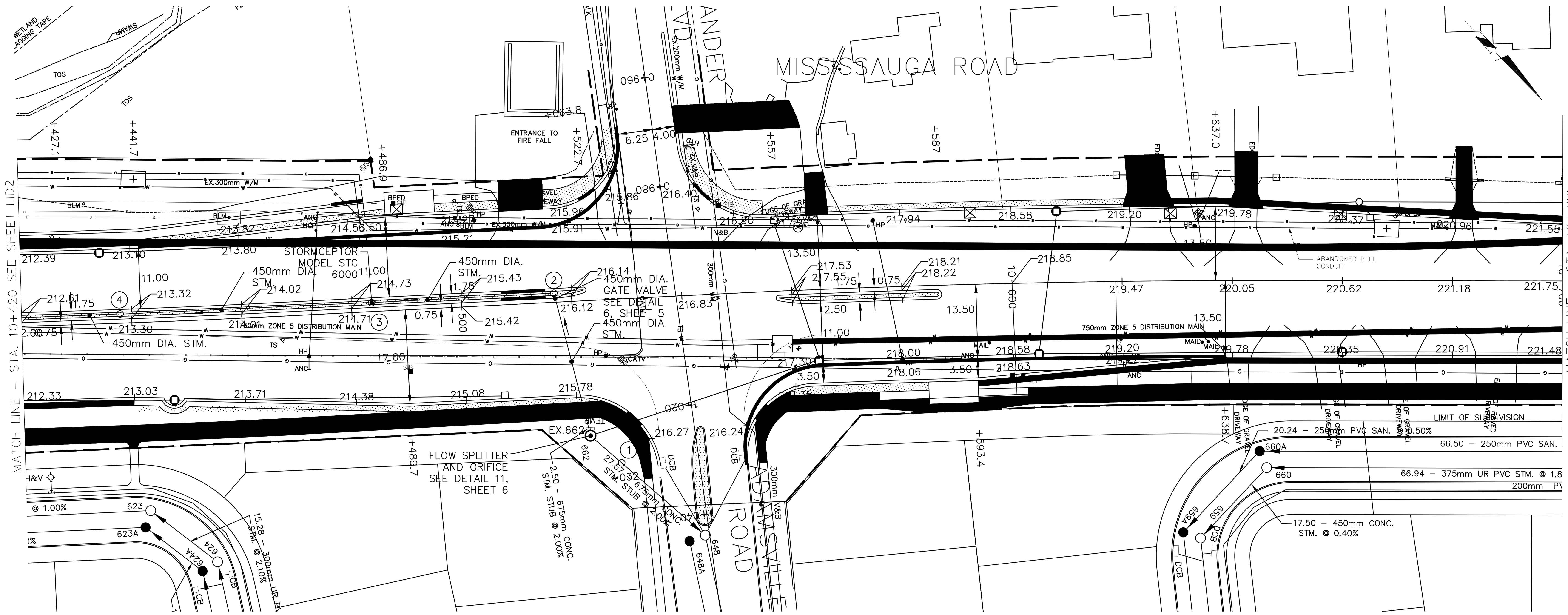
10m 0 10 20 30m HORIZONTAL SCALE
2m 0 2 4 6m VERTICAL SCALE

Region of Peel
Working for you

MISSISSAUGA ROAD
(FROM QUEEN STREET TO BOVAIRD DRIVE)
L.I.D – PLAN AND PROFILE 2
STA. 10+140 TO STA. 10+420

CAD Area | Area | Project No.
Checked by | Drawn by HT
Date 04/12/14 | Sheet 2 of 6 | Plan No. LID 2



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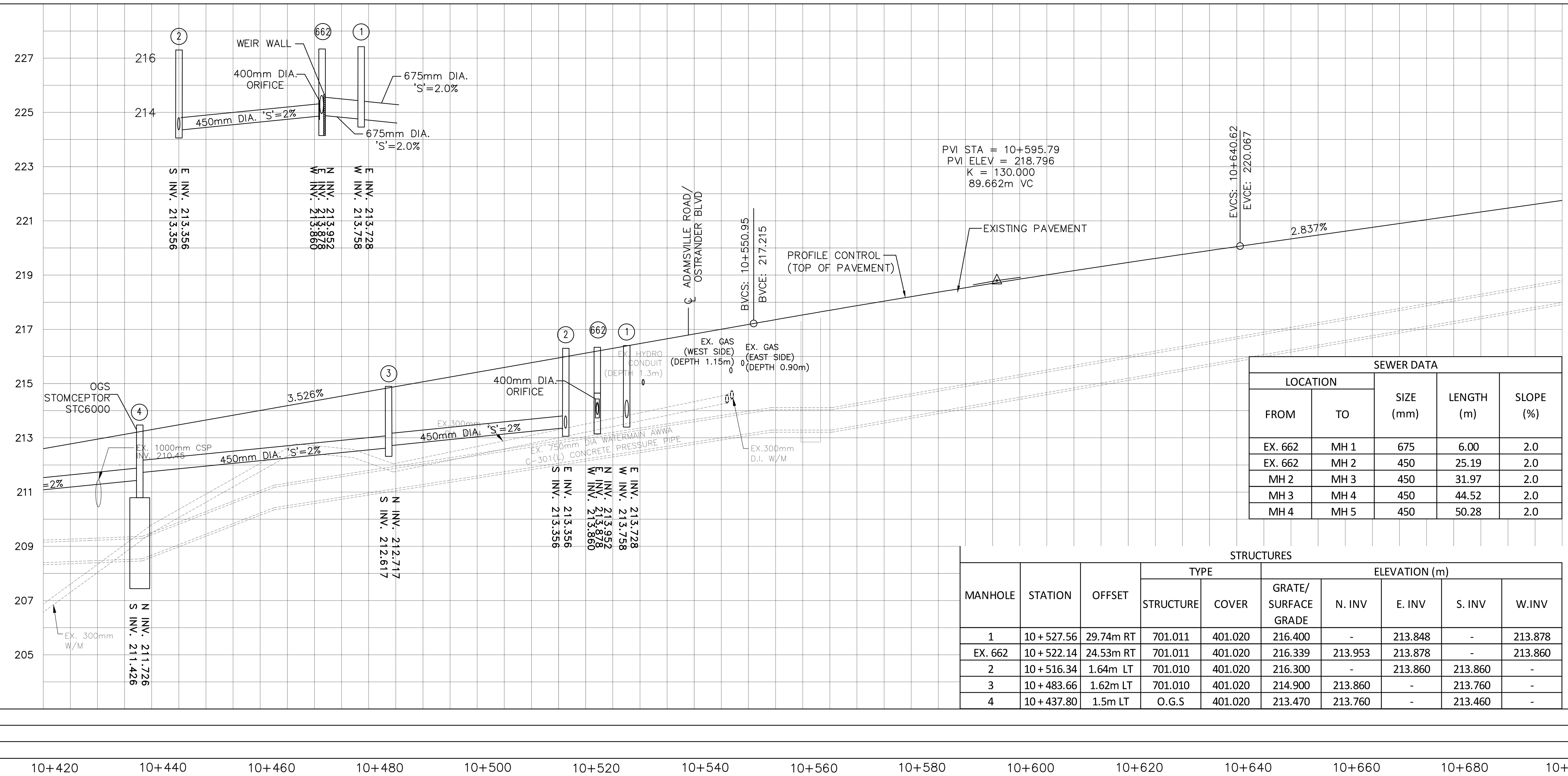

SEWER DATA

LOCATION		SIZE (mm)	LENGTH (m)	SLOPE (%)
FROM	TO			
EX. 662	MH 1	675	6.00	2.0
EX. 662	MH 2	450	25.19	2.0
MH 2	MH 3	450	31.97	2.0
MH 3	MH 4	450	44.52	2.0
MH 4	MH 5	450	50.28	2.0

STRUCTURES

MANHOLE	STATION	OFFSET	TYPE		ELEVATION (m)				
			STRUCTURE	COVER	GRATE/ SURFACE GRADE	N. INV	E. INV	S. INV	W.INV
1	10+527.56	29.74m RT	701.011	401.020	216.400	-	213.848	-	213.878
EX. 662	10+522.14	24.53m RT	701.011	401.020	216.339	213.953	213.878	-	213.860
2	10+516.34	1.64m LT	701.010	401.020	216.300	-	213.860	213.860	-
3	10+483.66	1.62m LT	701.010	401.020	214.900	213.860	-	213.760	-
4	10+437.80	1.5m LT	O.G.S	401.020	213.470	213.760	-	213.460	-

SERVICE DATA

SERVICE	DATE	INIT.	SERVICE	DATE	INIT.
SAN SEWERS			GAS MAINS		
STORM SEWERS			BELL U/G CABLE		
WATERMAINS			HYDRO U/G CABLE		
TRANSIT			HYDRO ONE		
PARKS & REC.			CTV		
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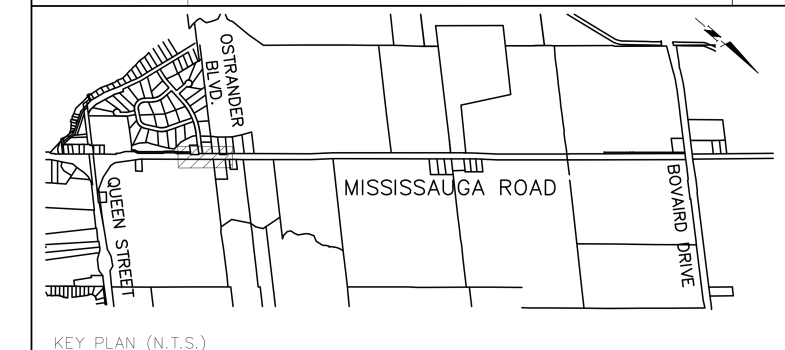

KEY PLAN (N.T.S.)

LEGEND

- Proposed Solid Pipe
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- WT Proposed Flow Control Weir
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Approved by ____ ____ ____ ____ ____

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ROGERS CABLE
ALLSTREAM
PSN (PUBLIC SECTOR NETWORK)
FUTUREWAY (FCI BROADBAND)

10m 0 10 20 30m HORIZONTAL SCALE

2m 0 2 4 6m VERTICAL SCALE

Region of Peel
Working for you

MISSISSAUGA ROAD

(FROM QUEEN STREET TO BOVAIRD DRIVE)

L.I.D - PLAN AND PROFILE 3

STA. 10+420 TO STA. 10+700

CAD Area	Area	Project No.
Checked by	Drawn by HT	
Date 04/12/14	Sheet 3 of 6	Plan No. LID 3

File : C:\Users\Will\WORK PROJECTS\CVC\65567 - Miss Road LID Retrofit\Project 1 Retrofit - Credit to Williams Pkwy\ASB Design CAD\ABL_MissABL Mississauga Rd_Phase 1_90%_DESIGN_V6(FEB 19, 2015).dwg, Layout : LID 3 Date :Feb 23, 2015 - 10:19am, Edit By : Will

BIOSWALE GENERAL NOTES:

1. BIOMEDIA AS PER TABLE 1 SHOULD BE OBTAINED PREMIXED FROM HERMANNS CONTRACTING LTD (905-939-1230), J.JENKINS AND SON LANDSCAPE CONTRACTORS LTD. (416 783-6137) OR EQUIVALENT. VENDOR TO PROVIDE TESTING RESULTS PRIOR TO INSTALLATION. DELIVERED MEDIA SHALL BE TESTED AND APPROVED BY FIELD ENGINEER PRIOR TO INSTALLATION. MEDIA INSTALLED WITHOUT FIELD ENGINEER CLEARANCE SHALL BE REMOVED AT THE CONTRACTOR'S EXPENSE IF DEEMED NECESSARY BY THE FIELD ENGINEER. THE CONTRACTOR WILL BE SOLELY RESPONSIBLE FOR ALL REQUIRED MEDIA TESTING EXPENSES. MEDIA TESTING RESULTS CAN BE EXPECTED APPROXIMATELY 2 - 3 WEEKS AFTER SUBMISSION TO LAB. THE CONTRACTOR IS RESPONSIBLE FOR ANY DELAYS SUFFERED AS A RESULT OF TESTING. NO COMPENSATION WILL BE PROVIDED FOR DELAYS DUE TO MEDIA ANALYSIS.

TABLE 1: MEDIA FOR BIOSWALES PLANTING BED

MEDIA	SIZE	% BY WEIGHT
1 - SAND	2 to 0.05mm	85 - 88%
2 - FINES	0.050mm	8 - 12%
3 - LEAF COMPOST (Organic Matter)	–	3 - 5%

Notes:
- CEC greater than 10 meq/100g
- PH = 5.5 - 7.5
- K greater than 25mm/hr

Soil Texture Classification:
No more than 50mm
Media obtained from vendor to be tested for conformance to design specifications prior to installation. Field engineer to confirm conformance with specifications prior to installation.

ENHANCED SWALES

Enhanced Swale media shall be comprised of the biomedia specified in Table 1 in addition to 20mm Ø washed clearstone 50% by Volume

2. UNDERDRAIN PERFORATED PIPE CONSTRUCTED IN ACCORDANCE WITH OPS 405. 10mm DIAMETER PERFORATIONS IN PIPE.ENDS TO BE CAPPED. NOTE: PIPES SHOULD TERMINATE 0.3m SHORT OF THE SIDES OF THE EXCAVATED OPENING

3. GEOTEXTILES SHALL BE PLACED ON THE SIDES OF EXCAVATION. SECURE IN PLACE TO PREVENT WRINKLING AND OVERLAP A MINIMUM OF 0.6m IN THE DIRECTION TO DRAINAGE. GEOTEXTILE FABRIC MUST CONFORM TO OPSS 1860 FOR CLASS II GEOTEXTILE FABRICS. ACCEPTABLE FABRICS INCLUDE ONE OF THE FOLLOWING:

A) NON-WOVEN NEEDLE PUNCHED FABRICS MUST HAVE AN APPARENT OPENING SIZE (AOS) OF ≤0.3mm (MAXIMUM AVERAGE ROLL VALUE)

OR

B) WOVEN MONOFILAMENT FABRICS MUST HAVE A PERCENT OPEN AREA (POA) OF ≥ 4% UNACCEPTABLE FABRICS INCLUDE WOVEN SILT FILMS AND OR NON-WOVEN HEAT BONDED FABRICS.

4. MANHOLE AND OVERFLOW GRATE ARE TO BE INSTALLED FROM THE UNDERDRAIN TO THE BIOSWALE SURFACE TO ACCOMMODATE OVERFLOW CONDITIONS AS PER BIOSWALE CROSS-SECTIONS AND CAN BE USED FOR MONITORING AND MAINTENANCE OF THE UNDERDRAIN SYSTEM.

5. SEDIMENT CONTROLS SHALL BE INSTALLED PRIOR TO THE COMMENCEMENT OF CONSTRUCTION TO PREVENT RUNOFF FROM CONTAMINATING EXCAVATED SURFACE OF THE NATIVE SOILS AND OR THE AGGREGATE BASE COURSES AND OF THE BIOSWALES.

6. FINAL GRADE OF THE BIOSWALE FACILITIES TO BE EXCAVATED IMMEDIATELY PRIOR TO BACKFILLING WITH SPECIFIED AGGREGATE MEDIA TO AVOID PREMATURE FACILITY CLOGGING.

7. ALL CONSTRUCTION MATERIALS ARE TO BE STORED DOWN-GRADIENT OF EXCAVATED SITE WHENEVER POSSIBLE. MATERIALS STORED UP-GRADIENT OF THE EXCAVATED SITE ARE TO BE ENCLOSED BY APPROPRIATE SEDIMENT CONTROL FENCING.

8. SEDIMENT LOGS/SOCKS TO BE PLACED SCREENED AT ALL CURB CUT LOCATIONS ENTRY POINTS TO PREVENT SEDIMENT ENTER INTO PROPOSED BIOSWALES.

9. APPROVED BIOMEDIA MIXES SHALL BE INSTALLED IMMEDIATELY PRIOR TO INSTALLATION OF THE PLANTINGS AND STABILIZATION MEASURES.

UNDERDRAIN/ PERFORATED PIPE NOTES

1. UNDERDRAIN PERFORATED PIPE TO BE CONSTRUCTED IN ACCORDANCE WITH OPS 405. MINIMUM PIPE DIAMETER 150mm 200mm, 10mm DIAMETER PERFORATIONS IN PIPE.
NOTE: PIPES SHOULD TERMINATE 0.3m SHORT OF THE ENDS OF THE EXCAVATED OPENING. ENDS TO BE CAPPED.

2. UNDERDRAIN MATERIAL SHOULD BE RESISTANT TO THE CHEMICALS PRESENT IN SOILS AND GROUNDWATER AND SHALL PROVIDE PROTECTION AGAINST DEGRADATION BY ULTRA - VIOLET LIGHT.

3. TUBING MUST BE UNIFORM IN COLOUR AND DENSITY AND FREE FROM VISIBLE DEFECTS

4. PERFORATED PIPE - WATER OPENING AREA SHALL NOT BE LESS THAN 16 m2/m OF TUBING. WATER OPENING SHOULD BE LOCATED IN THE BOTTOM OF EXTERIOR CORRUGATION VALLEYS

5. THE TUBING SHALL HAVE A STIFFNESS OF NO LESS THAN 170 N/m 2 AT 5% DEFLECTION AND 130 N/m 2 AT 10% DEFLECTION WHEN TESTED IN ACCORDANCE WITH ASTM D2412.

UNDERDRAIN/ PERFORATED PIPE NOTES, CON'T

1. DRAINAGE PIPES SHALL BE INSTALLED WITH CONSTANT GRADES TO DRAIN, HAVE SMOOTH TRANSITIONS AND ALL APPROPRIATE FITTINGS ACCORDING TO MANUFACTURER'S SPECIFICATIONS. CLEANOUT RISERS SHALL BE INSTALLED WHERE JUNCTIONS, GRADE OR DIRECTION CHANGES MAY CAUSE SILTATION WITHIN THE DRAIN LINES. MINIMUM SLOPE FOR UNDERDRAINS SHALL BE 0.5%.

2. PIPES SHALL BE LAID IN A TRUE LINE AND GRADIENT ON A FIRM BED, FREE FROM LOOSE MATERIAL. PIPES ARE NOT TO BE LAID ON SOIL BACKFILL OR IN A SLURRY AND ARE TO BE SECURELY POSITIONED TO AVOID DISPLACEMENT BEFORE BACKFILLING

3. THE INSIDE OF THE UNDERDRAIN SHALL BE KEPT CLEAN AND FREE OF DEBRIS DURING CONSTRUCTION. ALL DEBRIS SHOULD BE REMOVED BEFORE ADDITIONAL PIPE IS INSTALLED.

4. AGGREGATE BACKFILL MATERIAL SHALL BE FREE FROM FROZEN SNOW, ICE, FROZEN MATERIALS, TRASH, BRICK, CLAY LUMPS, BROKEN CONCRETE, TREE ROOTS, SOD, ASHES, GLASS PLASTER, VEGETABLE MATTER AND ANY OTHER FOREIGN MATTER.

5. UNDERDRAIN PIPES ARE TO BE JOINED USING APPROPRIATE FITTINGS AS PER PIPE MANUFACTURER SPECIFICATIONS.

6. ALL CONNECTIONS TO MANHOLES AND CATCH BASIN SHALL BE PER OPSD AND REGION STANDARDS

GENERAL CONSTRUCTION SEQUENCING:

1. EROSION AND SEDIMENTATION PROTECTION MEASURES ARE REQUIRED PRIOR TO THE COMMENCEMENT OF ANY AND ALL EXCAVATION ACTIVITIES.

2. FLOW SPLITTER AND CONNECTION WITH EXISTING MANHOLE 662 SHALL NOT BE CONNECT/CONSTRUCTED UNTIL THE FINAL STAGES OF CONSTRUCTION SUCH THAT STORMWATER CONTINUES TO BYPASS TO THE EXISTING SWM POND DURING CONSTRUCTION.

3. REMOVED EXISTING PLANTER RETAINING WALLS IN AREAS TO BE REPLACED BY ENHANCED SWALES, BIOSWALE AND PLANTING BEDS

4. REMOVED CURB AND CENTER MEDIAN SURFACE TREATMENT AS REQUIRED TO INSTALL PROPOSED STORM SEWERS, MANHOLES AND OGS INSTALLATION. EXIST CURB SHALL BE MAINTAINED AS MUCH AS POSSIBLE.

5. INSTALL PROPOSED STORM SEWERS, MANHOLES, OGS, GATE VALVE, UPSTREAM OF OUTLET TO ENHANCED SWALES

6. EXCAVATE ENHANCED SWALES AND INSTALL HEADWALLS AND WEIR STRUCTURES AT DESIGNATED LOCATIONS.

7. EXCAVATE BIOSWALE AND PLANTING BEDS "A" AND "B"

8. INSTALL SIDE INLET CURB CUTS ALONG PLANTING BED "A" AND ENSURE ESC CONTROLS (WOODEN BARRIERS) ARE IN PLACE

9. INSTALL ALL CLEARSTONE, UNDERDRAINS, BIOMEDIA AND CLEARSTONE/CLEAR STONE BIOMEDIA MIXES WITHIN LID SYSTEMS AND INSTALL ESC AS REQUIRED. MAKE CONNECTIONS WITH EXISTING STORM SEWER NETWORK AS DETAILED ON THE GENERAL PLANS.

10. INSTALL SURFACE TREATMENTS FOR EACH LID SYSTEM AND PLANTING MATERIAL PER LANDSCAPE PLAN.

11. ONCE SYSTEMS ARE STABILIZED AS APPROVED BY CONTRACT ADMINISTRATOR, CONSTRUCT FLOW SPLITTER AND INSTALL ORIFICE WITHIN EXISTING MANHOLE 662.TO BRING SYSTEMS ONLINE.

LID SYSTEM SPECIFIC CONSTRUCTION SEQUENCING:

1. EROSION AND SEDIMENTATION PROTECTION MEASURES ARE REQUIRED PRIOR TO THE COMMENCEMENT OF ANY AND ALL EXCAVATION ACTIVITIES.

2. ROUGH EXCAVATION OF THE BIOSWALES, ENHANCED SWALES, AND PLANTING BED IS PERMITTED TO A MAXIMUM 100mm OF FINAL GRADE. FINAL GRADE OF THE BIOSWALE FACILITY TO BE EXCAVATED IMMEDIATELY PRIOR TO BACKFILLING WITH SPECIFIED AGGREGATE MEDIA TO AVOID PREMATURE FACILITY CLOGGING.

3. EXCAVATION, BACKFILLING AND MEDIA INSTALLATION IS ONLY TO OCCUR AFTER THE CONTRIBUTING DRAINAGE AREA HAS BEEN STABILIZED.

4. EXCAVATION OF FINAL 100mm OF NATIVE MATERIAL TO FINAL FACILITY INVERT AS PER DESIGN DRAWINGS AND INSTALL GEOTEXTILE FABRIC, AS REQUIRED. SURFACE OF EXCAVATION SHALL BE SCARIFIED PRIOR TO INSTALLATION OF BACKFILL MATERIALS.

A - FOR BIOSWALE AND PLANTING BED "A", PLACE DESIRED DEPTH OF 20mm ø WASHED CLEAR STONE BENEATH UNDERDRAIN SYSTEM. SHOULD BE CLEAN WASHED: NO FINES SHOULD BE PRESENT IN MATERIAL (LESS THAN 1% PASSING 0.075MM SIEVE). (SEE GENERAL UNDERDRAIN/PERFORATED PIPE NOTES).

B - FOR BIOSWALE AND PLANTING BED "A", INSTALL UNDERDRAIN /PERFORATED PIPE AS PER DRAWING, PLACE REMAINING 20mm ø WASHED CLEAR STONE TO DESIGN ELEVATION. (SEE GENERAL UNDERDRAIN/PERFORATED PIPE NOTES).

C - FOR ALL SYSTEMS, APPLY BIOMEDIA OR BIOMEDIA 20mm WASHED CLEARSTONE MIX IN 300mm LIFTS UNTIL DESIRED ELEVATION IS ACHIEVED. THOROUGHLY WET EACH LIFT BEFORE ADDING NEXT LIFT. ALLOW WATER TO FULLY PERCOLATE THROUGH THE SOIL BEFORE ADDING EACH COURSE.

D - FINISH GRADING:

A. THE BIOMEDIA OR BIOMEDIA 20mm WASHED CLEARSTONE MIX SHALL BE FINE GRADED AFTER PLACEMENT. FINISHED GRADING SHALL CONFORM TO THE GRADE ELEVATIONS AND CONTOURS AS SHOWN ON THE DESIGN DRAWINGS AND SHALL BE FREE OF DEBRIS AND OTHER MATERIALS THAT WOULD BE DETRIMENTAL TO THE PERFORMANCE OF THE GROWING MEDIA.

B. THE FINISHED SURFACE SHALL BE SMOOTH AND UNIFORM, AND BE FIRM AGAINST DEEP FOOTPRINTING, WITH A FINE LOOSE SURFACE TEXTURE.

C. PROTECTION OF THE FINISHED GRADE AND CORRECTION OF ANY IRREGULARITIES CAUSED BY WORK OPERATIONS OVER THE FINISHED GRADE SHALL BE ENFORCED.

D. SETTLING OF ANY FINISHED GRADE SHALL NOT BE MORE THAN 10mm FROM SPECIFIED ELEVATIONS, AND IF SETTLING IS GREATER, THE CONTRACTOR SHALL BRING THE GRADE TO THE SPECIFIED ELEVATIONS.

6. APPLY APPROPRIATE SURFACE TREATMENT "A" OR "B" FOR EACH SYSTEM AS INDICATED ON THE DESIGN DETAILS

6. PLANTINGS ARE TO OCCUR IN ACCORDANCE WITH THE LANDSCAPE PLANS. AS NECESSARY, PROVIDE A MINIMUM OF 1 IRRIGATION PER WEEK IN THE FIRST 2 MONTHS.

7. THE LID SYSTEMS SHOULD BE INSPECTED BY THE CONTRACTOR AFTER EACH STORM 10mm OR A MIN. OF TWICE POST INSTALLATION DURING THE FIRST SIX MONTHS AFTER PLACING THE FACILITY ON-LINE. ANY DEVIATIONS FROM DESIGN DRAWINGS TO BE CORRECTED.

9. ALL LID SYSTEMS ARE TO BE INSPECTED A MIN. ONCE ANNUALLY (TYPICALLY IN SPRING) AND AFTER EACH EVENT GREATER THAN 10mm.

ESC NOTES

1. DURING CONSTRUCTION, PROVISIONS SHALL BE MADE FOR PROPER WATER MANAGEMENT AND DRAINAGE OF THE SITE. THIS SHALL INCLUDE SILT TRAPS, ALL EROSION CONTROL MEASURES, TEMPORARY WATER COLLECTION DITCHES AND OVERFLOW STRUCTURE, AS WELL AS THE PROPER MAINTENANCE OF SUCH THROUGHOUT THE CONSTRUCTION PERIOD. AT NO TIME SHALL SEDIMENT LADEN WATER BE ALLOWED TO ENTER THE EXCAVATED/BACKFILLED OR COMPLETED BIOSWALE , ENAHNCED SWALE, OR PLANTING BED AREAS. PRIOR TO THE STABILIZATION OF THE LID SYSTEMS, NO SITE DRAINAGE AND/OR STORM DRAINAGE IS TO ENTER THE PROPOSED LID AREAS. SHOULD SEDIMENT ENTER THE FACILITY PRIOR TO RECEIVING APPROVAL FROM FIELD ENGINEER/ LANDSCAPE ARCHITECT, THE INFILTRATION RATE OF THE CONTAMINATED AREA SHOULD BE TESTED USING THE GUELPH PERMEAMETER TEST TO CONFIRM NO LOSS IN INFILTRATION POTENTIAL. SHOULD A LOSS OF INFILTRATION CAPACITY BE CONFIRMED, THE CONTRACTOR WILL BE RESPONSIBLE FOR THE REPAIR/ REMEDIATION OF THE CONTAMINATED AREA TO THE SATISFACTION OF THE CLIENT/ ENGINEER/ LANDSCAPE ARCHITECT, USING APPROVED MEASURES/ MATERIALS AND PRACTICES.

2. ADHERENCE TO CONSTRUCTION SEQUENCING IS REQUIRED AS PART OF THE ESC PLAN. CONSTRUCTION SEQUENCING IS AN INTEGRAL COMPONENT OF ESC PROCEDURES/ PRACTICES AND HAS BEEN DESIGNED IN ORDER TO ENSURE THAT NO CONTAMINATION/ REDUCTION IN INFILTRATION CAPACITY TAKES PLACE AS A RESULT OF CONSTRUCTION ACTIVITIES.

3. TEMPORARY SEDIMENT CONTROLS TO BE INSTALLED PRIOR TO THE START OF CONSTRUCTION.

4. SEDIMENT CONTROL FOR THE SIDE INLET CATCH BSAINS SHALL CONSIST OF WOODED BARRIER (IF REQUIRED) AND SEDIMENT SOCKS INSTALLED ALONG SIDE INLET OPENING TO PREVENT FLOWS FROM ENTERING THE LID FACILITIES. THE WOODEN BARRIER SHALL BE STALKED SECURELY IN PLACE ON THE BACKSIDE OF THE PROPOSED SIDE INLET CURB CUTS. FILTER CLOTH SHALL BE PLACED BETWEEN THE CURB CUT AND THE WOODEN BARRIER TO PREVENT SEDIMENT FROM BYPASSING THE WOODEN BARRIERS VIA CRACKS OR SMALL OPENINGS. BARRIER MATERIALS SHALL BE APPROVED BY THE FIELD ENGINEER PRIOR TO INSTALLATION.

5. THE CONTRACTOR SHALL PLACE SEDIMENT LOGS/SOCKS AT CURB-CUT LOCATIONS AND ENTRY POINTS TO THE PLANTING BEDS TO PREVENT SEDIMENT ENTRY INTO THE PROPOSED BIOSWALES.

6. SEDIMENT TRAPS OR APPROVED EQUIVALENT SHALL BE INSTALLED AT PROPOSED ALL CATCH BASINS AND STORM SEWER INLET POINTS PRIOR TO LID CONSTRUCTION TO PREVENT SEDIMENT ENTERING THE STORM SEWER NETWORK.

7. CONTRACTOR IS RESPONSIBLE FOR ANY REMEDIATION/REPAIR OF INFILTRATION FACILITIES DAMAGED AS A RESULT OF INADEQUATE OR IMPROPER SEDIMENT CONTROL.

8. THE CONTRACTOR SHALL DELINEATE THE REQUIRED WORKING AREA ON-SITE PRIOR TO THE START OF WORK AND SHALL CONFINE OPERATIONS WITHIN THE DEFINED AREA.

9. TEMPORARY TOPSOIL AND/OR FILL MATERIAL STOCKPILE AREAS TO BE ENCLOSED WITH SILTATION CONTROL PER THE ESC PLAN. MATERIALS ARE NOT TO BE STOCKPILED UPSTREAM OF PROPOSED FACILITIES.

10. LOCATION OF STOCKPILE AREAS TO BE DETERMINED ON-SITE PRIOR TO CONSTRUCTION AND APPROVED BY THE ENGINEER.

11. WORKING AREAS, ACCESS REQUIREMENTS, AND TEMPORARY MATERIAL STORAGE AREAS TO BE MAINTAINED IN GOOD CONDITION BY THE CONTRACTOR AT ALL TIMES. AREAS AFFECTED BY THE CONTRACTOR'S ACTIVITIES TO BE REINSTATED TO THE EXISTING CONDITIONS OR BETTER.

12. NO RUNOFF FROM EXCAVATED OR UNVEGETATED AREAS SHALL BE DISCHARGED OFF SITE INTO ACTIVE AND/OR INACTIVE STORM SEWERS OR WATERCOURSES.

13. ALL ACCUMULATED SEDIMENTS TO BE REMOVED PRIOR TO THE REMOVAL OF CONTROLS AND DISPOSED OF IN AN APPROVED ON-SITE LOCATION BY THE CONTRACTOR (LOCATION TO BE DETERMINED IN THE FIELD).

14. ON-SITE EQUIPMENT REFUELING AND MAINTENANCE TO BE ONLY COMPLETED IN DESIGNATED AREAS.

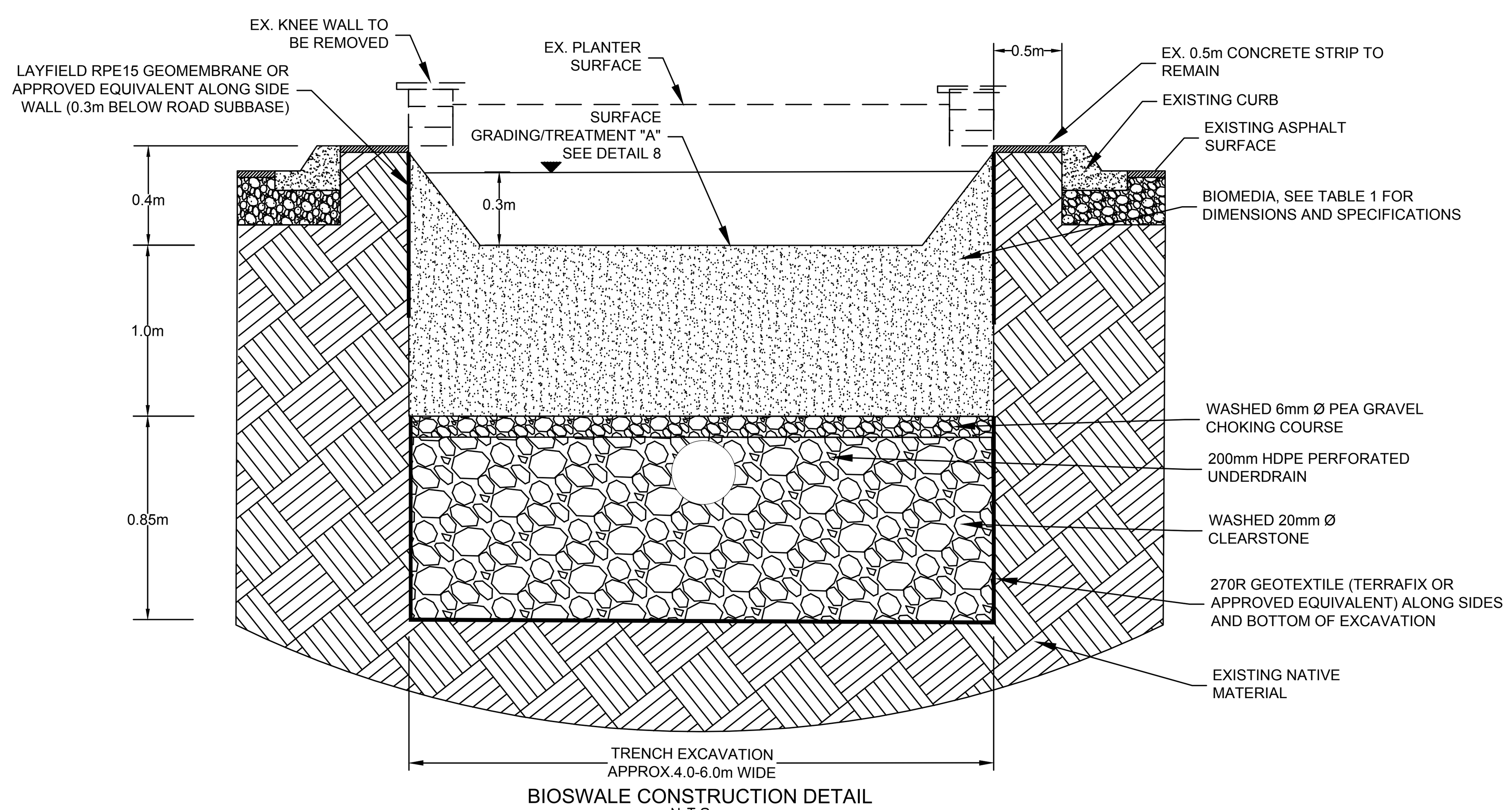
15. SEDIMENT CONTROLS TO BE INSPECTED WEEKLY AND AFTER EACH RAINFALL EVENT. SEDIMENT CONTROLS TO BE MAINTAINED AND REPAIRED BY THE CONTRACTOR UNTIL COMPLETION OF CONSTRUCTION AND SITE RESTORATION.

16. ALL SITE RESTORATION TO BE IN ACCORDANCE WITH THE RESTORATION PLAN AND DETAILS.

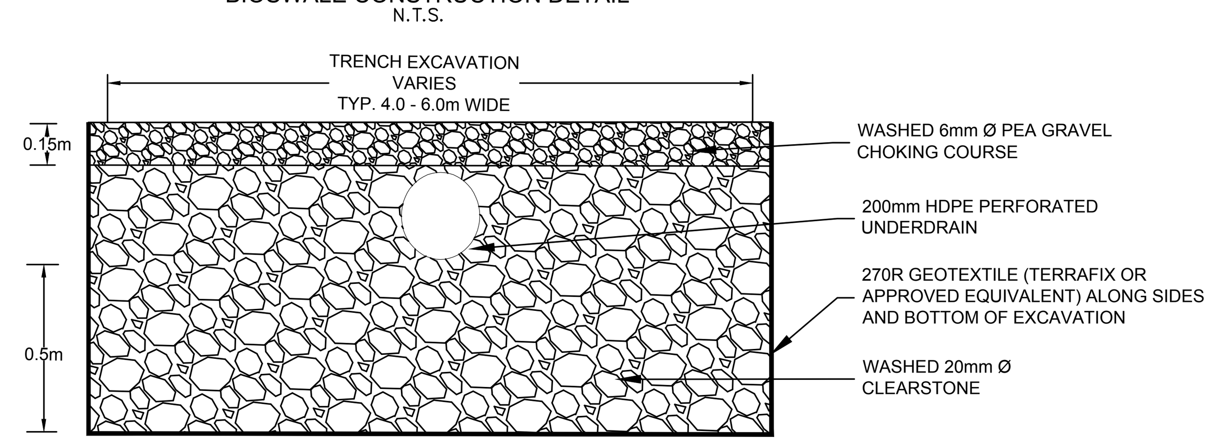
17. ALL ROADWAYS TO BE CLEANED OF SEDIMENTS RESULTING FROM CONSTRUCTION TRAFFIC FROM THE SITE EACH DAY.

18. EROSION PROTECTION TO BE PROVIDED AROUND ALL EXISTING STORM AND SANITARY MHs , DICBs AND CBs PRIOR TO CONSTRUCTION.

19. REMOVE TEMPORARY SEDIMENT CONTROLS FOLLOWING COMPLETION OF CONSTRUCTION AND SITE RESTORATION, AND REINSTATE AFFECTED AREAS TO EXISTING CONDITIONS OR BETTER.



BIOSWALE CONSTRUCTION DETAIL
N.T.S.

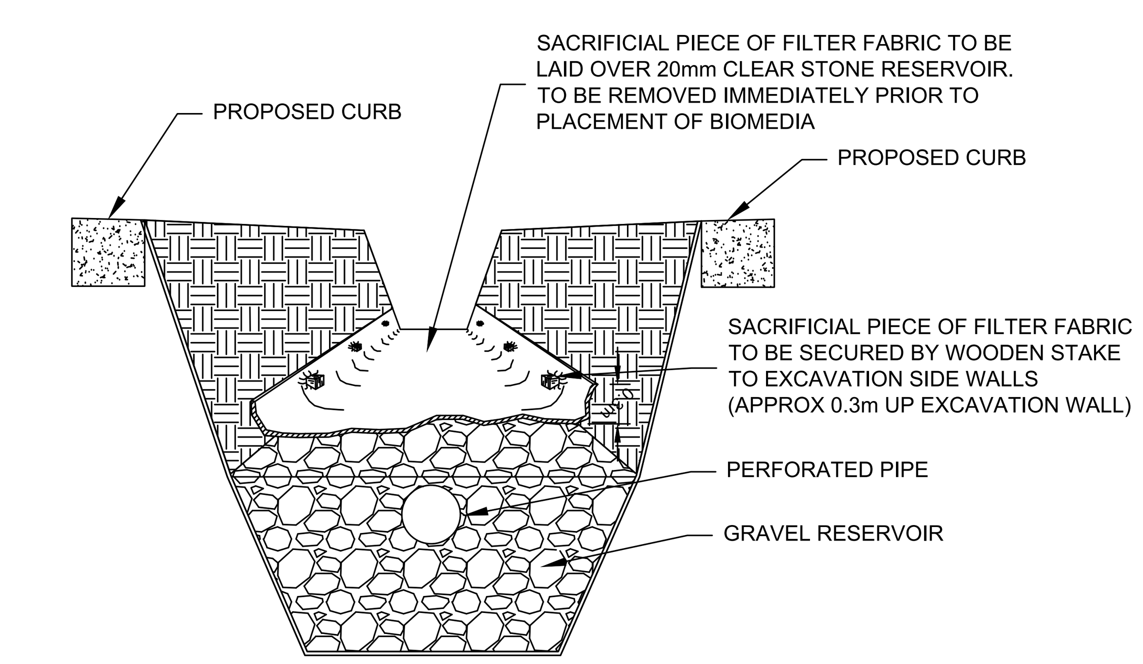


BIOSWALE UNDERDRAIN DETAIL
N.T.S.

Notes:

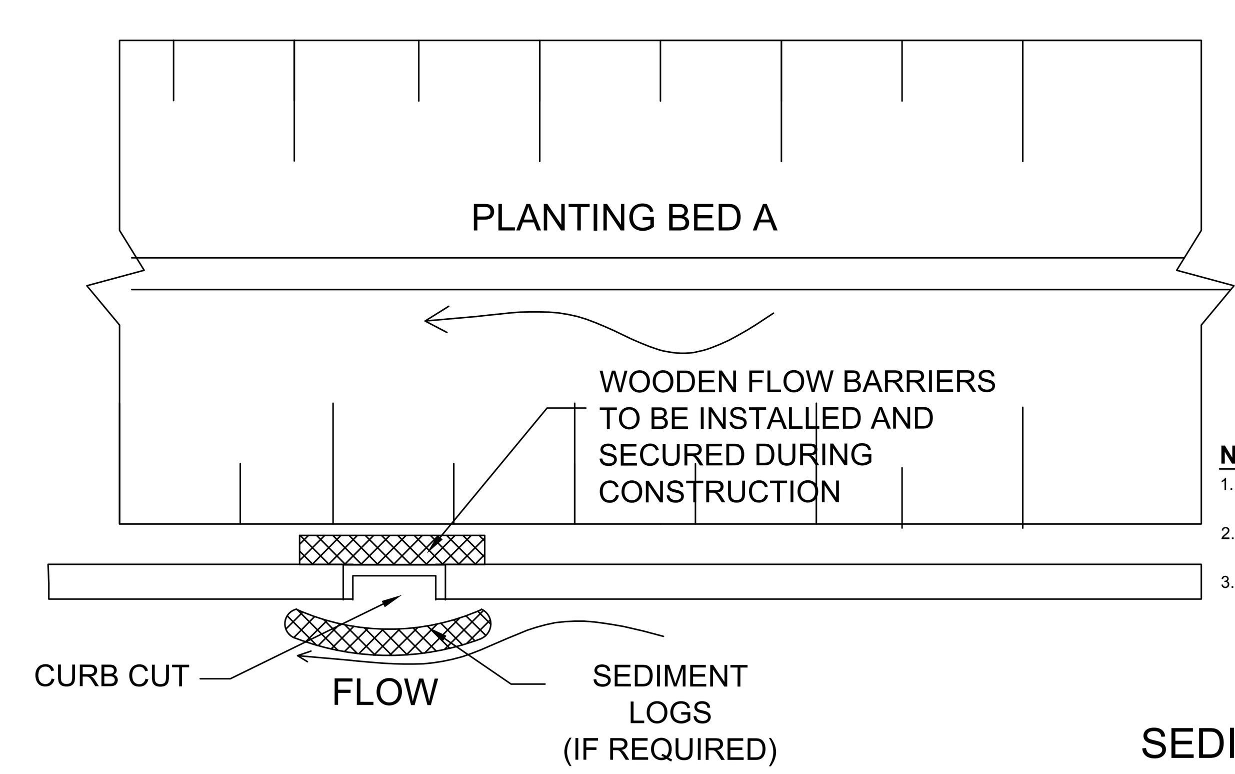
1. TRENCH WIDTH SHALL VARY WHERE UTILITIES ARE ENCOUNTERED. TRENCH WITH MAY BE DECREASED, AS APPROVED BY THE FIRLED ENGINEER, IN ORDER TO AVOID UTILITIES OR OTHER OBSTRUCTION ENCOUNTERED DURING EXCAVATION.
2. PIPE CONFIGURATION DETAILED ON THE PLAN MAY BE ALTERED IN THE FIELD AS APPROVED BY THE FIELD ENGINEER IN ORDER TO AVOID UTILITIES OR OBSTRUCTIONS.
3. EXCAVATION AND CLEARSTONE GRADING SHALL FOLLOW EMBEDDED PIPE GRADE AS SPECIFIC ON ACCOMPANYING DATA TABLES. BIOMEDIA DEPTHS SHALL VARY SUCH THAT SPECIFIED SURFACE GRADING IS ACHIEVED.
4. FINAL GRADING OF BIOMEDIA SHALL ACCOUNT FOR REQUIRED SURFACE TREATMENTS SUCH THAT SPEFICIED SURFACE GRADING IS ACHIEVED.

DETAIL 1
BIOSWALE DETAILS
N.T.S.



Notes:

1. SACRIFICIAL FILTER FABRIC SHALL SPAN THE ENTIRE LENGTH OF THE BIOSWALE TO PREVENT SEDIMENT FROM CLOGGING THE GRAVEL RESERVOIR OR THE FILTER FABRIC WHICH WRAPS THE RESERVOIR.
2. THE SACRIFICIAL PIECE OF FILTER FABRIC SHALL BE INSTALLED IMMEDIATELY FOLLOWING THE PLACEMENT OF THE UNDERDRAINS AND WASHED 20mm CLEAR STONE AND REMAIN IN PLACE UNTIL THE PLACEMENT OF BIOMEDIA APPROVED BY THE FIELD ENGINEER
3. THE CONDITION OF THE SACRIFICIAL PRICE OF FILTER FABRIC SHALL BE INSPECTED DAILY ESPECIALLY FOLLOWING A SIGNIFICANT STORM EVENT IN WHICH SEDIMENT ENTERS THE FACILITY. IN SUCH CASE THE SACRIFICIAL PIECE OF FILTER FABRIC SHALL BE REMOVED AND REPLACE AS SPECIFIED BY THE FIELD ENGINEER.
4. THE SACRIFICIAL PRICE OF FILTER FABRIC SHALL BE FREE OF ANY RIPS OF TEARS. SHALL AND RIPS OF TEARS BE PRESENT THE SECTION SHALL BE CUT, REMOVED AND REPLACED.
5. THE SACRIFICIAL PIECE OF FILTER FABRIC SHALL BE STAKED IN PLACE USING WOODEN STAKE EVERY 1.0m ALONG THE EDGE OF THE FABRIC. THE FABRIC SHALL EXTEND UP THE WALLS OF EXCAVATION 0.3m.



Notes:

1. SEDIMENT LOGS SHALL BE INSTALLED FOLLOWING THE LAYOUT OF THE PLANTERS PRIOR TO EXCAVATION AND EARTH MOVING ACTIVITIES.
2. SEDIMENT LOGS DAMAGES DURING CONSTRUCTION ACTIVITIES SHALL BE REMOVED AND REPLACED PRIOR TO CONTINUING THE WORKS
3. SEDIMENT LOGS WOODEN BARRIERS SHALL BE INSTALLED AT ALL CURB CURB OPENINGS AND STAKED IN PLACE.

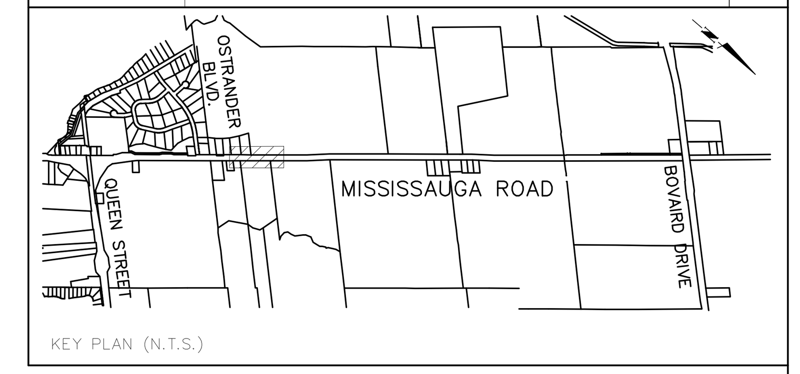
DETAIL 2: EROSION AND SEDIMENTATION CONTROL DETAILS
N.T.S.

SERVICE DATA

SERVICE	DATE	INIT.	SERVICE	DATE	INIT.
SAN SEWERS			GAS MAINS		
STORM SEWERS			BELL U/G CABLE		
WATERMAINS			HYDRO U/G CABLE		
TRANSIT			HYDRO ONE		
PARKS & REC.			CTV		
ONT. CLEAN WATER			COMMUNIC. CABLES		

REVISIONS

DATE	DETAILS	INIT.
05/12/2014	60% DESIGN SUBMISSION	W.C
17/01/2015	90% DESIGN SUBMISSION	W.C



KEY PLAN (N.T.S.)

1. ALL ELEVATIONS ARE IN METRES AND REFERENCED TO LOCAL DATUM. ALL DIMENSIONS ARE IN METRIC UNITS.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR LAYOUT AND SURVEY CONTROL DURING CONSTRUCTION.
3. THE CONTRACTOR IS RESPONSIBLE FOR LOCATION OF ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION.
4. LOCATIONS OF THE EXISTING INFRASTRUCTURE INCLUDING SUBSURFACE PIPING AND MANHOLES ARE BASED ON AVAILABLE SURVEY AND BACKGROUND INFORMATION AND ARE NOT EXACT. THE CONTRACTOR IS RESPONSIBLE FOR LOCATION OF ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION.
5. THE CONTRACTOR SHALL DELINEATE THE REQUIRED WORKING AREA ON-SITE PRIOR TO THE START OF WORK AND SHALL CONFINE OPERATIONS WITHIN THE DEFINED AREA. ALL ACTIVITIES, INCLUDING MAINTENANCE PROCEDURES, WILL BE CONTROLLED TO PREVENT ENTRY OF PETROLEUM PRODUCTS, DEBRIS, RUBBLE, CONCRETE OR OTHER DELETERIOUS SUBSTANCES INTO ANY WATER/WATERCOURSE/WETLAND NATURAL FEATURE. VEHICLE REFUELING AND MAINTENANCE MUST BE CONDUCTED AT LEAST 30 METRES FROM ANY WATER/WATERCOURSE/WETLAND NATURAL FEATURE. ON-SITE EQUIPMENT REFUELING AND MAINTENANCE TO BE ONLY COMPLETED IN DESIGNATED AREAS.
6. WORKING AREAS, ACCESS REQUIREMENTS, SEDIMENT CONTROL MEASURES, AND TEMPORARY MATERIAL STORAGE AREAS TO BE MAINTAINED IN GOOD REPAIR BY THE CONTRACTOR AT ALL TIMES. AREAS AFFECTED BY THE CONTRACTORS ACTIVITIES ARE TO BE REINSTATED TO THE EXISTING CONDITIONS OR BETTER. ALL DISTURBED AREAS WILL BE RESTORED WITH NATIVE NON-INVASIVE VEGETATION SPECIES FOLLOWING CONSTRUCTION. ANY DAMAGED SOD SHALL BE REMOVED AND REPLACED WITH SOD (TYP.) AND TOPSOIL AS REQUIRED AT THE CONTRACTORS OWN EXPENSE.
7. EROSION AND SEDIMENT CONTROLS (ESC) SHOWN ON ESC1 (SHEET 7) ARE THE MINIMUM THAT IS REQUIRED. THE CONTRACTOR IS RESPONSIBLE FOR ENSURING THAT ALL ESCS ARE FUNCTIONAL AND ARE REQUIRED TO USE ADDITIONAL APPROPRIATE ESC MEASURES IF NEEDED AND AS NEEDED, TO PREVENT THE RELEASE OF SEDIMENT INTO ANY ADJACENT WATERCOURSE, WATERBODY, ADJACENT NATURAL FEATURE,AND RAIN GARDEN AREA.
8. EROSION AND SEDIMENT CONTROL MEASURES WILL BE IMPLEMENTED PRIOR TO AND MAINTAINED DURING THE CONSTRUCTION PHASES TO PREVENT ENTRY OF SEDIMENT INTO ANY WATER. THESE EROSION AND SEDIMENT CONTROL MEASURES WILL BE REMOVED FOLLOWING CONSTRUCTION COMPLETION AND WHEN DISTURBED AREAS HAVE BEEN STABILIZED AND VEGETATION ESTABLISHED. ALL AREAS WHICH REMAIN DISTURBED FOR MORE THAN 30 DAYS MUST BE STABILIZED TO THE SATISFACTION OF THE RELEVANT AGENCIES, THE CLIENT AND OR THE SITE ENGINEER.
9. THE CONTRACTOR SHALL MONITOR THE WEATHER SEVERAL DAYS BEFORE CONSTRUCTION TO ENSURE THAT WORK WILL BE CONDUCTED DURING FAVOURABLE WEATHER CONDITIONS (I.E. DRY CONDITIONS). EROSION AND SEDIMENT CONTROLS SHALL BE CHECKED AND REINFORCED WHERE MAINTENANCE IS REQUIRED TO REDUCE THE RISK OF SEDIMENT RELEASE DURING THE STORM EVENT. THE CONTRACTOR IS RESPONSIBLE FOR MONITORING SITE CONDITIONS IF WET WEATHER IS EXPECTED, INCLUDING OVERNIGHT, WEEKENDS AND HOLIDAYS.
10. ALL SITE RESTORATION TO BE IN ACCORDANCE WITH THE REHABILITATION/PLANTING PLANS AND DETAILS.
11. THE CONTRACTOR IS TO PROVIDE THE REGION OF PEEL WITH 48 HOURS ADVANCE NOTICE PRIOR TO INITIATION OF CONSTRUCTION.
12. ALL GENERAL BACKFILL, INCLUDING ALL BERM STRUCTURES TO BE OF APPROVED MATERIAL AND COMPACTED TO A MINIMUM 95% STANDARD PROCTOR DENSITY (SPD) UNLESS OTHERWISE STATED. ACCEPTABLE SOILS SHALL BE LOW PERMEABILITY SOILS AND APPROVED BY GEOTECHNICAL AND OR SITE ENGINEER.
13. THE CONTRACTOR IS RESPONSIBLE FOR REMOVAL AND DISPOSAL OF ALL DEBRIS AND SHALL BECOME THE OWNER OF ANY AND ALL UNUTILIZED OR SURPLUS MATERIALS.
14. ALL SEDIMENTS AND EROSION CONTROL MEASURES SHALL BE INSPECTED DAILY TO ENSURE THAT THEY ARE FUNCTIONING PROPERLY AND ARE MAINTAINED AND/OR UPGRADED AS REQUIRED.
15. ALL PROPOSED GRADES ARE FINAL GRADES WHICH MUST INCLUDE HEIGHT/THICKNESS OF SOD OR MULCH MATERIALS. ALL PONDING DEPTHS SHALL BE MAINTAINED PER THE DESIGN DRAWINGS.
16. HYDRO DUCT DETAILS AND DRAWINGS SHALL BE MADE AVAILABLE BY THE TOWN UPON REQUEST. THE CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING ALL UTILITIES AND FOLLOWING PROPER EXCAVATION PROCEDURES AS SPECIFIED BY THE LOCATES (I.E. HAND DIGGING AND DAYLIGHTING). VERIDIAN CONNECTIONS MUST BE NOTIFIED MIN 36 HOURS PRIOR TO EXCAVATION NEAR HYDRO DUCT.

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Designed by Approved by
Chkd.

Aquafor Beech Limited

#6–202–2600 SKYMARK Ave, MISSISSAUGA, ONTARIO, L4W 5B2
PHONE: (905) 629–0099
FAX: (905) 629–0089

55 REGAL ROAD, UNIT 3 GUELPH, ONTARIO, N1K 1B6
PHONE: (519) 224–3740
FAX: (519) 224–3750

NOTICE TO CONTRACTOR
48 HOURS PRIOR TO COMMENCING WORK NOTIFY THE FOLLOWING

THE REGIONAL MUNICIPALITY OF PEEL	CABLE TELEVISION/FIBREOPTIC PROVIDERS:
CITY OF MISSISSAUGA WORKS DEPT.	BELL CANADA
CITY OF BRAMPTON WORKS DEPT.	ENERSOURCE TELECOM
TOWN OF CALEDON WORKS DEPT.	HYDRO ONE TELECOM
BELL CANADA	ROGERS CABLE
ENBRIDGE INCORPORATED–GAS DISTRIBUTION	ALLSTREAM
ONTARIO MINISTRY OF TRANSPORTATION	PSN (PUBLIC SECTOR NETWORK)
ONTARIO CLEAN WATER AGENCY	FUTUREWAY (FCI BROADBAND)
HYDRO ONE NETWORKS	
ENERSOURCE, HYDRO MISSISSAUGA	
HYDRO ONE BRAMPTON	

10m 0 10 20 30m HORIZONTAL SCALE
2m 0 2 4 6m VERTICAL SCALE

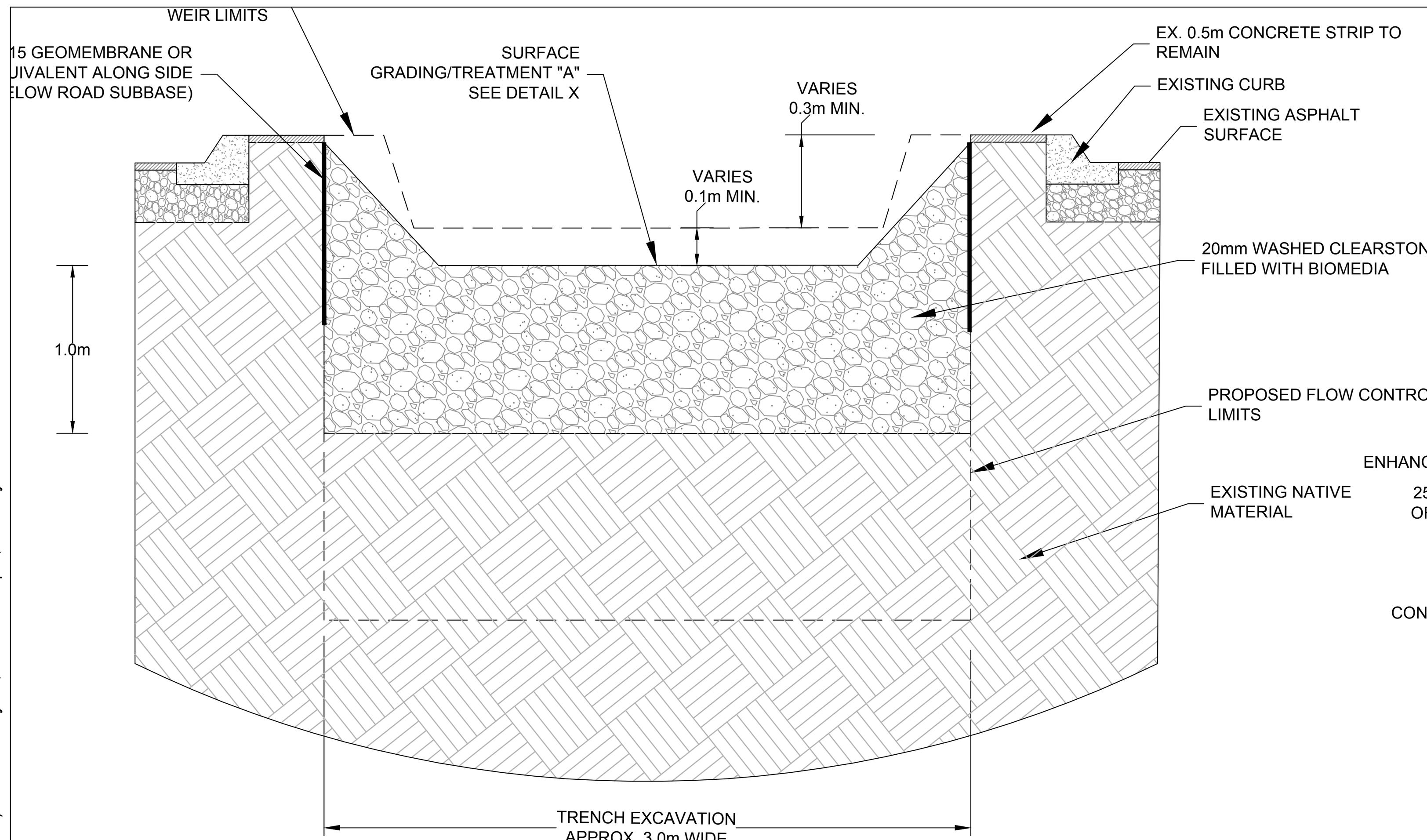
Region of Peel
Working for you

MISSISSAUGA ROAD
(FROM QUEEN STREET TO BOVAIRD DRIVE)
LID CONSTRUCTION DETAILS

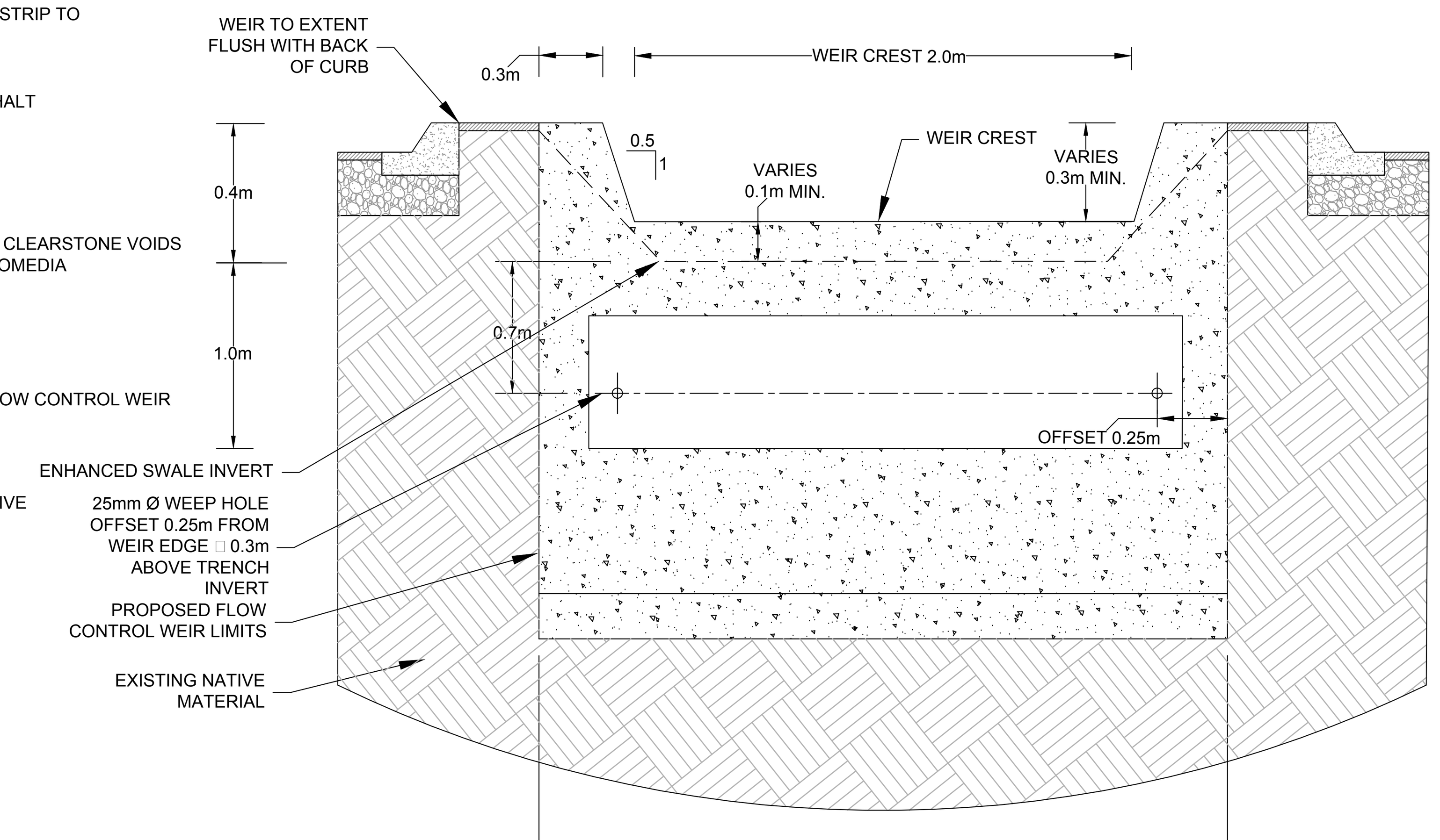
CAD Area	Area	Project No.
Checked by	Drawn by HT	
Date 17/02/15	Sheet 4 OF 6	Plan No. LID 4

THIS IS 2 mm

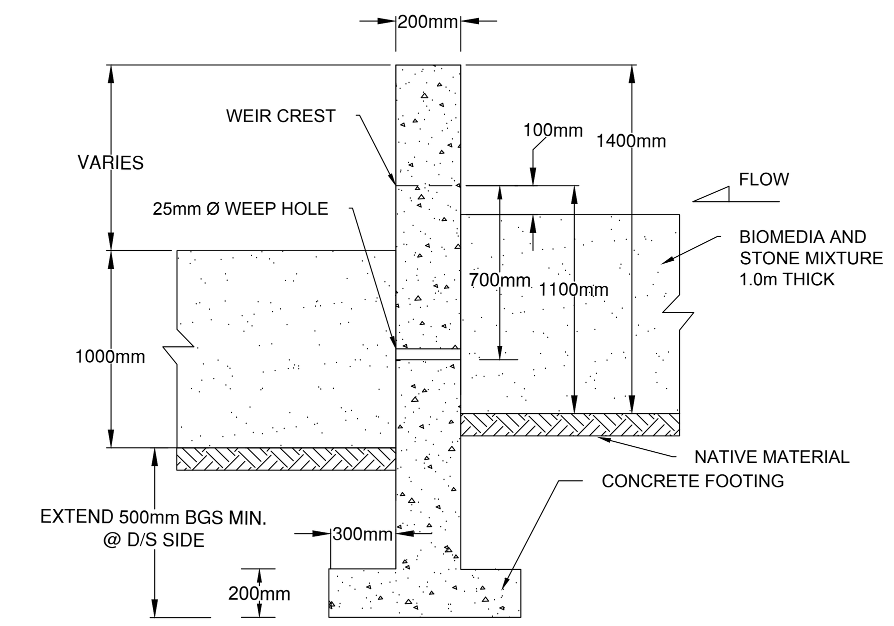
File : C:\Users\Will\WORK PROJECTS\CVC\65567 - Miss Road LID Retrofit\Project 1 Retrofit - Credit to Williams Pkwy\ASB Design CAD\ABL_MissABL Mississauga Rd_Phase 1_100%_DESIGN DETAILS_V1 (APRIL 21, 2015).dwg,   Layout : DESIGN DETAILS 2 (LID 5)   Date :May 04, 2015 - 4:46pm,   Edit By : Will



ENHANCED SWALE CONSTRUCTION DETAIL



ENHANCED SWALE WEIR CONSTRUCTION DETAIL

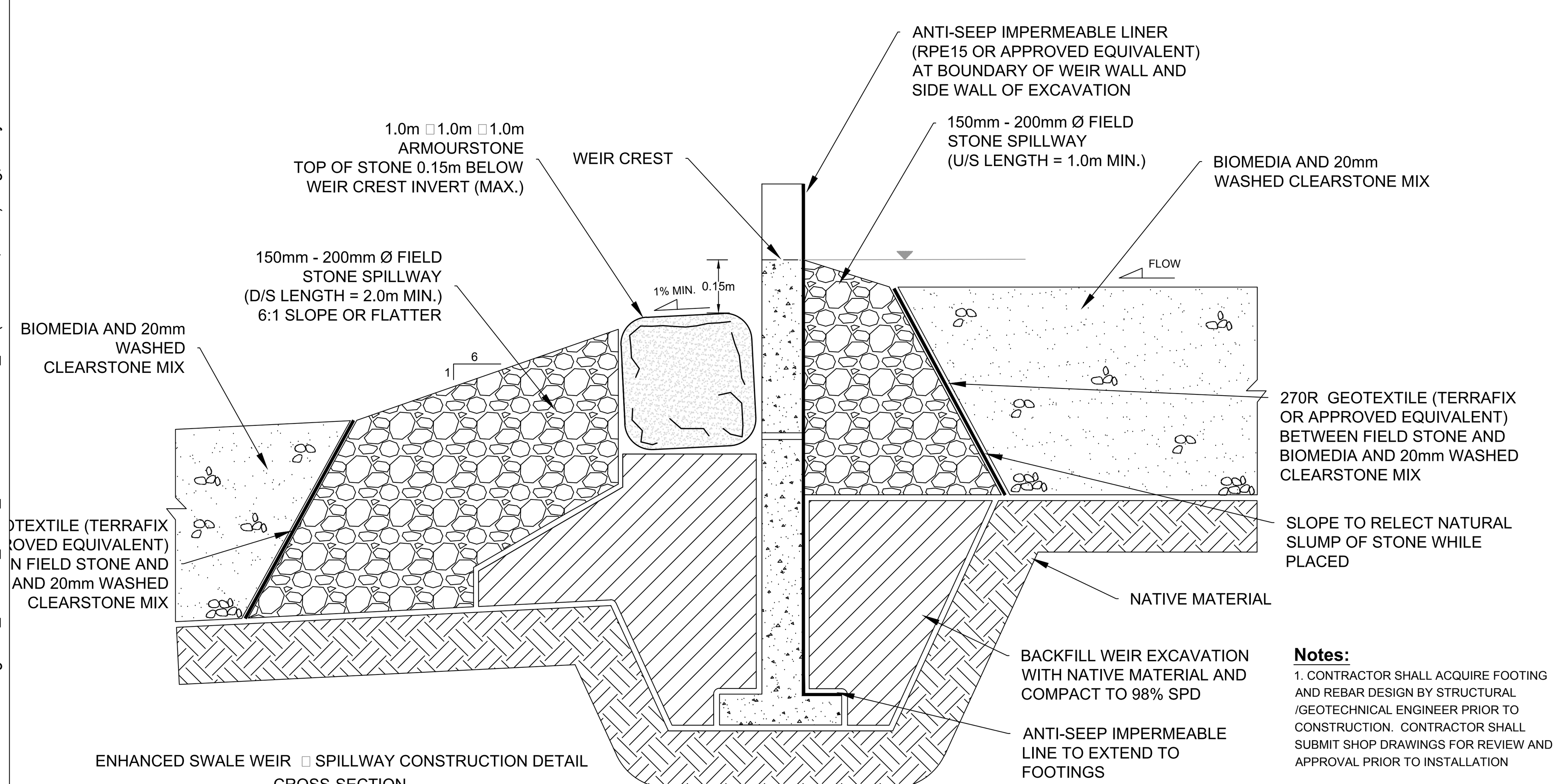


Notes:

1. CONTRACTOR SHALL ACQUIRE FOOTING AND REBAR DESIGN BY STRUCTURAL /GEOTECHNICAL ENGINEER PRIOR TO CONSTRUCTION. CONTRACTOR SHALL SUBMIT SHOP DRAWINGS FOR REVIEW AND APPROVAL PRIOR TO INSTALLATION

ENHANCED SWALE WEIR CONSTRUCTION DETAIL
CROSS-SECTION

DETAIL 3: ENHANCED SWALE AND WEIR CONSTRUCTION DETAILS
N.T.S.



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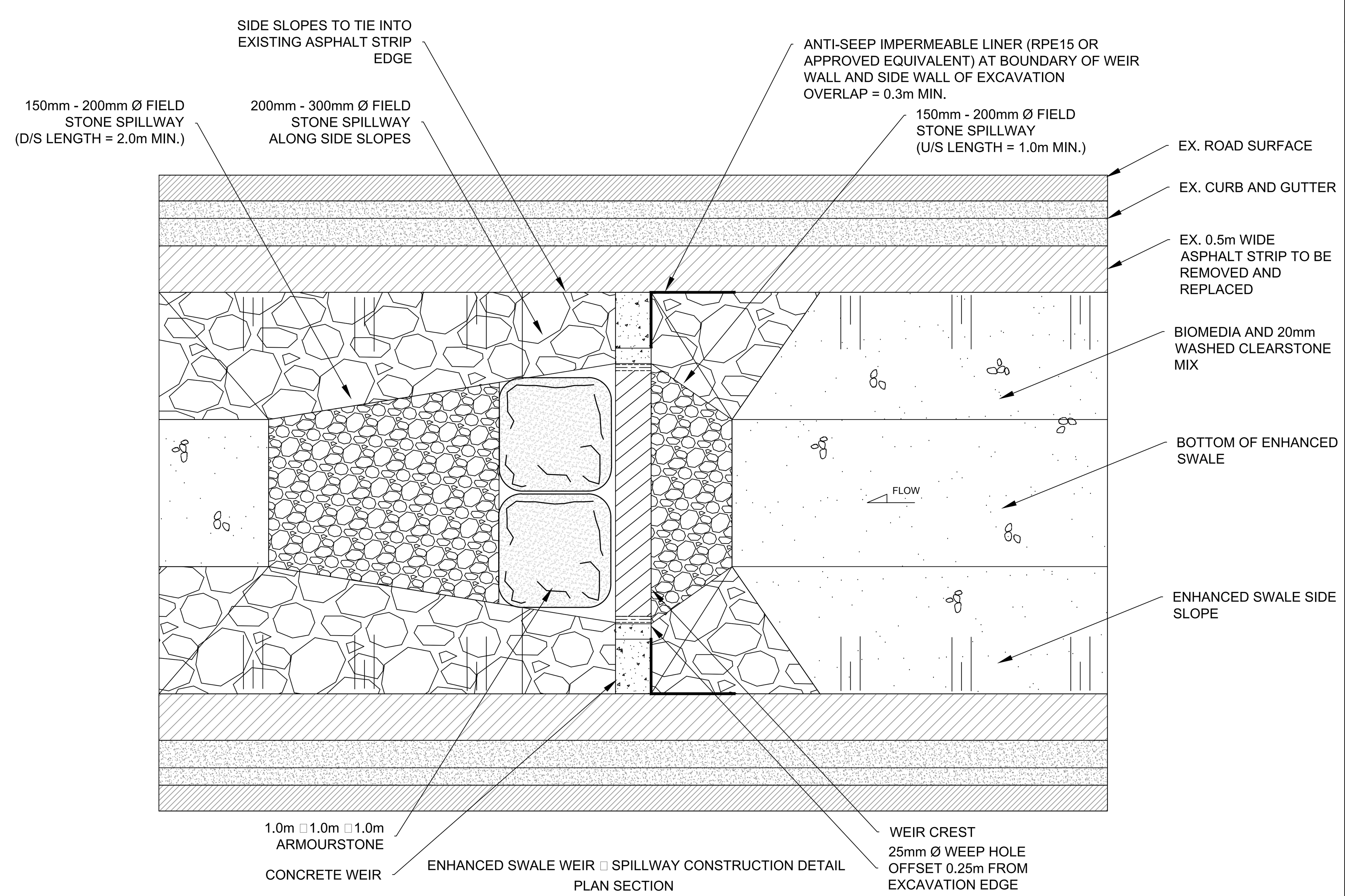
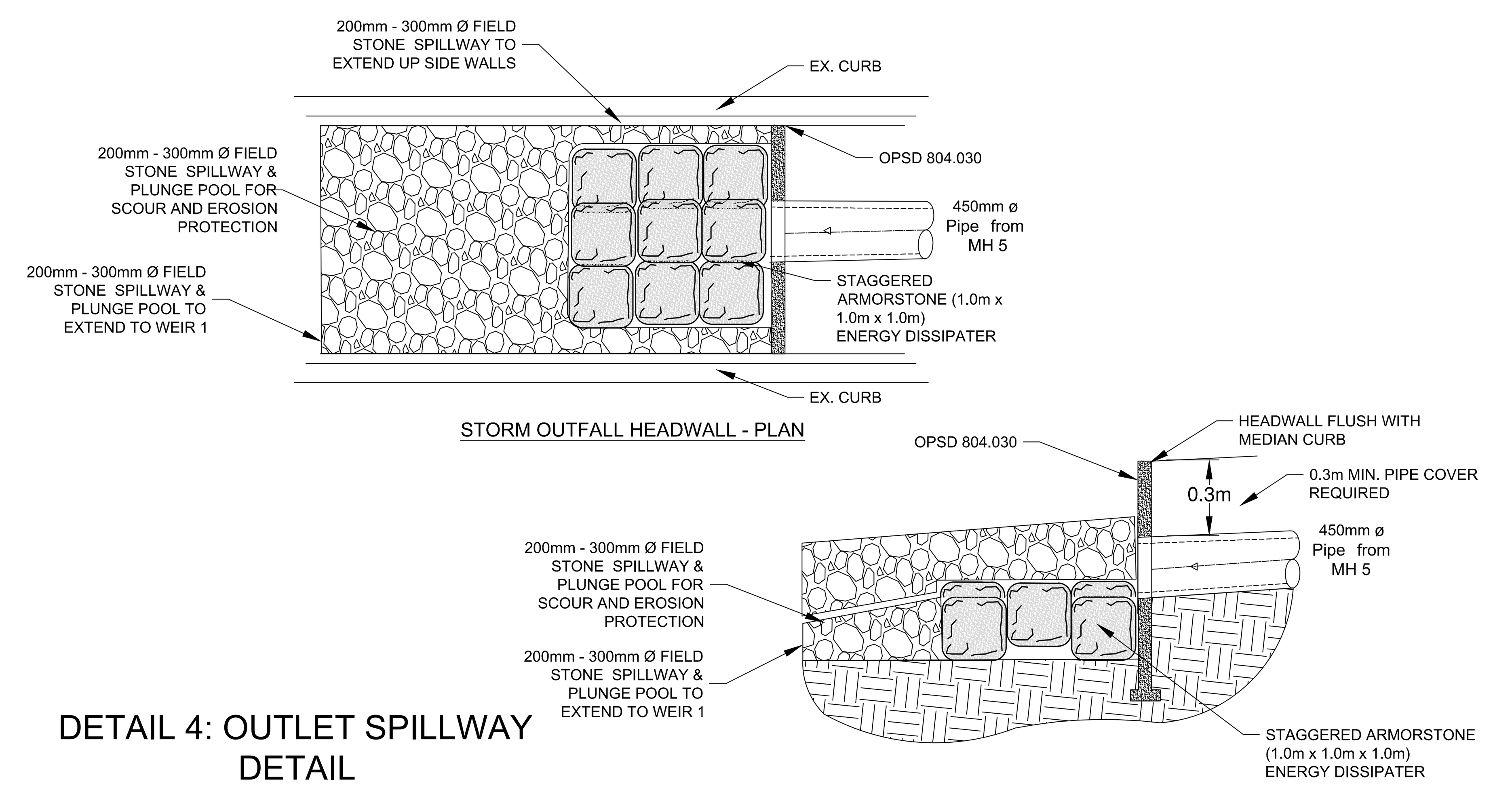
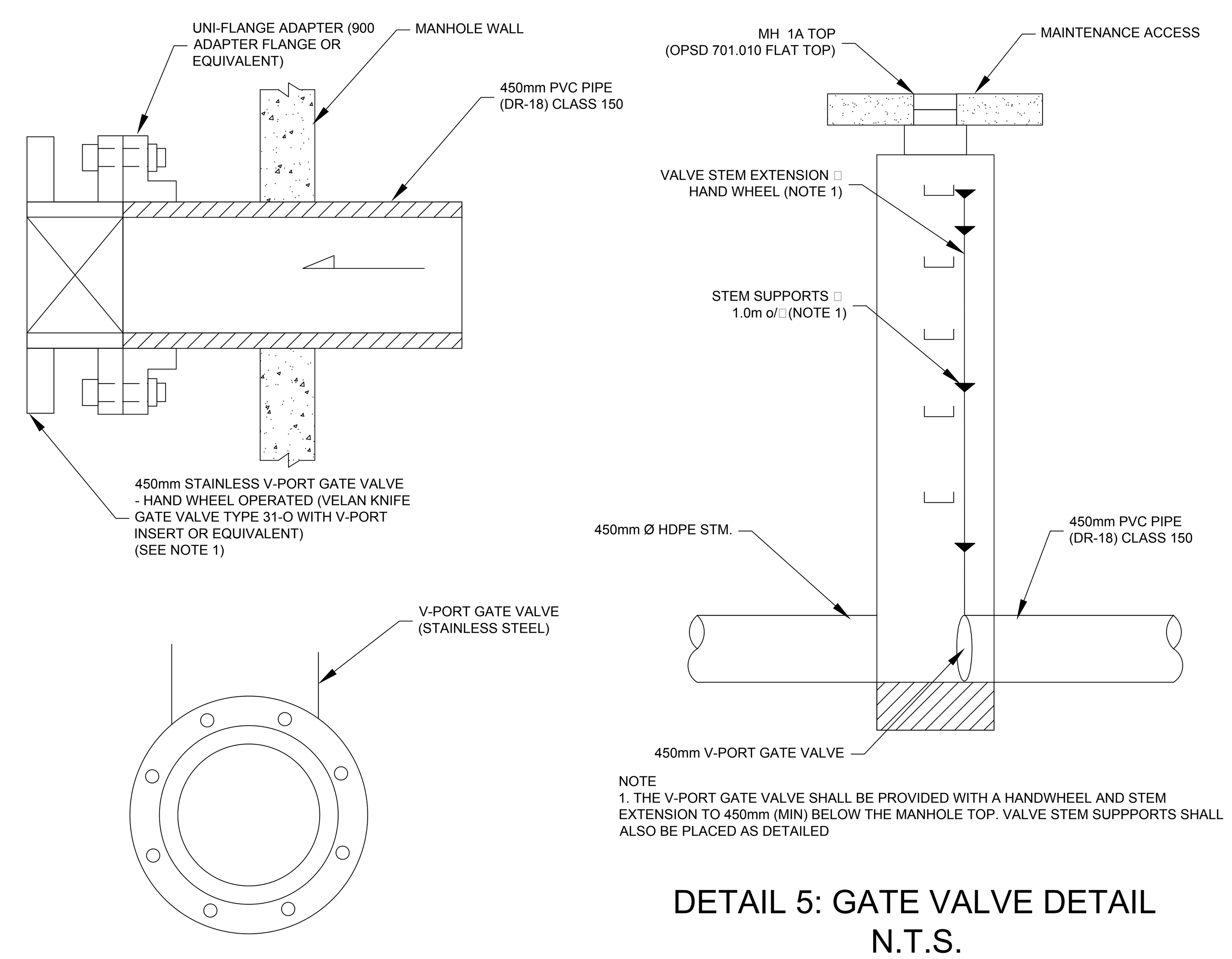
ENHANCED SWALE WEIR SPILLWAY CONSTRUCTION DETAIL
CROSS-SECTION



ENHANCED SWALE WEIR SPILLWAY CONSTRUCTION DETAIL
PLAN SECTION



DETAIL 4: OUTLET SPILLWAY DETAIL
N.T.S.



NOTE
1. THE V-PORT GATE VALVE SHALL BE PROVIDED WITH A HANDWHEEL AND STEM EXTENSION TO 450mm (MIN) BELOW THE MANHOLE TOP. VALVE STEM SUPPPORTS SHALL ALSO BE PLACED AS DETAILED

DETAIL 5: GATE VALVE DETAIL
N.T.S.

SERVICE DATA

SERVICE	DATE	INIT.	SERVICE	DATE	INIT.
SAN SEWERS			GAS MAINS		
STORM SEWERS			BELL U/G CABLE		
WATERMAINS			HYDRO U/G CABLE		
TRANSIT			HYDRO ONE		
PARKS & REC.			CTV		
ONT. CLEAN WATER			COMMUNIC. CABLES		

REVISIONS

DATE	DETAILS	INIT.
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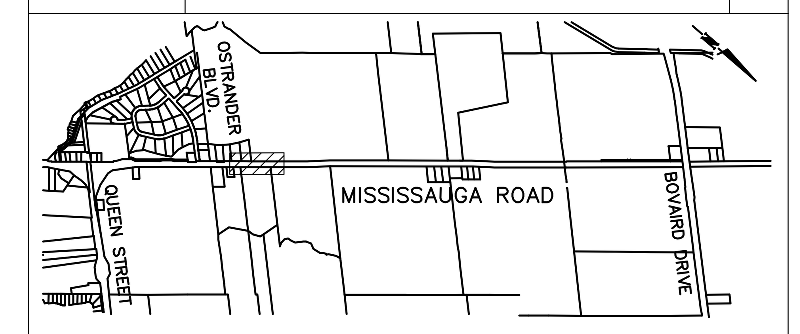
17/02/2015	90% DESIGN SUBMISSION	W.C.



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Designed by ______ Chkd. ______ Approved by ______

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ENBRIDGE INCORPORATED-GAS DISTRIBUTION
ONTARIO MINISTRY OF TRANSPORTATION
ONTARIO CLEAN WATER AGENCY
HYDRO ONE NETWORKS
ENERSOURCE, HYDRO MISSISSAUGA
HYDRO ONE BRAMPTON

CABLE TELEVISION/FIBREOPTIC PROVIDERS:
BELL CANADA
ENERSOURCE TELECOM
HYDRO ONE TELECOM
ROGERS CABLE
ALLSTREAM
PSN (PUBLIC SECTOR NETWORK)
FUTUREWAY (FCI BROADBAND)

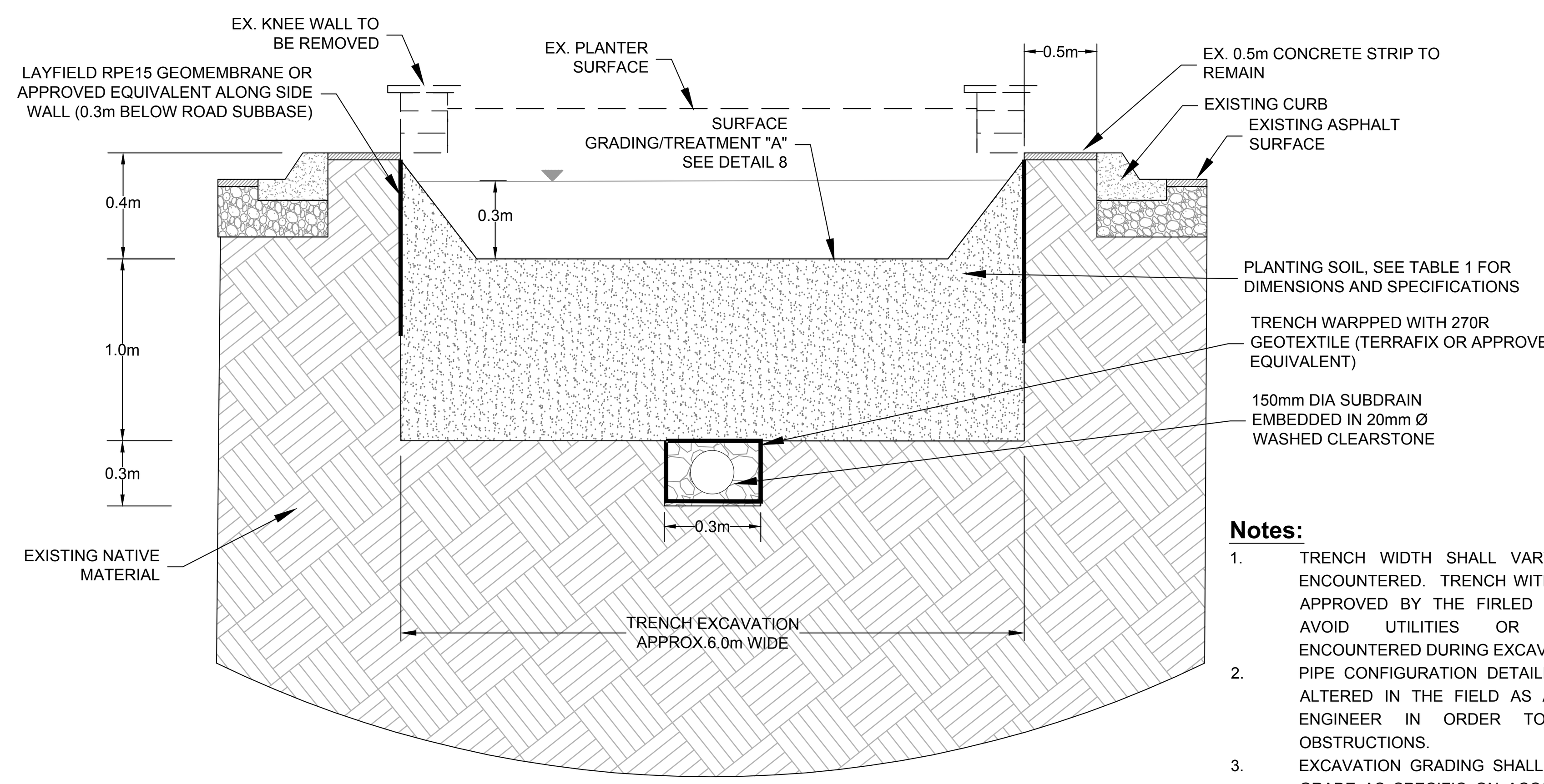
10m 0 10 20 30m HORIZONTAL SCALE
2m 0 2 4 6m VERTICAL SCALE

Region of Peel
Working for you

MISSISSAUGA ROAD

LID CONSTRUCTION DETAILS

CAD Area	Area	Project No.
Checked by	Drawn by HT	
Date 17/02/15	Sheet 5 OF 6	Plan No. LID 5

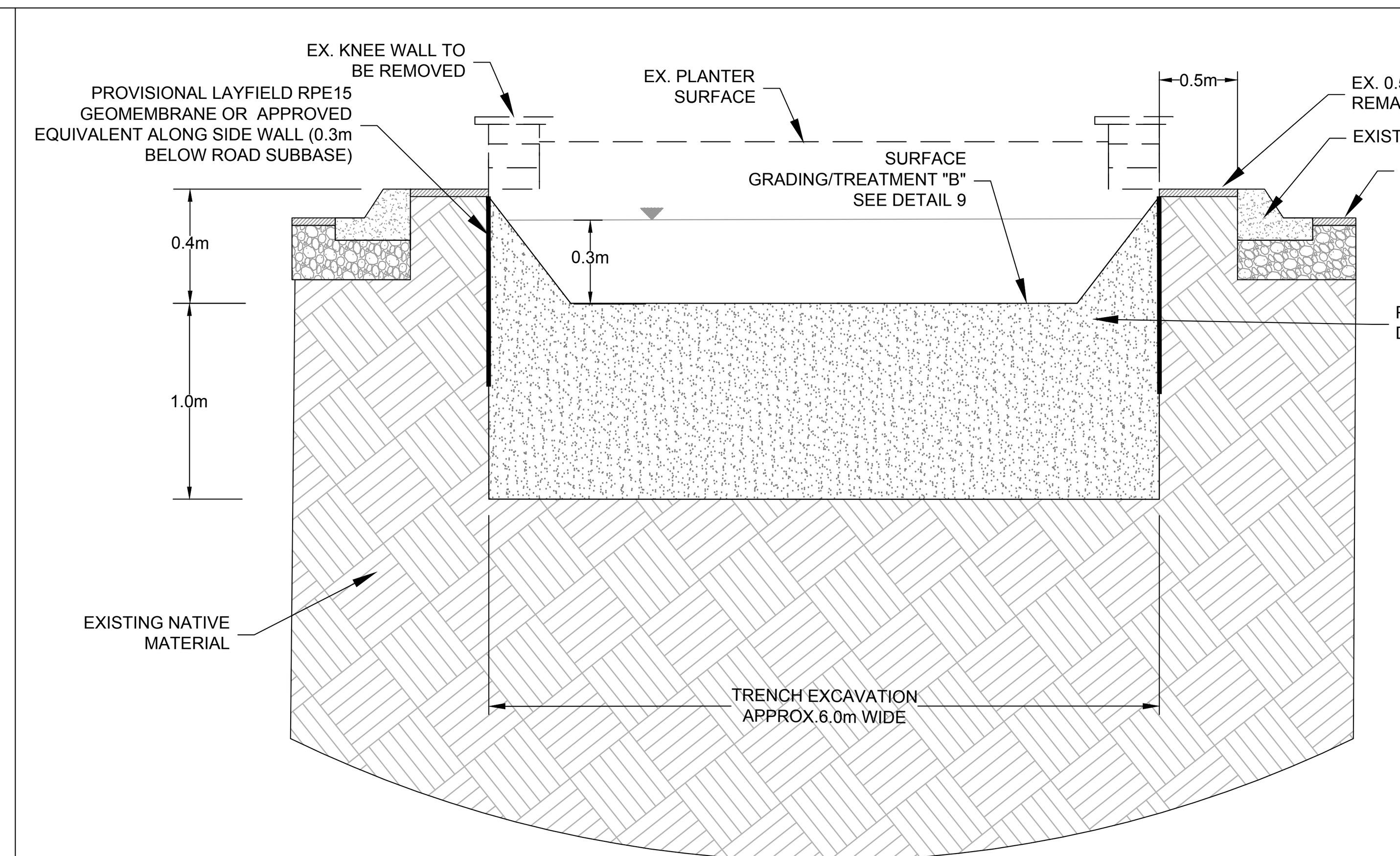


PLANTING BED A: CONSTRUCTION DETAIL
N.T.S.

Notes:

1. TRENCH WIDTH SHALL VARY WHERE UTILITIES ARE ENCOUNTERED. TRENCH WITH MAY BE DECREASED, AS APPROVED BY THE FIRLED ENGINEER, IN ORDER TO AVOID UTILITIES OR OTHER OBSTRUCTION ENCOUNTERED DURING EXCAVATION.
2. PIPE CONFIGURATION DETAILED ON THE PLAN MAY BE ALTERED IN THE FIELD AS APPROVED BY THE FIELD ENGINEER IN ORDER TO AVOID UTILITIES OR OBSTRUCTIONS.
3. EXCAVATION GRADING SHALL FOLLOW EMBEDDED PIPE GRADE AS SPECIFIC ON ACCOMPANYING DATA TABLES. PLANTING SOIL DEPTHS SHALL VARY SUCH THAT SPECIFIED SURFACE GRADING IS ACHIEVED.
4. FINAL GRADING OF PLANTING SOIL SHALL ACCOUNT FOR REQUIRED SURFACE TREATMENTS SUCH THAT SPECIFIED SURFACE GRADING IS ACHIEVED.

DETAIL 6: PLANTING BED "A" DETAIL
N.T.S.



PLANTING BED B: CONSTRUCTION DETAIL
N.T.S.

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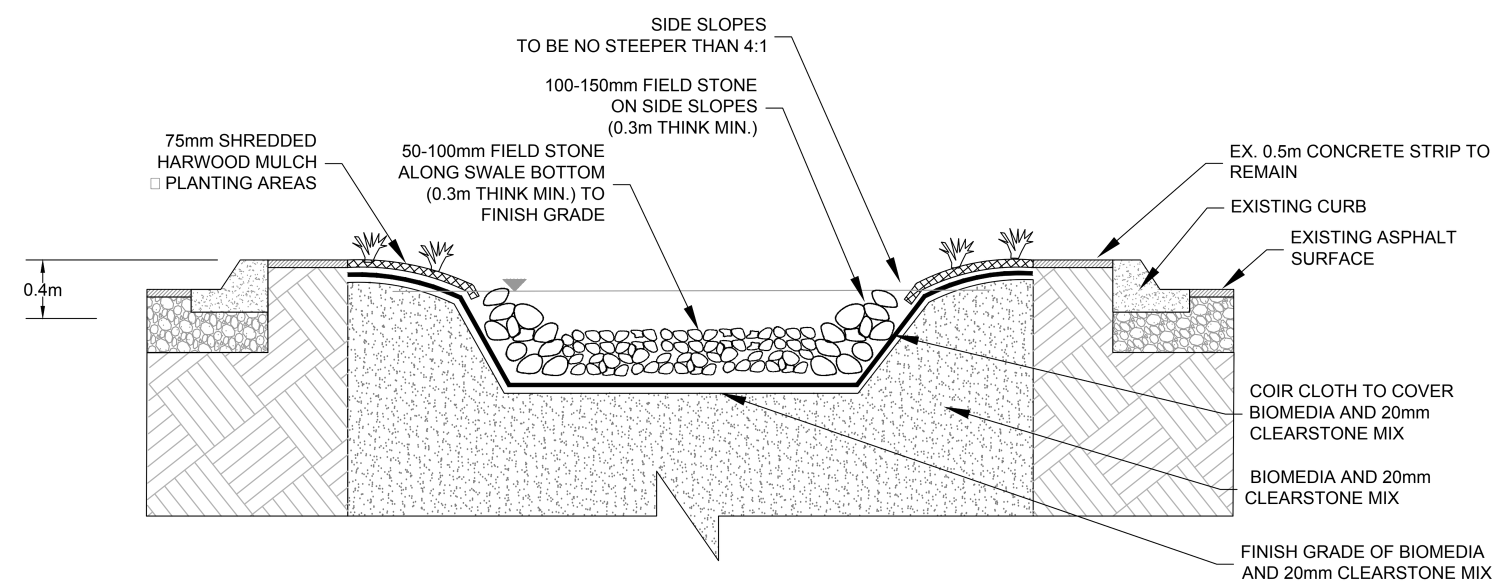
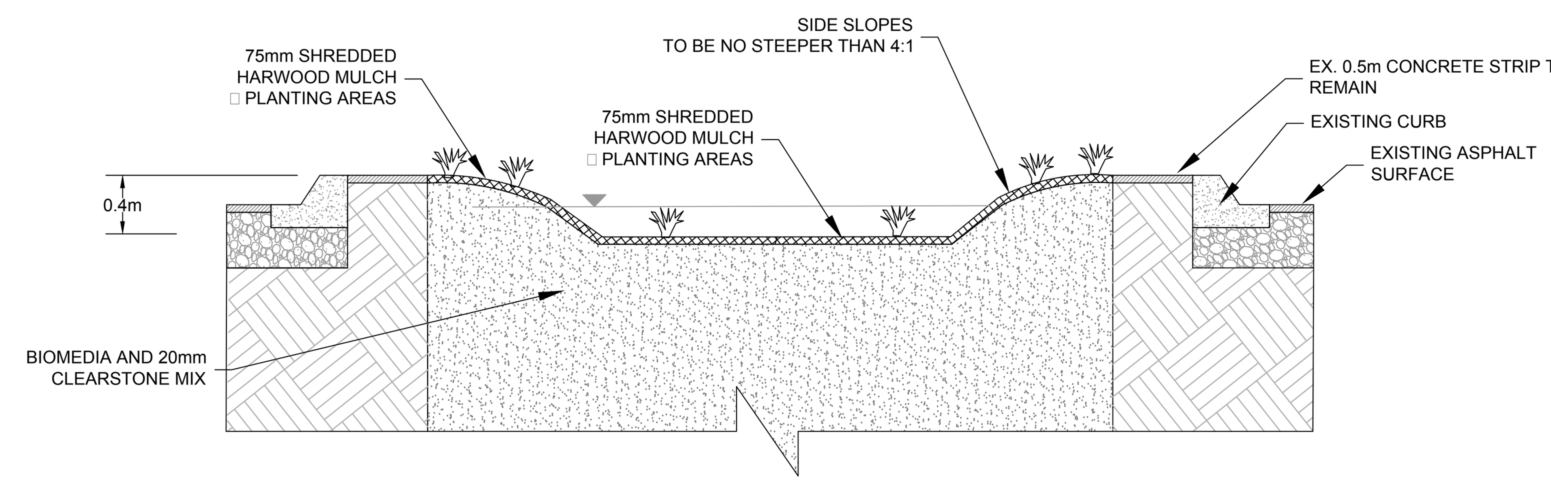
2. SURFACE AND EXCAVATION GRADING SHALL FOLLOW EXISTING CURB PROFILE.
3. FINAL GRADING OF PLANTING SOIL SHALL ACCOUNT FOR REQUIRED SURFACE TREATMENTS SUCH THAT SPECIFIED SURFACE GRADING IS ACHIEVED.

DETAIL 7: PLANTING BED "B" DETAIL
N.T.S.



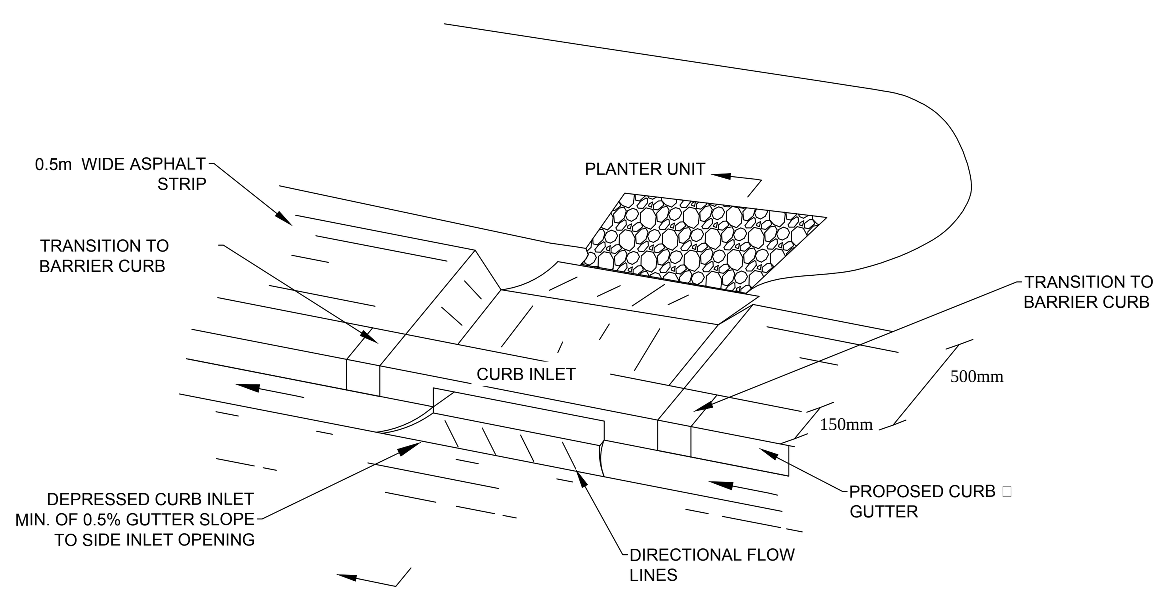
SURFACE TREATMENT "A"
N.T.S.

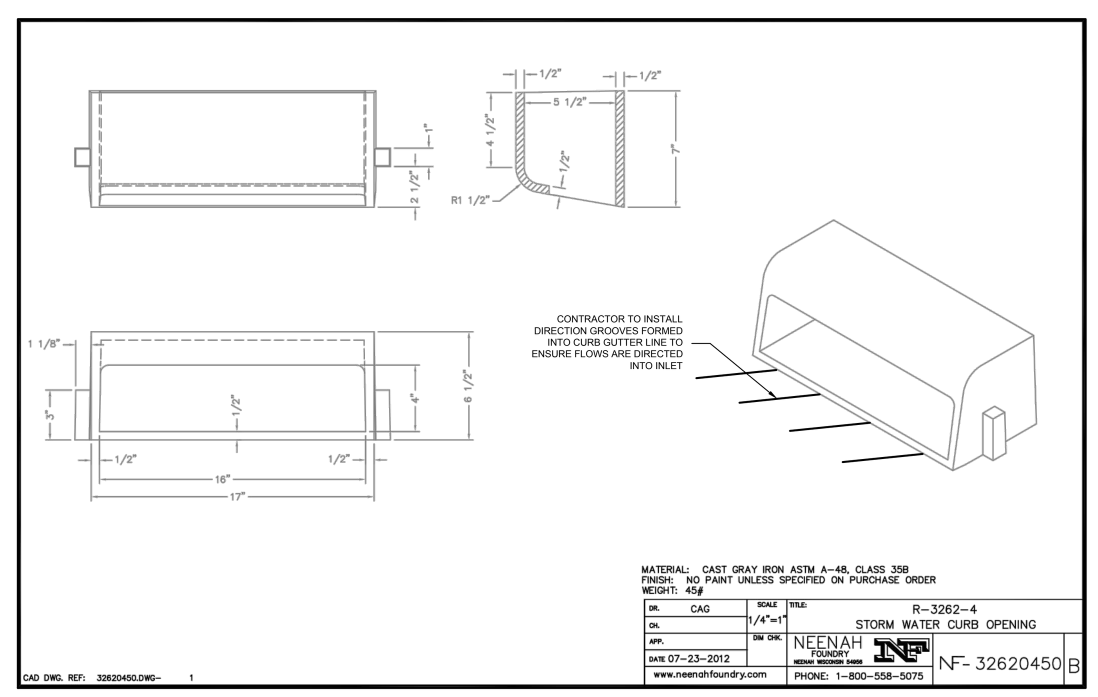
DETAIL 8: SURFACE TREATMENT "A" DETAIL
N.T.S.

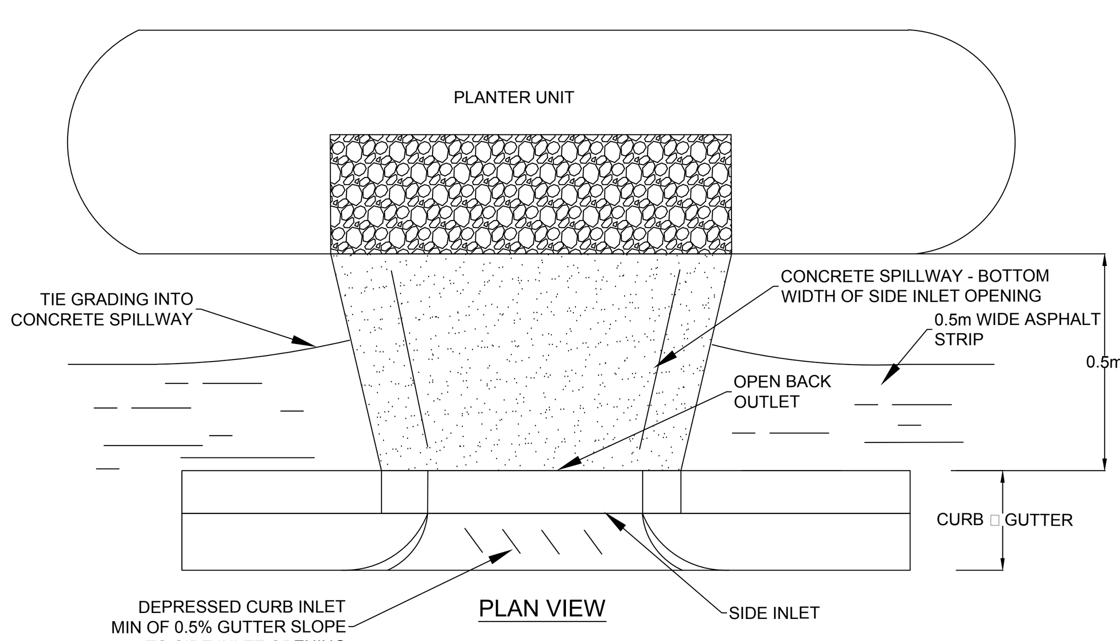


SURFACE TREATMENT "B"
N.T.S.

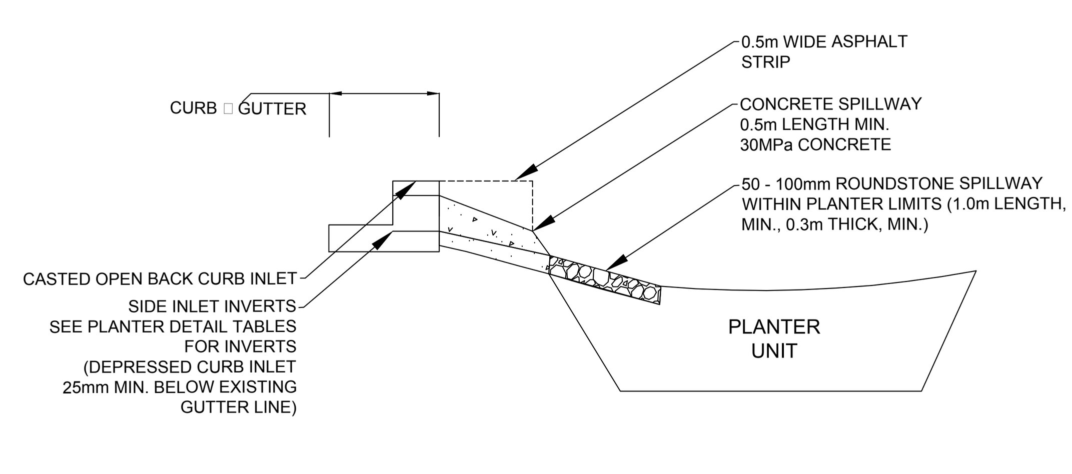
DETAIL 9: SURFACE TREATMENT "B" DETAIL
N.T.S.





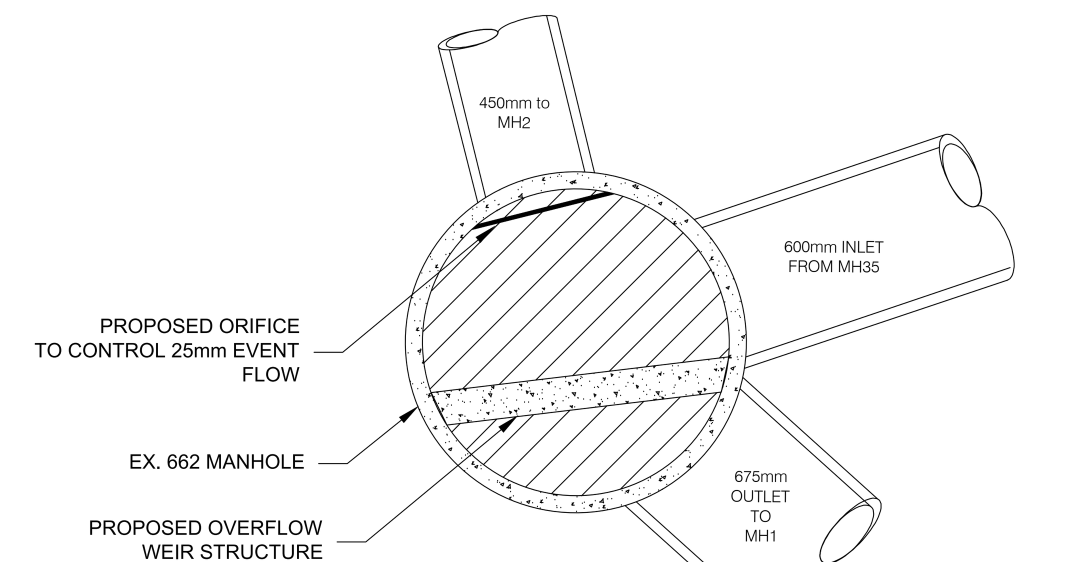


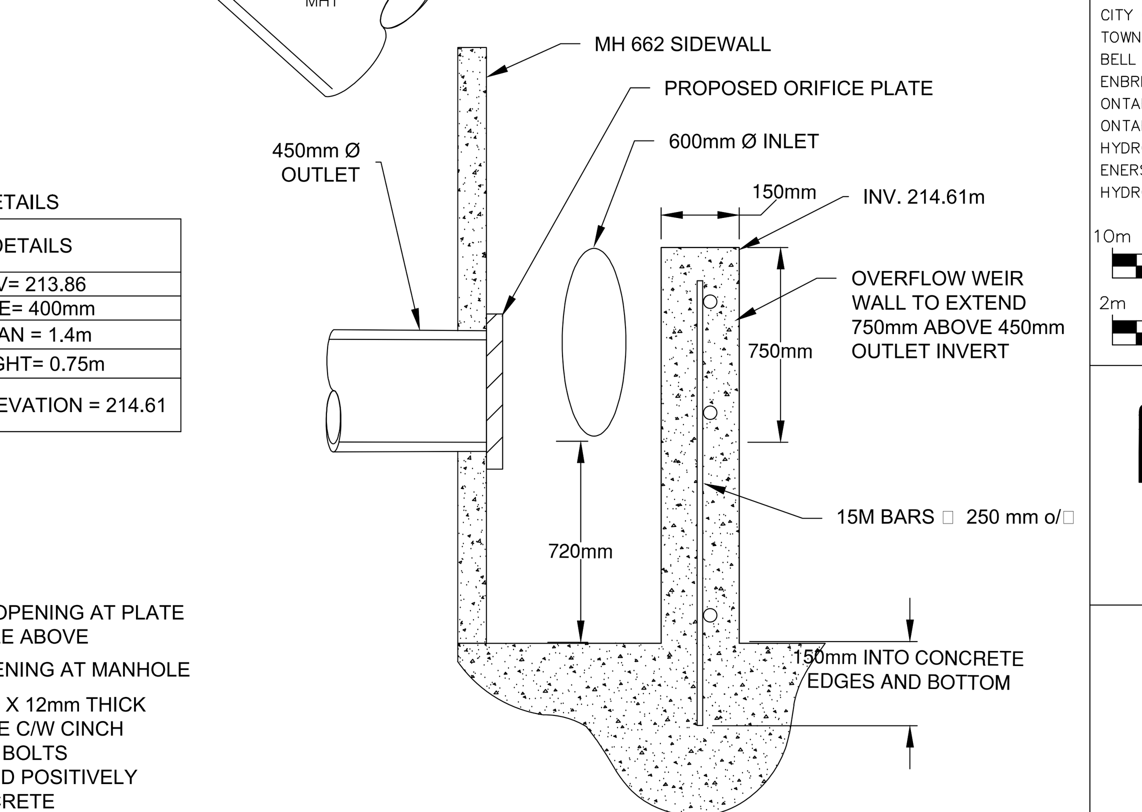
PLAN VIEW



SECTION VIEW

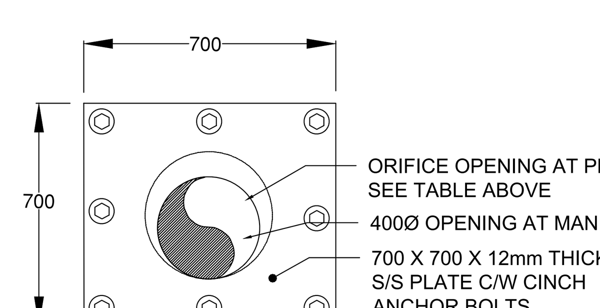
DETAIL 10: SIDE INLET CURB CUT DETAIL
N.T.S.





FLOW CONTROL STRUCTURE DETAILS

FLOW CONTROL	DETAILS
ORIFICE	INV= 213.86 SI E= 400mm
OVERFLOW WEIR	SPAN = 1.4m HEIGHT= 0.75m CREST ELEVATION = 214.61



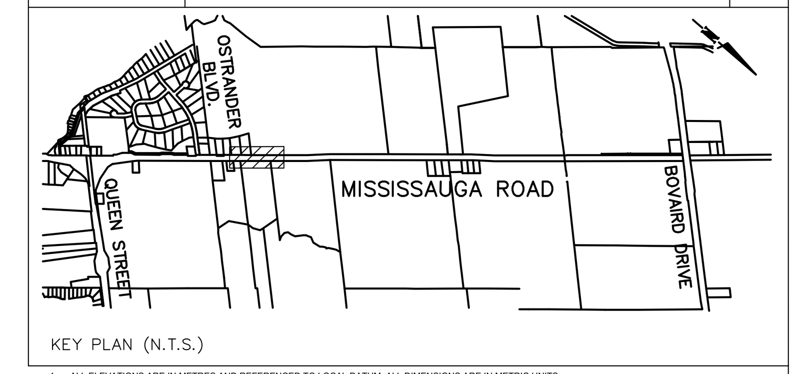
DETAIL 11: FLOW SPLITTER DETAIL (MH662)
N.T.S.

SERVICE DATA

SERVICE	DATE	INIT.	SERVICE	DATE	INIT.
SAN SEWERS			GAS MAINS		
STORM SEWERS			BELL U/G CABLE		
WATERMAINS			HYDRO U/G CABLE		
TRANSIT			HYDRO ONE		
PARKS & REC.			CTV		
ONT. CLEAN WATER			COMMUNIC. CABLES		

REVISIONS

DATE	DETAILS	INIT.
05/12/2014	60% DESIGN SUBMISSION	W.C
17/02/2015	90% DESIGN SUBMISSION	W.C



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B.M. No. Elev.

The Contractor Is Responsible For Locating And Protecting All Existing Utilities Prior To And During Construction Location of Existing Utilities Approximate Only, To Be Verified In Field By Contractor. For final layout approval prior to installation, please contact Tahar Singh at 905-874-2750 ext 2397 or Chris Lafleur ext 2358.

Designed by Chkd. Approved by

Aquafor Beech Limited
#6-202-2600 SKYMARK Ave, MISSISSAUGA, ONTARIO, L4W 5B2
PHONE: (905) 629-0099
FAX: (905) 629-0089
55 REGAL ROAD, UNIT 3 GUELPH, ONTARIO, N1K 1B6
PHONE: (519) 224-3740
FAX: (519) 224-3750

NOTICE TO CONTRACTOR
48 HOURS PRIOR TO COMMENCING WORK NOTIFY THE FOLLOWING

THE REGIONAL MUNICIPALITY OF PEEL	CABLE TELEVISION/FIBREOPTIC PROVIDERS:
CITY OF MISSISSAUGA WORKS DEPT.	BELL CANADA
CITY OF BRAMPTON WORKS DEPT.	ENERSOURCE TELECOM
TOWN OF CALEDON WORKS DEPT.	HYDRO ONE TELECOM
BELL CANADA	ROGERS CABLE
ENBRIDGE INCORPORATED-GAS DISTRIBUTION	ALLSTREAM
ONTARIO MINISTRY OF TRANSPORTATION	PSN (PUBLIC SECTOR NETWORK)
ONTARIO CLEAN WATER AGENCY	FUTUREWAY (FCI BROADBAND)
HYDRO ONE NETWORKS	
ENERSOURCE, HYDRO MISSISSAUGA	
HYDRO ONE BRAMPTON	

10m 0 10 20 30m HORIZONTAL SCALE
2m 0 2 4 6m VERTICAL SCALE

Region of Peel
Working for you

MISSISSAUGA ROAD
(FROM QUEEN STREET TO BOVAIRD DRIVE)
L.I.D – CONSTRUCTION DETAILS
STA. 10+700 TO STA. 10+980

CAD Area	Area	Project No.
Checked by	Drawn by HT	
Date 17/02/15	Sheet 6 OF 6	Plan No. LID 6

Hydrogeological Study

Mississauga Road Improvements Project

Between West Brampton Pumping Station & Reservoir and Bovaird Drive,

Brampton, Ontario

Prepared for

The Municipal Infrastructure Group Ltd.

Submitted by

AES International Environmental Consultants Inc.

November 2010

The Peel Plain consists of level to undulating clay soils that slope towards Lake Ontario. The Peel Plain is composed of till containing large amounts of shale and limestone. Areas of the Peel Plain are underlain by clay, which is occasionally observed to be varved. Various Rivers (Credit, Humber, Don and Rouge) have cut deep valleys throughout the Plain and sandy alluvium is occasionally found adjacent to these valleys at some locations.

3.3 Geology

3.3.1 Prior Investigations

A number of investigations have been completed along Mississauga Road between Queen Street and Bovaird Drive. These include geotechnical investigations completed by Trow Associates Inc. (2005), Geo-Canada Ltd. (2005) and Alston Associates Inc. (2009a, 2009b and 2010). The investigations involved the advancement of boreholes and/or coreholes, and insitu and laboratory testing. The borehole logs (locations shown Figure 2) provide a useful profile of the geology encountered in the subsurface (Figure 3). The reports produced by Trow Associates Inc. (2005) and Geo-Canada Ltd. (2005) also include the results of chemical analyses undertaken on soil samples collected along the alignment.

The regional bedrock consists of Upper Ordovician aged shale of the Queenston Formation. This unit has a distinctive reddish brown colour, and is described as slightly to non-calcareous, sparsely fossiliferous and may contain interbeds of limestone and siltstone. The overburden is dominated by the Halton Till, a fine-textured diamicton with incorporated lacustrine sediments. The Halton Till is commonly stiff to hard in consistency, but near surface weathering can result in it being degraded to a soft or firm consistency. The till contains cobbles and boulders. Lenses and pockets of silt, sand and gravel are common throughout the unit. The contact with the underlying shale is frequently described in logs as a shaly clay or weathered shale.

A discussion of the results and findings contained in the geotechnical investigations completed in the Study Area follows:

Preliminary Geotechnical Investigation (2005): Thirteen (13) shallow boreholes were advanced along Mississauga Road during work completed for a Preliminary Geotechnical Investigation by Trow Associates Inc. 2005. Four of the boreholes (BH10 through BH13) are located in the Study area. The boreholes ranged from 1.8 to 2.3 m in depth and encountered fill materials (asphalt, granular base and clayey silt) ranging in thickness from 0.9 to 2.1 m. Buried asphalt was noted at BH11 and BH12. Borehole BH13 (northern-most) encountered clayey silt till, trace gravel under the fill at a depth of 1.2 m.

Fill samples were collected from BH10 and BH13 and submitted for analysis of parameters for Part XV.1 of the EPA. The chemistry (general and inorganic) met the Table 3 standards, with the exception of the EC and SAR (sodium absorption ratio). This may be related to salt de-icing use on the roadway.

Geotechnical Investigation – 1200mm and 750mm Feedermains (2005): Geo-Canada Ltd. undertook a geotechnical investigation on behalf of KMK Consultants Limited, between Bovaird Drive and Queen Street. The work involved advancing eight (8) shallow boreholes along the shoulder of Mississauga Road to depths between 6.1 m and 7.6 m. Piezometers were installed in four of the boreholes. Selected soil samples were submitted for chemical analysis.

Four of the boreholes BH1 (northern-most), BH2, BH3 and BH3a (southern-most) are located in the Study Area. Boreholes BH1 and BH3 were competed with piezometers. Summary information on the boreholes follows:

Borehole No.	Approximate Location	Surface Elevation mASL	Stratigraphy	Bedrock Elevation mASL
1	Sta. 12+915	235.8	0.0 to 0.9 m Medium to fine sand fill 0.9 to 2.3 m Mixed fill (silt clay) 2.3 to 3.7 m Silt clay with sand 3.7 to 4.7 m Clay till, weathered shale 4.7 to 6.1 m Shale	231.1
2	Sta. 12+630	233.5	0.0 to 0.6 m asphalt, granular A, sand fill 0.6 to 3.4 m Mixed fill (silt clay) 3.4 to 3.7 m Clay till, weathered shale 3.7 to 6.1 m Shale	229.8
3	Sta.12+190	236.5	0.0 to 0.6 m Granular A 0.6 to 1.5 m Mixed fill (silt clay) 1.5 to 2.9 m Fine to medium sand (fill?) 2.9 to 7.6 m Fine sand some silt 7.6 to 7.8 m Shale	228.9
3a	Sta. 11+880	239.9	0.0 to 0.4 m Asphalt and Granular A 0.4 to 1.7 m Mixed fill (silt clay) 1.7 to 2.1 m Silty fine sand 2.1 to 3.0 m Fine sandy silt 3.0 to 4.9 m Sand 4.9 to 6.6 m Fine sand, some silt	n/a

Groundwater was observed in BH1 and BH3 at about 234 mASL August 2005).

Soil samples were collected from BH1 and BH 2 and submitted for analysis of parameters for Part XV.1 of the EPA. The chemistry (general and inorganic) met the Table 2 through Table 5 standards, with the exception of the sodium absorption ratio (SAR). The elevated SAR is may be related to salt de-icing use on the roadway.

BH1 was advanced in the general vicinity of the service station located at the southwest corner of the intersection of Bovaird Drive and Mississauga Road. The soil sample collected from BH1 at a depth of about 2.3 m exhibited a gasoline odour. Toluene was detected at a concentration of 0.23 mg/L.

Geotechnical Investigation – Roads Improvements (2009): Nineteen (19) boreholes were advanced along Mississauga Road between Queen Street and Bovaird Drive during work completed for a Geotechnical Investigation by Alston Associates (Alston) in 2009. The boreholes were advanced along Mississauga Road and ranged from 2.7 m to 7.7 m in depth.

Eight of the boreholes (BH111 through BH118) are along the Mississauga Road in the study area. Boreholes BH112, BH114, BH 116 and BH117, were completed with standpipes. A summary of the borehole data follows.

Borehole No.	Approximate Location	Surface Elevation mASL	Stratigraphy	Bedrock Elevation mASL
111	Sta. 11+810	238.9	0.0 to 0.8 m Asphalt and granular fill 0.8 to 0.9 m Silt clay with sand, gravel 0.9 to 2.8 m Silt and fine sand 2.8 to 5.0 m Sand some silt	n/a
112	Sta. 12+054	238.3	0.0 to 0.8 m Granular fill 0.8 to 1.6 m Mixed fill (silt clay) 1.6 to 2.1 m Silty clay with sand, gravel 2.1 to 3.7 m Silty sand 3.7 to 7.8 m Med.to coarse sand & gravel 7.8 to 9.2 m Shaly clay to weathered shale	230.5
113	Sta. 12+282	235.9	0.0 to 0.8 m Granular fill 0.8 to 1.4 m Mixed fill (silt clay) 1.4 to 6.6 m Fine sand trace silt	n/a
114	Sta. 12+400	234.3	0.0 to 0.6 m Granular fill 0.6 to 1.4 m Mixed fill (silt clay) 1.4 to 2.2 m Sandy silty clay, with silt 2.2 to 3.0 m Silt and fine sand 3.0 to 3.3 m Coarse sand & gravel 3.3 to 4.1 m Sand some gravel 4.1 to 5.4 m Silty clay to sandy, trace gravel 5.4 to 6.3 m Shaly clay	228.9
115	Sta. 12+571	233.2	0.0 to 0.2 m Asphalt and granular fill 0.2 to 1.5 m Mixed fill (silt clay) 1.5 to 2.2 m Sandy silty clay, trace gravel 4.7 to 5.0 m Silty sand, trace gravel/clay	n/a
116	Sta. 12+706	233.7	0.0 to 1.1 m Granular fill 1.1 to 2.2 m Mixed fill (silt clay) 2.2 to 4.4 m Silty sand, trace clay/gravel 4.4 to 6.1 m Shaly clay and weathered shale	229.3
117	Sta. 12+812	235.0	0.0 to 0.7 m Granular fill 0.7 to 1.5 m Mixed fill (silt clay) 1.5 to 3.0 m Sandy, silty clay trace gravel 3.0 to 5.7 m Sandy silt to silty sand 5.7 to 6.1 m Weathered Shale	229.4
118	Sta. 11+917	235.6	0.0 to 0.6 m Granular fill 0.6 to 2.4 m Mixed fill (silt clay) 2.4 to 3.7 m Silty sand trace gravel/shale 3.7 to 4.6 m Shaley clay to weathered Shale	232

The native soils encountered were generally composed of silty clay or silty sand to sandy silt, with a trace of gravel and clay. This material is likely Halton Till. Most of the native soil north of BH114 is likely till. Medium to coarse sand and gravel layers, encountered at BH112 and BH114, are 4.2 and 0.7 m thick, respectively. As indicated above, the shale bedrock was encountered between an elevation of 232 mASL and 228.5 mASL.

The water table, measured shortly after borehole completion (February 2009), was encountered at 232.1 mASL (BH117), 232.2 mASL (BH116), 232.8 mASL (BH114) and 235.9 mASL (BH112).

Geotechnical Investigation, Proposed Sanitary Sewer (2009a and 2010): Twelve (12) deep bedrock boreholes were advanced along Mississauga Road as part of a geotechnical investigation for deep sewer installation by Alston in July 2009. The boreholes were advanced along Mississauga Road between Queen Street and Bovaird Drive and ranged in depth from 29 to 44 mBGS.

Five of the boreholes (BH207 through BH211) were completed along Mississauga Road in the Study Area. The borehole logs are summarized below:

Borehole No.	Approximate Location	Surface Elevation mASL	Stratigraphy	Bedrock Elevation mASL
207	Sta. 11+945	239.3	0.0 to 1.4 m Silty sand, trace gravel (fill?) 1.4 to 2.2 m Silty clay, trace sand, gravel 2.2 to 8.7 m Fine sand, trace silt 8.7 to 10.7 m medium to coarse sand 10.7 to 44.1 m Shale	228.5
208	Sta. 12+175	236.4	0.0 to 0.7 m Granular fill 0.7 to 1.3 m Fill silty clay, trace sand/gravel 1.3 to 2.8 m Silt 2.8 to 3.6 m Sand, trace silt, gravel 3.6 to 7.9 m Medium to coarse sand, gravel 7.9 to 42.8 m Shale	228.5
209	Sta. 12+470	233.6	0.0 to 0.7 m Granular fill 0.7 to 1.6 m Fill silty clay, trace sand/gravel 1.6 to 2.3 m Silty clay 2.3 to 4.5 m Sandy silt to silty sand 4.5 to 7.7 m Sandy silt, trace gravel 7.7 to 37.8 m Shale	225.9
210	Sta. 12+730	234.2	0.0 to 0.7 m Granular fill 0.7 to 1.5 m Fill silty sand, clay, trace gravel 1.5 to 2.2 m Granular fill 2.2 to 6.1 m Sandy silt, trace gravel 6.1 to 37.0 m Shale	228.1
211	Sta. 13+020	237.6	0.0 to 0.3 m Topsoil 0.3 to 2.8 m Silt fine sand 2.8 to 6.4 m Sandy silt, trace gravel 6.4 to 39.9 m Shale	231.3

The overburden encountered ranged from 6.1 m (BH210) to 10.7 m (BH 207) in thickness. Between 2 m and 4.5 m of medium to coarse sand and gravel was observed in Boreholes BH 207 and BH208. Layers of sandy silt to silty sand were observed in all the boreholes. The bedrock encountered at all locations was the Queenston Formation and the overburden/bedrock contact was gradational, changing from hard silty clay to weathered shale. From the borehole logs the Queenston Formation is described as a moderately to highly weathered horizontally bedded, red shale with occasional limestone seams. All the boreholes terminated in the Queenston Formation. Although specific information is not provided in the logs, the water table was observed to be at a depth of 1.5 m to 3 m below the ground surface.

3.3.2 Current Investigation

The three boreholes (BH1-10, BH2-10 and BH3-10) advanced as part of this investigation, varied from 5.5 m to 8.9 m in depth and were terminated in hard red shaly clay, interpreted to be the top of the weathered bedrock. Fill material was observed at all three locations and was thickest at BH2-10 (~1.5 m). The native overburden observed at BH1-10 and BH2-10 was similar, and consisted of silty clay and silt and fine sand, underlain by hard shaly clay. The silt and fine sand layer observed at BH2-10 is about 2 m thick. The native overburden at BH3-10 consisted of silty clay and silty sand underlain by a 4.8 m thick layer of gravelly sand to sand and gravel. A more detailed description of the geology is presented in the borehole logs in Appendix C.

3.3.3 Summary Observations

Figure 3, is a cross section extending along Mississauga Road between the WBPSR and Bovaird Drive. The surficial deposits are classified as either fill materials, fine textured deposits (clays, silts and fine sand) or coarse textured deposits (coarse sands and gravels). As illustrated, the majority of the native surficial materials are fine textured. Coarse textured deposits were identified in two areas in the southern portion of the study area, the largest deposit occurring between BH3-10 (Sta. 12+060) and BH208 (Sta. 12+180). Although the lateral extent of this deposit is not known, it may extend about 350 m eastward to Huttonville Creek, where sand overburden associated with groundwater discharge conditions, are known to occur along the creek channel.

A second, thin pocket of medium to coarse sand and gravel was observed at BH114 (Sta. 12+400). This unit appears to be of limited extent along the alignment as it was not observed in other boreholes in the area.

The overburden north of BH115 (Sta. 12+571m) consists of compact to dense, silty clay to silty sand, with traces of gravel. This material is most likely till.

Shale bedrock was encountered between an elevation of 232 mASL and 225.9 mASL in the Study Area. The bedrock surface is weathered.

LEGEND

SURFACE WATER FEATURES

CONTOURS (5 m)

BH1-10 APPROXIMATE LOCATION OF BOREHOLE AND MONITORING WELL INSTALLED BY AES (2010)

MP1-10 APPROXIMATE LOCATION OF MINI-PIEZOMETER INSTALLED BY AES (2010)

BH114 APPROXIMATE LOCATION OF BOREHOLE AND MONITORING WELL INSTALLED BY ALSTON ASSOCIATES INC. (2010)

BH117 APPROXIMATE LOCATION OF BOREHOLE ADVANCED BY ALSTON ASSOCIATES INC. (2009)

BH1 APPROXIMATE LOCATION OF BOREHOLE ADVANCED BY KMK CONSULTANTS LTD. (2005)

SW1 APPROXIMATE LOCATION OF SURFACE WATER SPOT FLOW MEASUREMENT BY AES (18-AUG-10)

NOTES:
1. ORTHOPHOTO PROVIDED BY THE MUNICIPAL INFRASTRUCTURE GROUP LTD. (2010).
2.BASE MAPPING PROVIDED BY ONTARIO BASE MAPPING, GOVERNMENT OF ONTARIO (2010).
3. BOREHOLES 116, 117 AND 119 INSTALLED BY ALSTON ASSOCIATES INC. IN 2009 WERE INSTRUMENTED WITH MONITORING WELLS.
4. BOREHOLES BH1, BH3, BH4 AND BH6 INSTALLED BY KMK CONSULTANTS LTD. (2005) WERE INSTRUMENTED WITH MONITORING WELLS, HOWEVER WERE NOT LOCATED IN THE FIELD.

1:4,000
SCALE

aesinternational

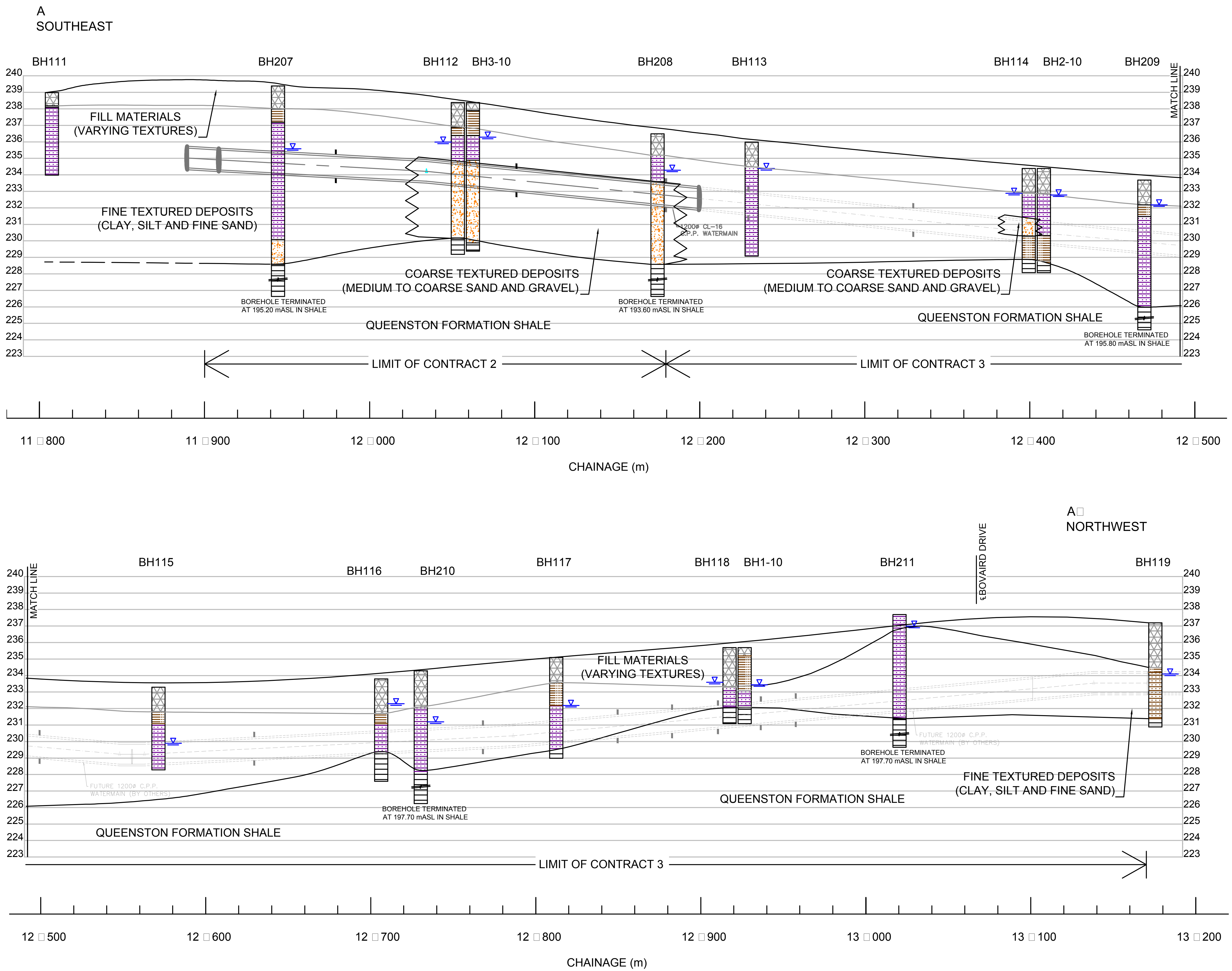
THE MUNICIPAL INFRASTRUCTURE GROUP LTD.
MISSISSAUGA ROAD HYDROGEOLOGIC STUDY

STUDY AREA PLAN

PROJECT NUMBER	FIGURE NUMBER
J00042	2
	ISSUE/REVISION

B SIZE 279 x 432 mm

FILE: J00042_PLAN_F02.dwg DATE PLOTTED: 19-Nov-10 DRAWN BY: TFB



LEGEND

WATER LEVEL ELEVATION AT TIME OF DRILLING

STUDY AREA

MEDIUM TO COARSE SAND AND GRAVEL

TILL (SANDY SILT, TRACE GRAVEL)

FINE SAND, SANDY SILT, SILT

QUEENSTON FORMATION SHALE

FILL

KEY PLAN, N.T.S.

DRAFT

NOTES:
1. STRATIGRAPHY AND SURVEY DATA BY OTHERS.
2. CROSS SECTION PRODUCED FROM DATA BY OTHERS.
3. EXISTING AND PROPOSED WATERMAIN ALIGNMENT, EXISTING UTILITIES AND CULVERTS FROM THE MUNICIPAL INFRASTRUCTURE GROUP INC. (2010).
4. ELEVATIONS IN METERS ABOVE SEA LEVEL (mASL).

AS NOTED.
SCALE

aesinternational

THE MUNICIPAL INFRASTRUCTURE GROUP LTD.
MISSISSAUGA ROAD
HYDROGEOLOGIC STUDY
CONCEPTUAL CROSS SECTION
SOUTHEAST TO NORTHWEST ALONG
MISSISSAUGA ROAD

PROJECT NUMBER	FIGURE NUMBER	
J00042	3	
	ISSUE/REVISION	D

FILE: J00042 X-SEC F03.dwg DATE PLOTTED: 19-Nov-10 DRAWN BY: TFB

B SIZE 279 x 432 mm

Wood Environment & Infrastructure Solutions
a Division of Wood Canada Limited
3450 Harvester Road, Suite 100
Burlington, ON L7N 3W5, Canada
T: 905-335-2353
www.woodplc.com

January 10, 2019
Our File: TP115085
Your File: EA 01-06-05

Ministry of the Environment, Conservation and Parks
Central Region
5775 Yonge Street, 8th Floor
North York, ON M2M 4J1

Attention: Trevor Bell, Regional Environmental Assessment Coordinator

Dear Mr. Bell:

Re: Mississauga Road from Queen Street West to Bovaird Drive West
Region of Peel
Schedule C Municipal Class Environmental Assessment
Draft Addendum to the Environmental Study Report, October 2018

Wood is pleased to provide the following responses to the comments received from the Ministry of the Environment, Conservation and Parks (MECP) on November 16, 2018 via email. The following provides the original comment followed by our response:

First paragraph of MECP letter

"We understand that the draft Addendum addresses the change in the preferred solution from the 2016 Environmental Study Report to widen the section of Mississauga Road from Queen Street West to Bovaird Drive West from four to six lanes."

Response: *Please note that the Addendum report addresses the change to the preferred solution from the 2006 Environmental Study Report.*

Air Quality Comments

1. Air quality assessments typically use five years of meteorological data to account for varying meteorological conditions. Please provide a justification for why only one year of meteorological data was used and why the year 2000 was selected.

   Air quality assessments also typically use five years of background data to capture representative background conditions. Please provide a justification for why only one year of background data was used.

   Future air quality assessments should use five years of both meteorological and background data.

Response: *The CAL3QHCR dispersion model can process only one year of meteorological data per model run. The model was run separately for each year (1996, 1997, 1998, 1999, and 2000) using the MECP approved regional meteorological data for the project area. Out of all five individual runs the modelling based on year 2000 data predicted the highest POI concentrations at the receptors. This year meteorological data was selected for all subsequent modelling runs as the most conservative.*

The 2015 background data was selected based on the following reasons.:

- *When the project started in 2015, the 2015 data was the newest complete annual set of data for the project area;*
- *The comparison with previous years data it was found that the ambient air shed in the area is pretty stable with minimal or no change in year to year observations;*
- *The latest year was selected as the most representative data to reflect the current status of industrial and transportation sources of air emissions pertaining to the study area.*
- *This background data was used in the modelling assessments to account for the cumulative impact effect.*

2. The AQA Report should clarify the assumption that NO_2 concentrations were equal to those of NOx. Since this assumption is conservative, typically NO_2 concentrations are estimated using the Ozone Limiting Method.

   Since the Ambient Air Quality Criteria and the Canadian Ambient Air Quality Criteria have been established for NO_2, modelled concentrations should be stated in terms of NO_2 rather than NOx. Furthermore, measured background concentrations should be provided for NO_2 rather than NOx.

   Response: *CALRoads modelling was done considering all NOx emissions to be in NO_2 form as this modelling package is not providing an algorithm to simulate NOx to NO_2 conversion Ozone Limiting Method. We are considering this approach to be more conservative and so acceptable for the purpose of the assessment. Tables 6-1, 6-2, and 3-2 are updated to show NO_2 instead of NOx. The footnote is added to clarify this approach.*

3. Since NAPS stations measure VOC concentrations every six days, the AQA Report should clarify what VOC concentrations were used for days where samples were not collected.

   Response: *A 1:6 day sampling schedule is appropriate unless concentrations are high. Specifically at the concentrations of Benzene and 1-3 Butadiene seen in the AQA report, the annual average relative error go from 6% to 3% and 6% to 4% respectively between a 6:1 and 1:1 sampling schedules (Bortnick and Stetzer, 2002). This sampling schedule is common across North America for measuring ambient air concentrations.*

4. The AQA Report should include the MOVES and CAL3QHCR input parameters.

   Response: *MOVES and CAL3QHCR input parameters are provided in the final AQA report.*

5. Although roads will be paved, re-entrainment of particulates still contributes to total emissions. Since this source of particulates was not assessed, the AQA Report currently underestimates particulate emissions.

   Response: *Re-entrainment of dust from paved roads is calculated and added to particulate emissions. Please see the revised tables 6-1 and 6-2. Background concentration PM_{10} is calculated based on the ratio of PM2.5 / PM10 = 0.54 (Lall et. all, 2004) and revised Table 6-2 accordingly. These two PM fractions were remodelled and showing the compliance with the applicable limits.*

6. The following changes should be made to Table 3.1 *Air Quality Criteria used for Study*:

   a. The NO_2 and SO_2 one-hour and annual CAAQS should be included;
   b. Since the year 2031 was assessed for the full build scenario, the 2020 $PM_{2.5}$ 24 hour CAAQS of 27 ug/m^3 should be used rather than the 2015 24 hour CAAQS of 28 ug/m^3;
   c. The annual PM2.5 CAAQS should be included; and
   d. The annual AAQCs for benzene and 1,3-butadiene should be included.

   Response: *Table 3-1 is updated based on the above mentioned comments.*

7. The following changes should be made to Table 3.2 *Background Concentrations* and Table 6.2 *Combined Effect of Modelled Effects and Background Air Concentrations*:

   a. 24 hour and annual SO_2 and NO_2 background, modelled and cumulative concentrations should be included for comparison against the 24 hour AAQCs and annual 2025 CAAQS;
   b. $PM_{2.5}$ annual background and cumulative concentrations should be included for comparison against 2020 annual CAAQS;
   c. PM_{10} & TSP 24 hour background, modelled and cumulative concentrations should be included for comparison against the 24 hour AAQCs. These concentrations are typically estimated from $PM_{2.5}$ measurements by applying a ratio of $PM_{2.5}/PM_{10} = 0.54$ (Lall et. all, 2004);
   d. Annual background, modelled and cumulative concentrations for benzene and 1,3- butadiene should be included for comparison against annual AAQCs;
   e. Background and cumulative concentrations for formaldehyde, acetaldehyde and acrolein should be included for all averaging periods for which there is an AAQC. NAPS stations including Newmarket, Etobicoke North, Etobicoke South and Windsor are often used for this background data.

   Response: *Tables 3-2, and 6-2 are updated based on the above mentioned comments.*

8. Eight-hour NO_2 and SO_2 concentrations should be removed from Tables 6.1 and 6.2 since the ministry does not have eight-hour average guidelines for these contaminants.

   Response: *Tables 6.1 and 6.2 are revised accordingly.*

9. The AQA Report should clarify what is meant by a "Tier 1 approach" mentioned in section 5.0 Dispersion Modelling.

   Response: *In Tier 1 approach, only one hour (peak hour) of ETS data (Emissions, Traffic and Signalization) are input into the CAL3QHCR model.*

10. The AQA Report should clarify the scale of the study area that was modelled. Typically a distance of between 300 m and 500 m is assessed on either side of the roadway.

    Response: *The AQA report assessed the impacts of the roadway widening at nearby sensitive receptors (residential). Residences are located within 20m – 40m each side of the Mississauga Road in the study area, considering that further away located receptors will experience less impacts from the type of sources of air emissions under assessment.*

    In future assessments the study area will be increased for completeness, but it will not likely change the findings of the report.

11. The AQA Report did not discuss potential impacts during construction in relation to air quality. During construction, please apply best management practices to mitigate any air quality impacts caused by construction dust. Please note that the ministry recommends that non-chloride dust suppressants be applied.

    For a comprehensive list of fugitive dust prevention and control measures, please refer to Cheminfo Services Inc. Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities. Report prepared for Environment Canada. March 2005.

    Response: *BMP will be developed to manage fugitive dust emissions from the construction phase of the project. Environment Canada and Climate Change (ECCC) and Ministry of the Environment, Conservation and Parks (MECP) guidelines will be followed for mitigation techniques of dust.*

Surface Water Comments

1. It is recommended that the Addendum include a description of the current status of the project, indicating whether the originally proposed road project/stormwater management and the residential/subdivision stormwater facilities/ponds (H3/W1) have been constructed, and weather any performance review was or will be conducted for these stormwater ponds. In addition, for the stormwater requirement analysis, it is recommended that the project baseline be set at the pre-development condition rather than the existing condition, since this is an addendum to the original Class EA.

   Response: *The details regarding the existing conditions of the study area, including existing stormwater management (SWM) infrastructure, are outlined in Section 2.0. Details pertaining to SWM Facilities W1 & H3 can be found in Section 2.1. It is unknown if a performance review was or will be completed for these SWM Facilities. It should be noted that these SWM Facilities are under the ownership of either the land developer or the City of Brampton. It is understood that a performance assessment would be the responsibility of the SWM Facility owner.*

   Please note that a pre-development condition was assessed for lands within the study area draining to Culvert C4 (ref. Section 2.4 of the EA Addendum SWM Report). A pre-development condition was not assessed for lands draining to SWM Facilities W1 & H3 as this was addressed by the SWM reports prepared for the respective SWM Facilities. Sections 4.1, 6.2 and 6.3 of the EA Addendum SWM Report outline that the future conditions drainage areas/impervious coverages do not exceed the amounts accounted for in the detailed design of the SWM Facilities, and as such, no further assessment is considered warranted.

2. It is acknowledged that the “Enhanced Level” of water quality protection has been adopted in the stormwater management plan. Based on the Stormwater Management Report (SWM Report), infiltration trenches will be installed to treat the increased stormwater runoff. The infiltration trenches will be designed to infiltrate the runoff volume generated from 27 mm storm event. In general, MECP has no concerns to apply Low Impact Development (LID) BMPs to treat the stormwater for this project. However, as the detailed design of the infiltration trenches has not been started, how to effectively use the proposed LID BMPs to achieve the enhanced water quality protection level is still unknown. It is recommended that further MECP review be required during the detailed design when all details about the preferred stormwater management plan are finalized.

   The SWM Report also recommended that part of the increased stormwater be directed into the residential/subdivision stormwater ponds, which based on the SWM Report, were designed to receive the stormwater from the proposed road section. In this regard, the originally proposed stormwater pond designs and their service areas should be more clearly described in the SWM Report.

Response: *The preliminary quality control solution is outlined within the SWM report (Appendix E of the ESR). A rather intensive investigation was completed to determine the suitability of the recommended LID BMPs, including review of; soil types and groundwater levels (ref. Section 2.3), geometric constraints based on available right-of-way space, and volumetric sizing completed in PCSWMM (ref. Section 6.0). The volumetric sizing completed in PCSWMM demonstrated that the LID BMPs can be sufficiently sized to capture and infiltrate the runoff volume from the 27 mm storm event. PCSWMM modelling can be made available for review if required.*

It is understood that the MECP will require soil infiltration rates to be confirmed within the areas of the proposed infiltration trenches, prior to providing an Environmental Compliance Approval (ECA). It should be noted that the infiltration rate testing will be completed at the detailed design stage as part of other geotechnical works. The infiltration rates will be used to ensure that the LID BMPs can be effectively used to achieve the required level of water quality protection. The locations and the configuration of the proposed infiltrations trenches can be adjusted and refined based on the soil infiltration rates determined within the detailed design process. Also, an ECA application will be submitted at the detailed design stage, which would include documentation of how the design of the infiltration trenches has incorporated the determined infiltration rates determined by the geotechnical assessment.

Sections 1.2.1 and 2.1 of the EA Addendum SWM Report outline details of the service areas for SWM Facilities W1 and H3. Drainage areas to the SWM facilities are also represented on the report figures. If additional details pertaining to the SWM Facilities are required, we recommend reviewing Certificate of Approval 6664-7GCQHL and Amended Certificate of Approval 3636-7UNP62.

3. The SWM Report concludes that the proposed stormwater management plan is able to achieve the target peak flow rates under designed 2-100 year storm events based on the modeling results. Given that a) the groundwater table is unusually high in the project area and would be further raised during a large storm event; and b) the permeable soil may become fully saturated during a large storm event, the designed infiltration/percolation rates can be significantly reduced under these scenarios. The reviewer needs to know how the model was used to simulate the infiltration trench performance to validate the conclusion. For the purpose of LID design, it is recommended that during the detailed design, a performance assessment/monitoring plan be included to verify that the proposed LID is able to capture/infiltrate the required runoff volumes.

   Response: *As outlined in the EA Addendum SWM Report, the SWM assessment was completed using PCSWMM. The infiltration trenches were incorporated into the PCSWMM model as storage elements representing the preliminary storage volumes physically provided by the infiltration trenches. Exfiltration into subsurface soils was not accounted for in the PCSWMM model, which is considered to be conservative. At the detailed design stage, a more detailed assessment of the infiltration rates and infiltration trench design will be completed. A performance assessment/monitoring plan will also be completed at this time.*

4. It is noted that the Credit River and its tributaries may support Redside Dace fish species. There is a concern regarding increased dissolved road salts entering the Credit River and its tributaries through the river crossing/bridge or sewer system as the road widening implies an increase in salt load during snowmelt seasons. The Addendum should review the current practice on road salt management in the project area and evaluate/discuss the potential impacts on the watercourses and fish habitats from the salt load.

Response: Environment Canada has produced a document titled "Five-year Review of Progress: Code of Practice for the Environmental Management of Road Salts (EC, 2012) which reviews the progress achieved in reducing salt use. The *Code of Practice for the Environmental Management of Road* Salts (EC, 2004) was developed to provide 'Best Practices' to help minimize its use. Environment Canada is continuing studies to reduce the amount of salt used. Region of Peel records since 2011 – 2018 list the amount of salt used has ranged from 11.09 tonnes /1 km lane to 28.60 tonnes / 1km lane, with an average weight of 14.8 tonnes/1km lane of salt per year. The roadway work for this project has provided two additional lanes.

Studies have shown that chloride concentrations continue to surpass levels that are harmful to aquatic organisms, especially in urban areas. Chloride does not degrade after application and will continue to migrate through surface and ground water, however, studies have also shown that reducing salt does lead to significantly less chloride in the soil and groundwater.

Most research for the toxicology of chloride impacts is based on aquatic ecosystems including streams, lakes and rivers, and has been studied since the 1960 and 1970's (EC, 2012). Salt can effect fish, invertebrates, and amphibians, and effect the species survival, growth and reproduction (ES, 2018) Studies have indicated chloride concentrations of less than 230 mg/l posed negligible risks to most aquatic organisms over a long term exposure of four days or less, while concentrations of 860 mg/l posed negligible risk to organisms in exposures of one hour or less (EC. 2012, ES, 2018). Natural background concentrations typically range from 1-10 mg/l (ES, 2018,). Some streams in Toronto which have had decades of salt use can have concentrations exceeding 1000 mg/l.

EC, 2012. Five-year Review of Progress: Code of Practice for the Environmental Management of Road Salts. Environment Canada, March 31, 2012. ISBN: 978-1-100-19681-7

ES. 2018. Environmental Services, New Hampshire Development of Environmental Services. Environmental, Health and Economic Impacts of Road Salt.

https://www.des.nh.gov/organization/divisions/water/wmb/was/salt-reduction-initiative/impacts.htm. 2018

The Region of Peel Council Endorsed Level of Service for winter operations on Regional Roads.

> *Level of Service*
>
> *Immediate after becoming aware of snow accumulation of 2.5 cm depth response. 4 hour route cycle time. Bare pavement* achieved within 4 hours after the end of precipitation.*
>
> **Bare pavement means in winter conditions, the pavement surface is maintained as bare as possible throughout winter precipitation event and returning pavement to bare condition within 4 hours once the precipitation has stopped. Peel aims to proactively achieve a bare pavement by utilizing anti-icing technique, monitoring weather conditions and use the snow fencing in areas of drifting snow.*

The Region of Peel developed its Salt Management Plan that established a framework for winter maintenance operations for salt storage, application of salts on roads, and disposal of snow containing road salts which may release salt to the environment. The Plan which recommends practices and outlines initiatives that can be adopted by the Region and each one plays a role in best practices for salt control. Efficiently using and handling salt "the right amount of material, at the right time, in the right place".

5. Please be advised that during construction, a Permit to Take Water (PTTW) for dewatering is required for taking/pumping water in excess of 400,000 litres per day. A guideline document and the Permit to Take Water application package can be downloaded directly from the MECP website. If the construction includes the discharge of any collected water from the dewatering activities into a surface watercourse, or a stormwater sewer that directly discharges into a surface watercourse, appropriate treatment and control/mitigation measures shall be provided to ensure that the proposed discharge will not result in any adverse impacts on the receiving waters. In such a case, further detailed review of the construction monitoring and mitigation plan by MECP will be required during the PTTW application process, when all the

detailed information, including the dewatering and discharge plan, and the monitoring, contingency, and erosion and sediment control plans developed for the proposed construction, becomes available. In addition, MECP emphasizes that every measure should be considered to prevent any contaminants from entering the watercourses both during and after construction.

Response: *Should a permit-to-take-water be required, it will be properly obtained at the detailed design stage*

General Comments

1. 1. The title of the draft Addendum reads "DRAFT ADDENDUM to the Class Environmental Assessment for the 2 to 4 lane widening on Mississauga Road from Queen Street West to Bovaird Drive East". This should be changed to "…Bovaird Drive West".

   Response: *This is revised.*

2. Please include a Table of Contents in the final Addendum report.

   Response: *This is included.*

3. Section 5.2 of the draft Addendum entitled Indigenous Consultation indicates that the Haudenosaunee Development Institute (HDI) wanted to meet to discuss the project, and have environmental field monitors present during field investigations, but several attempts to meet were unsuccessful. Please elaborate on this to identify why meeting attempts were unsuccessful and whether consultation efforts with HDI are ongoing.

   Response: In a separate email, you were provided a complete timeline between February 26, 2016 and January 24, 2017 of the engagement efforts by phone / email that occurred between the Region (and its consultant, Wood) and HDI. Meetings were arranged with HDI and cancelled by HDI as identified below; HDI informed Wood they would identify other meeting dates, but no dates were shared. The Region, through its consultant, continued to communicate with HDI in good faith towards reaching agreement for HDI to participate in field activities. No agreement was finalized. Notice of Completion and Letter will be mailed out on January 7, 2019.

   The following has been added to the Addendum report:

   *"**Follow-up consultation – March 30, 2016 to January 2019**: Continued correspondence to HDI was issued throughout the study. A letter and Notice of Filing Addendum was mailed to HDI in January 2019."*

4. Section 4.1 of the draft Addendum entitled Summary of the Potential Effects and Recommended Mitigation Measures indicates that there is some concern regarding the protection of Redside Dace and their habitat in the project area. Please include in this section a description of the mitigation measures for this species and its protected habitat that are found in Appendix B.

   Response: Specific mitigation measures have been developed to minimize and/or avoid significant short-term and long-term adverse environmental effects on fish and fish habitat. Principal mitigation measures for construction activities in or near to a watercourse include:

   - Prior to commencement of works, design and implement standard Erosion and Sediment Control (ESC) measures, consistent with Ontario Provincial Standards and Specifications (OPSS) and maintained ESC measures through all phases of the Project until vegetation is re-established, all disturbed ground is permanently stabilized. The ESC measures should be installed and meet the following requirements:

  - Installation of silt fencing consisting of geotextile and wooden stakes. Fencing is installed such that a minimum of 600 mm of geotextile is above ground and a minimum of 300 mm is buried;
  - Dewatering stations shall be located a minimum of 30 m from the channel edge in a vegetated area;
  - Note that more stringent measures, e.g., double-row non-woven, wire-backed silt fencing and the installation of staked straw bales between the silt fences, may be necessary adjacent to drainage feature C1 to prevent silt from entering downstream Redside Dace habitat;
  - All ESC measures should be inspected at least weekly and during and immediately following rainfall events to ensure that they are functioning properly and are maintained and/or upgraded as required. If the sediment and erosion control measures are not functioning properly, no further work would occur until the sediment and/or erosion problem is addressed.
  - The ESC silt fencing should be installed around the Project footprint, allowing vehicle and construction staff access to the Project footprint only at designated areas.

  Additional ESC measures relative to mitigating impacts of the aquatic ecosystem include:

  - Soil sediment and other impurities must be prevented from entering the watercourse located immediately downstream of the site.
  - Stockpiles and embankments are to be protected whenever there is potential for soil erosion to impact to the river.

- All materials and equipment used for the purpose of site preparation and Project construction should be operated and stored in a manner that prevents any deleterious substance (e.g., petroleum products, silt, etc.) from entering the watercourses present on site:

  - Any stockpiled materials should be stored and stabilized at least 30 m away from the drainages.
  - Refuelling and maintenance of construction equipment should occur a minimum of 30 m from the drainage features draining into a watercourse.
  - Any part of equipment entering the water would be free of fluid leaks and externally cleaned / degreased to prevent any deleterious substance from entering the watercourse.
  - Only clean material, free of fine particulate matter would be placed in the water.

- A protocol to minimize spills/leaks and their impact to the environment should be provided in the Emergency Response Plan. Routine inspection of the Project construction site should be conducted to ensure continued use and function of best management practices, mitigation measures and spill control and prevention measures. As appropriate, spills should be reported to the MOECC Spills Action Centre;

  - Scheduling work within drainage ditches to avoid wet, windy and rainy periods that may increase erosion and sedimentation.

- Materials such as sand bags, straw bales, geotextile filters, and/or pumps should be readily available on-site in case of unexpected stream flow during construction activities;

- Staging of the Project should limit vegetation disturbance and minimize the amount of time disturbed soil is exposed;

- Temporarily store, handle and dispose of all materials used or generated (e.g., organics, soils, construction waste and debris, etc.) during site preparation, construction, and clean-up in a manner that prevents their entry to the watercourse located downstream of the site;

- Concrete wash water must never be released into a watercourse, catch basin, ditch, or any other part of a land drainage system. Mitigation measures should include:
    - Wash-out facilities should be available on site, with waterproof lining to prevent soil and groundwater contamination. These wash-out facilities should be situated away from watercourses or drains;
    - Liquid and solid concrete waste is disposed of lawfully using licensed haulers and licensed receiving facilities; and
- Land drainage systems, whether naturally occurring or man-made are not to be used as receptors for any substance or material other than clean water complying with local municipal bylaws or storm water as intended.

Offset protection is already provided adjacent to Huttonville Creek in the reach that runs parallel to Mississauga Road and is ongoing construction in 2016/2017. A slope retention structure was designed and constructed on the east slope of Mississauga Road during the 2016 to 2018 roadway construction works. Significant impacts to aquatic habitat in the vicinity of Mississauga Road are not anticipated as a result of scheduled project works. There is potential for localized changes in hydrology and water quality due to the increase in impervious surfaces; however, mitigation measures and best management practices are expected to prevent these changes from impacting aquatic habitat.

Should you have any questions or require additional information, please feel free to contact the undersigned.

Yours truly,

Wood Environment & Infrastructure Solutions
a Division of Wood Canada Limited

Per: Matthew Britton, E.I.T.
Water Resources E.I.T.

Per: Steve Chipps, P.Eng.
Senior Engineer, Water Resources

Per: Akhter Iqbal, P.Eng.
Senior Air Quality Engineer

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