Appendix E
Stormwater Management and Drainage Report

H136921, Rev. 0

Region of Peel

Schedule 'C' Class Environmental Assessment for Winston Churchill Boulevard from Highway 401 to Embleton Road

Stormwater Management Report

Revision Status History

D	Final Report	M. Mallik	E. May J. Hemingway	M. Alexander	28 Oct 2022
C	Draft Report	M. Mallik	E. May J. Hemingway	M. Alexander	29 Oct 2021
B	Draft Report	M. Mallik	E. May J. Hemingway	M. Alexander	14 July 2021
A	Draft Report	M. Mallik	W. Burmeister J. Hemingway	M. Alexander	21 May 2021
Rev No.	**Description**	**Originator**	**Checked**	**Approved**	**Date**

Project Report

October 27, 2022

Region of Peel

Schedule 'C' Class Environmental Assessment for Winston Churchill Boulevard from Highway 401 to Embleton Road

Distribution

Stormwater Management Report

Table of Contents

List of Table

List of Figure

List of Appendices

Glossary of Terms and Acronyms

CN:	Curve Number
CSP:	Corrugated Steel Pipe
CVC:	Credit Valley Conservation
EA:	Environmental Assessment
GIS:	Geographical Information Systems
HEC-RAS:	Hydrologic Engineering Centre's River Analysis System
HW/D:	Headwater depth to culvert diameter
LID:	Low Impact Development
MOE / MECP:	Ministry of the Environment, Ministry of the Environment, Conservation and Parks
MNRF:	Ministry of Natural Resources and Forestry
MTO:	Ministry of Transportation (Ontario)
OGS:	Oil/Grit Separators
ROW:	Right-of-Way
SWM:	Stormwater Management
TSS:	Total Suspended Solids
WSEL:	High-Water Surface Elevation

Executive Summary

The Region of Peel is undertaking a Schedule "C" Municipal Class Environmental Assessment (EA) for the proposed widening of Winston Churchill Boulevard from Highway 401 to Embleton Road. The Schedule "C" EA is being completed to evaluate alternative options for the widening and intersection improvements to Winston Churchill Boulevard to address both short- and long-term considerations for planned future growth up to 2031.As part of this process, a Stormwater Management (SWM) Report has been prepared to support of the Class EA. It serves to summarize the existing drainage conditions and the proposed SWM Plan to mitigate the potential impacts of the proposed improvements to Winston Churchill Boulevard on the receiving drainage systems.

Winston Churchill Boulevard is a north-south arterial road with a 2-lane rural cross section from Embleton Road to Maple Lodge Farms where it reverts to a 4-lane cross section. The subject site is located within the Mullet Creek and Levi Creek sub-watersheds. The current sub-watershed land use is a mixture of primarily residential estates, agricultural lands, and several large-scale commercial properties. Storm water runoff from the study area catchments is currently conveyed via a combination of overland sheet flow to low spots along both sides of the ROW and/or storm sewer networks and eventually discharges into ten (10) outfall locations in the Levi Creek (North and South) and Mullet Creek sub-watersheds.

Under proposed conditions, the Winston Churchill Boulevard improvement plan involves the addition of two (2) new traffic lanes and a raised centre median with provision for separate left-turn lanes at intersections in certain segments. The proposed road widening will have different ROW width (varies from 45m to 63m) with an urban cross-section including a 6-lane roadway, raised impervious median island, multi-use path (MUP) trail and green zone. In general, under proposed roadway widening conditions, post- development runoff for road ROW catchments is expected to increase due to the increase in overall imperviousness coverage.

A SWM Plan has been developed to meet stormwater management design criteria from Region of Peel, Credit Valley Conservation (CVC), Ministry of the Environment, Conservation and Parks (MECP), and the Ministry of Transportation (MTO).Under proposed condition, the quantity of runoff resulting from major storms will be convey to the existing outlets as overland flow. For the minor drainage system, stormwater will be collected by a series of catchbasins and conveyed to the underground infiltration chambers with eventual discharge to the existing outlets. The storage volume will be provided through the proposed underground infiltration chambers at each outlet.

For the water quality control underground infiltration chambers have been proposed to achieve water quality objectives.

The proposed underground infiltration chambers and the green areas within the ROW will provide infiltration to meet water balance and runoff volume control criteria of on-site retention of all runoffs from the first 27-28mm of each rainfall event.

1. Introduction

1.1 Project Description

The Region of Peel is undertaking a Schedule "C" Municipal Class Environmental Assessment (EA) for the proposed widening of Winston Churchill Boulevard from Highway 401 to Embleton Road. The Schedule "C" EA is being completed to evaluate alternative options for the widening and intersection improvements to Winston Churchill Boulevard to address both short- and long-term considerations for planned future growth up to 2031.

1.2 Project Background

The proposed road widening work (see Figure 1-1) along Winston Churchill Boulevard extends from Highway 401 to Embleton Road for a total length of approximately 4.5 km. At present Winston Churchill Boulevard is a north-south arterial road with a 2-lane rural cross section from Embleton Road to Maple Lodge Farms where it reverts to a 4-lane cross section.

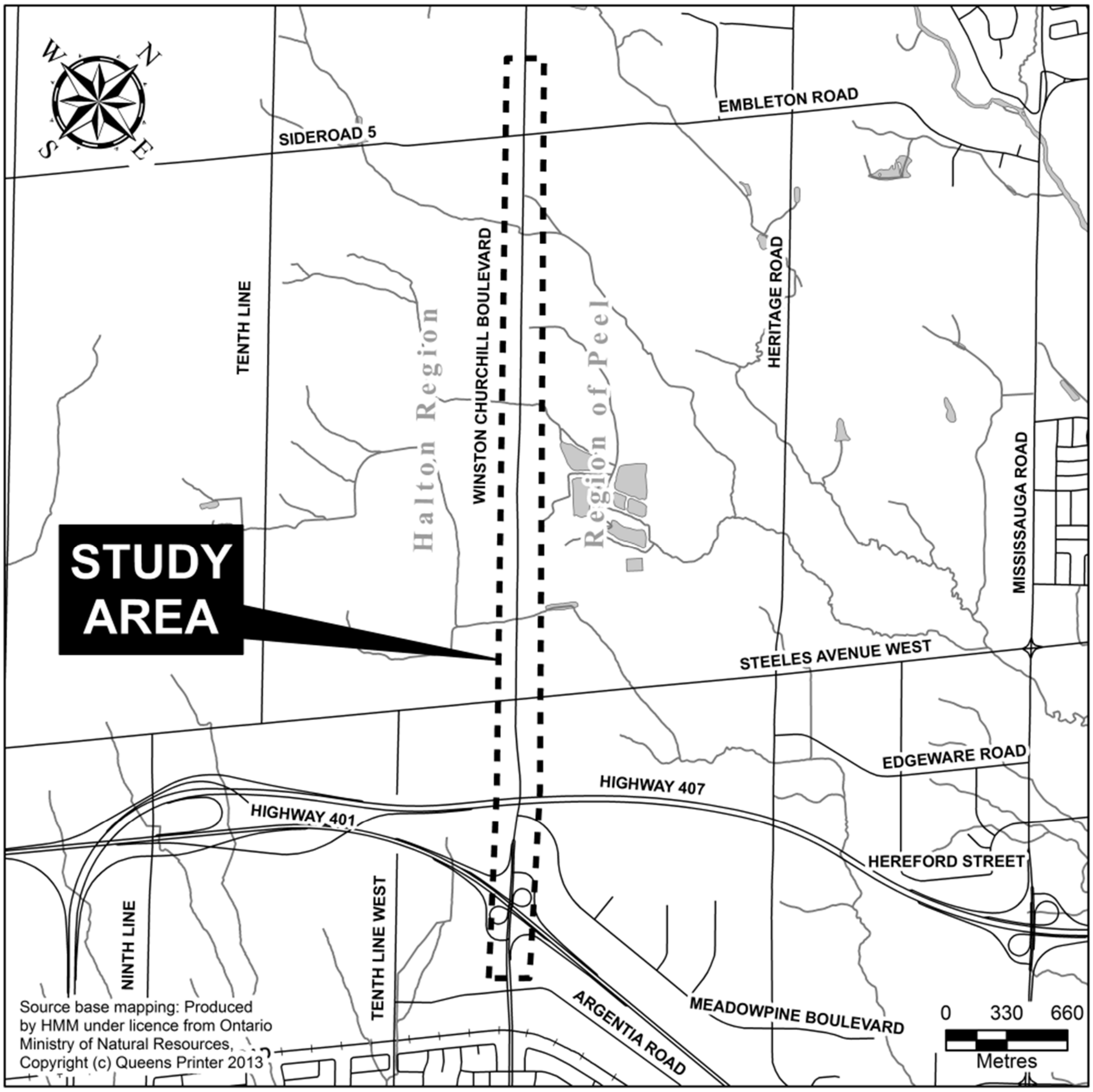
The subject site is located within the Mullet Creek and Levi Creek sub-watersheds. The current sub-watershed land use is a mixture of primarily residential estates, agricultural lands, and several large-scale commercial properties.

1.3 Purpose

This purpose of this report is:

1. To evaluate existing hydrologic conditions in the EA study area in regard to current drainage flow patterns;
2. To examine proposed changes to the hydrologic conditions following the road widening and improvement of the Winston Churchill Boulevard study corridor;
3. To assess hydrologic flows and hydraulic capacity at various crossings (minor and major culverts) locations along the existing and the proposed roadway alignment;
4. To review drainage and stormwater management (SWM) objectives and criteria for the study area; and,
5. To identify options for drainage and SWM features to meet applicable water quantity and quality control requirements, while accounting for local site restrictions and design criteria.

Figure 1-1: Project Area



1.4 Background Documents and Reference Data

The following standards, guidelines, and background information have been reviewed and utilized to develop this drainage and SWM report.

- Region of Peel, June 2019. Public Works Stormwater Design Criteria and Procedural Manual (v2.1);
- Credit Valley Conservation, August 2012. Stormwater Management Criteria;
- Ministry of the Environment (MOE), 2003. Stormwater Management Planning and Design Manual;
- Ministry of Transportation (MTO), 1997. MTO Drainage Management Manual.

2. Drainage Design Criteria and SWM Objectives

The drainage and SWM objectives have been developed using stormwater management design criteria from several agencies including the Region of Peel, Credit Valley Conservation (CVC), Ministry of the Environment, Conservation and Parks (MECP), the Ministry of Transportation (MTO), and the Ministry of Natural Resources and Forestry (MNRF) and include:

- Maintain existing watershed boundaries and drainage patterns.
- Manage post-development runoff from road ROW within ROW infrastructure, as feasible.
- Improve post-development runoff water quality prior to discharge to the identified site outlets.
- Provide drainage conveyance reducing flood safety risks, thus preventing damage to private and public properties.

2.1 Drainage Design Criteria

Storm sewer system

- The minor drainage system to be sized to convey runoff from a 10-year storm event with a 10-minute inlet time (Time of Concentration) for the roadway ROW only.

Major System Drainage

- The major system flows (i.e., storms exceeding a 10-year event) will be conveyed overland to receiving drainage watercourses.

Culverts

- Under the urban arterial classifications,
  - all the crossroad culverts with a total span up to 6m are designed for the 50-year design storm event; and
  - all the crossroad culverts with a total span above 6m are designed for the 100-year design storm event.
- The headwater depth to culvert diameter (HW/D) ratio to not exceed 1.5;
- A minimum freeboard of 1 m to be provided from the design water elevation to the edge of travelled road.

2.2 Stormwater Management Objectives

The following section documents the key guiding SWM targets for the study area. These key SWM criteria include water quantity, water quality, and water balance.

Stormwater Quantity (Flood) Control

- At a minimum post-development flows must be equal to the pre-development level for 2 to 100-year design storms.

CVC Flood Control Criteria

- For Levi Creek and Mullet Creek: Provide post development flow to pre development flow for various storms (i.e. 2,5,10,25,50 & 100 year) and Regional storm.

Water Quality

- Where possible retain rural cross-section using low-impact development (LID).
- Level 1 Enhanced treatment through the long-term removal of 80 percent Total Suspended Solids (TSS).
- Grass Swales are to be designed to meet the following MECP criteria for quality control;
  - Minimum length of swale: 5 m
  - Allowable velocity (25 mm 4-hour Chicago storm): 0.5 m/s
  - Minimum bottom width of swale: 0.75 m
  - Maximum flow depth: 0.5 m

Runoff Volume Control

- To control the runoff from the Regional specific 90th percentile volume (27-28mm) using LID infiltration techniques.

Water Balance

- To provide a minimum post development recharge of the first 5 mm for any precipitation event.

Erosion Control

- To provide a minimum post development recharge of the first 5 mm for any precipitation event.

3. Existing Drainage Conditions

The existing drainage system for the study area is illustrated in **Appendix A – Exhibit E-1 to E-7,** which shows the delineated catchment boundaries (ROW and External), location of existing culverts and the existing drainage patterns. For the purpose of the EA, the study area can be divided into three (3) distinct segments.

3.1 Tributary Areas, Outlets and Drainage Patterns

The roadway corridor within the study area external to the roadway corridor currently consists of predominantly agricultural and/or undeveloped lands (open space and grassland areas). The terrain adjacent to the roadway corridor is very flat with an average slope of 1 percent.

Storm water runoff from the study area catchments is currently conveyed via a combination of overland sheet flow to low spots along both sides of the ROW and/or storm sewer networks and eventually discharges into ten (10) outfall locations in the Levi Creek (North and South) and Mullet Creek sub-watersheds. These outfall structures include:

- Seven (7) Concrete and/or Corrugated Steel Pipe (CSP) culverts at various road crossings; and
- Three (3) large Concrete Box Culverts across the Mullet Creek, Levi Creek South, and Levi Creek North tributaries.

Segment 1 (Highway 401 to Steeles Avenue) (St 0+000 to St 0+928)

- Right of Way (ROW) catchments:
    - A total of four (4) contributing catchment areas (R.13.02, R13.01, R12.02, R12.01) with impervious coverage up to 75 percent.
    - Typical land cover includes pavement, gravel and grassland.
    - Significant source of imperviousness: paved roadway surfaces, driveways and sidewalks along the roadway.
    - There are two (3) distinct concrete storm sewer network systems with pipe diameters ranging in size from 600mm to 825mm crossing Winston Churchill Boulevard and connected to the Steeles Avenue storm sewer system.
- There are no external contributing external catchments adjacent to the ROW within this segment.
    - This catchment segment area features two major bridge structures over Highways 401 and 407, which feature facilities that manage their own drainage and discharge to external areas surrounding the corridor.

Segment 2 (North of Steeles Avenue to Maple Lodge Farms) (St 0+928 to St 2+070)

- Right of Way (ROW) catchments:
    - A total of four (4) contributing catchment areas (R11.02, R11.01, R10.02, R10.01) with impervious coverage up to 76 percent.
    - Typical land cover includes pavement, gravel and grassland.
    - Significant source of imperviousness: paved roadway surfaces and sidewalk driveways.
- External catchments adjacent to the ROW:
    - A total of five (5) contributing catchment areas consist of mostly pervious land use type.
    - Typical land cover includes farmland, open area and grassland areas.
    - Imperviousness coverage sources for the catchments include building roof areas, paved driveways and parking lots.

Field surveys and data indicate that at present, existing stormwater quality control and conveyance measures are currently located along the Winston Churchill Boulevard corridor north of Steeles Avenue to north of the Maple Lodge Farm property.

- There are three (3) distinct concrete storm sewer network systems with pipe diameters ranging in size from 375mm to 525mm.
- Three (3) Oil/Grit Separators (OGS) have been installed at the three (3) distinct storm sewer network roadway catchment outlets.

Segment 3 (North of Maple Lodge Farms to Embleton Road) (St 2+070 to St 4+010)

- Right of Way (ROW) catchments:
    - A total of ten (10) contributing catchment areas (R8.02, R8.01, R6.02, R6.01, R5.02, R5.01, R4.02, R4.01, R2.02, R2.01) with impervious coverage up to 67%.
    - Typical land cover includes pavement, gravel and grassland.
    - Significant source of imperviousness: paved roadway surfaces and sidewalk driveways.
- External catchments adjacent to the ROW:
    - A total of fifteen (15) contributing catchment areas consist of mostly pervious land use type.
    - Typical land cover includes farmland, open area and grassland areas.
    - Insignificant sources of imperviousness coverage from building roof areas and paved parking lots.

Table 3-1 provides summary of catchment areas that are currently draining to nine (9) outlets located along the study area.

Table 3-1: Existing Right of Way (ROW) Catchment Area

CATCHMENT ID	AREA (ha)	FLOW DIRECTION	DRAINAGE OUTLET
R.2-01	0.88	West to East	C2 Culvert
R.2-02	1.03		
R.4-01	0.48	West to East	C4 Culvert
R.4-02	0.15		
R.5-01	0.43	West to East	C5 Culvert
R.5-02	0.34		
R.6-01	0.37	West to East	C6 Culvert
R.6-02	0.34		
R.8-01	1.02	West to East	C8 Culvert
R.8-02	2.01		
R.10-01	2.58	West to East	C10 Culvert
R.10-02	0.68		
R.11-01	0.45	West to East	C11 Culvert
R.11-02	0.59		
R.12-01	0.69	West to East	825mm STM Pipe
R.12-02	1.79		
R.13-01	1.32	West to East	Ditch on East Side
R.13-02	0.28		

All outlets within the study area ultimately discharge into Levi and Mullet Creek. There are four (4) OGS units for quality control within the project corridor.

Table 3-2 provides a summary of external catchment areas that are currently draining to the cross-culverts within the study area.

Table 3-2: Existing External Catchment Area

CATCHMENT ID	WATERSHED	AREA (ha)	FLOW DIRECTION	DRAINAGE OUTLET
A.2-05	LEVI CREEK	5.48	West to East	C2 Culvert
A.2-06		8.47		
A.3-01		212.54	West to East	C3 Culvert
A.4-01		3.06	West to East	C4 Culvert
A.5-01		12.08	West to East	C5 Culvert
A.6-01		4.26	West to East	C6 Culvert
A.7-01		9.94	West to East	C7 Culvert
A.8-01		98.34	West to East	C8 Culvert

CATCHMENT ID	WATERSHED	AREA (ha)	FLOW DIRECTION	DRAINAGE OUTLET
A.9-01		6.84	West to East	C9 Culvert
A.9-02		5.77	West to East	C10 Culvert
A.10-01		3.15	West to East	C10 Culvert
A.10-02	MULLET CREEK	266.41	West to East	C10 Culvert
A.11-01		0.23	West to East	C11 Culvert
A.11-02		20.84	West to East	Roadside Ditch on Westside

3.2 Condition of Receiving Watercourses

The Winston Churchill Boulevard EA study area is located within the Mullet Creek and Levi Creek watersheds, which contains tributaries of Mullet Creek and Levi Creek South and North.

The flow path of all watercourses is generally from northwest to southeast and is generally contained within the stream banks. Very little to non-existent flows during the summer months are considered normal within this watershed, and many of the smaller tributaries tend to be ephemeral in nature.

The Winston Churchill EA Boulevard study area alignment stretches across three (3) headwater areas and tributaries within two watersheds (the Mullet Creek watershed and the Levi creek watershed), as described below:

Mullet Creek Watershed:

- The watershed (CVC watershed 4) features a series of poorly and/or well-defined vegetated swales draining to the East of Winston Churchill Boulevard.

Levi Creek Watershed:

- The watershed (CVC watershed 6) features a meadow marsh community that drains via a continuous drainage swale to the east of Winston Churchill Boulevard.

The tributaries within this watershed provide conveyance of surface water discharge during heavy rainfall events, and are mostly dry with no runoff.

3.3 Soil and Groundwater Conditions

The study area consists primarily of clay loams of the Chinguacousy series, with low permeability and imperfect natural drainage. It is made up of lacustrine soils over heavy till. The topography is smooth gently sloping creating low internal drainage and can be classified as Hydrologic Soil Group “C” (CSIS,1953).

Based on the geotechnical investigation and hydrogeological investigation conducted in 2016, it was noted that generally gravelly sand is found up to depths of 0.6m and below that is silty clay to clayey still. Rising head tests were conducted at only two locations, near the north end of the project, and resulted in hydraulic conductivity ranging from 4 mm/hr. to 10 mm/hr. This means that the soil is not good for infiltration. Based on these preliminary findings, it is recommended that a more detailed geotechnical investigation be conducted in the detailed design stage to have an accurate description of soil condition and validate the stormwater management plans presented in this report.

3.4 Hydrologic and Hydraulic Assessment

Hydrologic modeling was conducted based upon two methodologies, Visual Otthymo V6.2 and the Rational Method to determine existing peak runoff flows from the existing external adjacent and road ROW contributing catchments to specific outlets at culverts and overland areas within the Winston Churchill Boulevard corridor.

- ***Visual Otthymo V6.2*** has been utilized for the adjacent external contributing catchments to aid in hydraulic evaluations of culvert crossings along Winston Churchill Boulevard and for peak flow estimation for ROW catchments at the regional storm event.
- ***Rational Method*** has been selected to evaluate ROW catchment hydrology. The rational method has been utilized to conservatively estimate peak flows within the ROW for 2-yr to 100-yr storm events, which aids in evaluating the capacity of existing and proposed storm sewers.
- In addition, the utilization of the volume associated with the proposed ROW ***Rational Method*** has been selected to determine potential future treatment volumes for the increase in impervious area along the corridor for specific design events.

For these hydrologic methodologies, the 2-yr to 100-yr return period 4-hour Chicago design storm event was simulated using the Region of Peel IDF curves data, as applicable over the appropriate sub-catchment areas. Based on the CVC guideline, the selected regional storm is 12hr Hurricane Hazel. Model parameters are based on:

- Catchment delineation, percent imperviousness, slopes, flow length and subsequent hydrologic parameters (i.e., time of concentration) were determined through GIS-based spatial analysis using acquired topographical data and aerial imagery.
- Time of concentration was determined using two methods for the road and adjacent external catchments. The roadway catchments employed the use of the Bransby Williams formula used for urban areas with a catchment impervious coefficient greater than 0.4. The Federal Aviation method (1970) was used for the adjacent catchments as the impervious areas are typically less than 0.4.
- The external adjacent catchments **do not change** between existing and proposed conditions.
- The runoff Curve Number (CN) was selected based on MTO Drainage Manual (1997) Design Chart 1.09 for Soil/Land Use Curve Numbers for HSG Group C.

Hydraulic analysis at each cross-road culvert outlet was conducted using the CulvertMaster software in order to evaluate existing culvert conveyance characteristics. The existing culverts are evaluated against the Region of Peel's Public Works Stormwater Design Criteria & Procedures Manual 2019, supplemented by the MTO (2008) Highway Drainage Design Standards criteria described in Section 2.1

In addition to the hydraulic analysis of culvert crossings, the hydraulics at three (3) existing watercourse crossings was evaluated using CVC's HEC-RAS models for Mullet Creek, Levi Creek North and South.

3.4.1 Runoff Estimation

Table 3-3 summarizes the hydrologic parameters for existing conditions across the study area used for ROW catchment parameters for peak runoff estimation.

Table 3-3: Existing ROW Catchment Characteristics

CATCHMENT ID	DRAINAGE OUTLET	AREA (ha)	% Imperviousness	Runoff Coefficient "C"
R.2-01	C2 Culvert	0.88	67%	0.79
R.2-02		1.03	64%	0.77
R.4-01	C4 Culvert	0.48	76%	0.82
R.4-02		0.15	75%	0.81
R.5-01	C5 Culvert	0.43	69%	0.79
R.5-02		0.34	65%	0.78
R.6-01	C6 Culvert	0.37	72%	0.80
R.6-02		0.34	58%	0.75
R.8-01	C8 Culvert	1.02	66%	0.78
R.8-02		2.01	62%	0.77
R.10-01	C10 Culvert	2.58	71%	0.80
R.10-02		0.68	77%	0.82
R.11-01	C11 Culvert	0.45	73%	0.81
R.11-02		0.59	83%	0.84
R.12-01	825mm dia. STM Pipe	0.69	76%	0.81
R.12-02		1.79	70%	0.79
R.13-01	Ditch on East Side	1.32	77%	0.82
R.13-02		0.28	78%	0.82

Table 3-4 summarizes the hydrologic parameters for existing conditions across the study area used for external catchment parameters for peak runoff estimation.

Table 3-4: Existing External Catchment Characteristics

CATCHMENT ID	DRAINAGE OUTLET	AREA (ha)	% Imperviousness	CN	Time of Concentration Tc (min)
A.2-05	C2 Culvert	5.48	0%	82.00	24.37
A.2-06		8.47	0%	82.00	25.71
A.3-01	C3 Culvert	212.54	1%	82.21	76.30
A.4-01	C4 Culvert	3.06	2%	82.31	21.14
A.5-01	C5 Culvert	12.08	6%	82.90	13.92
A.6-01	C6 Culvert	4.26	8%	83.20	21.32
A.7-01	C7 Culvert	9.94	10%	83.53	27.33
A.8-01	C8 Culvert	98.34	1%	82.19	75.99
A.9-01	C9 Culvert	6.84	1%	82.19	34.00
A.9-02	C10 Culvert	5.77	0%	82.00	10.00
A.10-01	C10 Culvert	3.15	18%	84.95	26.57
A.10-02	C10 Culvert	266.41	0%	82.07	104.93
A.11-01	C11 Culvert	0.23	0%	82.00	59.00
A.11-02	Roadside Ditch on Westside	20.84	16%	84.50	43.70

Based on the rational method calculation and time of concentration (Tc) as 10 minutes, Table 3-5 summarizes the peak runoff from each ROW catchment under existing conditions for various design storms (i.e., 2- to 100-yr and regional storm events).

Table 3-5: Existing ROW Catchment Peak Runoff

CATCHMENT ID	2-yr flow (m^3/s)	5-yr flow (m^3/s)	10-yr flow (m^3/s)	25-yr flow (m^3/s)	50-yr flow (m^3/s)	100-yr flow (m^3/s)	Regional Storm (m^3/s)
R.2-01	0.16	0.21	0.26	0.30	0.34	0.38	0.13
R.2-02	0.19	0.24	0.30	0.35	0.39	0.44	0.15
R.4-01	0.09	0.12	0.15	0.17	0.19	0.21	0.07
R.4-02	0.03	0.04	0.05	0.05	0.06	0.07	0.02
R.5-01	0.08	0.10	0.13	0.15	0.16	0.18	0.06
R.5-02	0.06	0.08	0.10	0.12	0.13	0.14	0.05
R.6-01	0.07	0.09	0.11	0.13	0.15	0.16	0.05
R.6-02	0.06	0.08	0.10	0.11	0.12	0.14	0.05
R.8-01	0.19	0.24	0.30	0.35	0.39	0.43	0.15
R.8-02	0.37	0.47	0.58	0.67	0.76	0.84	0.29
R.10-01	0.49	0.63	0.77	0.90	1.01	1.13	0.36
R.10-02	0.13	0.17	0.21	0.24	0.27	0.31	0.10
R.11-01	0.09	0.11	0.14	0.16	0.18	0.20	0.06
R.11-02	0.12	0.15	0.18	0.22	0.24	0.27	0.09

CATCHMENT ID	2-yr flow (m^3/s)	5-yr flow (m^3/s)	10-yr flow (m^3/s)	25-yr flow (m^3/s)	50-yr flow (m^3/s)	100-yr flow (m^3/s)	Regional Storm (m^3/s)
R.12-01	0.13	0.17	0.21	0.24	0.28	0.31	0.10
R.12-02	0.34	0.43	0.53	0.62	0.69	0.77	0.25
R.13-01	0.26	0.33	0.40	0.47	0.53	0.59	0.19
R.13-02	0.06	0.07	0.09	0.10	0.11	0.13	0.04

Based on the Visual Otthymo hydrologic modelling, Table 3-6 summarizes the modelled peak runoff from each external contributing catchment under existing conditions for various design storms (i.e., 2- to 100-yr and regional storm events).

Table 3-6: Existing External Catchment Peak Runoff

CATCHMENT ID	2-yr flow (m^3/s)	5-yr flow (m^3/s)	10-yr flow (m^3/s)	25-yr flow (m^3/s)	50-yr flow (m^3/s)	100-yr flow (m^3/s)	Regional Storm (m^3/s)
A.2-05	0.14	0.25	0.37	0.47	0.56	0.67	0.74
A.2-06	0.20	0.37	0.54	0.69	0.84	1.00	1.13
A.3-01	2.55	4.55	6.63	8.42	10.15	12.06	22.70
A.4-01	0.09	0.17	0.25	0.32	0.39	0.47	0.42
A.5-01	0.38	0.69	1.01	1.30	1.58	1.88	1.65
A.6-01	0.12	0.22	0.33	0.42	0.50	0.60	0.58
A.7-01	0.25	0.45	0.66	0.84	1.02	1.21	1.34
A.8-01	1.18	2.10	3.07	3.89	4.70	5.58	10.50
A.9-01	0.14	0.25	0.37	0.47	0.57	0.68	0.89
A.9-02	0.17	0.32	0.46	0.60	0.73	0.87	0.80
A.10-01	0.09	0.16	0.23	0.29	0.35	0.41	0.43
A.10-02	2.55	4.53	6.57	8.31	10.01	11.90	26.16
A.11-01	0.01	0.01	0.02	0.02	0.03	0.04	0.03
A.11-02	0.33	0.59	0.85	1.08	1.30	1.53	2.42

3.4.2 *Culvert Crossings Evaluation*

Based on the hydraulic analysis of all existing culvert crossings along the study area and established culvert evaluation criteria, Table 3-7 summarizes culvert hydraulic capacity results.

Hydraulic analysis results (see Appendix B) indicate that four (4) existing road culvert crossings are *inadequate* to convey the 50-yr design flow as per Region of Peel and MTO standards. Road ROW catchments have been excluded in the existing hydraulics evaluation for all culverts crossing Winston Churchill Boulevard within the study area.

Table 3-7: Existing Culvert Crossing Evaluation

CULVERT ID	FLOW DIRECTION	CONTRIBUTING AREA (ha)	LENGTH (m)	DIMENSION (mm)	50-yr DESIGN FLOW (m^3/s)	H/D Ratio < 1.5?	FREEBOARD > 0.3m?
C2	West to East	14.27	23.69	1200	2.062	Yes	Yes
C4	West to East	3.06	23.24	600	0.553	Yes	Yes
C5	West to East	12.08	20	600	2.225	**No**	**No**
C6	West to East	4.26	20.16	600	0.723	**No**	Yes
C7	West to East	9.94	20	600	1.483	**No**	**No**
C9	West to East	6.84	24.2	600	0.851	**No**	Yes
C11	West to East	0.23	35	600	0.041	Yes	Yes

Culvert Master Output are presented in **Appendix B**

3.4.3 Existing Regulated Watercourse Crossings Evaluation

Existing regulated watercourse crossings includes Levi Creek North, Levi Creek South and Mullet Creek.

Table 3-8 below summarizes the key recommendations during structure inspection for these culverts from the inspection reports. The full reports can be found in **Appendix C**.

Table 3-8 Recommendation for Regulated Watercourse Crossings in Inspection Reports

Culvert Description	Site Number	Overall Comments	Drainage Recommendations
Levi Creek North	19-1196390 BR01	-Minor Rehabilitation required -Seal wide cracks in barrier wall -Path repair concrete on soffit	Drainage through structure needs to be regraded
Levi Creek South	19-1196390 BR03	None	Drainage through structure needs to be regraded
Mullet Creek	19-1196390 BR05	-Minor Rehabilitation required -Patch repair at PVC outlet	Minor Rehabilitation Drainage through structure needs to be regraded

In summary, all structures are acceptable for extension with minor rehabilitation work or no work. Minor rehabilitation shall be completed in detailed stage of the project.

Hydraulic analysis was completed for each of the existing structures to be maintained. Table 3-9 summarizes modelled elevations from the existing CVC's HEC-RAS models modified to reflect existing surveyed stream cross-sections and crossing openings at each watercourse crossing. The proposed extension will require structural design, a detailed general arrangement, and connection details as they are greater than 3m in span.

The table shows that under existing conditions:

- For the 100-yr design flow, the High-Water Surface Elevation (WSEL) is well *below* the top of road deck at all watercourse crossings.
- For the Regional flow all three crossings do not overtop the roadway.

Table 3-9: Existing Watercourse Crossing Evaluation

Culvert Description	HEC-RAS ID	Crossing Type	Span (m)	Rise (m)	Stream Invert	Top of Road Deck (m)	100-yr WSEL (m)	Regional WSEL (m)	100 yr H/D Ratio	100 yr Freeboard [m]
Levi Creek North	9523	Concrete Box	10.973	2.44	206.78	209.22	207.89	207.98	0.77	0.77
Levi Creek South	125	Concrete Box	5.49	2.44	204.41	207	205.32	205.35	0.37	1.68
Mullet Creek	9523	Concrete Box	10.363	2.44	203.55	206.19	205.42	205.83	0.45	1.33

4. Post-Development Conditions

The fundamental components of the proposed design that feature a variety of stormwater measures to effectively achieve stormwater quantity and quality control objectives, while accounting for local site restrictions and design criteria are presented below

4.1 Proposed Road Configurations

Under proposed conditions, the Winston Churchill Boulevard improvement plan involves the addition of two (2) new traffic lanes and a raised centre median with provision for separate left-turn lanes at intersections in certain segments. The proposed road widening will have different ROW width (varies from 45m to 63m) with an urban cross-section including a 6-lane roadway, raised impervious median island, multi-use path (MUP) trail and green zone. The typical proposed cross-section of the road is shown in Figure 4-1.

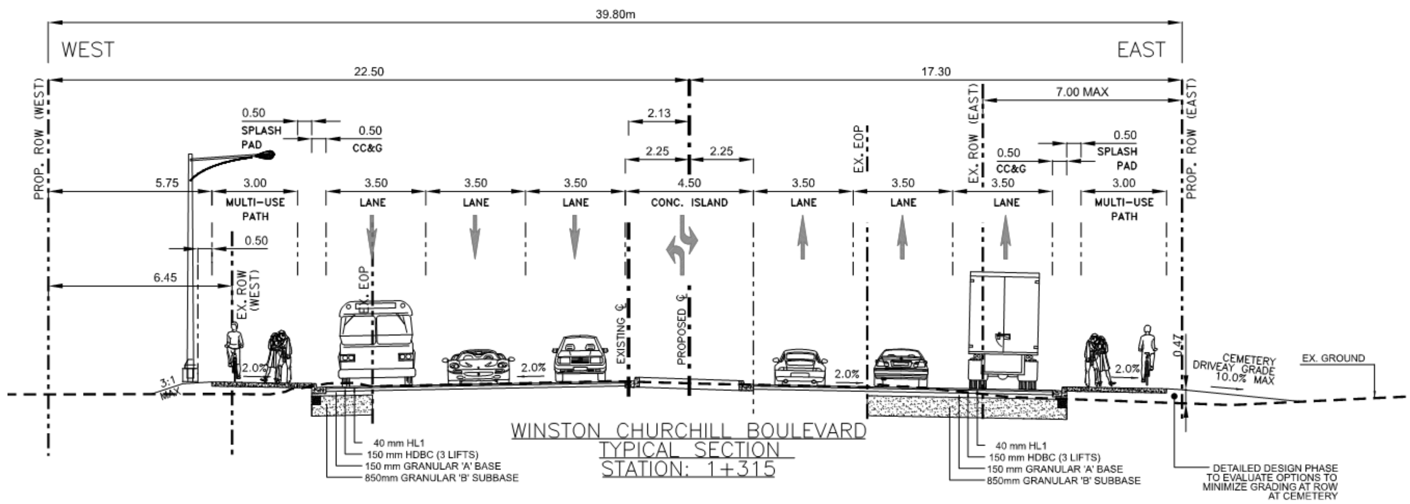


Figure 4-1: Proposed Typical Road Cross-Section

4.2 Proposed Drainage Patterns

In general, under proposed roadway widening conditions, post- development runoff for road ROW catchments is expected to increase due to the increase in overall imperviousness coverage. Table 4-1 demonstrates the increase (~42%) in impervious area along the road ROW catchments within the Winston Churchill Boulevard study area.

The proposed drainage patterns from external catchments are expected to remain identical to the existing condition.

Table 4-1: Percent Increase in ROW Catchment

CATCHMENT ID	Total Impervious Area (ha)		Percent Increase (%)
	Existing	Proposed	
R.2-01	0.14	0.79	34%
R.2-02	0.69	1.00	44%
R.4-01	0.31	0.54	75%
R.4-02	0.11	0.19	69%
R.5-01	0.32	0.46	44%
R.5-02	0.23	0.33	39%
R.6-01	0.24	0.39	63%
R.6-02	0.24	0.35	43%
R.8-01	0.59	1.01	71%
R.8-02	1.33	1.74	31%
R.10-01	1.60	2.39	49%
R.10-02	0.49	0.78	61%
R.11-01	0.35	0.40	15%
R.11-02	0.43	0.55	27%
R.12-01	0.57	0.63	11%
R.12-02	1.35	1.53	13%
R.13-01	0.92	1.28	39%
R.13-02	0.22	0.27	22%

Exhibits P1 to P7, presented in **Appendix A**, depict the proposed condition within the project limits, drainage area delineation, outlets, and the direction of overland flow routes. The existing internal and external catchment areas have been maintained in the proposed condition, as well as the existing outlets and drainage patterns. Proposed runoff will continue to drain into existing outlets.

4.3 Hydrologic Runoff Estimation

The hydrologic parameters for the adjacent external catchments across the study area used for peak runoff estimation are equivalent to the parameters utilized for the existing condition. Due to *no future developments* identified within the Winston Churchill Boulevard corridor, proposed external catchment peak flows and characteristics are *expected to remain the same*.

Table 4-2 summarizes the hydrologic parameters for the proposed road catchments across the study area used for peak runoff estimation.

Table 4-2: Proposed ROW Catchment Characteristics

CATCHMENT ID	DRAINAGE OUTLET	AREA (ha)	% Imperviousness	Runoff Coefficient "C"
R.2-01	C2 Culvert	1.11	71%	0.80
R.2-02		1.37	73%	0.81
R.4-01	C4 Culvert	0.68	78%	0.82
R.4-02		0.24	81%	0.83
R.5-01	C5 Culvert	0.59	78%	0.82
R.5-02		0.43	76%	0.81
R.6-01	C6 Culvert	0.47	83%	0.84
R.6-02		0.43	81%	0.83
R.8-01	C8 Culvert	1.27	79%	0.83
R.8-02		2.27	77%	0.82
R.10-01	C10 Culvert	3.07	78%	0.82
R.10-02		1.00	79%	0.82
R.11-01	C11 Culvert	0.52	77%	0.82
R.11-02		0.59	93%	0.88
R.12-01	825mm dia STM Pipe	0.69	92%	0.87
R.12-02		1.84	84%	0.84
R.13-01	Ditch on East Side	1.46	88%	0.86
R.13-02		0.34	78%	0.82

Table 4-3 summarizes the peak runoff from each contributing catchment (road ROW and external) under proposed conditions for various design storms (i.e., 2- to 100-yr storm events) calculated using the Rational Method and regional storm using Visual Otthymo).

Table 4-3: Proposed ROW Catchment Peak Runoff

CATCHMENT ID	2-yr flow (m^3/s)	5-yr flow (m^3/s)	10-yr flow (m^3/s)	25-yr flow (m^3/s)	50-yr flow (m^3/s)	100-yr flow (m^3/s)	Regional Storm (m^3/s)
R.2-01	0.21	0.27	0.33	0.39	0.44	0.49	0.16
R.2-02	0.26	0.34	0.41	0.48	0.54	0.60	0.20
R.4-01	0.13	0.17	0.21	0.24	0.28	0.31	0.10
R.4-02	0.05	0.06	0.07	0.09	0.10	0.11	0.04
R.5-01	0.12	0.15	0.18	0.21	0.24	0.27	0.09
R.5-02	0.08	0.11	0.13	0.15	0.17	0.19	0.06
R.6-01	0.09	0.12	0.15	0.17	0.19	0.22	0.07
R.6-02	0.08	0.11	0.13	0.16	0.17	0.19	0.06
R.8-01	0.25	0.32	0.39	0.46	0.52	0.58	0.19
R.8-02	0.44	0.57	0.69	0.81	0.91	1.01	0.33
R.10-01	0.60	0.77	0.94	1.10	1.24	1.38	0.44
R.10-02	0.20	0.25	0.31	0.36	0.40	0.45	0.14
R.11-01	0.10	0.13	0.16	0.19	0.21	0.23	0.07
R.11-02	0.12	0.16	0.19	0.22	0.25	0.28	0.09
R.12-01	0.14	0.18	0.22	0.26	0.29	0.33	0.10
R.12-02	0.37	0.47	0.58	0.67	0.76	0.84	0.27
R.13-01	0.30	0.38	0.47	0.54	0.61	0.68	0.21
R.13-02	0.07	0.09	0.10	0.12	0.14	0.15	0.05

Table 4-4 summarizes the increase in 100-yr design flows from road ROW catchments under proposed conditions showing an overall increase in runoff flows as compared to existing conditions.

Table 4-4 Percent Increase in 100-year Runoff

CATCHMENT ID	Percent Imperviousness Increase (%)	100-year flow (m3/s)		
		Existing	Proposed	Percent Increase (%)
R.2-01	34%	0.38	0.49	29%
R.2-02	44%	0.44	0.60	39%
R.4-01	75%	0.21	0.31	44%
R.4-02	69%	0.07	0.11	63%
R.5-01	44%	0.18	0.27	44%
R.5-02	39%	0.14	0.19	32%
R.6-01	63%	0.16	0.22	33%
R.6-02	43%	0.14	0.19	40%
R.8-01	71%	0.43	0.58	33%
R.8-02	31%	0.84	1.01	20%
R.10-01	49%	1.13	1.38	22%
R.10-02	61%	0.31	0.45	47%
R.11-01	15%	0.20	0.23	17%
R.11-02	27%	0.27	0.28	4%
R.12-01	11%	0.31	0.33	7%
R.12-02	13%	0.77	0.84	9%
R.13-01	39%	0.59	0.68	15%
R.13-02	22%	0.13	0.15	20%

4.4 Culvert Hydraulics - External Catchments

For the most part Winston Churchill Boulevard within the study area is currently classified as a rural arterial road. However, it is expected that with the proposed improvements, the roadway will become an urban arterial road. Therefore, all the road cross culverts have been assessed under the 50-year design storm event. The proposed design hydraulics have been divided into proposed minor culvert hydraulics and regulated watercourse crossing hydraulics.

4.4.1 Proposed Minor Culvert Crossings

The hydraulic analysis of the minor culverts C2, C4, C5, C6, C7, C9 and C11 are based on the CulvertMaster. Due to road widening, all the culverts in the study area need to be extended. In addition, culverts C5, C6, C7 and C9 are recommended to be upsized due to the hydraulic criteria not being met.

Table 4-5 summarizes the preliminary proposed culvert design within the study area.

Table 4-5: Proposed Culvert Design

CULVERT ID	CONTRIBUTING AREA (ha)	LENGTH (m)		DIMENSION (mm)		50-yr DESIGN FLOW (m^3/s)	H/D Ratio < 1.5	FREEBOARD > 0.3m
		Existing	Proposed	Existing	Proposed			
C2	14.27	23.69	43	1200	Extend	2.062	1.08	1.16
C4	3.06	23.24	59	600	Extend	0.553	1.32	0.63
C5	12.08	20	40	600	2 x 750	2.225	0.81	0.60
C6	4.26	20.16	39.3	600	750	0.723	1.17	0.49
C7	9.94	20	49	600	2 x 750	1.483	1.07	0.60
C9	6.84	24.2	40	600	750	0.851	1.37	0.78
C11	0.23	35	43	600	Extend	0.041	0.33	1.30

4.5 Regulated Watercourse Crossings

Under future conditions, extensions of all three (3) watercourse crossings will be required. No upsizing of the Mullet Creek, Levi Creek South and North crossings are recommended as under existing conditions, no overtopping of the road is expected.

For the purpose of this EA, the provided HEC-RAS model was adapted to evaluate the impacts of increased deck widths on upstream WSEL at a preliminary level. No significant change in the modelled peak flows for Mullet Creek (i.e., 26.3 m^3/s for 100-yr and 37.4 m^3/s for Regional), Levi Creek North (i.e., 9.4 m^3/s for 100-yr and 10.0 m^3/s for Regional) and Levi Creek North (i.e., 45.9 m^3/s for 100-yr and 56.4 m^3/s for Regional) is anticipated

As summarized in Table 4-6 increasing the deck width for all regulated watercourse crossings (C10, C8, and C3) does not cause overtopping of the road or dramatically increase WSELs at all three crossings compared to the existing condition, for all storm events up to the regional event. For hydraulic purposes, it is not recommended that the structures be upsized given that the proposed hydraulics meet the criteria and minimal increases are anticipated as a result of the increased deck width.

Table 4-6: Proposed Watercourse Crossing Hydraulics

Description	Proposed Span (m)	Proposed Rise (m)	Deck Width [m]	Stream Invert (m)	Top of Road Deck (m)	100-yr Flow		Regional Flow	100-yr H/D Ratio	100-yr Freeboard [m]
						WSEL (m)	Change in WSEL (m)	WSEL (m)		
C10 Mullet Creek	10.36	2.44	30	203.55	206.19	205.43	0.01	205.87	0.77	0.76
C8 Levi Creek South	5.49	2.44	20	204.41	207	205.32	0.02	205.35	0.37	1.68
C3 Levi Creek North	10.97	2.44	23.69	206.78	209.22	207.79	-0.1	207.89	0.41	1.43

Hydraulic modelling is recommended at detailed design to more accurately assess the impacts of road widening and bridge design at Mullet Creek and Levi Creek North and South. The final hydraulic model should include the following

- design of structures;
- road profiles and
- additional stream survey data along the corridor.

In addition, per the CVC's Fluvial Geomorphic Guidelines, it is recommended that the substrate of the structure will match the existing conditions to the best extent possible and promote fish passage. The low-flow channel should be designed based on MTO principles (WC-12).

4.6 Geomorphic Stream Assessment

Water's Edge was retained by Hatch Mott MacDonald to complete a fluvial assessment and natural channel designs for three stream crossings – two tributaries of Levi's Creek and one tributary of Mullet Creek on Winston Churchill Blvd, in the Region of Peel. The report can be found in **Appendix D**. Within all future design stages, any work within regulated floodplains will require further engagement with CVC.

The proposed road widening may require realignment of the north tributary of Levi Creek which runs along the existing road embankment on the west side of Winston Churchill Blvd. Potential property acquisition limit due to the stream alternation is shown in P-6 and P-7 of the proposed drainage plan in **Appendix A**. As per the recommendations in the geomorphic assessment, channel realignment should properly observe the final meander beltwidths and closely resemble existing geomorphic parameters. Proper pool/riffle sequences, substrates, and low flow channel should also be considered.

4.7 Proposed Drainage System Plan

The drainage concepts for the study have been divided and grouped by Segments 1, 2 and 3. The recommendations have been based on the existing site conditions, future road design considerations, soil condition and available space.

- For the minor system flow (10-year design flow), the drainage from the urban cross-section is drained to the catchbasins which are connected to the storm sewer network located under the median of the road.
- The major flows will follow the road system to the major culvert outlets. Overland flows are to be conveyed to the downstream end of the culvert crossing structures.
- The culvert crossings are to convey the external flows across the Winston Churchill Boulevard.
- Underground storage chambers (Stormtech or equivalent) and OGS are to be installed as part of stormwater management facility.

Preliminary sizing of proposed storm sewer system is presented in **Appendix E**

Segment 1 (Highway 401 to Steeles Avenue) (St 0+000 to St 0+928)

The proposed drainage conditions for Segment 1 are summarized below in Table 4-7

Table 4-7: Segment 1 Proposed Drainage Features

Stationing	Catchment ID	Drainage features and Particulars	Outlet ID
0+000 to 0+400	R.13-01 R.13-02	Minor system drainage (10-yr design storm event) to be conveyed by approximately 345m of total main storm sewer length along the road ROW. The proposed storm sewers are to convey minor system flows to the proposed underground chamber that eventually flows into the proposed OGS units prior to the existing ditch on the east side of Winston Churchill Boulevard. Major system flows (in excess of the 10-yr design storm) within the study area to be conveyed via road curb system towards low points in the road profile and local geography, eventually discharging into existing ditch.	Existing Ditch
0+400 to 0+928	R.12-01 R.12-02	Minor system drainage (10-yr design storm event) to be conveyed by approximately 500m of total main storm sewer length along the road ROW. The proposed storm sewers are to convey minor system flows to the proposed underground chamber that eventually flows into the proposed OGS units prior to the final outlet at existing 825mm storm sewer at the intersection of Steeles Avenue and Winston Churchill Boulevard. Major system flows (in excess of the 10-yr design storm) within the study area to be conveyed via road curb system towards low points in the road profile and local geography, eventually discharging into receiving watercourses.	Existing 825mm STM

Segment 2 (North of Steeles Avenue to Maple Lodge Farms) (St 0+928 to St 2+070)

The proposed drainage conditions for Segment 2 are summarized below in Table 4-8.

Table 4-8: Segment 2 Proposed Drainage Features

Stationing	Catchment ID	Drainage features and Particulars	Outlet ID
0+928 to 1+174	R.11-01 R.11-02	Minor system drainage (10-yr design storm event) to be conveyed by approximately 150m of total main storm sewer length along the road ROW. The proposed storm sewers are to convey minor system flows to the proposed underground chamber that eventually flows into the proposed OGS units prior to the downstream of culvert C11. Major system flows (in excess of the 10-yr design storm) within the study area to be conveyed via road curb system towards low points in the road profile and local geography, eventually discharging into receiving watercourse.	C11
1+174 to 2+070	R.10-01 R.10-02	Existing storm sewer and catchbasins to be removed and new storm sewer installed. Minor system drainage (10-yr design storm event) to be conveyed by approximately 160m of total main storm sewer length along the road ROW. The proposed storm sewers are to convey minor system flows to the proposed underground chamber that eventually flow into the proposed OGS units prior to the final outlet at the Mullet Creek (C10). Major system flows (in excess of the 10-yr design storm) within the study area to be conveyed via road curb system towards low points in the road profile and local geography, eventually discharging into receiving watercourses.	C10

Segment 3 (North of Maple Lodge Farms to Embleton Road) (St 2+070 to St 4+010)

The proposed drainage conditions for Segment 3 are summarized below in Table 4-9

Table 4-9: Segment 3 Proposed Drainage Features

Station	Catchment ID	Drainage features and Particulars	Outlet ID
2+070 to 2+850	R.8-01 R.8-02	Existing storm sewer and catchbasins to be removed and new storm sewer installed. Minor system drainage (10-yr design storm event) to be conveyed by approximately 635m of total main storm sewer length along the road ROW. The proposed storm sewers are to convey minor system flows to the proposed underground chamber that eventually flows into the proposed OGS units prior to the downstream of culvert C8 and C9. Major system flows (in excess of the 10-yr design storm) within the study area to be conveyed via road curb system towards low points in the road profile and local geography, eventually discharging into receiving watercourse.	C8 and C9
2+850 to 3+050	R.6-01 R.6-02	Existing storm sewer and catchbasins to be removed and new storm sewer installed. Minor system drainage (10-yr design storm event) to be conveyed by approximately 160m of total main storm sewer length along the road ROW. The proposed storm sewers are to convey minor system flows to the proposed underground chamber that eventually flows into the proposed OGS units prior to the final outlet at Culvert C6. Major system flows (in excess of the 10-yr design storm) within the study area to be conveyed via road curb system towards low points in the road profile and local geography, eventually discharging into receiving watercourses.	C6
3+050 to 3+275	R.5-01	Minor system drainage (10-yr design storm event) to be conveyed by approximately 166m of total main storm sewer length along the road ROW. The proposed storm sewers are to convey minor	C5

Station	Catchment ID	Drainage features and Particulars	Outlet ID
	R.5-02	system flows to the proposed underground chamber that eventually flows into the proposed OGS units prior to the downstream of culvert C4. Major system flows (in excess of the 10-yr design storm) within the study area to be conveyed via road curb system towards low points in the road profile and local geography, eventually discharging into receiving watercourse.	
3+275 to 3+473	R.4-01 R.4-02	Minor system drainage (10-yr design storm event) to be conveyed by approximately 255m of total main storm sewer length along the road ROW. The proposed storm sewers are to convey minor system flows to the proposed underground chamber that eventually flows into the proposed OGS units prior to the downstream of culvert C4. Major system flows (in excess of the 10-yr design storm) within the study area to be conveyed via road curb system towards low points in the road profile and local geography, eventually discharging into receiving watercourse.	C4
3+473 to 4+010	R.2-01 R.2-02	Minor system drainage (10-yr design storm event) to be conveyed by approximately 500m of total main storm sewer length along the road ROW. The proposed storm sewers are to convey minor system flows to the proposed underground chamber that eventually flows into the proposed OGS units prior to the downstream of culvert C2. Major system flows (in excess of the 10-yr design storm) within the study area to be conveyed via road curb system towards low points in the road profile and local geography, eventually discharging into receiving watercourse.	C2

4.8 Proposed SWM Plan

In order to mitigate the quantity and quality impacts of the increased runoff from the widened road ROW, it should be recognized that the applicability of traditional SWM measures is limited due to the linear nature of the study corridor with multiple drainage outlets. In addition, surface space availability along the road ROW for SWM features is also limited.

4.8.1 SWM/LID Options Assessment

Table 4-10 presents traditional SWM measures and Low Impact Development (LID) options considered for the study corridor. The applicability of each option was assessed based on:

- Potential to manage stormwater runoff within road ROW and mitigate water quality and quantity impacts;
- Availability of area (surface and sub-surface) within the road ROW;
- Road cross-section type (i.e., rural vs urban);
- Connectivity with proposed drainage conveyance infrastructure and outlets; and
- Overall cost-effectiveness, operating and maintenance cost.

An assessment of LID concluded that the in-situ soils and high groundwater table did not make LID measures appropriate for the site. This led to use of end-of-pipe storage facilities (storage tanks) at each outlet.

Therefore, in order to meet drainage and SWM objectives for the proposed road widening, a *treatment train approach* through the implementation of SWM controls in combination with linear LID features was considered. LID features encourage runoff reduction through infiltration to provide water quantity and balance benefits, along with pollutant settling for water quality benefits.

Table 4-10: SWM/LID Options

SWM/LID Control Measures	Type of Control		Applicability to		
	Water Quantity	*Water Quality*	*Segment 1 (Highway 401 to Steeles Avenue)*	*Segment 2 (Steeles Avenue to north of Maple Lodge Farms)*	*Segment 3 (north of Maple Lodge Farms to Embleton Road)*
SWM Pond/Wetland	Most Effective Peak Flow Reduction	Most Effective Pollutant Removal	**Not feasible >>** Highway bridge structures along this segment, roadway outlets to large drainage ditches and end-of-pipe treatments between and around the bridges.	**Not feasible >>** End-of pipe treatment, multiple outlets along ROW require several ponds, large footprint requirement beyond ROW, high cost and maintenance	**Not feasible >>** End-of pipe treatment, multiple outlets along ROW require several ponds, large footprint requirement beyond ROW, high cost and maintenance
Oversized Storage Pipe	Runoff Reduction	N/A	**Limited feasibility >>** Largely bridge and overland conveyance to existing outlets. Potential at Steeles Avenue West intersection.	**Limited feasibility >>** Existing storm sewer system within this area, could be used by outlet connection. Involves high cost and maintenance.	**Limited feasibility >>** Potential clearance and outlet connection. Issues include high cost and maintenance.
Oil-Grit Separator	N/A	Moderately Effective, Requires Treatment Train	**<u>Recommended</u>** at each outlet from storm sewer and/or LID SWM facility	**<u>Recommended</u>** at each outlet from storm sewer and/or LID SWM facility	**<u>Recommended</u>** at each outlet from storm sewer and/or LID SWM facility
Pervious Pavement, Porous Asphalt	Runoff Reduction	Moderate Pollutant Removal	**<u>Recommended</u>** for use along MUP	**<u>Recommended</u>** for use along MUP	**<u>Recommended</u>** for use along MUP
Enhanced Grassed Swales	Peak Flow Attenuation Only	Moderate Pollutant Removal	**<u>Recommended</u>** for drainage conveyance from rural cross-section	**Limited feasibility >>** Limited space available within ROW due to urban cross-section	**Limited feasibility >>** Limited space available within ROW due to urban cross-section
Filter Strips	N/A	Pretreatment Only	**Limited feasibility >>** Limited space available within ROW	**Limited feasibility >>** Limited space available within ROW	**Limited feasibility >>** Limited space available within ROW

SWM/LID Control Measures	**Type of Control**		**Applicability to**		
	Water Quantity	***Water Quality***	***Segment 1 (Highway 401 to Steeles Avenue)***	***Segment 2 (Steeles Avenue to north of Maple Lodge Farms)***	***Segment 3 (north of Maple Lodge Farms to Embleton Road)***
Bioretention Swales	Peak Flow and Volume Reduction	Effective Pollutant Removal	**Not applicable >>** Urban cross-section	**Not applicable >>** Urban cross-section	**Not applicable >>** Urban cross-section
Infiltration Trench	Peak Flow and Volume Reduction	Somewhat Effective Pollutant Removal with Potential for GW Contamination	**Not applicable >>** Urban cross-section	**Not applicable** >> Urban cross-section	**Not applicable >>** Urban cross-section
Underground Detention (Infiltration Chambers, Perforated Pipe Exfiltration System)	Peak Flow and Volume Reduction	Effective Pollutant Removal	**Limited Feasibility >>** Chambers under road near bridges not recommended. Limited space available within ROW.	**Recommended** under MUP	**Recommended** under MUP

4.8.2 Preferred SWM/LID Strategy

Based on the assessment of applicable SWM/LID options above, the following SWM/LID measures are recommended to be implemented to treat, reduce and infiltrate road ROW runoff from design events where feasibly possible for quality and quantity control. It is recommended that water quantity and quality control for the study area shall be through underground storage chambers.

4.9 Stormwater Quantity Control

Runoff from ROW will be captured by catch basins and conveyed by storm sewer for the 10-year minor storm event and flow directed to the proposed underground storage chambers. This chamber is designed to control post development flow to the pre-development level for all storm events up to 100-year storm.

The required storage volumes were calculated using Modified Rational Method and are presented in Table 4-11 and summarized in **Appendix F**

Table 4-11: Water Quantity Control Requirements

CATCHMENT ID	DRAINAGE OUTLET	PROPOSED ROW AREA (ha)	100-year flow (m^3/s)		QUANTITY CONTROL STORAGE REQUIRED (m^3)
			EXISTING	PROPOSED	
R.2-01	C2 Culvert	1.11	0.38	0.49	66.47
R.2-02		1.37	0.44	0.60	100.92
R.4-01	C4 Culvert	0.68	0.21	0.31	56.36
R.4-02		0.24	0.07	0.11	25.36
R.5-01	C5 Culvert	0.59	0.18	0.27	48.75
R.5-02		0.43	0.14	0.19	28.23
R.6-01	C6 Culvert	0.47	0.16	0.22	32.24
R.6-02		0.43	0.14	0.19	33.26
R.8-01	C8 Culvert	1.27	0.43	0.58	85.14
R.8-02		2.27	0.84	1.01	102.40
R.10-01	C10 Culvert	3.07	1.13	1.38	151.27
R.10-02		1.00	0.31	0.45	85.41
R.11-01	C11 Culvert	0.52	0.20	0.23	19.86
R.11-02		0.59	0.27	0.28	6.67
R.12-01	825mm dia. STM Pipe	0.69	0.31	0.33	12.87
R.12-02		1.84	0.77	0.84	41.96
R.13-01	Ditch on East Side	1.46	0.59	0.68	54.53
R.13-02		0.34	0.13	0.15	15.40

For the purpose of this EA, the design of LID features along the road ROW considered the following:

- Underground detention to be provided via manufactured infiltration chambers (e.g., Stormtech, StormTank etc.) embedded within clearstone under the MUP to maximize storage volume availability within 3m for both the east and west sides of the WCB corridor.
- Underground detention chambers are to be connected to manholes at both inlet and outlet ends. This is to include an orifice to encourage complete infiltration of design flows and be available for operations/routine maintenance (i.e., flushing of chambers following sediment accumulation/clogging).
- Due to the low permeability of sandy-silty-clay subgrade soils along the study corridor, a very low exfiltration rate from the underground detention chambers is expected. As such stormwater detained in the chambers is expected to exfiltrate into subgrade soils over a prolonged period *following* a storm event, with no immediate outflow.

- During detailed design, location-specific soil infiltration testing will be required to optimize underground detention chamber sizing. Additional boreholes at LID feature locations may be considered to understand shallow groundwater water levels that may impact the functionality of LIDs.
- At the detailed design stage, consideration for alternative LID configurations including perforated pipe exfiltration systems instead of underground detention, pre-treatment via inlet biofiltration products (e.g., Filterra or other similar products) can also be explored. Implementation of engineered soils to compensate for the moderate to poor native soil drainage conditions may also be required.
- Discussions with the Region's operations staff will be required for understanding and developing regular maintenance procedures of LID features.

Appendix G provides preliminary sizing of underground storage chambers.

4.10 Water Quality Control Measures

Under existing conditions, there are four (4) OGS units installed for water quality treatment measures at Mullet Creek and Levi Creek culvert. Water quality control is required for any additional paved areas associated with the proposed improvements of the WCB corridor. Due to the nature of this facility (i.e., linear transportation corridor) and limited space within the ROW, it is determined that possible water quality through OGS is preferred to achieve water quality control objectives.

Bioretention planters can also be implemented at the sidewalks and/or green zones to retain the water from small storm events and enhance the water quality. Due to the soil condition of the project site, infiltration is not recommended. Instead, an underdrain can be provided to drain the water out of the facility.

It shall be noted that underground storage chambers come with an isolator row which is typically designed to capture the "first flush" and helps to achieve 80 percent TSS removal. Therefore, underground storage chambers with isolator rows can be used as part of treatment train approach to achieve 80% TSS removal.

4.11 Water Balance and Runoff Volume Control Measures

Based on the water balance and runoff volume control criteria outlined in the Region of Peel stormwater design criteria and procedural manual (2019), the proposed design for the WCB Corridor must provide, at a minimum, on-site retention of all run-off from the first 27-28mm of each rainfall event through infiltration, re-use and/or evapotranspiration. Table 4-12 summarizes the water balance requirements for the project.

Table 4-12: Water Balance Requirement

Facility	Area (ha)	Storage Requirement to retain 27mm of Rainfall (m^3)
WCB Corridor	15.5	4185

Best efforts shall be made to meet the water balance on-site. The underground storage chambers and green areas within the ROW will provide some infiltration for the water balance requirements.

5. Erosion and Sediment Control

If uncontrolled, the construction activities associated with WCB improvements could result in increased rates of erosion and sedimentation within and adjacent to the study area and Mullet and Levi Creek subwatersheds. Erosion, for the purposes of this discussion, is described as the process whereby soil particles are detached from an exposed surface and transported by water, wind or some other agent. Sedimentation is defined as the deposition of (eroded) particles at a "downstream" point, typically a watercourse. The potential environmental impacts from increased erosion and sedimentation include: degradation of water quality; destruction of fisheries habitat; and, increased flooding potential.

Erosion and sedimentation processes are typically accelerated due to construction activities. Literature indicates that construction activities can increase erosion and sedimentation rates by 2 to 3 orders of magnitude over that expected from a natural forested area. Erosion and sedimentation control are therefore an integral and important component in the design and construction of any project.

5.1 Erosion and Sediment Control Measures

To minimize the potential environmental impacts, the following erosion and sedimentation control practices will serve to guide the design and implementation phase of the Erosion and Sedimentation Control Plan:

- limit size of disturbed area,
- limit duration of soil exposure,
- retain existing vegetation where feasible,
- limit slope length and gradient of disturbed areas,
- preserve overland sheet flow and micro-drainage (avoid concentrated channel flows),
- break and redirect flows to lower gradients,
- design and implement staged stripping,
- prevent disturbance of previously stripped and stabilized parcels, and
- stabilize stripped parcels with temporary vegetative controls.
- design inlet and outlet protection treatment based on Highway Drainage and Design Standards
- engage geomorphic design for any stream realignment or rehabilitation

Based on the erosion control criteria outlined in the section 2, the proposed design for the WCB Corridor must provide, at a minimum, on-site retention of all run-offs from the 5mm of each rainfall event through infiltration, re-use and/or evapotranspiration.

The erosion control storage volume for the site area was determined by multiplying a 5mm rainfall depth across the entire site area, then multiplying by the ultimate condition site runoff coefficient. The resulting erosion control storage volume for the site is **620 m^3**. Best efforts shall be made to meet the erosion control on-site. The underground storage chambers and green areas within the ROW will provide some infiltration for erosion control.

6. Conclusions

This report summarizes the preliminary drainage and SWM of approximately 4.5 km of Winston Churchill Boulevard from south of Highway 401 to north of Embleton Road.

In order to provide adequate conveyance for drainage across the study corridor for road ROW and external catchments, the proposed drainage plan includes:

- Minor system drainage (10-yr design storm event) to be conveyed by main storm sewer along the road ROW.
- The proposed storm sewers are to convey minor system flows to the proposed underground chambers (stormtech chambers or equivalent) that eventually flow into the proposed OGS units prior to the final outlet.
- Major system flows (in excess of the 10-yr design storm) within the study area to be conveyed via road curb system towards low points in the road profile and local geography, eventually discharging into receiving watercourses.
- Proposed regulated watercourse crossings and drainage culverts which meet the hydraulic criteria.

The following SWM/LID measures are proposed to be implemented to treat, reduce and infiltrate road ROW runoff from design events within the corridor as much as feasibly possible in order to meet water quality and quantity control objectives:

- Water quantity control through the use of linear LID sub-surface underground detention chambers located under the MUP designed to capture and detain road ROW runoff from impervious areas via catchbasins from the 10-yr storm event. Runoff from less frequent, larger events (> 10-yr) is expected to overflow through storm sewers to outlets (i.e., culvert crossing/downstream development sewer connections).
- Current water quality control of runoff from paved surfaces is to be maintained through a treatment train approach using catchbasin inserts at curb and gutter prior to directing runoff to proposed and retrofitted underground detention chambers to encourage pollutant settling. Any overflows from the underground detention will be treated via end-of-pipe OGS devices prior to discharge to suitable outlets.
- Existing water quality devices to be evaluated and updated for future water quality impacts associated with the increase in impervious area within the study limits.

During the detailed design stage, all applicable Region, MECP, and CVC standards for drainage system design should be followed. All hydraulic (i.e., HEC-RAS and CulvertMaster) models should be updated for evaluation based on final design of road profiles, bridge design and comprehensive survey data of the stream corridor and adjacent land topography.

At the detailed design stage, soil infiltration testing at proposed LID feature locations should be conducted in order to determine exfiltration rates from the underground detention chambers and optimize chamber sizing. Erosion and sedimentation control measures should be designed during the detailed design stage of the project and must be implemented during construction.

7. Recommendations and Next Steps

As per comments received from CVC, several aspects shall be considered and addressed in detailed design stage of the project.

- The following items shall be considered when determining the extent of work and developing the workplan for the identified subject sites:
    - The proposed works associated with the crossing should not create additional offsite flooding upstream and/or downstream of the crossing. Therefore, any alterations to existing crossings must not have any off-site flooding impacts during all design storms from 2-year to 100-year and Regional events.
    - CVC's expectation for crossing replacements is that the crossing should be designed to be flood free to the best extent possible. If changes to the design are proposed, a hydraulic assessment will be required.
    - It must be confirmed that the preferred alternative will not have any offsite flooding impacts due to the proposed work being completed. CVC's Technical Guidelines for Watercourse Crossings (September 2019) shall be referred for more detailed guidance.
    - The hydraulic model shall follow the CVC Standard Parameters unless otherwise directed or justified.
- A method of pre-treatment would be required to ensure that the underground chambers and isolator rows would function as per intended design. During detail design the location(s) of the pre-treatment measures on the typical cross-sections shall be provided to ensure they are utilized in the appropriate location.
- For the proposed storm chamber design, an in-depth investigation must take place to determine the soil conditions and elevated groundwater conditions within the study area and design the measures appropriately. The following shall be referred for additional design considerations for the storage chambers:
    - Refer to Sustainable Technologies Evaluation Program for additional design guidance of Infiltration Chambers.
    - Provide a typical detail of the storm chambers including details of the overflow method and depth of separation between the bottom of the chamber and the seasonally high groundwater elevation. The MECP

requires a minimum separation of 1.0m from the bottom of the infiltration gallery to the seasonally high groundwater elevation.

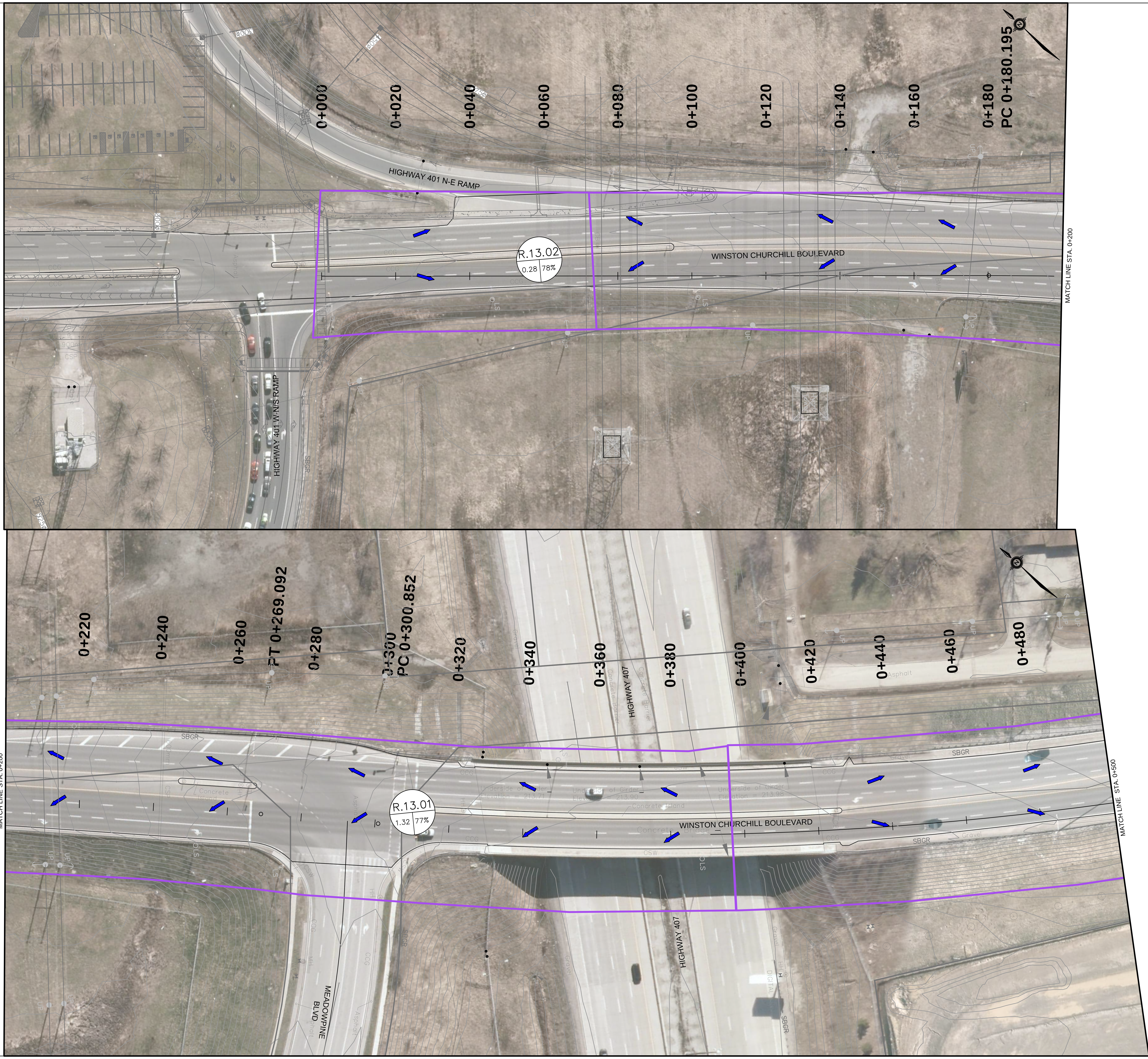
  - Clearly indicate the method being used as an overflow for the underground storage chambers.

- Section 4.8 provides further detail of the underground detention chambers. An orifice will be designed and installed to encourage complete infiltration of the design flows. The design parameters and details of each orifice shall be provided during detailed design stage.
- A detailed general arrangement plan for the regulated watercourse crossings of Levi Creek North, Levi Creek South and Mullet Creek shall be provided including the existing and proposed crossing details (invert and obverts, sizing, etc.) on these plans.
- Regulated watercourse crossing BR01 and BR05 require minor rehabilitation within the existing structure.
- All proposed infrastructure (specifically storm outlets) must be located outside of the local erosion hazard associated with the regulated watercourses. This will be determined in conjunction with the geomorphic assessment at the detailed design stage.
  - The detailed design of these outlets must incorporate appropriate erosion control measures and treatment as outlined in the EA.
- The proponent is responsible for the submission and ultimate implementation of a comprehensive ESC plan for each stage of construction, specific to the work completed at and adjacent to the regulated watercourse crossings. If the construction duration is relatively long and/or the watercourse is sensitive, multi-stage construction ESC plans will be required to ensure adequate control for the entire period of work.
  - If necessary, a flow diversion or by-pass plan must also be submitted.
  - In the instances where groundwater is high and dewatering is required, during construction activities, a dewatering plan will be required by a qualified person.
  - Refer to the Standard Notes for Drawings Submitted for CVC Review and apply the notes to the Erosion and Sediment Control drawings as necessary
- Clearly define the limit of disturbance within the subject site and incorporate appropriate silt control to ensure downstream regulated features and watercourses do not receive sediment laden runoff due to the construction of the culvert.

- All drawings and reports must be signed and stamped by a registered Professional Engineer / qualified professional prior to receiving approval from the conservation authority.

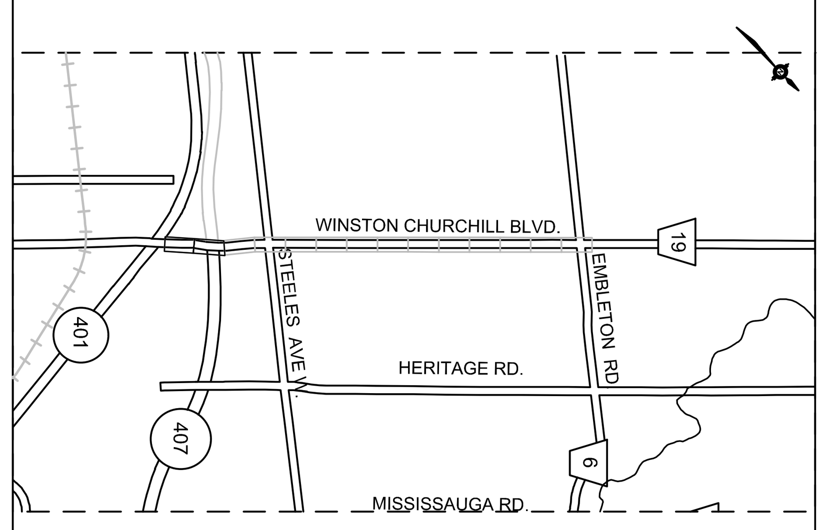
Appendix A

Exhibits



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.
04-26-2021	SWM EA	MM



KEY PLAN (N.T.S.)

LEGEND:

- EXISTING CULVERT
- EXISTING ROADWAY CATCHMENT BOUNDARY
- EXTERNAL CATCHMENT BOUNDARY
- EXISTING MAJOR FLOW DIRECTION
- EXISTING MINOR FLOW DIRECTION
- EXISTING STM
- EXISTING OGS UNIT
- WETLAND
- WATERCOURSE
- R.2-01 / 0.88 / 67% — CATCHMENT ID, PERCENTAGE OF IMPERVIOUS AREA, CATCHMENT AREA (HA)
- LEVI CREEK SUBWATERSHED
- MULLET CREEK SUBWATERSHED

HATCH

Designed by
Chkd.
Approved by

10m 0 10 20 30m
HORIZONTAL SCALE

Region of Peel
Working for you

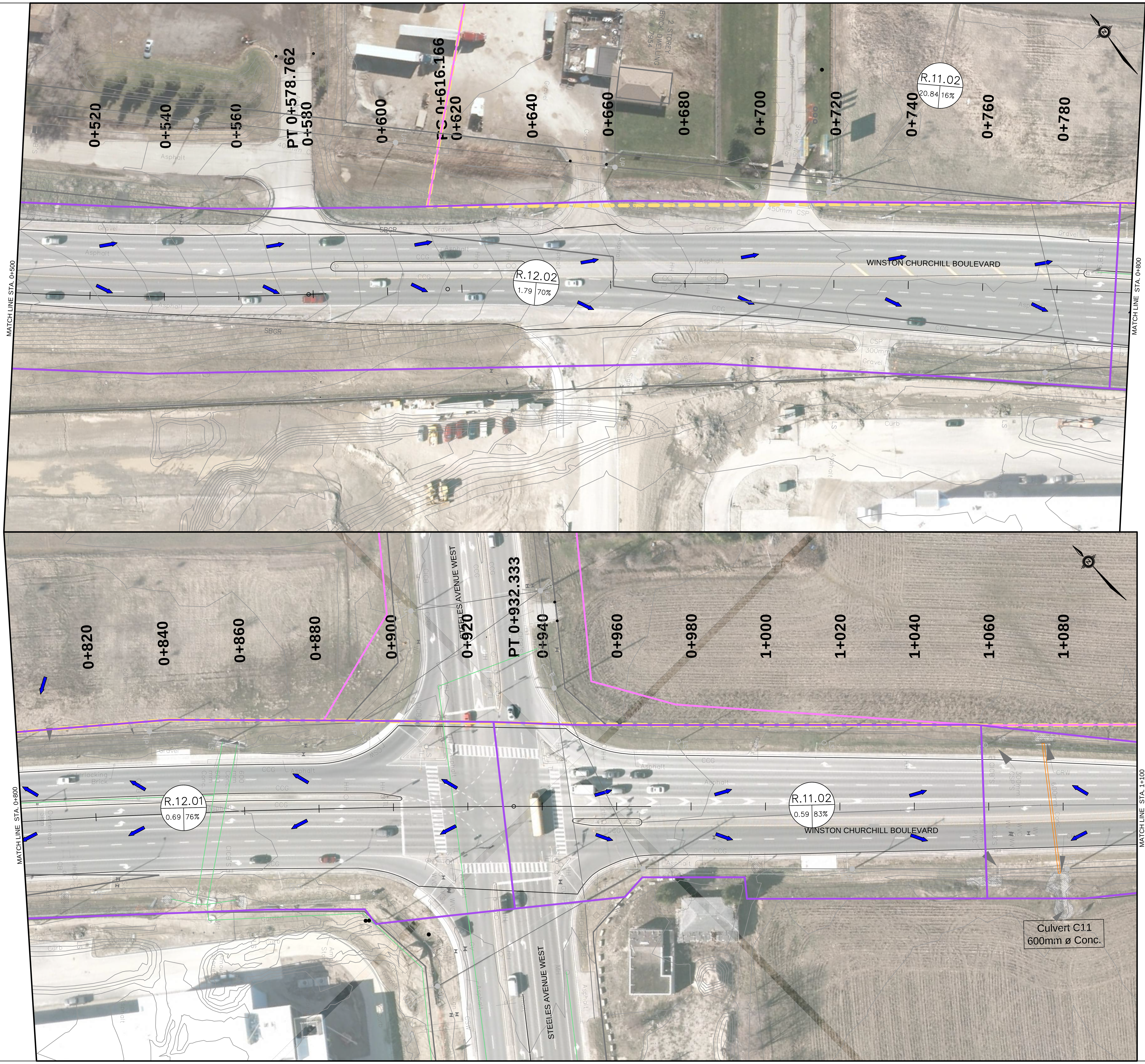
WINSTON CHURCHILL BLV.

(FROM HIGHWAY 401 TO EMBLETON ROAD)

EXISTING DRAINAGE PLAN

STA. 0+000 TO STA. 0+500

EXHIBIT E-1

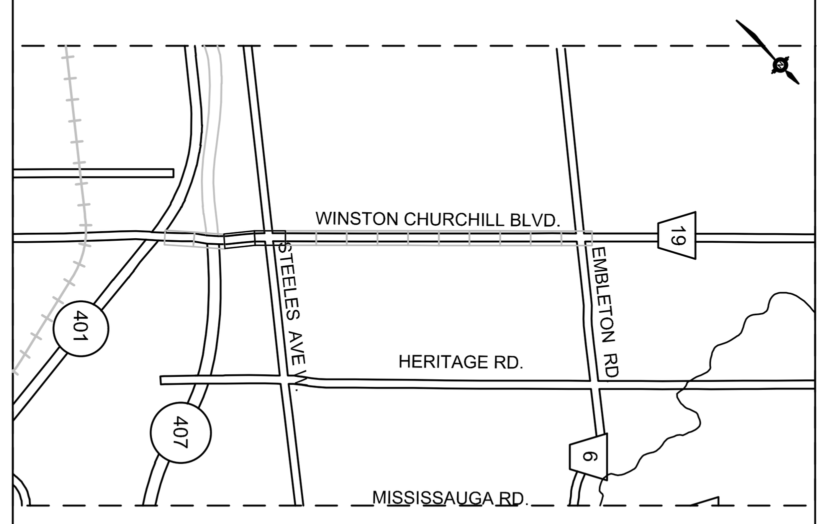


SERVICE DATA

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.
04-26-2021	PRELIMINARY	MM



KEY PLAN (N.T.S.)

LEGEND:

- EXISTING CULVERT
- EXISTING ROADWAY CATCHMENT BOUNDARY
- EXTERNAL CATCHMENT BOUNDARY
- EXISTING MAJOR FLOW DIRECTION
- EXISTING MINOR FLOW DIRECTION
- EXISTING STM
- EXISTING OGS UNIT
- WETLAND
- WATERCOURSE
- R.2-01 / 0.88 / 67%: CATCHMENT ID; PERCENTAGE OF IMPERVIOUS AREA; CATCHMENT AREA (HA)
- LEVI CREEK SUBWATERSHED
- MULLET CREEK SUBWATERSHED

HATCH

Designed by ______ Chkd. ______

Approved by ______

10m 0 10 20 30m HORIZONTAL SCALE

Region of Peel
Working for you

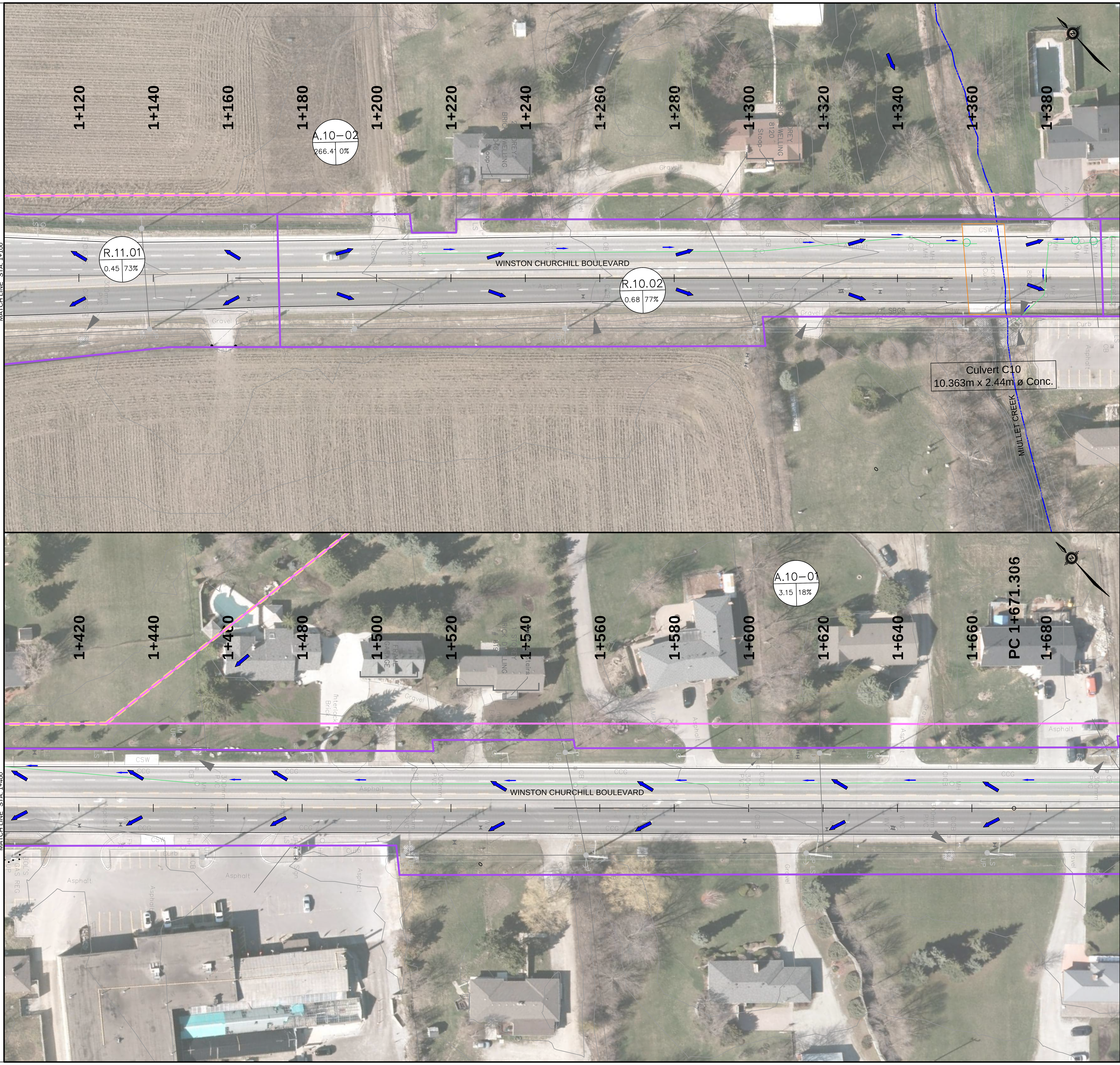
WINSTON CHURCHILL BLV.

(FROM HIGHWAY 401 TO EMBLETON ROAD)

EXISTING DRAINAGE PLAN

STA. 0+500 TO STA. 1+100

EXHIBIT E-2

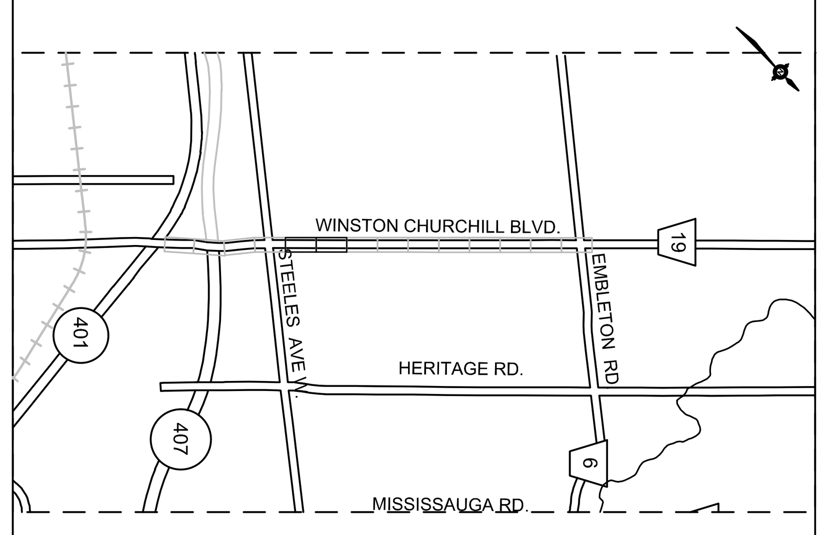


SERVICE DATA

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.
04-26-2021	SWM EA	MM



KEY PLAN (N.T.S.)

LEGEND:

- EXISTING CULVERT
- EXISTING ROADWAY CATCHMENT BOUNDARY
- EXTERNAL CATCHMENT BOUNDARY
- EXISTING MAJOR FLOW DIRECTION
- EXISTING MINOR FLOW DIRECTION
- EXISTING STM
- EXISTING OGS UNIT
- WETLAND
- WATERCOURSE
- R.2–01 / 0.88 | 67%: CATCHMENT ID; PERCENTAGE OF IMPERVIOUS AREA; CATCHMENT AREA (HA)
- LEVI CREEK SUBWATERSHED
- MULLET CREEK SUBWATERSHED

HATCH

Designed by _______ Chkd. ____

Approved by _______

10m 0 10 20 30m
HORIZONTAL SCALE

Region of Peel
Working for you

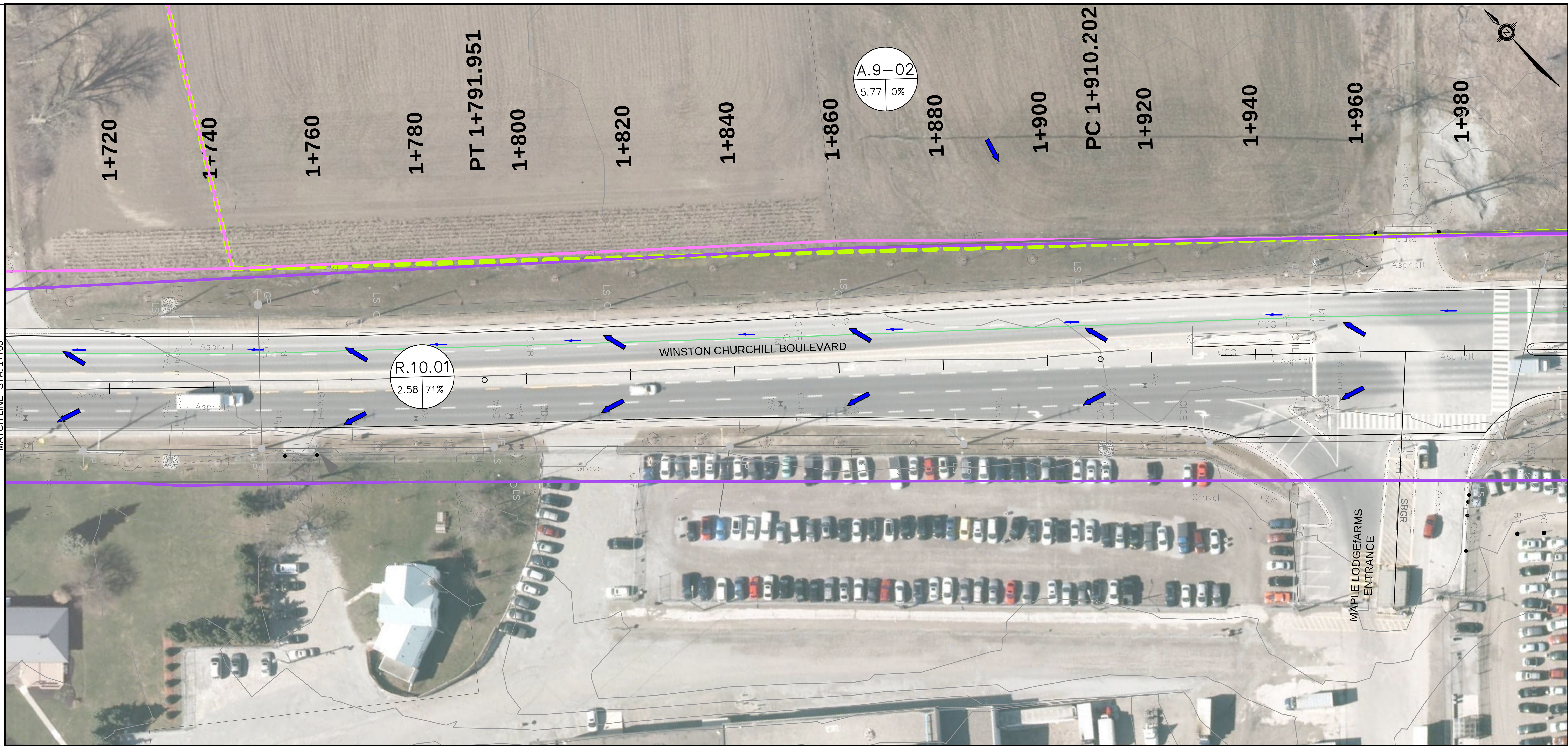
WINSTON CHURCHILL BLV.

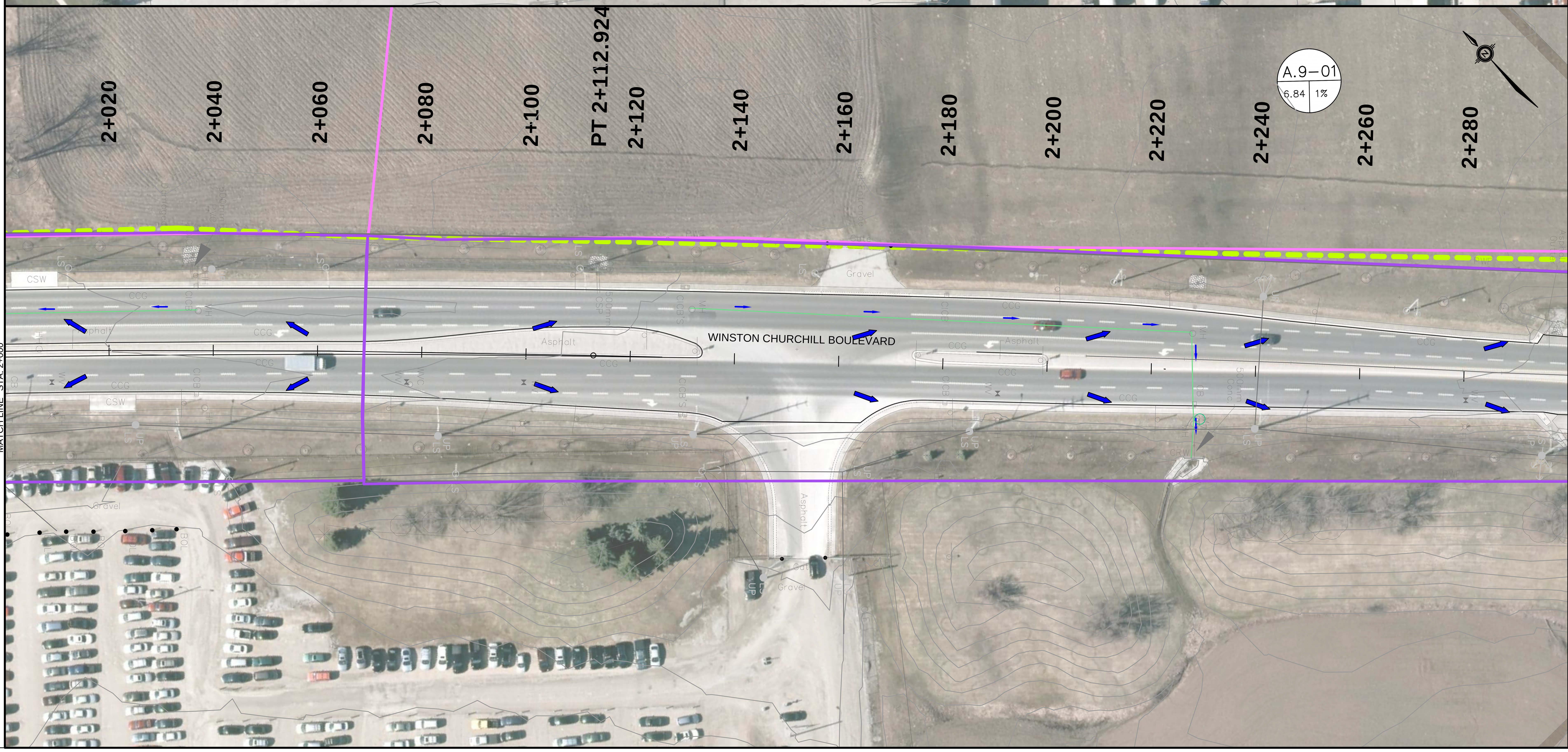
(FROM HIGHWAY 401 TO EMBLETON ROAD)

EXISTING DRAINAGE PLAN

STA. 1+100 TO 1+700

EXHIBIT E-3



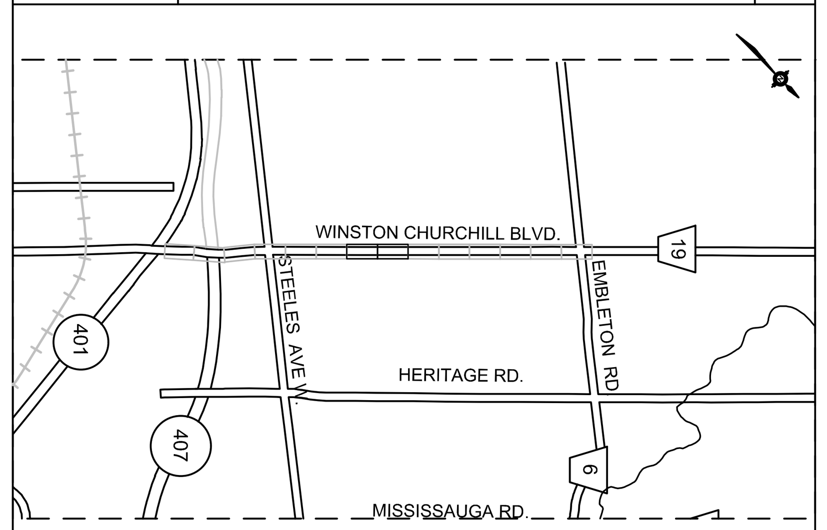


SERVICE DATA

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.
04-26-2021	SWM EA	MM



KEY PLAN (N.T.S.)

LEGEND:

- EXISTING CULVERT
- EXISTING ROADWAY CATCHMENT BOUNDARY
- EXTERNAL CATCHMENT BOUNDARY
- EXISTING MAJOR FLOW DIRECTION
- EXISTING MINOR FLOW DIRECTION
- EXISTING STM
- EXISTING OGS UNIT
- WETLAND
- WATERCOURSE
- R.2–01: CATCHMENT ID / PERCENTAGE OF IMPERVIOUS AREA / CATCHMENT AREA (HA)
- LEVI CREEK SUBWATERSHED
- MULLET CREEK SUBWATERSHED

HATCH

Designed by
Chkd.
Approved by

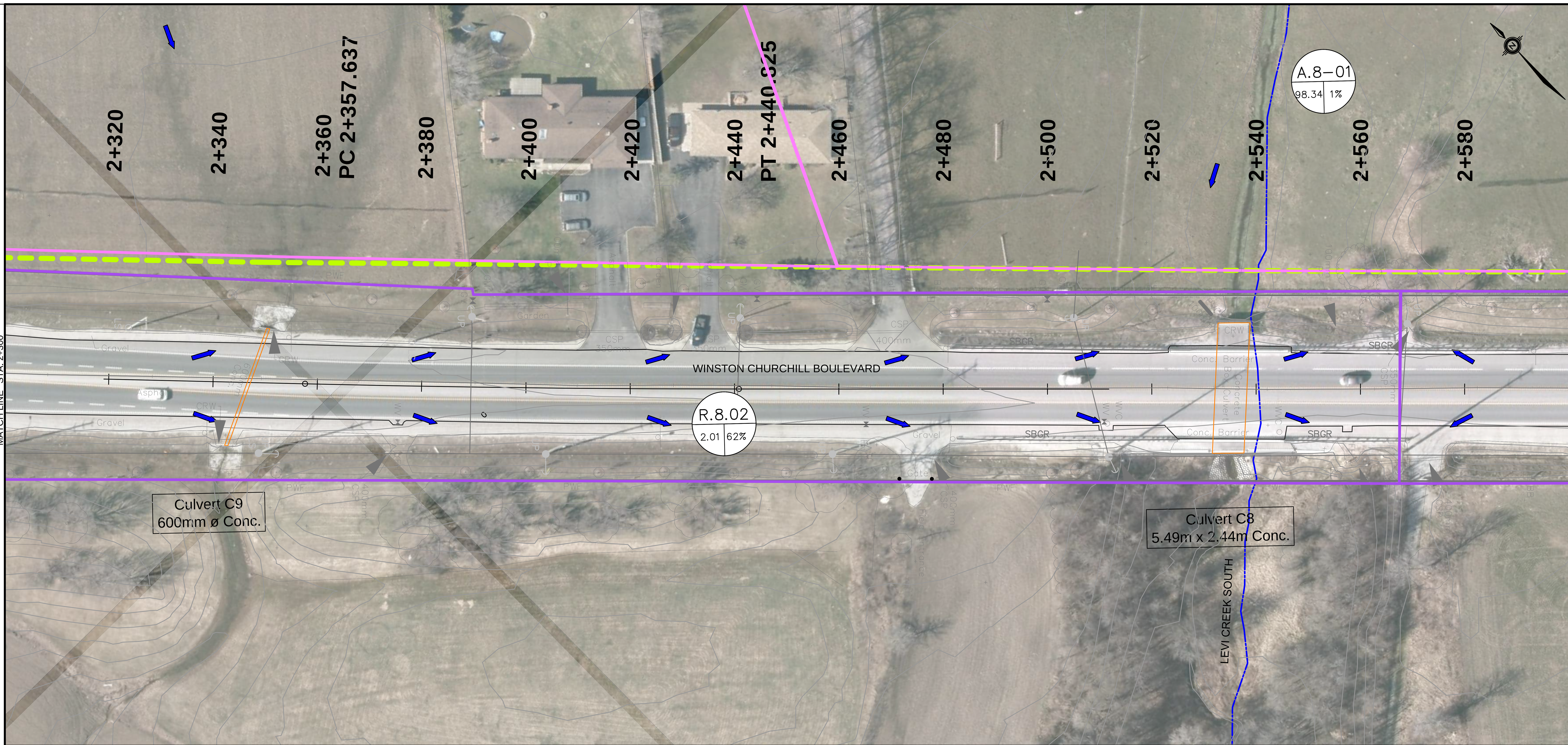
10m 0 10 20 30m HORIZONTAL SCALE

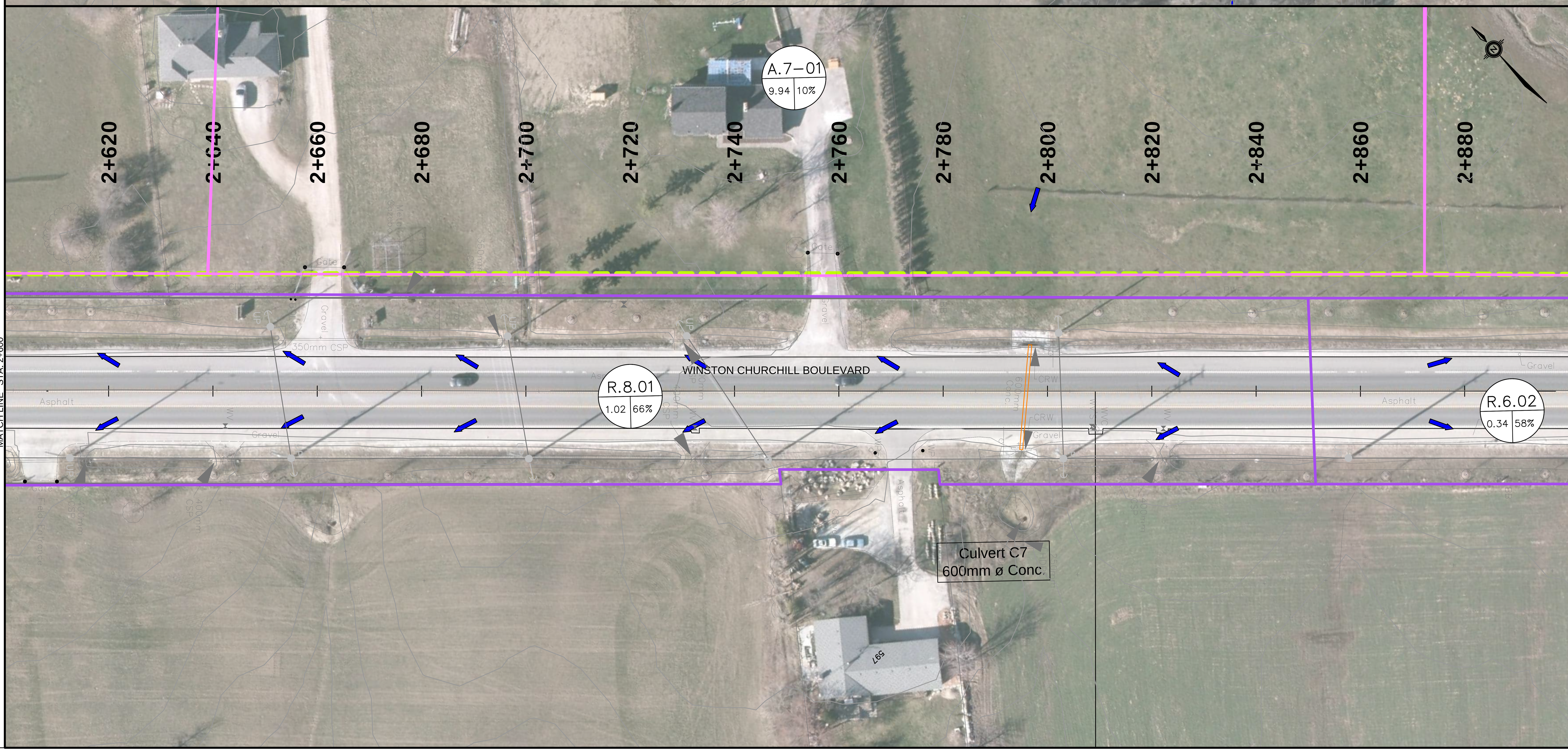
Region of Peel
Working for you

WINSTON CHURCHILL BLV.
(FROM HIGHWAY 401 TO EMBLETON ROAD)
EXISTING DRAINAGE PLAN

STA. 1+700 TO STA. 2+300

EXHIBIT E-4



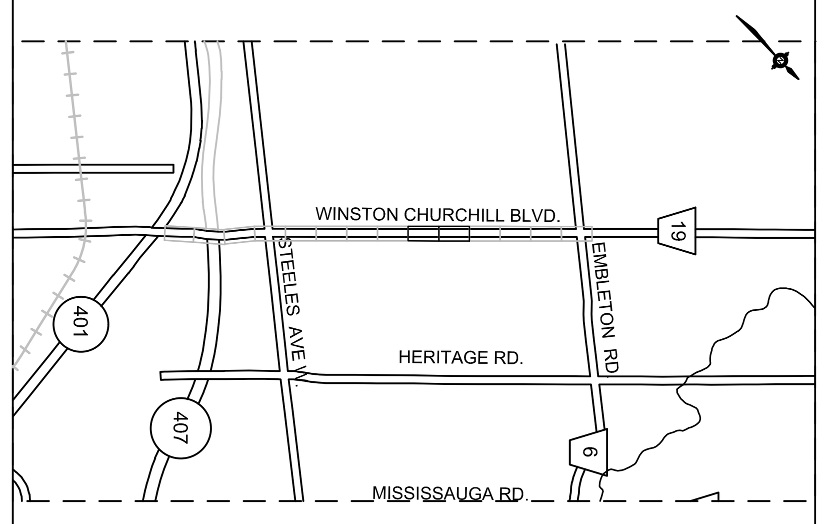


SERVICE DATA

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.
04-26-2021	SWM EA	MM



KEY PLAN (N.T.S.)

LEGEND:

- EXISTING CULVERT
- EXISTING ROADWAY CATCHMENT BOUNDARY
- EXTERNAL CATCHMENT BOUNDARY
- EXISTING MAJOR FLOW DIRECTION
- EXISTING MINOR FLOW DIRECTION
- EXISTING STM
- EXISTING OGS UNIT
- WETLAND
- WATERCOURSE
- CATCHMENT ID
- PERCENTAGE OF IMPERVIOUS AREA
- CATCHMENT AREA (HA)
- LEVI CREEK SUBWATERSHED
- MULLET CREEK SUBWATERSHED

HATCH

Designed by ____ Chkd. ____ | Approved by ____

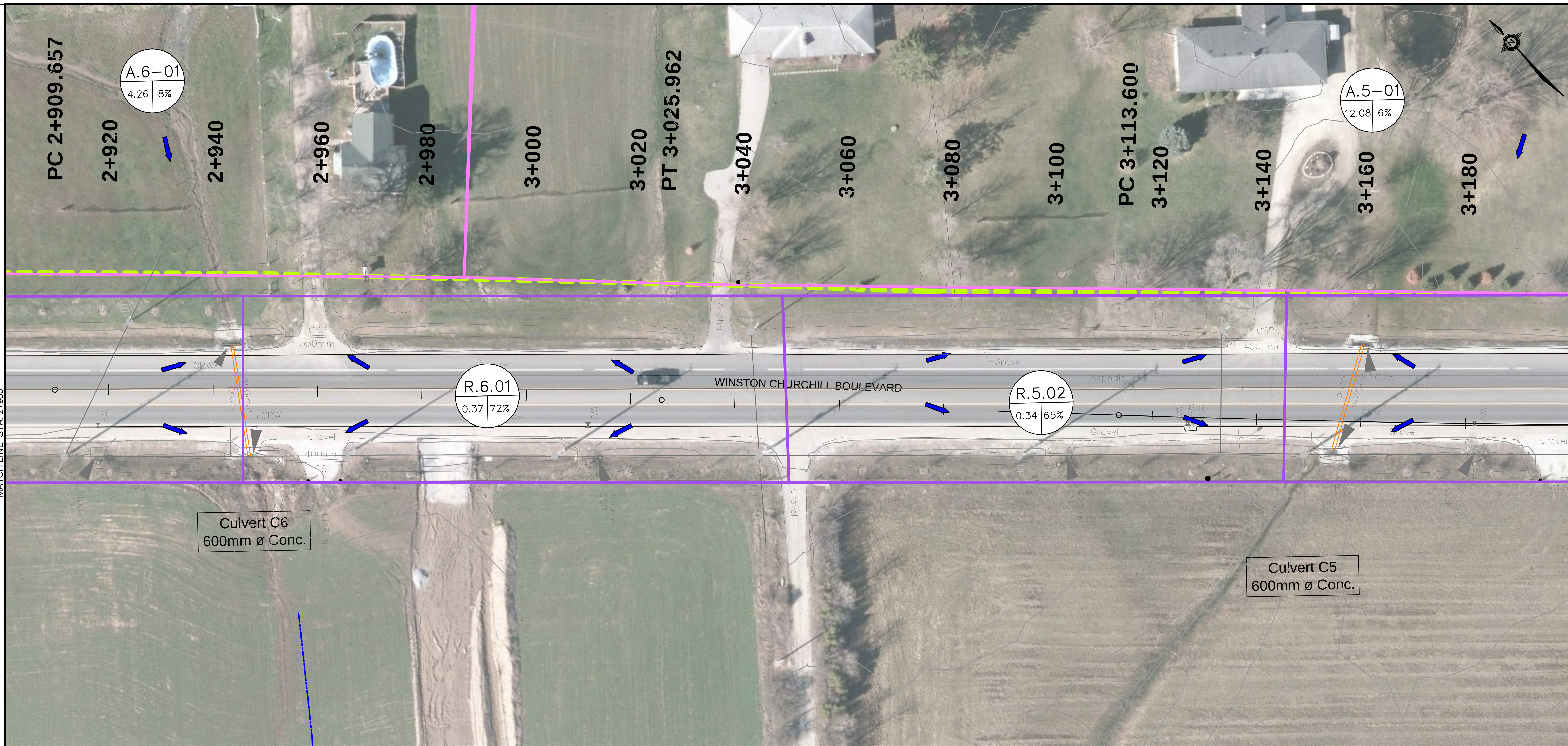
10m 0 10 20 30m HORIZONTAL SCALE

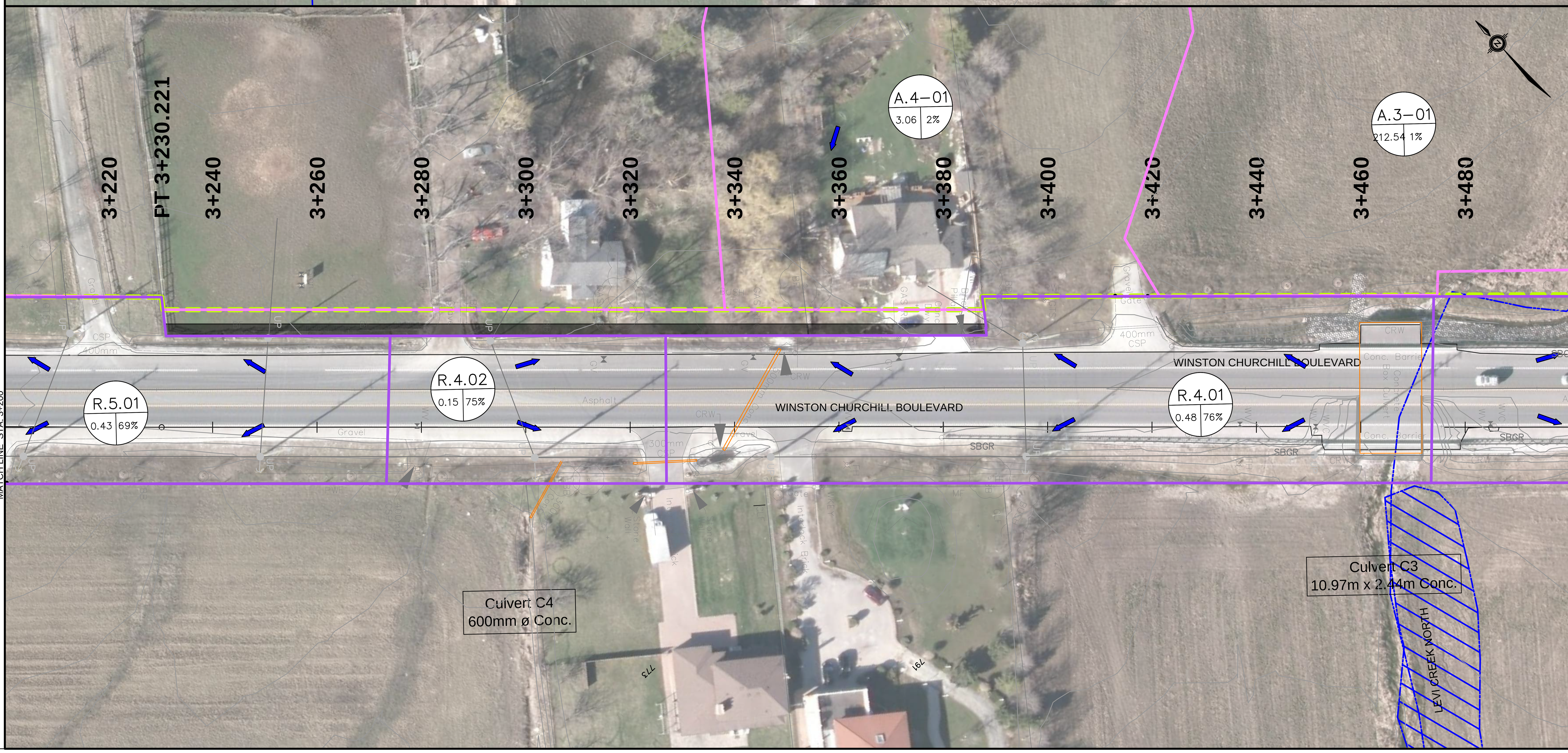
Region of Peel
Working for you

WINSTON CHURCHILL BLV.
(FROM HIGHWAY 401 TO EMBLETON ROAD)
EXISTING DRAINAGE PLAN

STA. 2+300 TO STA. 2+900

EXHIBIT E-5



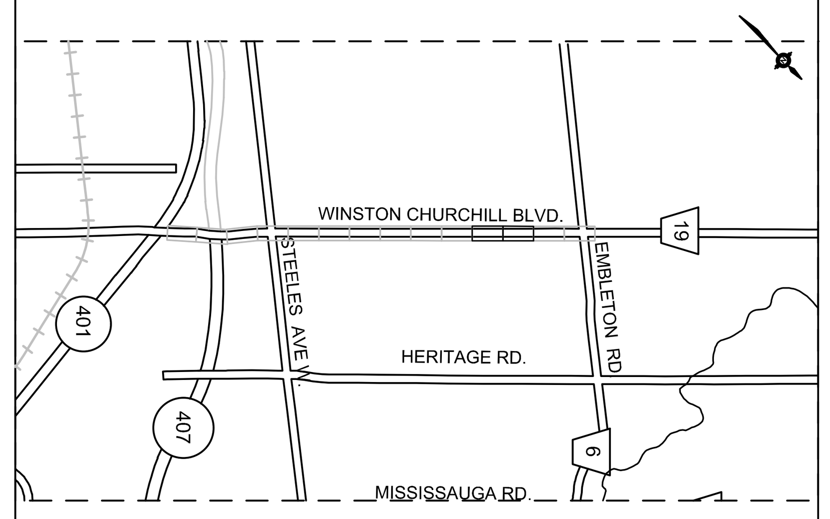


SERVICE DATA

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.
04-26-2021	SWM EA	MM



KEY PLAN (N.T.S.)

LEGEND:

- EXISTING CULVERT
- EXISTING ROADWAY CATCHMENT BOUNDARY
- EXTERNAL CATCHMENT BOUNDARY
- EXISTING MAJOR FLOW DIRECTION
- EXISTING MINOR FLOW DIRECTION
- EXISTING STM
- EXISTING OGS UNIT
- WETLAND
- WATERCOURSE
- R.2–01 0.88 67% — CATCHMENT ID / PERCENTAGE OF IMPERVIOUS AREA / CATCHMENT AREA (HA)
- LEVI CREEK SUBWATERSHED
- MULLET CREEK SUBWATERSHED

HATCH

Designed by ______ Chkd. ______

Approved by ______

10m 0 10 20 30m HORIZONTAL SCALE

Region of Peel
Working for you

WINSTON CHURCHILL BLV.

(FROM HIGHWAY 401 TO EMBLETON ROAD)

EXISTING DRAINAGE PLAN

STA. 2+900 TO STA. 3+500

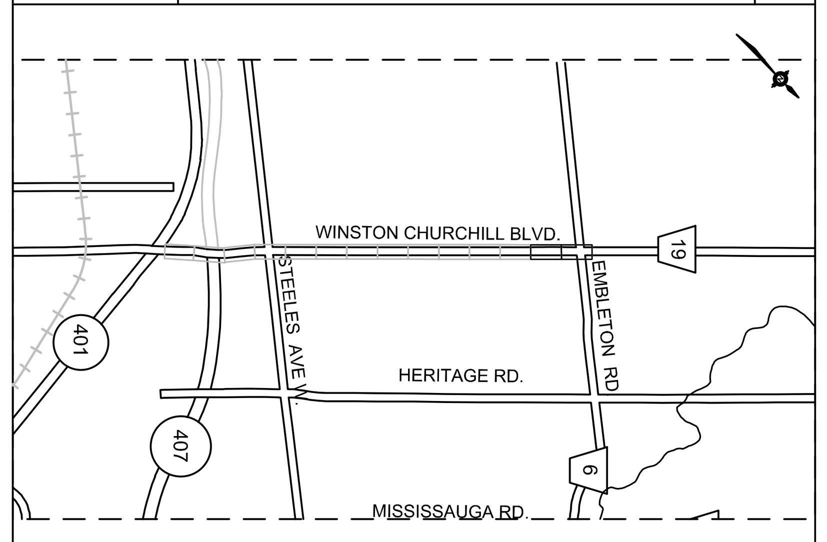
EXHIBIT E-6

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.
04-26-2021	SWM EA	MM



KEY PLAN (N.T.S.)

LEGEND:

- EXISTING CULVERT
- EXISTING ROADWAY CATCHMENT BOUNDARY
- EXTERNAL CATCHMENT BOUNDARY
- EXISTING MAJOR FLOW DIRECTION
- EXISTING MINOR FLOW DIRECTION
- EXISTING STM
- EXISTING OGS UNIT
- WETLAND
- WATERCOURSE
- CATCHMENT ID / PERCENTAGE OF IMPERVIOUS AREA / CATCHMENT AREA (HA)
- LEVI CREEK SUBWATERSHED
- MULLET CREEK SUBWATERSHED

HATCH

Designed by ________ Chkd. ____

Approved by ________

10m 0 10 20 30m HORIZONTAL SCALE

Region of Peel
Working for you

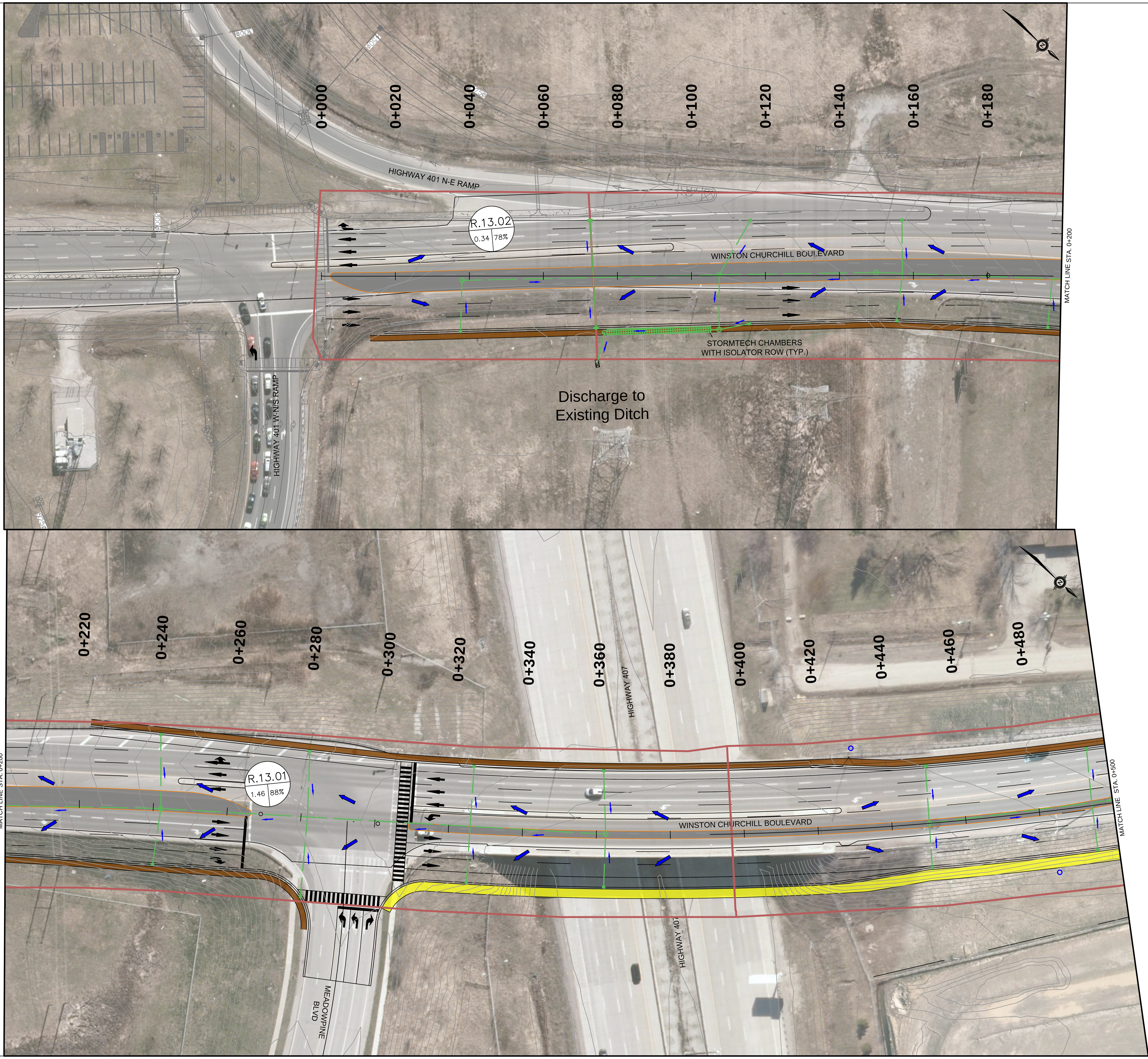
WINSTON CHURCHILL BLV.

(FROM HIGHWAY 401 TO EMBLETON ROAD)

EXISTING DRAINAGE PLAN

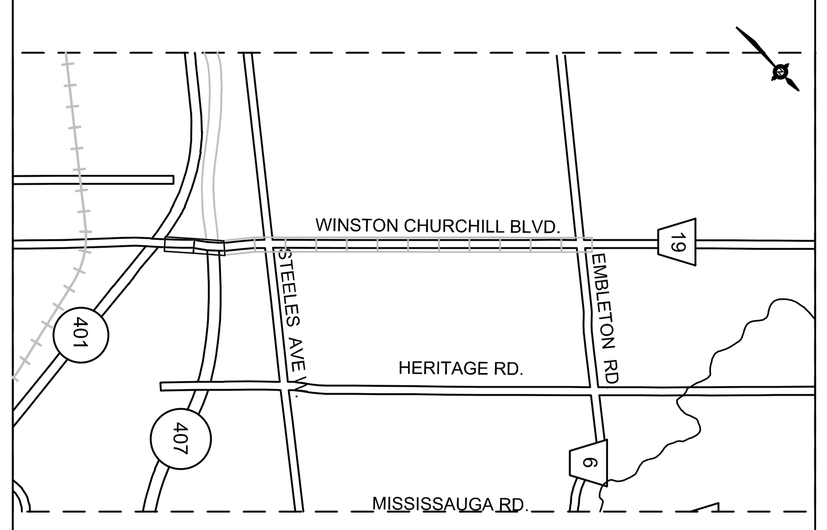
STA. 3+500 TO STA. 4+059

EXHIBIT E-7



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.
04-26-2021	SWM EA	MM



KEY PLAN (N.T.S.)

LEGEND:

- EXISTING STM
- PROPOSED STM
- PROPOSED MH
- PROPOSED CB
- EXTEND/UPGRADE EXISTING CULVERT
- PROPOSED STORMTECH CHAMBER
- PROPOSED MAJOR FLOW DIRECTION
- PROPOSED MINOR FLOW DIRECTION
- PROPOSED ROADWAY CATCHMENT BOUNDARY
- EXTERNAL CATCHMENT BOUNDARY
- WETLAND
- WATERCOURSE
- R.2-01 / 0.88 / 67%: CATCHMENT ID; PERCENTAGE OF IMPERVIOUS AREA; CATCHMENT AREA (HA)
- LEVI CREEK SUBWATERSHED
- MULLET CREEK SUBWATERSHED
- PROPOSED HYDRO POLE
- PROPOSED GREENZONE
- PROPOSED MULTI-USE PATH
- PROPOSED SIDEWALK
- PROPOSED RAISED ISLAND
- **POTENTIAL PROPERTY AQUISITION (FOR STREAM ALTERATION)**

HATCH

Designed by ________ Chkd. ____ Approved by ________

10m 0 10 20 30m HORIZONTAL SCALE

Region of Peel
Working for you

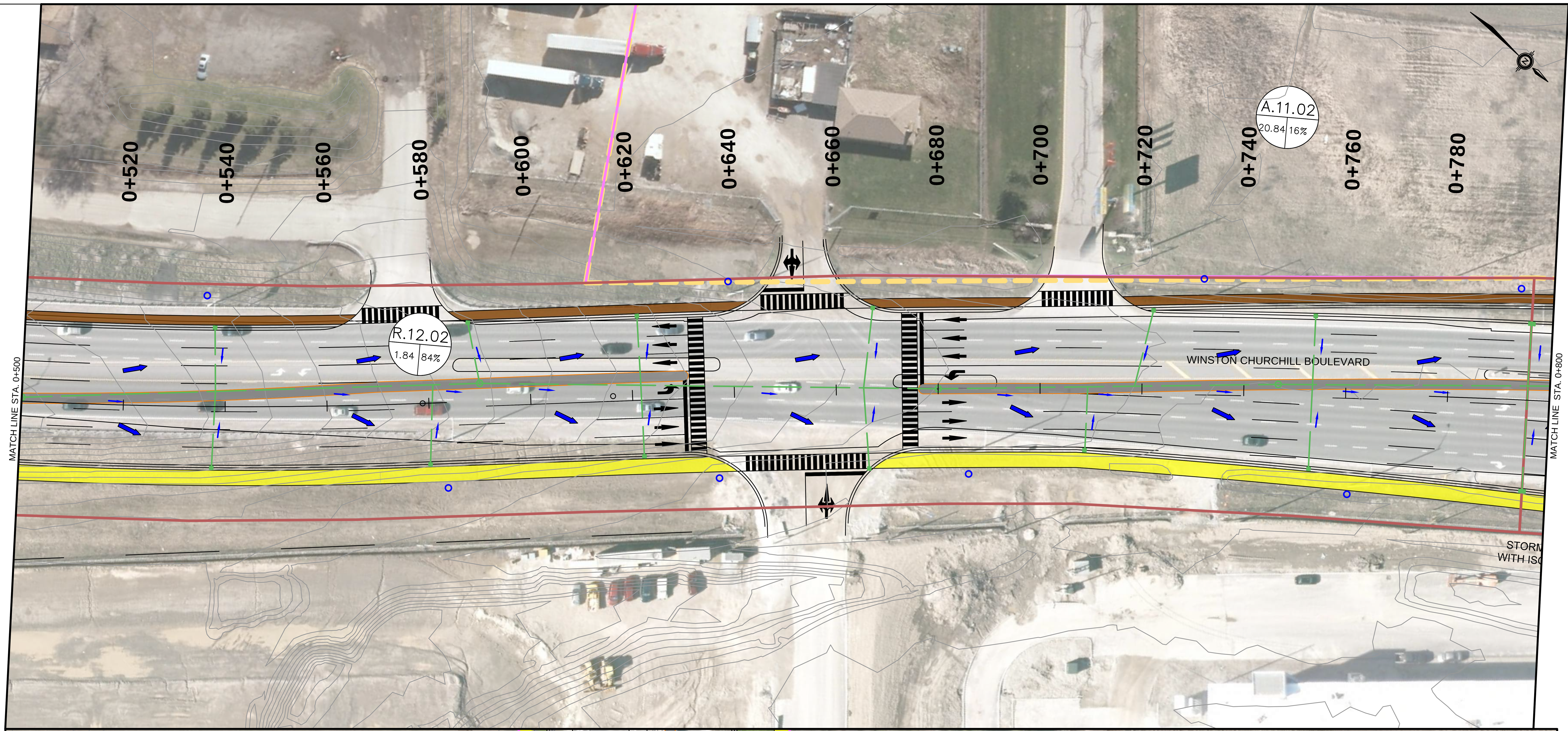
WINSTON CHURCHILL BLV.

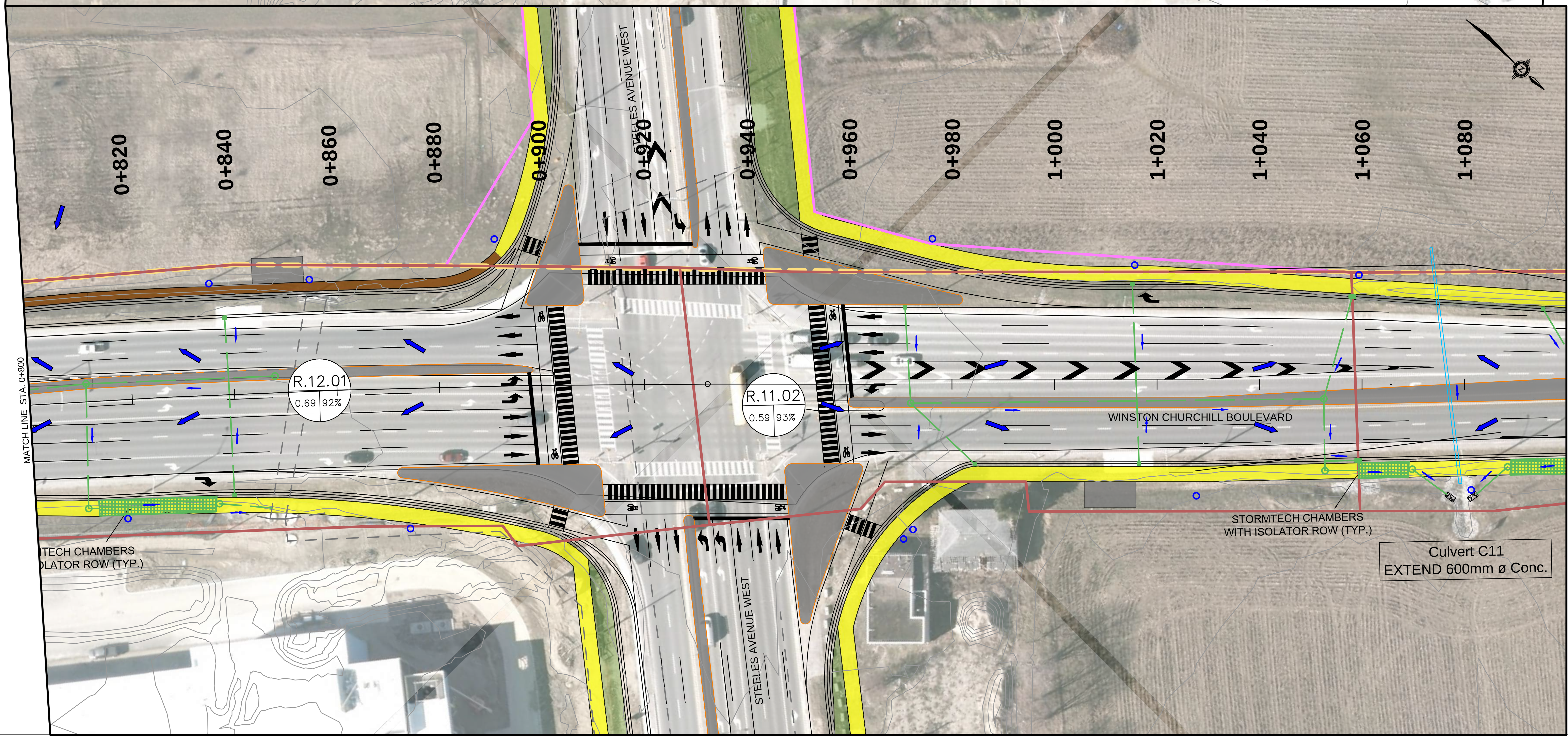
(FROM HIGHWAY 401 TO EMBLETON ROAD)

PROPOSED DRAINAGE PLAN

STA. 0+000 TO STA. 0+500

EXHIBIT P-1



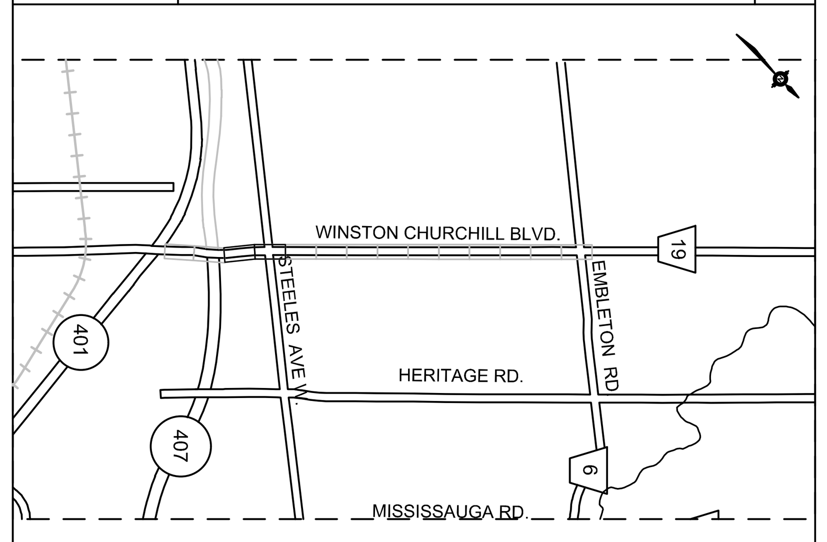


SERVICE DATA

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.
04-26-2021	PRELIMINARY	MM



KEY PLAN (N.T.S.)

LEGEND:

- EXISTING STM
- PROPOSED STM
- PROPOSED MH
- PROPOSED CB
- EXTEND/UPGRADE EXISTING CULVERT
- PROPOSED STORMTECH CHAMBER
- PROPOSED MAJOR FLOW DIRECTION
- PROPOSED MINOR FLOW DIRECTION
- PROPOSED ROADWAY CATCHMENT BOUNDARY
- EXTERNAL CATCHMENT BOUNDARY
- WETLAND
- WATERCOURSE
- R.2-01 / 0.88 / 67%: CATCHMENT ID; PERCENTAGE OF IMPERVIOUS AREA; CATCHMENT AREA (HA)
- LEVI CREEK SUBWATERSHED
- MULLET CREEK SUBWATERSHED
- PROPOSED HYDRO POLE
- PROPOSED GREENZONE
- PROPOSED MULTI-USE PATH
- PROPOSED SIDEWALK
- PROPOSED RAISED ISLAND
- **POTENTIAL PROPERTY AQUISITION (FOR STREAM ALTERATION)**

HATCH

Designed by

Chkd.

Approved by

10m 0 10 20 30m

HORIZONTAL SCALE

Region of Peel
Working for you

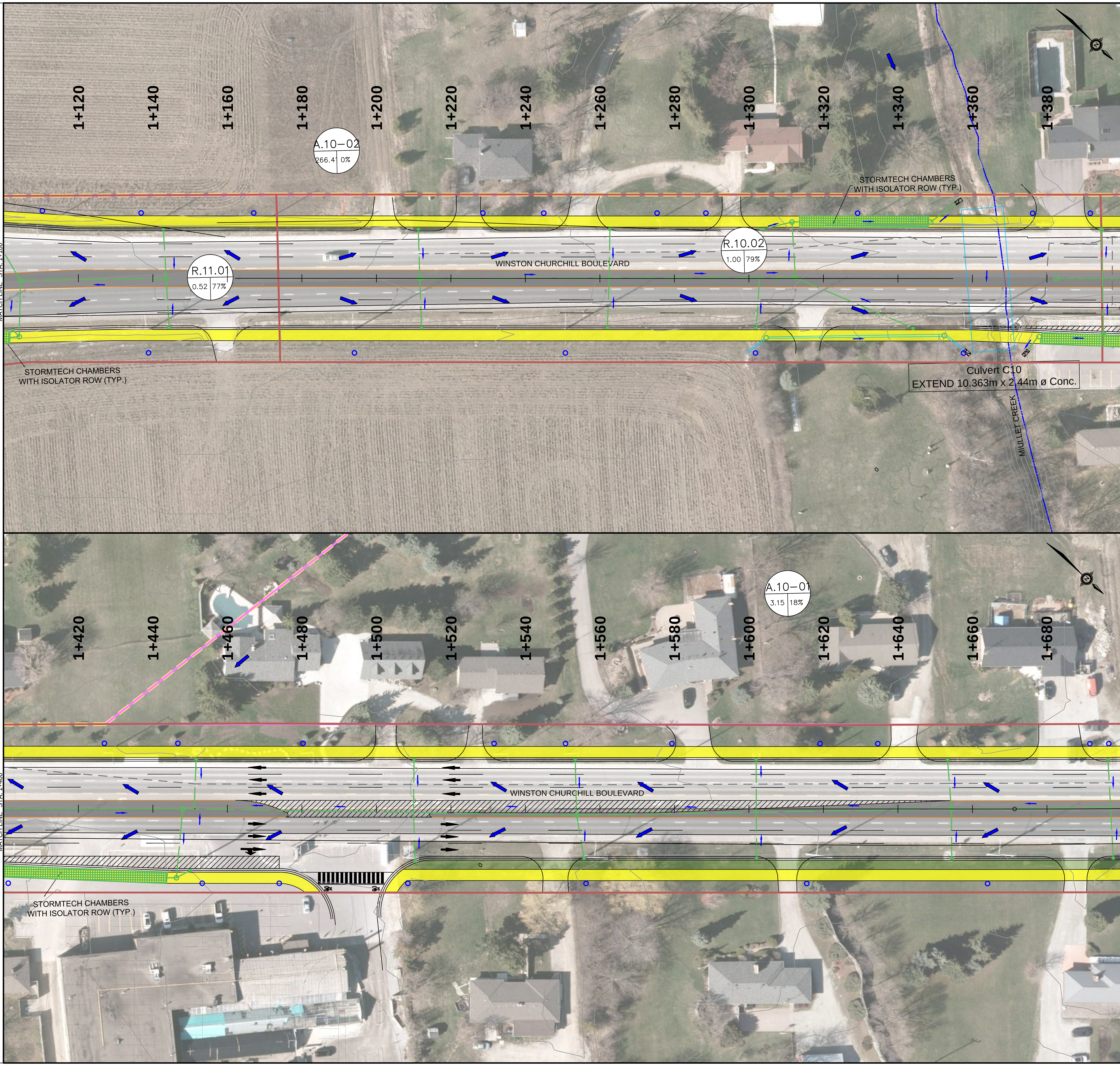
WINSTON CHURCHILL BLV.

(FROM HIGHWAY 401 TO EMBLETON ROAD)

PROPOSED DRAINAGE PLAN

STA. 0+500 TO STA. 1+100

EXHIBIT P-2

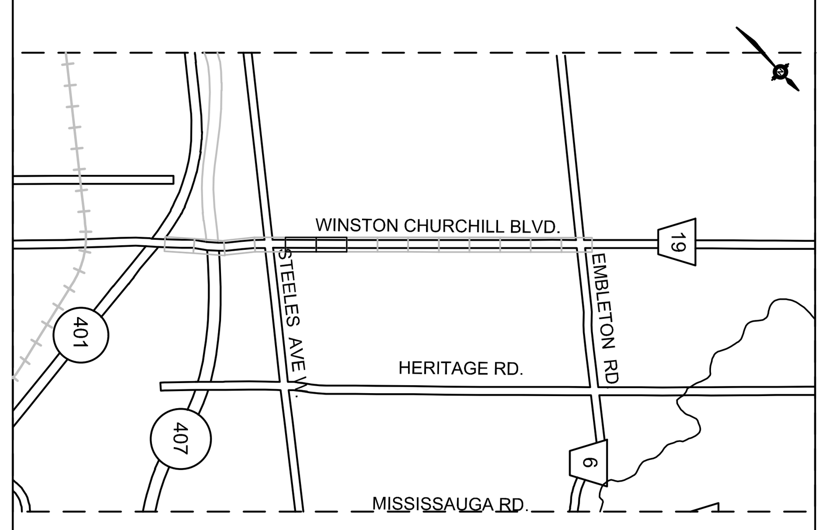


SERVICE DATA

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.
04-26-2021	SWM EA	MM



KEY PLAN (N.T.S.)

LEGEND:

- EXISTING STM
- PROPOSED STM
- PROPOSED MH
- PROPOSED CB
- EXTEND/UPGRADE EXISTING CULVERT
- PROPOSED STORMTECH CHAMBER
- PROPOSED MAJOR FLOW DIRECTION
- PROPOSED MINOR FLOW DIRECTION
- PROPOSED ROADWAY CATCHMENT BOUNDARY
- EXTERNAL CATCHMENT BOUNDARY
- WETLAND
- WATERCOURSE
- R.2-01 / 0.88 / 67%: CATCHMENT ID; PERCENTAGE OF IMPERVIOUS AREA; CATCHMENT AREA (HA)
- LEVI CREEK SUBWATERSHED
- MULLET CREEK SUBWATERSHED
- PROPOSED HYDRO POLE
- PROPOSED GREENZONE
- PROPOSED MULTI-USE PATH
- PROPOSED SIDEWALK
- PROPOSED RAISED ISLAND
- POTENTIAL PROPERTY AQUISITION (FOR STREAM ALTERATION)

HATCH

Designed by

Chkd.

Approved by

10m 0 10 20 30m HORIZONTAL SCALE

Region of Peel
Working for you

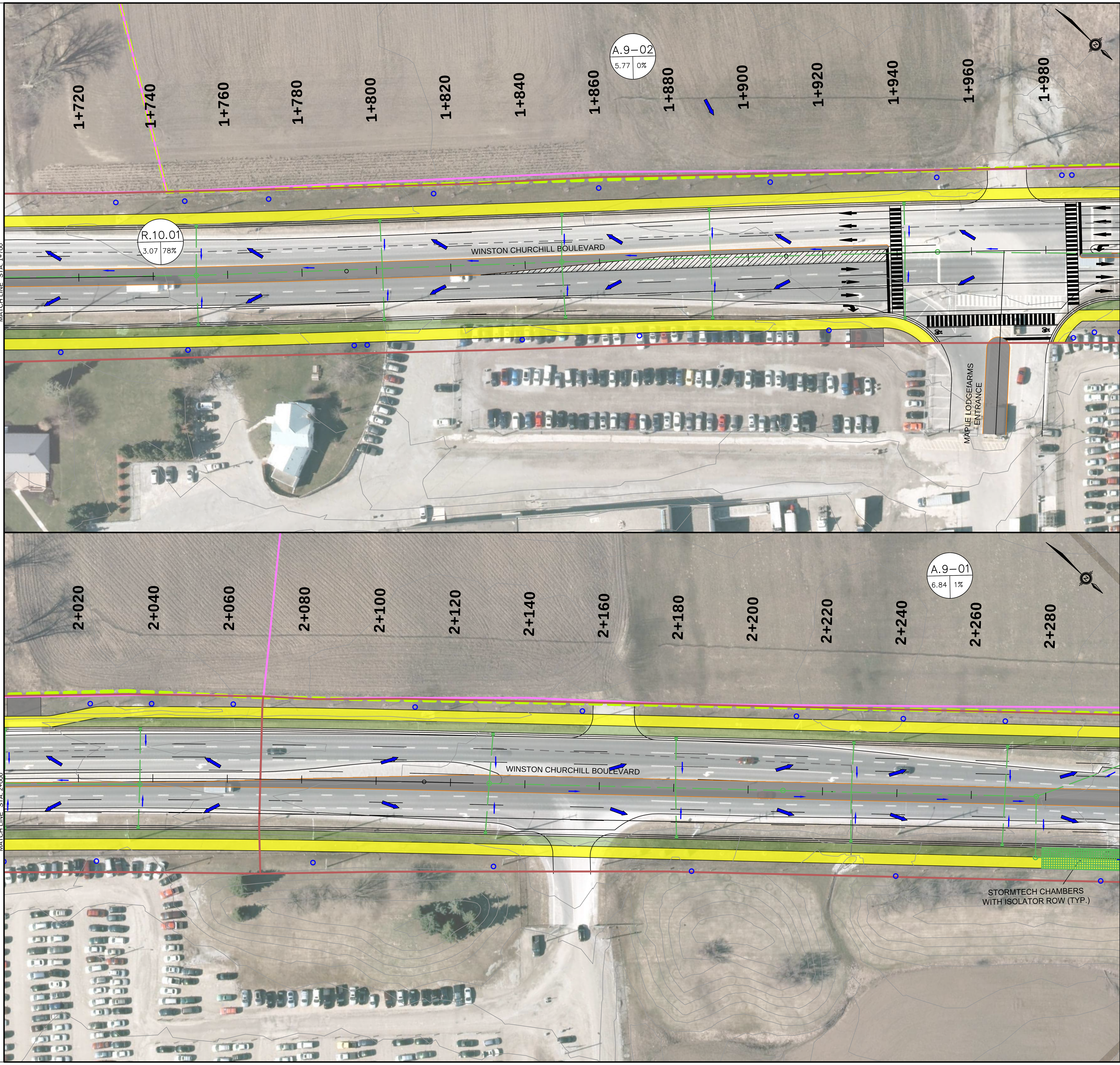
WINSTON CHURCHILL BLV.

(FROM HIGHWAY 401 TO EMBLETON ROAD)

PROPOSED DRAINAGE PLAN

STA. 1+100 TO 1+700

EXHIBIT P-3

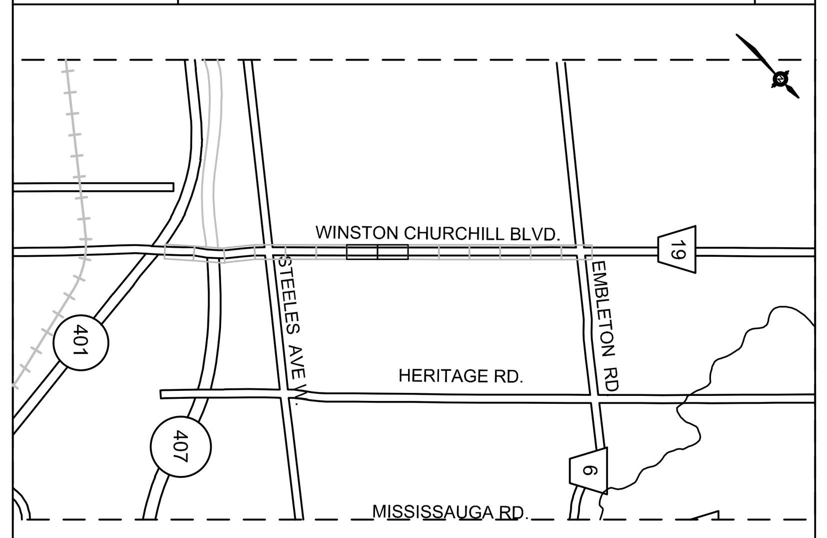


SERVICE DATA

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.
04-26-2021	SWM EA	MM



KEY PLAN (N.T.S.)

LEGEND:

- EXISTING STM
- PROPOSED STM
- PROPOSED MH
- PROPOSED CB
- EXTEND/UPGRADE EXISTING CULVERT
- PROPOSED STORMTECH CHAMBER
- PROPOSED MAJOR FLOW DIRECTION
- PROPOSED MINOR FLOW DIRECTION
- PROPOSED ROADWAY CATCHMENT BOUNDARY
- EXTERNAL CATCHMENT BOUNDARY
- WETLAND
- WATERCOURSE
- R.2–01 / 0.88 / 67%: CATCHMENT ID; PERCENTAGE OF IMPERVIOUS AREA; CATCHMENT AREA (HA)
- LEVI CREEK SUBWATERSHED
- MULLET CREEK SUBWATERSHED
- PROPOSED HYDRO POLE
- PROPOSED GREENZONE
- PROPOSED MULTI–USE PATH
- PROPOSED SIDEWALK
- PROPOSED RAISED ISLAND
- POTENTIAL PROPERTY AQUISITION (FOR STREAM ALTERATION)

HATCH

Designed by
Chkd.
Approved by

10m 0 10 20 30m
HORIZONTAL SCALE

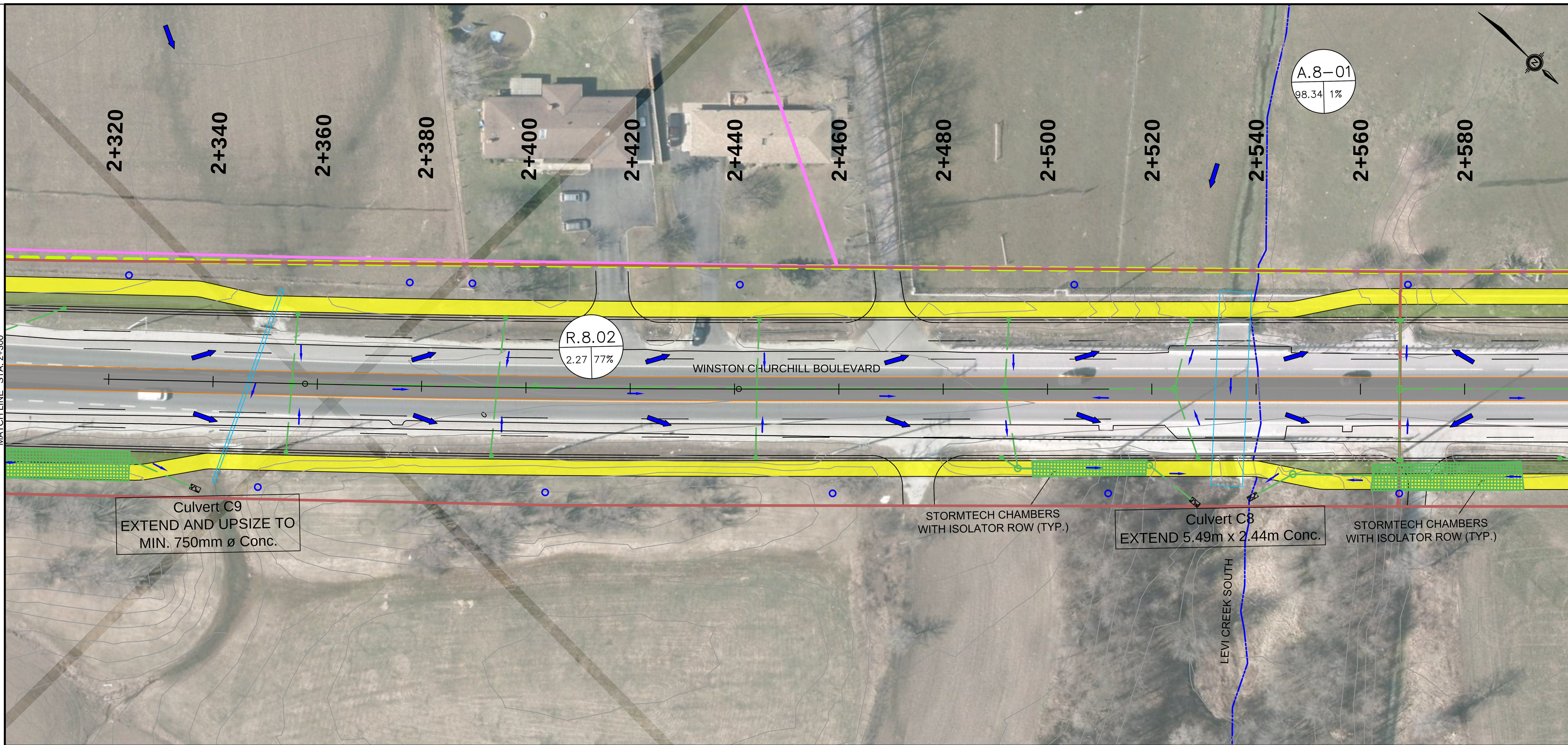
Region of Peel
Working for you

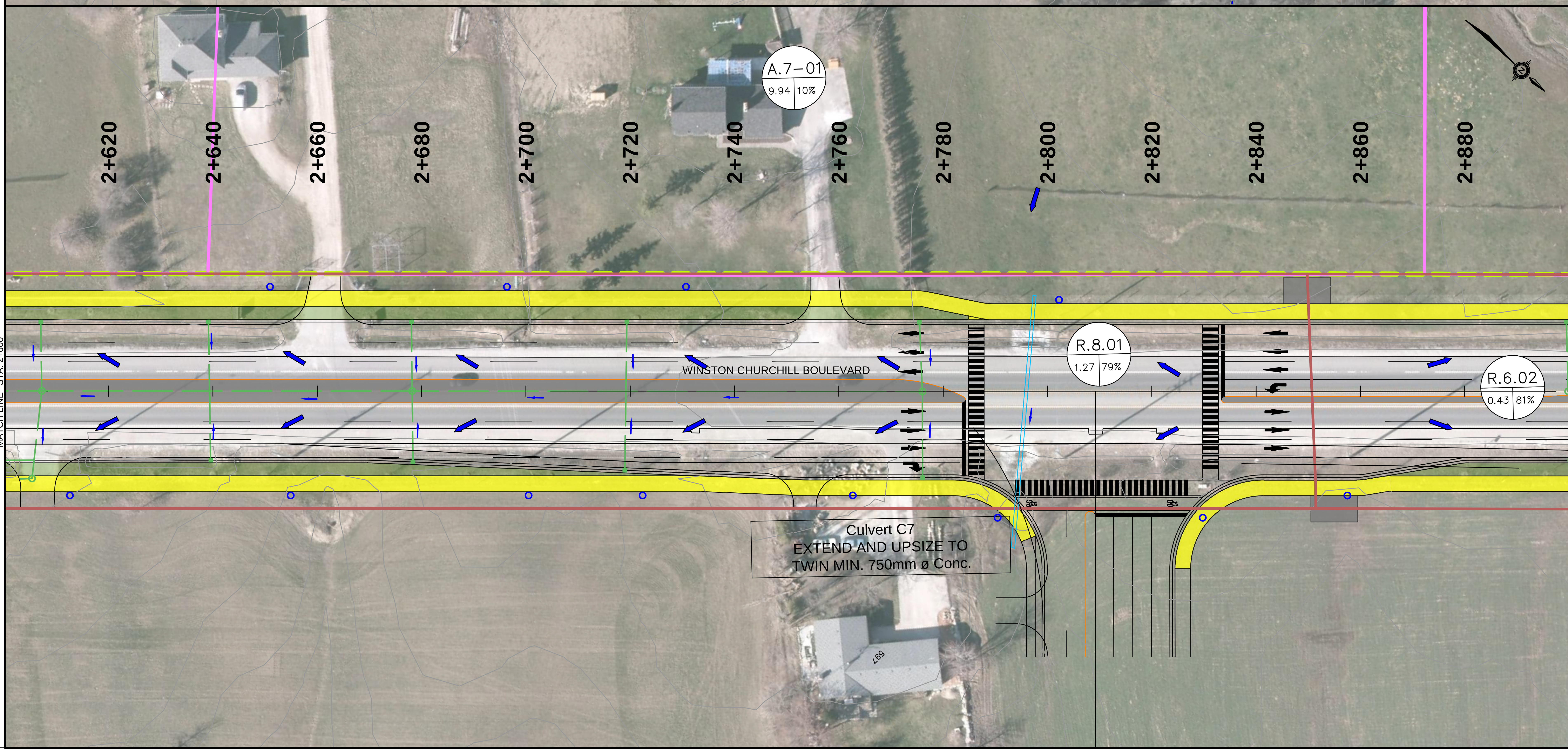
WINSTON CHURCHILL BLV.
(FROM HIGHWAY 401 TO EMBLETON ROAD)

PROPOSED DRAINAGE PLAN

STA. 1+700 TO STA. 2+300

EXHIBIT P-4



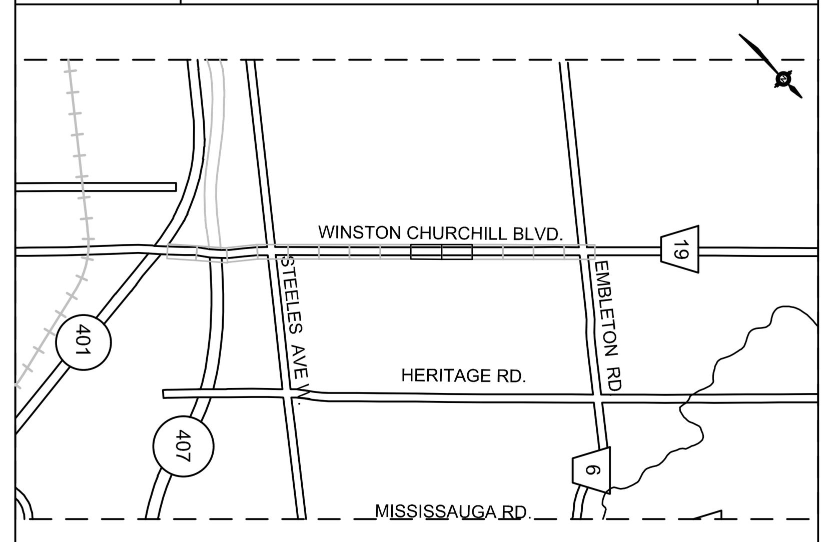


SERVICE DATA

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.
04-26-2021	SWM EA	MM



KEY PLAN (N.T.S.)

LEGEND:

- EXISTING STM
- PROPOSED STM
- PROPOSED MH
- PROPOSED CB
- EXTEND/UPGRADE EXISTING CULVERT
- PROPOSED STORMTECH CHAMBER
- PROPOSED MAJOR FLOW DIRECTION
- PROPOSED MINOR FLOW DIRECTION
- PROPOSED ROADWAY CATCHMENT BOUNDARY
- EXTERNAL CATCHMENT BOUNDARY
- WETLAND
- WATERCOURSE
- R.2–01 / 0.88 / 67%: CATCHMENT ID; PERCENTAGE OF IMPERVIOUS AREA; CATCHMENT AREA (HA)
- LEVI CREEK SUBWATERSHED
- MULLET CREEK SUBWATERSHED
- PROPOSED HYDRO POLE
- PROPOSED GREENZONE
- PROPOSED MULTI–USE PATH
- PROPOSED SIDEWALK
- PROPOSED RAISED ISLAND
- **POTENTIAL PROPERTY AQUISITION (FOR STREAM ALTERATION)**

HATCH

Designed by

Chkd.

Approved by

10m 0 10 20 30m HORIZONTAL SCALE

Region of Peel
Working for you

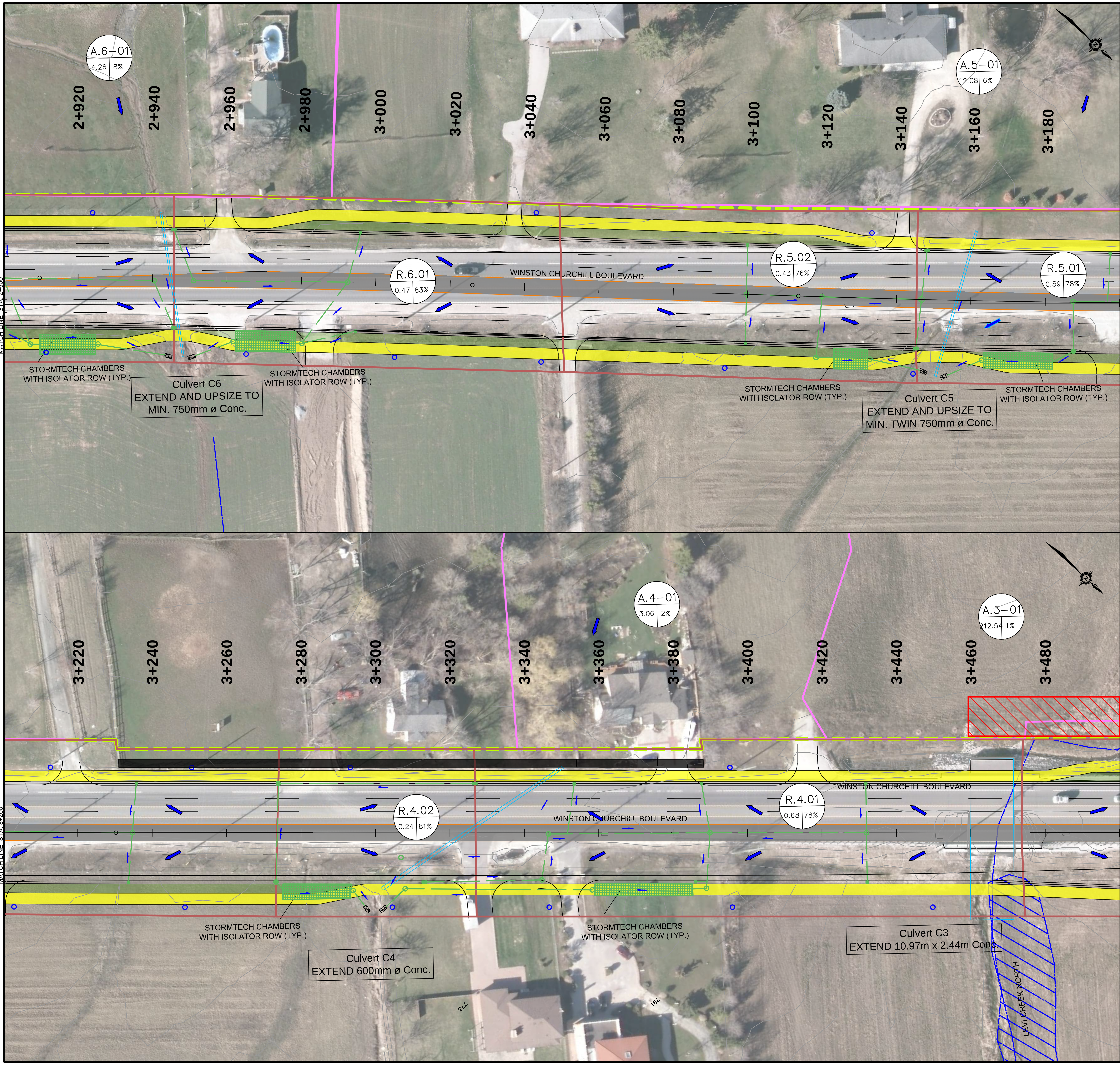
WINSTON CHURCHILL BLV.

(FROM HIGHWAY 401 TO EMBLETON ROAD)

PROPOSED DRAINAGE PLAN

STA. 2+300 TO STA. 2+900

EXHIBIT P-5

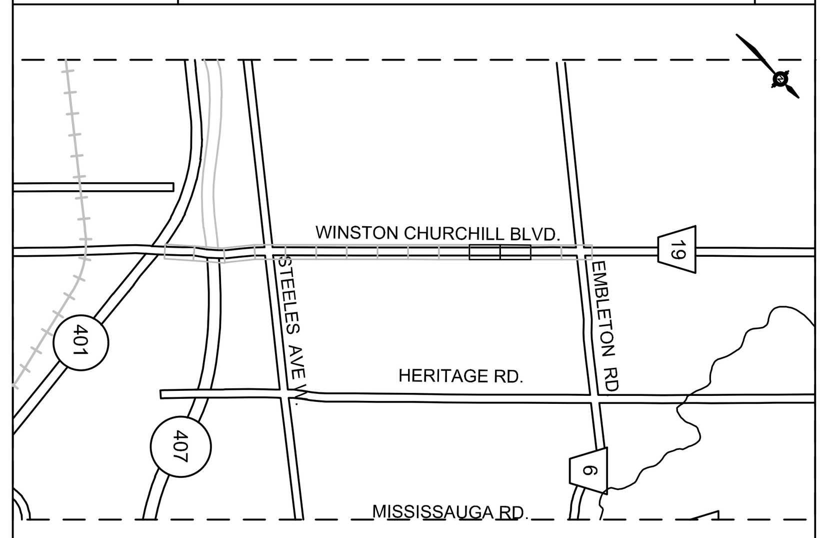


SERVICE DATA

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.
04-26-2021	SWM EA	MM



KEY PLAN (N.T.S.)

LEGEND:
- EXISTING STM
- PROPOSED STM
- PROPOSED MH
- PROPOSED CB
- EXTEND/UPGRADE EXISTING CULVERT
- PROPOSED STORMTECH CHAMBER
- PROPOSED MAJOR FLOW DIRECTION
- PROPOSED MINOR FLOW DIRECTION
- PROPOSED ROADWAY CATCHMENT BOUNDARY
- EXTERNAL CATCHMENT BOUNDARY
- WETLAND
- WATERCOURSE
- CATCHMENT ID
- PERCENTAGE OF IMPERVIOUS AREA
- CATCHMENT AREA (HA)
- LEVI CREEK SUBWATERSHED
- MULLET CREEK SUBWATERSHED
- PROPOSED HYDRO POLE
- PROPOSED GREENZONE
- PROPOSED MULTI-USE PATH
- PROPOSED SIDEWALK
- PROPOSED RAISED ISLAND
- POTENTIAL PROPERTY AQUISITION (FOR STREAM ALTERATION)

HATCH

Designed by

Chkd.

Approved by

10m 0 10 20 30m

HORIZONTAL SCALE

Region of Peel

Working for you

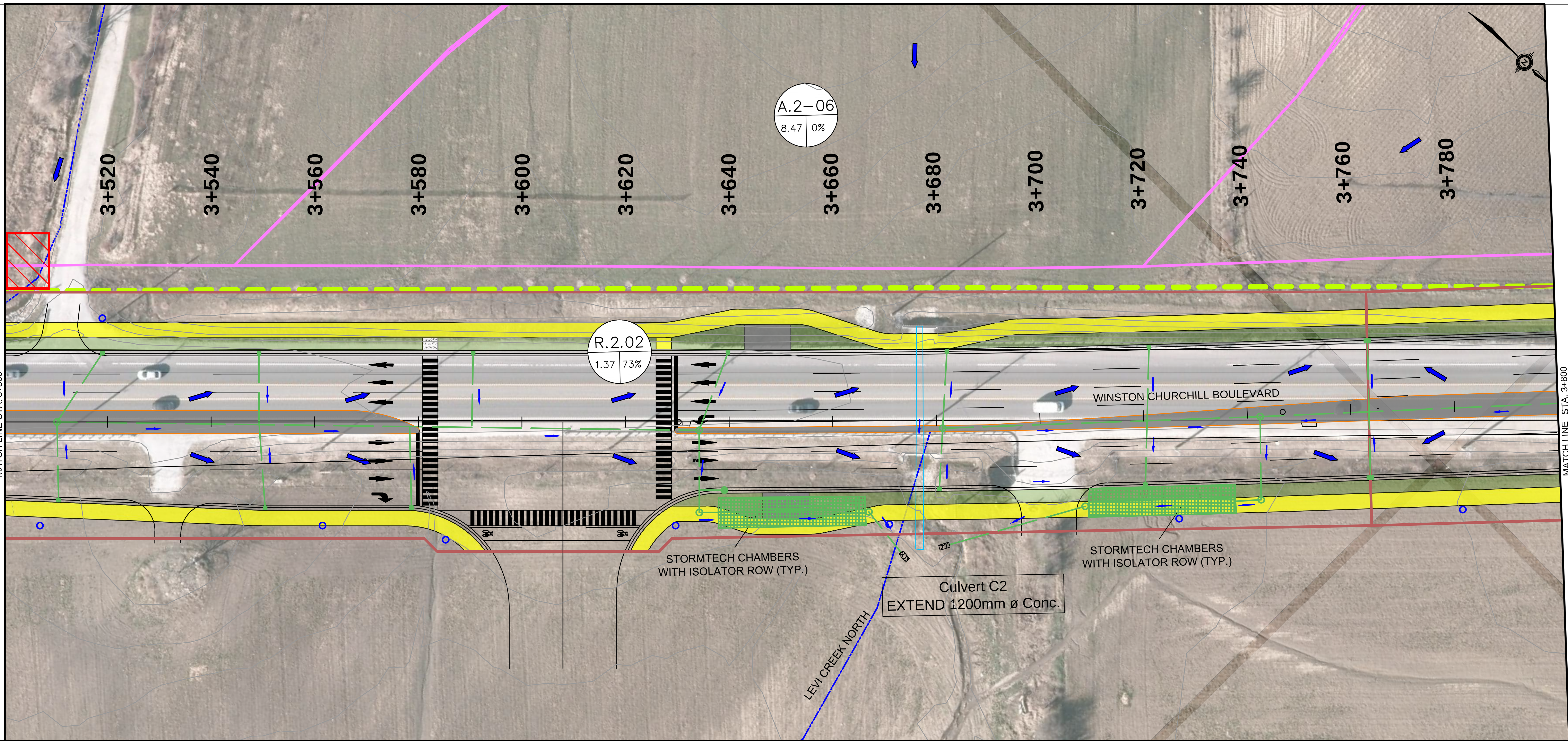
WINSTON CHURCHILL BLV.

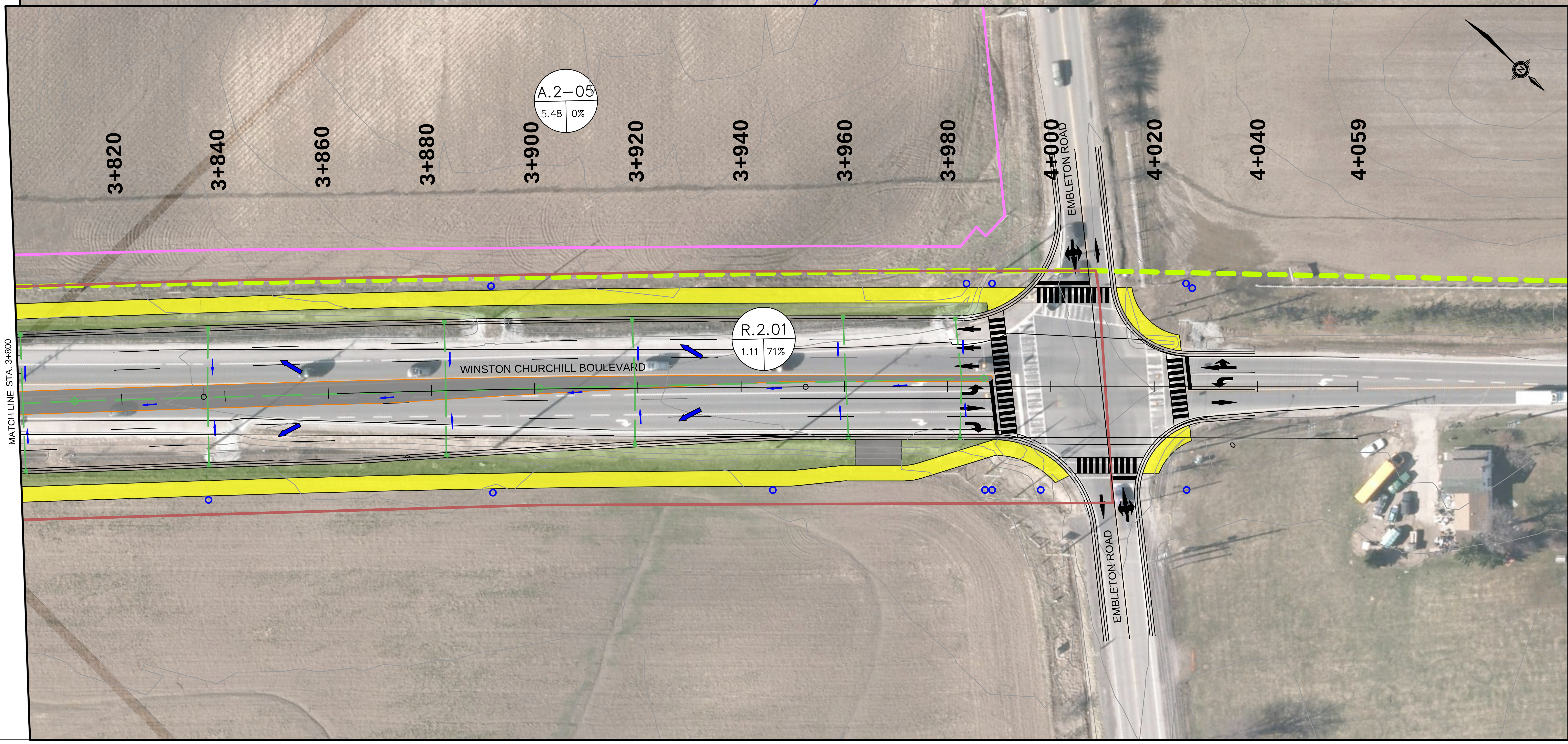
(FROM HIGHWAY 401 TO EMBLETON ROAD)

PROPOSED DRAINAGE PLAN

STA. 2+900 TO STA. 3+500

EXHIBIT P-6



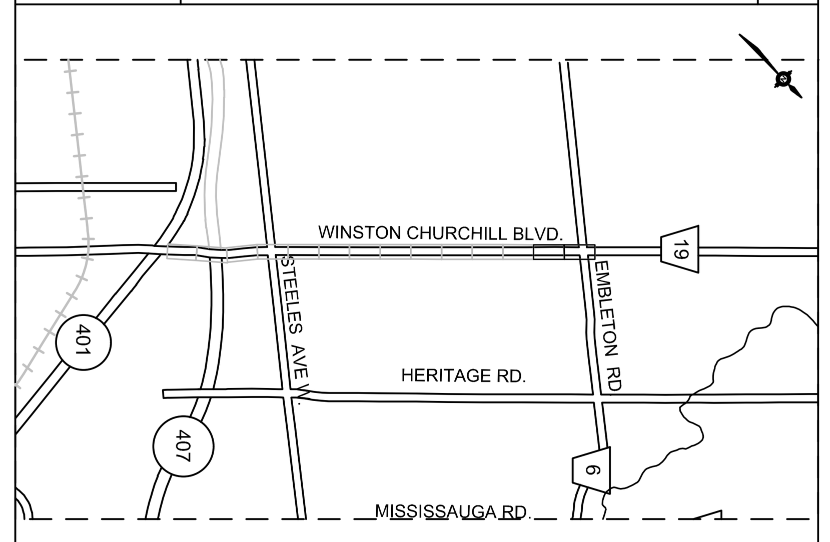


SERVICE DATA

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.
04-26-2021	SWM EA	MM



KEY PLAN (N.T.S.)

LEGEND:

- EXISTING STM
- PROPOSED STM
- PROPOSED MH
- PROPOSED CB
- EXTEND/UPGRADE EXISTING CULVERT
- PROPOSED STORMTECH CHAMBER
- PROPOSED MAJOR FLOW DIRECTION
- PROPOSED MINOR FLOW DIRECTION
- PROPOSED ROADWAY CATCHMENT BOUNDARY
- EXTERNAL CATCHMENT BOUNDARY
- WETLAND
- WATERCOURSE
- R.2-01 / 0.88 / 67%: CATCHMENT ID; PERCENTAGE OF IMPERVIOUS AREA; CATCHMENT AREA (HA)
- LEVI CREEK SUBWATERSHED
- MULLET CREEK SUBWATERSHED
- PROPOSED HYDRO POLE
- PROPOSED GREENZONE
- PROPOSED MULTI-USE PATH
- PROPOSED SIDEWALK
- PROPOSED RAISED ISLAND
- **POTENTIAL PROPERTY AQUISITION (FOR STREAM ALTERATION)**

HATCH

Designed by ______ Chkd. ______

Approved by ______

10m 0 10 20 30m HORIZONTAL SCALE

Region of Peel
Working for you

WINSTON CHURCHILL BLV.

(FROM HIGHWAY 401 TO EMBLETON ROAD)

PROPOSED DRAINAGE PLAN

STA. 3+500 TO STA. 4+059

EXHIBIT P-7

FOR INFORMATION
NOT FOR CONSTRUCTION

HATCH

SCALE
Horizontal
Vertical

WINSTON CHURCHILL BLVD.
Class Environmental Assesement
6 LANE ROAD WIDENING
FROM STA. 0+000 TO STA. 4+420

OCTOBER 25, 2022

Appendix B

Culvert Master Output

Culvert Hydraulic Evaluation Summary

Crossing Identifier			Structure Dimensions										HMM Hydrology Design Flows		Hydraulic Assessment (50 yr Design Flow)			
Culvert Identifier	Stn.	Material	Barrels [-]	Length [m]	Span [m]	Rise [m]	Slope [m/m]	Upstream Invert [m]	Downstream Invert [m]	Edge of Pavement [m]	Observed Outlet HWL [m]	Tailwater Elevation [m]	Drainage Area [ha]	50 yr	Computed Headwater Elevation [m]	Depth of Headwater / Height of Opening [H/D]	D/H < 1.5 (Design Storm)	Freeboard (> 0.3m) [m]
C2	3+680	Concrete	1	23.69	1.2	1.2	0.019417476	206.13	205.67	208.594	205.67	206.48	14.27	2.062	207.43	1.22	Yes	1.16
C4	3+340	Concrete	1	23.24	0.6	0.6	0.006884682	206.98	206.82	208.397	206.82	207.3	3.06	0.55	207.85	1.29	Yes	0.55
C5	3+156	Concrete	1	20	0.6	0.6	0.0185	206.54	206.17	207.754	206.17	206.78	12.08	2.23	207.88	2.23	No	-0.13
C6	2+945	Concrete	1	20.16	0.6	0.6	0.018849206	206.2	205.82	207.569	205.82	206.36	4.26	0.72	207.27	1.78	No	0.30
C7	2+796	Concrete	1	20	0.6	0.6	0.0125	206.21	205.96	207.614	205.96	206.56	9.94	1.48	207.68	2.45	No	-0.07
C9	2+347	Concrete	1	24.2	0.6	0.6	0.006198347	206.3	206.15	208.107	206.15	206.72	6.84	0.851	207.69	2.32	No	0.42
C11	1+075	Concrete	1	35	0.6	0.6	0.009714286	206.06	205.72	207.557	205.72	205.85	0.23	0.04	206.24	0.30	Yes	1.32

Replace Existing Culvert
Extend Existing Culvert

Proposed Culvert Analysis

Crossing Identifier			Structure Dimensions										HMM Hydrology Design Flows		Hydraulic Assessment (50 yr Design Flow)			
Culvert Identifier	Stn.	Material	Barrels [-]	Length [m]	Span [m]	Rise [m]	Slope [m/m]	Upstream Invert [m]	Downstream Invert [m]	Edge of Pavement [m]	Observed Outlet HWL [m]	Tailwater Elevation [m]	Drainage Area [ha]	50 yr	Computed Headwater Elevation [m]	Depth of Headwater / Height of Opening [H/D]	D/H < 1.5 (Design Storm)	Freeboard (> 0.3m) [m]
C2	3+680	Concrete	1	43	1.2	1.2	0.010697674	206.13	205.67	208.594	205.67	206.69	14.27	2.062	207.6	1.23	Yes	0.99
C4	3+340	Concrete	1	59	0.6	0.6	0.002711864	206.98	206.82	208.397	206.82	207.3	3.06	0.553	207.77	1.32	Yes	0.63
C5	3+156	Concrete	2	40	0.75	0.75	0.00925	206.54	206.17	207.754	206.17	206.84	12.08	2.225	207.25	0.95	Yes	0.50
C6	2+945	Concrete	1	39.3	0.75	0.75	0.009669211	206.2	205.82	207.569	205.82	206.14	4.26	0.723	207.08	1.17	Yes	0.49
C7	2+796	Concrete	2	49	0.75	0.75	0.005102041	206.21	205.96	207.614	205.96	206.5	9.94	1.483	207.01	1.07	Yes	0.60
C9	2+347	Concrete	1	40	0.75	0.75	0.00375	206.3	206.15	208.107	206.15	206.75	6.84	0.851	207.33	1.37	Yes	0.78
C11	1+075	Concrete	1	43	0.6	0.6	0.007906977	206.06	205.72	207.557	205.72	205.89	0.23	0.041	206.26	0.33	Yes	1.30

Culvert Analysis Report
C11 Existing

Analysis Component			
Storm Event	Design	Discharge	0.0400 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	0.0400 m³/s	Check Discharge	0.0000 m³/s

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	0.0400 m³/s	Bottom Elevation	205.72 m
Depth	0.10 m	Velocity	0.34 m/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-600 mm Circular	0.0400 m³/s	206.26 m	1.09 m/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Analysis Report
C11 Existing

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	206.26 m	Discharge	0.0400 m^3/s
Inlet Control HW Elev.	206.23 m	Tailwater Elevation	205.82 m
Outlet Control HW Elev.	206.26 m	Control Type	Entrance Control
Headwater Depth/Height	0.33		

Grades			
Upstream Invert	206.06 m	Downstream Invert	205.72 m
Length	35.00 m	Constructed Slope	0.009714 m/m

Hydraulic Profile			
Profile	S2	Depth, Downstream	0.11 m
Slope Type	Steep	Normal Depth	0.11 m
Flow Regime	Supercritical	Critical Depth	0.13 m
Velocity Downstream	1.09 m/s	Critical Slope	0.006089 m/m

Section			
Section Shape	Circular	Mannings Coefficient	0.015
Section Material	Concrete	Span	0.61 m
Section Size	600 mm	Rise	0.61 m
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	206.26 m	Upstream Velocity Head	0.04 m
Ke	0.70	Entrance Loss	0.03 m

Inlet Control Properties			
Inlet Control HW Elev.	206.23 m	Flow Control	N/A
Inlet Type	Beveled ring, 33.7° bevels	Area Full	0.3 m^2
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

Culvert Analysis Report
C11 Proposed

Analysis Component			
Storm Event	Design	Discharge	0.0400 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	0.0400 m³/s	Check Discharge	0.0000 m³/s

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	0.0400 m³/s	Bottom Elevation	205.72 m
Depth	0.10 m	Velocity	0.34 m/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-600 mm Circular	0.0400 m³/s	206.26 m	1.21 m/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Analysis Report
C11 Proposed

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	206.26 m	Discharge	0.0400 m³/s
Inlet Control HW Elev.	206.23 m	Tailwater Elevation	205.82 m
Outlet Control HW Elev.	206.26 m	Control Type	Entrance Control
Headwater Depth/Height	0.33		

Grades			
Upstream Invert	206.06 m	Downstream Invert	205.72 m
Length	35.00 m	Constructed Slope	0.009714 m/m

Hydraulic Profile			
Profile	S2	Depth, Downstream	0.10 m
Slope Type	Steep	Normal Depth	0.10 m
Flow Regime	Supercritical	Critical Depth	0.13 m
Velocity Downstream	1.21 m/s	Critical Slope	0.004573 m/m

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	0.61 m
Section Size	600 mm	Rise	0.61 m
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	206.26 m	Upstream Velocity Head	0.04 m
Ke	0.70	Entrance Loss	0.03 m

Inlet Control Properties			
Inlet Control HW Elev.	206.23 m	Flow Control	Unsubmerged
Inlet Type	Beveled ring, 33.7° bevels	Area Full	0.3 m²
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

Culvert Analysis Report
C2 Existing

Analysis Component			
Storm Event	Design	Discharge	2.0620 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	2.0620 m³/s	Check Discharge	0.0000 m³/s

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	2.0620 m³/s	Bottom Elevation	205.67 m
Depth	0.56 m	Velocity	0.95 m/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-1200 mm Circular	2.0620 m³/s	207.43 m	3.92 m/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Analysis Report
C2 Existing

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	207.43	m	Discharge	2.0620	m^3/s
Inlet Control HW Elev.	207.28	m	Tailwater Elevation	206.23	m
Outlet Control HW Elev.	207.43	m	Control Type	Entrance Control	
Headwater Depth/Height	1.07				

Grades					
Upstream Invert	206.13	m	Downstream Invert	205.67	m
Length	23.69	m	Constructed Slope	0.019417	m/m

Hydraulic Profile					
Profile	S2		Depth, Downstream	0.56	m
Slope Type	Steep		Normal Depth	0.51	m
Flow Regime	Supercritical		Critical Depth	0.79	m
Velocity Downstream	3.92	m/s	Critical Slope	0.004585	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	1.22	m
Section Size	1200 mm		Rise	1.22	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	207.43	m	Upstream Velocity Head	0.34	m
Ke	0.50		Entrance Loss	0.17	m

Inlet Control Properties					
Inlet Control HW Elev.	207.28	m	Flow Control	Unsubmerged	
Inlet Type	Beveled ring, 33.7° bevels		Area Full	1.2	m^2
K	0.00180		HDS 5 Chart	3	
M	2.50000		HDS 5 Scale	B	
C	0.02430		Equation Form	1	
Y	0.83000				

Culvert Analysis Report
C2 Proposed

Analysis Component			
Storm Event	Design	Discharge	2.0620 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	2.0620 m³/s	Check Discharge	0.0000 m³/s

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	2.0620 m³/s	Bottom Elevation	206.69 m
Depth	0.56 m	Velocity	0.95 m/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-1200 mm Circular	2.0620 m³/s	207.60 m	1.77 m/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Analysis Report
C2 Proposed

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	207.60 m	Discharge	2.0620 m³/s
Inlet Control HW Elev.	207.28 m	Tailwater Elevation	207.25 m
Outlet Control HW Elev.	207.60 m	Control Type	Outlet Control
Headwater Depth/Height	1.21		

Grades			
Upstream Invert	206.13 m	Downstream Invert	205.67 m
Length	43.00 m	Constructed Slope	0.010698 m/m

Hydraulic Profile			
Profile	PressureProfile	Depth, Downstream	1.58 m
Slope Type	N/A	Normal Depth	0.60 m
Flow Regime	N/A	Critical Depth	0.79 m
Velocity Downstream	1.77 m/s	Critical Slope	0.004585 m/m

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	1.22 m
Section Size	1200 mm	Rise	1.22 m
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	207.60 m	Upstream Velocity Head	0.16 m
Ke	0.50	Entrance Loss	0.08 m

Inlet Control Properties			
Inlet Control HW Elev.	207.28 m	Flow Control	Unsubmerged
Inlet Type	Beveled ring, 33.7° bevels	Area Full	1.2 m²
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

Culvert Analysis Report
C4 Existing

Analysis Component			
Storm Event	Design	Discharge	0.5500 m^3/s

Peak Discharge Method: User-Specified			
Design Discharge	0.5500 m^3/s	Check Discharge	0.0000 m^3/s

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	0.5500 m^3/s	Bottom Elevation	206.82 m
Depth	0.35 m	Velocity	0.68 m/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-600 mm Circular	0.5500 m^3/s	207.85 m	2.22 m/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Analysis Report
C4 Existing

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	207.85	m	Discharge	0.5500	m^3/s
Inlet Control HW Elev.	207.85	m	Tailwater Elevation	207.17	m
Outlet Control HW Elev.	207.83	m	Control Type	Inlet Control	
Headwater Depth/Height	1.43				

Grades					
Upstream Invert	206.98	m	Downstream Invert	206.82	m
Length	23.24	m	Constructed Slope	0.006885	m/m

Hydraulic Profile					
Profile	M2		Depth, Downstream	0.48	m
Slope Type	Mild		Normal Depth	0.52	m
Flow Regime	Subcritical		Critical Depth	0.48	m
Velocity Downstream	2.22	m/s	Critical Slope	0.007865	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	207.83	m	Upstream Velocity Head	0.22	m
Ke	0.50		Entrance Loss	0.11	m

Inlet Control Properties					
Inlet Control HW Elev.	207.85	m	Flow Control	Submerged	
Inlet Type	Square edge w/headwall		Area Full	0.3	m^2
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Analysis Report
C4 Proposed

Analysis Component			
Storm Event	Design	Discharge	0.5500 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	0.5500 m³/s	Check Discharge	0.0000 m³/s

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	0.5500 m³/s	Bottom Elevation	206.82 m
Depth	0.35 m	Velocity	0.68 m/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-600 mm Circular	0.5500 m³/s	208.02 m	2.22 m/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Analysis Report
C4 Proposed

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	208.02	m	Discharge	0.5500	m^3/s
Inlet Control HW Elev.	207.85	m	Tailwater Elevation	207.17	m
Outlet Control HW Elev.	208.02	m	Control Type	Outlet Control	
Headwater Depth/Height	1.70				

Grades					
Upstream Invert	206.98	m	Downstream Invert	206.82	m
Length	59.00	m	Constructed Slope	0.002712	m/m

Hydraulic Profile					
Profile	CompositeM2PressureProfile		Depth, Downstream	0.48	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.48	m
Velocity Downstream	2.22	m/s	Critical Slope	0.007865	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	208.02	m	Upstream Velocity Head	0.18	m
Ke	0.20		Entrance Loss	0.04	m

Inlet Control Properties					
Inlet Control HW Elev.	207.85	m	Flow Control	Submerged	
Inlet Type	Square edge w/headwall		Area Full	0.3	m^2
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Analysis Report
C5 Existing

Analysis Component			
Storm Event	Design	Discharge	2.2300 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	2.2300 m³/s	Check Discharge	0.0000 m³/s

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	2.2300 m³/s	Bottom Elevation	206.17 m
Depth	0.62 m	Velocity	0.97 m/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-600 mm Circular	0.8072 m³/s	207.88 m	2.77 m/s
Weir	Roadway (Constant Elevation)	1.4255 m³/s	207.88 m	N/A
Total	----------------	2.2327 m³/s	207.88 m	N/A

Culvert Analysis Report
C5 Existing

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	207.88 m	Discharge	0.8072 m^3/s
Inlet Control HW Elev.	207.65 m	Tailwater Elevation	206.79 m
Outlet Control HW Elev.	207.88 m	Control Type	Outlet Control
Headwater Depth/Height	2.19		

Grades			
Upstream Invert	206.54 m	Downstream Invert	206.17 m
Length	20.00 m	Constructed Slope	0.018500 m/m

Hydraulic Profile			
Profile	PressureProfile	Depth, Downstream	0.62 m
Slope Type	N/A	Normal Depth	0.55 m
Flow Regime	N/A	Critical Depth	0.56 m
Velocity Downstream	2.77 m/s	Critical Slope	0.018362 m/m

Section			
Section Shape	Circular	Mannings Coefficient	0.015
Section Material	Concrete	Span	0.61 m
Section Size	600 mm	Rise	0.61 m
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	207.88 m	Upstream Velocity Head	0.39 m
Ke	0.70	Entrance Loss	0.27 m

Inlet Control Properties			
Inlet Control HW Elev.	207.65 m	Flow Control	Submerged
Inlet Type	Beveled ring, 33.7° bevels	Area Full	0.3 m^2
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

Culvert Analysis Report
C5 Existing

Component:Weir

Hydraulic Component(s): Roadway (Constant Elevation)					
Discharge	1.4255	m^3/s	Allowable HW Elevation	207.88	m
Roadway Width	100.00	m	Overtopping Coefficient	1.65	SI
Length	20.00	m	Crest Elevation	207.75	m
Headwater Elevation	207.88	m	Discharge Coefficient (Cr)	2.99	
Submergence Factor (Kt)	1.00				

Sta (m)	Elev. (m)
0.00	207.75
20.00	207.75

Culvert Analysis Report
C5 Proposed

Analysis Component			
Storm Event	Design	Discharge	2.2300 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	2.2300 m³/s	Check Discharge	0.0000 m³/s

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	2.2300 m³/s	Bottom Elevation	206.17 m
Depth	0.62 m	Velocity	0.97 m/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	2-900 mm Circular	2.2300 m³/s	207.25 m	2.34 m/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Analysis Report
C5 Proposed

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	207.25 m	Discharge	2.2300 m^3/s
Inlet Control HW Elev.	207.15 m	Tailwater Elevation	206.79 m
Outlet Control HW Elev.	207.25 m	Control Type	Outlet Control
Headwater Depth/Height	1.13		

Grades			
Upstream Invert	206.22 m	Downstream Invert	206.17 m
Length	20.00 m	Constructed Slope	0.002500 m/m

Hydraulic Profile			
Profile	M2	Depth, Downstream	0.62 m
Slope Type	Mild	Normal Depth	N/A m
Flow Regime	Subcritical	Critical Depth	0.62 m
Velocity Downstream	2.34 m/s	Critical Slope	0.005352 m/m

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	0.91 m
Section Size	900 mm	Rise	0.91 m
Number Sections	2		

Outlet Control Properties			
Outlet Control HW Elev.	207.25 m	Upstream Velocity Head	0.20 m
Ke	0.50	Entrance Loss	0.10 m

Inlet Control Properties			
Inlet Control HW Elev.	207.15 m	Flow Control	Unsubmerged
Inlet Type	Beveled ring, 33.7° bevels	Area Full	1.3 m^2
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

Culvert Analysis Report
C6 Existing

Analysis Component			
Storm Event	Design	Discharge	0.7200 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	0.7200 m³/s	Check Discharge	0.0000 m³/s

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	0.7200 m³/s	Bottom Elevation	205.82 m
Depth	0.36 m	Velocity	0.79 m/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-600 mm Circular	0.7200 m³/s	207.27 m	3.23 m/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Analysis Report
C6 Existing

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	207.27 m	Discharge	0.7200 m³/s
Inlet Control HW Elev.	207.19 m	Tailwater Elevation	206.18 m
Outlet Control HW Elev.	207.27 m	Control Type	Entrance Control
Headwater Depth/Height	1.76		

Grades			
Upstream Invert	206.20 m	Downstream Invert	205.82 m
Length	20.16 m	Constructed Slope	0.018849 m/m

Hydraulic Profile			
Profile	S2	Depth, Downstream	0.44 m
Slope Type	Steep	Normal Depth	0.42 m
Flow Regime	Supercritical	Critical Depth	0.54 m
Velocity Downstream	3.23 m/s	Critical Slope	0.011283 m/m

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	0.61 m
Section Size	600 mm	Rise	0.61 m
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	207.27 m	Upstream Velocity Head	0.35 m
Ke	0.50	Entrance Loss	0.18 m

Inlet Control Properties			
Inlet Control HW Elev.	207.19 m	Flow Control	Submerged
Inlet Type	Beveled ring, 33.7° bevels	Area Full	0.3 m²
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

Culvert Analysis Report
C6 Proposed

Analysis Component			
Storm Event	Design	Discharge	0.7200 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	0.7200 m³/s	Check Discharge	0.0000 m³/s

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	0.7200 m³/s	Bottom Elevation	205.82 m
Depth	0.36 m	Velocity	0.79 m/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-750 mm Circular	0.7200 m³/s	207.08 m	2.65 m/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Analysis Report
C6 Proposed

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	207.08 m	Discharge	0.7200 m³/s
Inlet Control HW Elev.	206.98 m	Tailwater Elevation	206.18 m
Outlet Control HW Elev.	207.08 m	Control Type	Entrance Control
Headwater Depth/Height	1.15		

Grades			
Upstream Invert	206.20 m	Downstream Invert	205.82 m
Length	39.30 m	Constructed Slope	0.009669 m/m

Hydraulic Profile			
Profile	S2	Depth, Downstream	0.44 m
Slope Type	Steep	Normal Depth	0.44 m
Flow Regime	Supercritical	Critical Depth	0.52 m
Velocity Downstream	2.65 m/s	Critical Slope	0.005752 m/m

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	0.76 m
Section Size	750 mm	Rise	0.76 m
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	207.08 m	Upstream Velocity Head	0.24 m
Ke	0.50	Entrance Loss	0.12 m

Inlet Control Properties			
Inlet Control HW Elev.	206.98 m	Flow Control	Unsubmerged
Inlet Type	Beveled ring, 33.7° bevels	Area Full	0.5 m²
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

Culvert Analysis Report
C7 Existing

Analysis Component			
Storm Event	Design	Discharge	1.4800 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	1.4800 m³/s	Check Discharge	0.0000 m³/s

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	1.4800 m³/s	Bottom Elevation	205.96 m
Depth	0.45 m	Velocity	0.86 m/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-600 mm Circular	0.8681 m³/s	207.68 m	3.06 m/s
Weir	Roadway (Constant Elevation)	0.6138 m³/s	207.68 m	N/A
Total	----------------	1.4819 m³/s	207.68 m	N/A

Culvert Analysis Report
C7 Existing

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	207.68	m	Discharge	0.8681	m³/s
Inlet Control HW Elev.	207.42	m	Tailwater Elevation	206.41	m
Outlet Control HW Elev.	207.68	m	Control Type	Outlet Control	
Headwater Depth/Height	2.42				

Grades					
Upstream Invert	206.21	m	Downstream Invert	205.96	m
Length	20.00	m	Constructed Slope	0.012500	m/m

Hydraulic Profile					
Profile	CompositeM2PressureProfile		Depth, Downstream	0.57	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.57	m
Velocity Downstream	3.06	m/s	Critical Slope	0.015873	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	207.68	m	Upstream Velocity Head	0.45	m
Ke	0.70		Entrance Loss	0.32	m

Inlet Control Properties					
Inlet Control HW Elev.	207.42	m	Flow Control	Submerged	
Inlet Type	Beveled ring, 33.7° bevels		Area Full	0.3	m²
K	0.00180		HDS 5 Chart	3	
M	2.50000		HDS 5 Scale	B	
C	0.02430		Equation Form	1	
Y	0.83000				

Culvert Analysis Report
C7 Existing

Component:Weir

Hydraulic Component(s): Roadway (Constant Elevation)					
Discharge	0.6138	m^3/s	Allowable HW Elevation	207.68	m
Roadway Width	25.00	m	Overtopping Coefficient	1.64	SI
Length	20.00	m	Crest Elevation	207.61	m
Headwater Elevation	207.68	m	Discharge Coefficient (Cr)	2.96	
Submergence Factor (Kt)	1.00				

Sta (m)	Elev. (m)
0.00	207.61
20.00	207.61

Culvert Analysis Report
C7 Proposed

Analysis Component			
Storm Event	Design	Discharge	1.4800 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	1.4800 m³/s	Check Discharge	0.0000 m³/s

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	1.4800 m³/s	Bottom Elevation	205.96 m
Depth	0.45 m	Velocity	0.86 m/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	2-750 mm Circular	1.4800 m³/s	207.09 m	2.18 m/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Analysis Report
C7 Proposed

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	207.09	m	Discharge	1.4800	m³/s
Inlet Control HW Elev.	207.01	m	Tailwater Elevation	206.41	m
Outlet Control HW Elev.	207.09	m	Control Type	Outlet Control	
Headwater Depth/Height	1.16				

Grades					
Upstream Invert	206.21	m	Downstream Invert	205.96	m
Length	49.00	m	Constructed Slope	0.005102	m/m

Hydraulic Profile					
Profile	M2		Depth, Downstream	0.53	m
Slope Type	Mild		Normal Depth	0.56	m
Flow Regime	Subcritical		Critical Depth	0.53	m
Velocity Downstream	2.18	m/s	Critical Slope	0.005856	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	0.76	m
Section Size	750 mm		Rise	0.76	m
Number Sections	2				

Outlet Control Properties					
Outlet Control HW Elev.	207.09	m	Upstream Velocity Head	0.22	m
Ke	0.50		Entrance Loss	0.11	m

Inlet Control Properties					
Inlet Control HW Elev.	207.01	m	Flow Control	Unsubmerged	
Inlet Type	Beveled ring, 33.7° bevels		Area Full	0.9	m²
K	0.00180		HDS 5 Chart	3	
M	2.50000		HDS 5 Scale	B	
C	0.02430		Equation Form	1	
Y	0.83000				

Culvert Analysis Report
C9 Existing

Analysis Component			
Storm Event	Design	Discharge	0.8510 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	0.8510 m³/s	Check Discharge	0.0000 m³/s

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	0.8510 m³/s	Bottom Elevation	206.15 m
Depth	0.60 m	Velocity	0.32 m/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-600 mm Circular	0.8510 m³/s	207.91 m	2.93 m/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Analysis Report
C9 Existing

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	207.91	m	Discharge	0.8510	m^3/s
Inlet Control HW Elev.	207.82	m	Tailwater Elevation	206.75	m
Outlet Control HW Elev.	207.91	m	Control Type	Outlet Control	
Headwater Depth/Height	2.65				

Grades					
Upstream Invert	206.30	m	Downstream Invert	206.15	m
Length	24.20	m	Constructed Slope	0.006198	m/m

Hydraulic Profile					
Profile	CompositeM2PressureProfile		Depth, Downstream	0.60	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.57	m
Velocity Downstream	2.93	m/s	Critical Slope	0.015262	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	207.91	m	Upstream Velocity Head	0.43	m
Ke	0.70		Entrance Loss	0.30	m

Inlet Control Properties					
Inlet Control HW Elev.	207.82	m	Flow Control	Submerged	
Inlet Type	Square edge w/headwall		Area Full	0.3	m^2
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Analysis Report
C9 Proposed

Analysis Component			
Storm Event	Design	Discharge	0.8510 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	0.8510 m³/s	Check Discharge	0.0000 m³/s

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	0.8510 m³/s	Bottom Elevation	206.15 m
Depth	0.60 m	Velocity	0.32 m/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-750 mm Circular	0.8510 m³/s	207.33 m	2.22 m/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Analysis Report
C9 Proposed

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	207.33	m	Discharge	0.8510	m^3/s
Inlet Control HW Elev.	207.27	m	Tailwater Elevation	206.75	m
Outlet Control HW Elev.	207.33	m	Control Type	Outlet Control	
Headwater Depth/Height	1.35				

Grades					
Upstream Invert	206.30	m	Downstream Invert	206.15	m
Length	40.00	m	Constructed Slope	0.003750	m/m

Hydraulic Profile					
Profile	M2		Depth, Downstream	0.60	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.57	m
Velocity Downstream	2.22	m/s	Critical Slope	0.006504	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	0.76	m
Section Size	750 mm		Rise	0.76	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	207.33	m	Upstream Velocity Head	0.19	m
Ke	0.70		Entrance Loss	0.13	m

Inlet Control Properties					
Inlet Control HW Elev.	207.27	m	Flow Control	Transition	
Inlet Type	Square edge w/headwall		Area Full	0.5	m^2
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Appendix C

Inspection Report for Regulated Watercourse Crossings

Hatch Mott MacDonald

Region of Halton

OSIM Inspection Forms

For the Bridge on Winston Churchill Blvd
Located 2.70 km North of Steeles Avenue
Structure No. 19-1196390 BR01

Prepared by:

Hatch Mott MacDonald
2800 Speakman Drive
Mississauga, ON, Canada L5K 2R7
T: 905 403 4455 F: 905 855 2607

Project Number: 336921

	Name, Title	Signature	Date
Prepared By	J.Hallett, E.I.T.	Juliettallett	MAY 27/15
Reviewed By	J.Luckai, P.Eng		May 27/15
Approved By	C.Pasqualino, P.Eng		MAY 28/15

Region of Halton

Municipal Structure Inspection Form — **Structure Number:** 19-1196390 BR01

Inventory Data

Structure Name	Winston Churchill Blvd, Lot 5, Conc XI	**Hwy No.**	19
Cross. Type Over	☑ Road ☐ Rail ☐ Ped ☐ Nav. ☐ Non-Nav. ☐ Other		
Cross. Type Under	☐ Road ☐ Rail ☐ Ped ☐ Nav. ☑ Non-Nav. ☐ Other		
Road Name	Winston Churchill Blvd		
Structure Location	2.70 km North of Steeles Avenue		
Northing	595206.0	**Easting**	4830795.0
Cur.Rep.Value	*		
Owner(s) / % Shared	Region of Halton	50%	
	Regional Municipality of Peel	50%	

Key Photo

MTO Region	Central	**Heritage Status**	Not Considered for Designation		
MTO District	Central	**Road Side Env.**	Rural		
County	Halton	**Road Class**	Arterial		
Geographic Twp.		**Lane Type**			
Structure Category	Bridge	**Posted Speed**	80	**No. of Lanes**	2
Struct.SubCategory	Frame	**AADT**	12,625	**Pct. Trucks**	0
Structure Type	Rigid Frame, Vertical Legs	**Interchange Number**			
Structure Material	Reinforced Precast Concrete	**Design Load Code**	CHBDC		

Total Deck Length	11.90 m	**Road Width**	17.70 m	**Interchange Structure Number**			
Overall Width	25.0 m	**Vert. Clear**	0.00 m	**Detour Length**	0 km	**Skew Angle**	0 °
Total Deck Area	297.50 m^2	**No. of Spans**	1	**Fill on Structure**	0 m	**Struct. Dir.**	North/South
Special Routes	☐ Transit ☑ School ☐ Truck ☐ Bicycle			**Insp. Duration**	1 hr		

*Current Replacement Value is based on in kind replacement of the existing structure and calculated using benchmark costs. Capital planning should consider site specific cost factors and requirements for widening or lengthening of the structure

Spans

Span Name	Span Lengths	Span Name	Span Lengths
Span 1	11.0 m		

Historical Data

Year Built	2011 yyyy	**Year of Last Major Rehab**	yyyy
Last OSIM Inspection	10/09/2012 mm/dd/yyyy	**Contract No. When Built**	
Last Enhanced OSIM	mm/dd/yyyy	**Last Evaluation**	mm/dd/yyyy
Last Enhanced Access	mm/dd/yyyy	**Current Load Limit**	t t t
Last Underwater Insp.	mm/dd/yyyy	**Load Limit By-Law No.**	mm/dd/yyyy
Last Condition Survey	mm/dd/yyyy	**By-Law Expiry Date**	mm/dd/yyyy

Rehab History

Rehab Date	Rehab Description
2011	Replacement of structure.

Region of Halton

Municipal Structure Inspection Form **Structure Number:** **19-1196390 BR01**

Field Inspection Information

Inspection Date	05/06/2015 mm/dd/yyyy	☐ Multi Day Inspection ☑ OSIM ☐ Enhanced OSIM	**BCI** 99.2
Inspector	C.Chan, E.I.T.	**Eng. Responsible**	J.Luckai, P.Eng
Others in Party	J.Hallett, E.I.T.		
Access Equip.	☐ Lift ☐ Ladder ☐ Boat ☐ Bridge Master	Other	
Other Equip.	Hammer, Camera, Measuring Tape		
Weather	Sunny	**Temperature**	20 °C

Additional Investigation Required:

Investigation	**None**	**Priority: Normal**	**Urgent**	**Estimated Cost**
Detailed Deck Condition Survey	☑	☐	☐	$0
Delamination Survey of Asphalt-Covered Deck	☑	☐	☐	$0
Concrete Substructure Condition Survey	☑	☐	☐	$0
Detailed Coating Condition Survey	☑	☐	☐	$0
Post-Tensioned Strand Investigation	☑	☐	☐	$0
Underwater Investigation	☑	☐	☐	$0
Fatigue Investigation	☑	☐	☐	$0
Seismic Investigation	☑	☐	☐	$0
Structure Evaluation	☑	☐	☐	$0
Monitoring of Deformation, Movements and Settlements	☑	☐	☐	$0
Monitoring of Crack Widths				$0
Investigation Notes			**Total Cost**	**$0**

Overall Structure Notes:

Recommended Work on Structure ☐ None ☑ Minor Rehab ☐ Major Rehab ☐ Replace ☐ Remove

Timing of Recommended Work ☑ 1 to 5 years ☑ 6 to 10 years

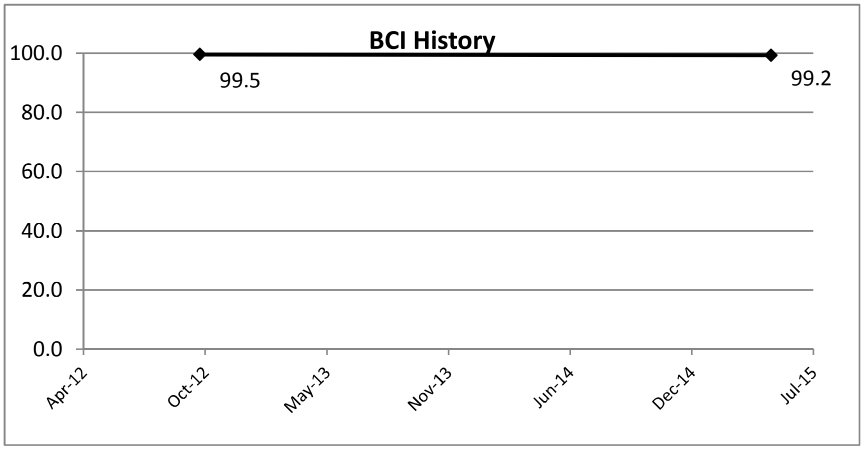
Overall Comments
- Seal wide cracks in barrier wall
- Patch repair concrete on soffit

BCI Change Justification

Next Inspection 05/06/2017 mm/dd/yyyy **Estimated Load Limit** t t t

BCI History

Inspection Date	BCI	Inspector
9-Oct-12	99.5	D.Kelly
6-May-15	99.2	J.Luckai



All Bci values are based on the MTO BCI methodology published in April 2008. As a result, BCI values for 2007 and earlier are approximate only, with potential discrepancies resulting from changes (over time) in the way quantities for certain elements are calculated

Standard Codes

Suspected Performance Deficiencies

01 Load carrying capacity
02 Excessive deformations (deflections & rotations)
03 Continuing settlement
04 Continuing movements
05 Seized bearings
06 Bearing not uniformly loaded/unstable
07 Jammed expansion joint
08 Pedestrian/vehicular hazard
09 Rough riding surface
10 Surface ponding
11 Deck drainage
12 Slippery surfaces
13 Flooding/channel blockage
14 Undermining of foundation
15 Unstable embankments
16 Other

Maintenance Needs

01 Lift and Swing Bridge Maintenance
02 Bridge Cleaning
03 Bridge Handrail Maintenance
04 Painting Steel Bridge Structures
05 Bridge Deck Joint Repair
06 Bridge Bearing Maintenance
07 Repair to Structural Steel
08 Repair of Bridge Concrete
09 Repair of Bridge Timber
10 Bailey bridges - Maintenance
11 Animal/Pest Control
12 Bridge Surface Repair
13 Erosion Control at Bridges
14 Concrete Sealing
15 Rout and Seal
16 Bridge Deck Drainage
17 Scaling (Loose Concrete or ACR Steel)

Region of Halton

Municipal Structure Inspection Form **Structure Number:** 19-1196390 BR01

Approaches - Wearing Surface (Approach)

Element Group	Approaches	**Length**	6.00
Element Name	Wearing Surface (Approach)	**Width**	17.70
Location	Above structure	**Height**	0.00
Material	Asphalt	**Count**	2.00
Element Type		**Total Quantity**	212.40
Protection System	None		

☑ Limited Inspection

Environment

☐ Benign
☐ Moderate
☑ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
sq.m	166.40	45.00	1.00	0.00

Comments

- Crack along both approach joints

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments
None	yrs.	$0	

Barriers - Barrier/Parapet Wall

Element Group	Barriers	**Length**	23.90
Element Name	Barrier/Parapet Wall / Interior	**Width**	0.00
Location	Both Sides	**Height**	0.95
Material	Cast-in-place Concrete	**Count**	2.00
Element Type	Safety Shape without railing	**Total Quantity**	45.41
Protection System	None		

☐ Limited Inspection

Environment

☐ Benign
☐ Moderate
☑ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
sq.m	26.41	15.00	3.00	1.00

Comments

- Wide crack on west barrier - 10.5m and 16.7m from South end of barrier
- Wide crack on east barrier - 10.5m and 16.5m from south end of barrier
- Light/medium scaling, more concentrated on bottom leg of barrer

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments
Minor Rehabilitation	6-10 yrs.	$2,500	Seal cracks

Barriers - Barrier/Parapet Wall

Element Group	Barriers	**Length**	23.90
Element Name	Barrier/Parapet Wall / Exterior	**Width**	0.00
Location	Both Ends	**Height**	0.80
Material	Cast-in-place Concrete	**Count**	2.00
Element Type	Safety Shape without railing	**Total Quantity**	38.24
Protection System	None		

☐ Limited Inspection

Environment
☐ Benign
☑ Moderate
☐ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
sq.m	31.24	5.00	1.00	1.00

Comments

- Wide crack on west barrier - 10.5m and 16.7m from South end of barrier
- Wide crack on east barrier East - 10.5m and 16.5m from south end of barrier
- Light scaling

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments
Minor Rehabilitation	6-10 yrs.	$2,500	Seal cracks.

Abutments - Abutment Walls

Element Group	Abutments	**Length**	
Element Name	Abutment Walls	**Width**	25.00
Location	North and South sides	**Height**	1.45
Material	Precast Concrete	**Count**	2.00
Element Type	Legs of rigid frame	**Total Quantity**	72.50
Protection System	None		

☐ Limited Inspection

Environment
☑ Benign
☐ Moderate
☐ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
sq.m	72.50	0.00	0.00	0.00

Comments

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments
None	yrs.	$0	

Foundation - Foundation (below ground level)

Element Group	Foundation	**Length**	
Element Name	Foundation (below ground level)	**Width**	
Location	Below Structure	**Height**	
Material		**Count**	
Element Type		**Total Quantity**	0.00
Protection System	None		

☑ Limited Inspection

Environment

☐ Benign
☐ Moderate
☐ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
	0.00	0.00	0.00	0.00

Comments

Limit Inspection.

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments

Approaches - Approach Slab

Element Group	Approaches	**Length**	6.00
Element Name	Approach Slab	**Width**	17.70
Location	Both Ends	**Height**	0.00
Material	Cast-in-place Concrete	**Count**	2.00
Element Type		**Total Quantity**	212.40
Protection System	Hot rubberized asphalt membrane		

☐ Limited Inspection

Environment

☐ Benign
☑ Moderate
☐ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
sq.m	212.40	0.00	0.00	0.00

Comments

Performance Deficiencies	Maintenance Needs	Priority	Comments

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments

Decks - Deck Top (with Thick Slab)

Element Group	Decks	**Length**	11.90
Element Name	Deck Top (with Thick Slab)	**Width**	25.00
Location	Above structure	**Height**	0.00
Material	Precast Concrete	**Count**	
Element Type	Precast solid or void without concrete topping	**Total Quantity**	297.50
Protection System	Hot Rubberized asphalt membrane		

☐ Limited Inspection

Environment

☐ Benign
☑ Moderate
☐ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
sq.m	297.50	0.00	0.00	0.00

Comments

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments

Decks - Soffit - Thick Slab

Element Group	Decks	**Length**	11.00
Element Name	Soffit - Thick Slab / Exterior	**Width**	3.70
Location	Underside of deck	**Height**	
Material	Precast Concrete	**Count**	
Element Type		**Total Quantity**	40.70
Protection System	None		

☐ Limited Inspection

Environment

☐ Benign
☑ Moderate
☐ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
sq.m	38.70	1.00	1.00	0.00

Comments

Medium scaling along edge (west side)

Performance Deficiencies	Maintenance Needs	Priority	Comments

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments

Decks - Soffit - Thick Slab

Element Group	Decks	**Length**	11.00
Element Name	Soffit - Thick Slab / Interior	**Width**	23.00
Location	Underside of deck	**Height**	
Material	Precast Concrete	**Count**	
Element Type		**Total Quantity**	253.00
Protection System	None		

☐ Limited Inspection

Environment
☑ Benign
☐ Moderate
☐ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
sq.m	248.00	3.00	1.00	1.00

Comments
- 3rd box from West End, 2.5 m from South Abutment Wall: 300mmx500mm delaminated piece of concrete
- Some joints have light spalling and light scaling
- foam has been forced out from between some joints (East Side)

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments
Minor Rehabilitation	1-5 yrs	$3,500	Removal and patch repair concrete

Decks - Wearing Surface

Element Group	Decks	**Length**	11.90
Element Name	Wearing Surface	**Width**	17.70
Location	Above structure	**Height**	0.00
Material	Asphalt	**Count**	
Element Type		**Total Quantity**	210.63
Protection System	None		

☐ Limited Inspection

Environment
☐ Benign
☐ Moderate
☑ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
sq.m	160.63	50.00	0.00	0.00

Comments

Performance Deficiencies	Maintenance Needs	Priority	Comments

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments

Embankments & Streams - Embankments

Element Group	Embankments & Streams		**Length**		**Width**
Element Name	Embankments		**Height**		**Count** 4.00
Location	All Quadrants			**Total Quantity**	4.00
Material	Other				
Element Type					
Protection System	None				

☐ Limited Inspection

Environment

☐ Benign
☐ Moderate
☐ Severe

Condition Data	**Units**	**Excell.**	**Good**	**Fair**	**Poor**
	Each	0.00	4.00	0.00	0.00

Comments

Performance Deficiencies	**Maintenance Needs**	**Priority**	**Comments**
None	None		

Rehab/Rehabilitation Recommendations	**Priority**	**Cost**	**Comments**

Embankments & Streams - Slope Protection

Element Group	Embankments & Streams		**Length**		**Width**
Element Name	Slope Protection		**Height**		**Count** 4.00
Location	All Quadrants			**Total Quantity**	4.00
Material	Vegetation				
Element Type					
Protection System	None				

☐ Limited Inspection

Environment

☐ Benign
☐ Moderate
☐ Severe

Condition Data	**Units**	**Excell.**	**Good**	**Fair**	**Poor**
	Each	0.00	4.00	0.00	0.00

Comments

Performance Deficiencies	**Maintenance Needs**	**Priority**	**Comments**

Rehab/Rehabilitation Recommendations	**Priority**	**Cost**	**Comments**

Sidewalks/Curbs - Curbs

Element Group	Sidewalks/Curbs	**Length**	11.90
Element Name	Curbs / Headwalls	**Width**	0.55
Location	East and West Sides	**Height**	0.20
Material	Cast-in-place Concrete	**Count**	2.00
Element Type		**Total Quantity**	17.85
Protection System	None		

☐ Limited Inspection

Environment
☐ Benign
☐ Moderate
☑ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
sq.m	17.85	0.00	0.00	0.00

Comments

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments

Embankments & Streams - Streams & Waterways

Element Group	Embankments & Streams	**Length**	
Element Name	Streams & Waterways	**Width**	
Location	Through structure	**Height**	
Material		**Count**	1.00
Element Type		**Total Quantity**	1.00
Protection System	None		

☐ Limited Inspection

Environment
☐ Benign
☐ Moderate
☐ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
All	0.00	1.00	0.00	0.00

Comments

-Ponding at east corners of structure - Regrade to provide positive drainage

Performance Deficiencies	Maintenance Needs	Priority	Comments
	Bridge Deck Drainage	1-5 years	Drainage **through** structure needs to be regraded

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments

Abutments - Wingwalls

Element Group	Abutments	**Length**	1.15
Element Name	Wingwalls	**Width**	
Location	East Side	**Height**	1.78
Material	Cast-in-place Concrete	**Count**	2.00
Element Type	Reinforced Concrete	**Total Quantity**	4.09
Protection System	None		

☐ Limited Inspection

Environment

☐ Benign
☑ Moderate
☐ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
sq.m	4.09	0.00	0.00	0.00

Comments

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments

Retaining Walls - Walls

Element Group	Retaining Walls	**Length**	6.00
Element Name	Walls	**Width**	
Location	East Side	**Height**	1.00
Material	Precast Concrete	**Count**	2.00
Element Type	Retained soil systems	**Total Quantity**	12.00
Protection System	None		

☐ Limited Inspection

Environment

☐ Benign
☑ Moderate
☐ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
sq.m	12.00	0.00	0.00	0.00

Comments

Performance Deficiencies	Maintenance Needs	Priority	Comments

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments

Approaches - Approach Guiderail

Element Group	Approaches			**Length**	
Element Name	Approach Guiderail	Extruder End		**Width**	
Location	All Quadrants			**Height**	
Material	Steel			**Count**	4.00
Element Type				**Total Quantity**	4.00
Protection System	Hot dip galvanized				

☐ Limited Inspection

Environment

☐ Benign
☐ Moderate
☑ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
Each	0.00	4.00	0.00	0.00

Comments

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments

East Elevation

West Elevation

Looking East (Note Scaling on Exterior Soffit)

Typical Joint

Form at Joint (several joints near East End)

Spall at Second Joint from East End

Delamination in third panel from West End

Wide Crack and Scaling on Barrier Wall (typical both sides)

Typical Wingwall / Retaining Wall

Typical RSS

Extension and Header Wall on West Side

Crack on Approach Wearing Surface

Looking North at Bridge

Looking South at Bridge

Hatch Mott MacDonald

Region of Halton

OSIM Inspection Forms

For the Bridge on Winston Churchill Blvd
Located 1.7 km North of Steeles Avenue
Structure No. 19-1196390 BR03

Prepared by:

Hatch Mott MacDonald
2800 Speakman Drive
Mississauga, ON, Canada L5K 2R7
T: 905 403 4455 F: 905 855 2607

Project Number: 336921

	Name, Title	Signature	Date
Prepared By	J.Hallett, E.I.T.	[signature]	MAY 27/15
Reviewed By	J.Luckai, P.Eng	[signature]	MAY 27/15
Approved By	C.Pasqualino, P.Eng	[signature]	MAY 28/15

Region of Halton

Municipal Structure Inspection Form **Structure Number:** **19-1196390 BR03**

Inventory Data

Structure Name	Winston Churchill Blvd, Lot 3, Conc XI	**Hwy No.**	19
Cross. Type Over	☑ Road ☐ Ral ☐ Ped ☐ Nav. Water ☐ Non-Nav. Water ☐ Other		
Cross. Type Under	☐ Road ☐ Ral ☐ Ped ☐ Nav. Water ☑ Non-Nav. Water ☐ Other		
Road Name	Winston Churchill Blvd		
Structure Location	1.7 km North of Steeles Avenue		
Northing	595918.0	**Easting**	4830092.0
Cur.Rep.Value	*		

Key Photo

Owner(s) / % Shared	Region of Halton	50%	
	Regional Municipality of Peel	50%	
Heritage Status	Not Considered for Designation		
MTO Region	Central	**Road Side Env.**	Rural
MTO District	Central	**Road Class**	Arterial
County	Halton	**Lane Type**	
Geographic Twp.		**Posted Speed**	80
No. of Lanes	2		
Structure Category	Bridge	**AADT**	12,625
Pct. Trucks	2		
Struct.SubCategory	Frame		
Structure Type	Rigid Frame, Vertical Legs	**Interchange Number**	
Structure Material	Reinforced Precast Concrete	**Design Load Code**	CHBDC
Total Deck Length	6.11 m	**Road Width**	16.57 m
Interchange Structure Number			
Overall Width	25.0 m	**Vert. Clear**	0.00 m
Detour Length	0 km	**Skew Angle**	0 °
Total Deck Area	152.75 m^2	**No. of Spans**	1
Fill on Structure	0.4 m	**Struct. Dir.**	North/South
Special Routes	☐ Transit ☑ School ☐ Truck ☐ Bicycle	**Insp. Duration**	1 hr

*Current Replacement Value is based on in kind replacement of the existing structure and calculated using benchmark costs. Capital planning should consider site specific cost factors and requirements for widening or lengthening of the structure

Spans

Span Name	Span Lengths	Span Name	Span Lengths
Span 1	5.2 m		

Historical Data

Year Built	2011 yyyy	**Year of Last Major Rehab**	yyyy
Last OSIM Inspection	10/09/2012 mm/dd/yyyy	**Contract No. When Built**	
Last Enhanced OSIM	mm/dd/yyyy	**Last Evaluation**	mm/dd/yyyy
Last Enhanced Access	mm/dd/yyyy	**Current Load Limit**	t t t
Last Underwater Insp.	mm/dd/yyyy	**Load Limit By-Law No.**	mm/dd/yyyy
Last Condition Survey	mm/dd/yyyy	**By-Law Expiry Date**	mm/dd/yyyy

Rehab History

Region of Halton

Municipal Structure Inspection Form **Structure Number:** 19-1196390 BR03

Field Inspection Information

Inspection Date	05/06/2015 mm/dd/yyyy	☐ Multi Day Inspection ☑ OSIM ☐ Enhanced OSIM	**BCI** 99.6
Inspector	C.Chan, E.I.T.	**Eng. Responsible**	J.Luckai, P.Eng
Others in Party	J.Hallett, E.I.T.		
Access Equip.	☐ Lift ☐ Ladder ☐ Boat ☐ Bridge Master	Other	
Other Equip.	Hammer, Camera, Measuring Tape		
Weather	Sunny	**Temperature**	20 °C

Additional Investigation Required:

Investigation	**None**	**Priority Normal**	**Urgent**	**Estimated Cost**
Detailed Deck Condition Survey	☑	☐	☐	$0
Delamination Survey of Asphalt-Covered Deck	☑	☐	☐	$0
Concrete Substructure Condition Survey	☑	☐	☐	$0
Detailed Coating Condition Survey	☑	☐	☐	$0
Post-Tensioned Strand Investigation	☑	☐	☐	$0
Underwater Investigation	☑	☐	☐	$0
Fatigue Investigation	☑	☐	☐	$0
Seismic Investigation	☑	☐	☐	$0
Structure Evaluation	☑	☐	☐	$0
Monitoring of Deformation, Movements and Settlements	☑	☐	☐	$0
Monitoring of Crack Widths	☑	☐	☐	$0
Investigation Notes			**Total Cost**	**$0**

Overall Structure Notes:

Recommended Work on Structure ☑ None ☐ Minor Rehab ☐ Major Rehab ☐ Replace ☐ Remove

Timing of Recommended Work ☑ 1 to 5 years ☐ 6 to 10 years

Overall Comments

BCI Change Justification Erroneous input on 9-Oct-12 Inspection Report

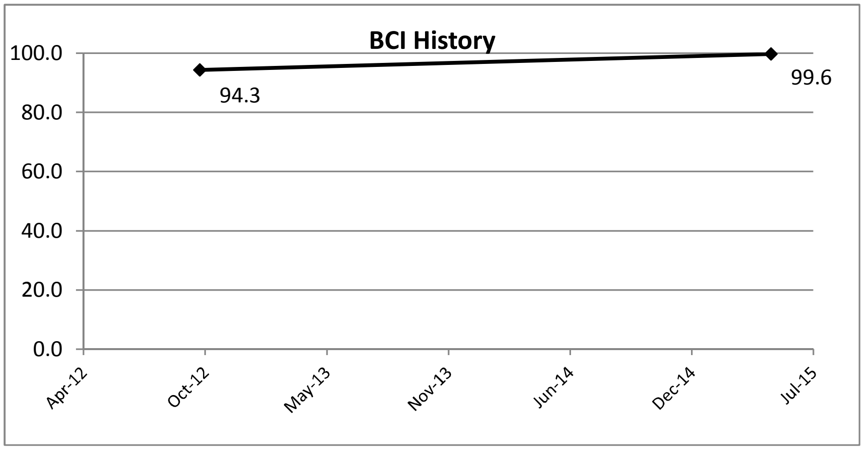
Next Inspection 05/06/2017 mm/dd/yyyy **Estimated Load Limit** t t t

Region of Halton

Municipal Structure Inspection Form **Structure Number:** **19-1196390 BR03**

BCI History

Inspection Date	BCI	Inspector
9-Oct-12	94.3	D.Kelly
6-May-15	99.6	J.Luckai



All Bci values are based on the MTO BCI methodology published in April 2008. As a result, BCI values for 2007 and earlier are approximate only, with potential discrepancies resulting from changes (over time) in the way quantities for certain elements are calculated

Standard Codes

Suspected Performance Deficiencies

01 Load carrying capacity
02 Excessive deformations (deflections & rotations)
03 Continuing settlement
04 Continuing movements
05 Seized bearings
06 Bearing not uniformly loaded/unstable
07 Jammed expansion joint
08 Pedestrian/vehicular hazard
09 Rough riding surface
10 Surface ponding
11 Deck drainage
12 Slippery surfaces
13 Flooding/channel blockage
14 Undermining of foundation
15 Unstable embankments
16 Other

Maintenance Needs

01 Lift and Swing Bridge Maintenance
02 Bridge Cleaning
03 Bridge Handrail Maintenance
04 Painting Steel Bridge Structures
05 Bridge Deck Joint Repair
06 Bridge Bearing Maintenance
07 Repair to Structural Steel
08 Repair of Bridge Concrete
09 Repair of Bridge Timber
10 Bailey bridges - Maintenance
11 Animal/Pest Control
12 Bridge Surface Repair
13 Erosion Control at Bridges
14 Concrete Sealing
15 Rout and Seal
16 Bridge Deck Drainage
17 Scaling (Loose Concrete or ACR Steel)

Approaches - Wearing Surface (Approach)

Element Group	Approaches	**Length**	6.00
Element Name	Wearing Surface (Approach)	**Width**	16.57
Location	Both Ends	**Height**	0.00
Material	Cast-in-place Concrete	**Count**	2.00
Element Type		**Total Quantity**	198.84
Protection System	Hot rubberized asphalt membrane		

☐ Limited Inspection

Environment

☐ Benign
☐ Moderate
☑ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
sq.m	198.84	0.00	0.00	0.00

Comments

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments
None	yrs.	$0	

Barriers - Barrier/Parapet Wall

Element Group	Barriers	**Length**	18.11
Element Name	Barrier/Parapet Wall — Interior	**Width**	0.00
Location	Both Sides	**Height**	0.95
Material	Cast-in-place Concrete	**Count**	2.00
Element Type	Safety Shape without railing	**Total Quantity**	34.41
Protection System	None		

☐ Limited Inspection

Environment

☐ Benign
☐ Moderate
☑ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
sq.m	24.41	9.00	1.00	0.00

Comments

- Light scaling

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments
None	yrs.	$0	

Barriers - Barrier/Parapet Wall

Element Group	Barriers		**Length**	18.11	**Width** 0.00
Element Name	Barrier/Parapet Wall	Exterior	**Height**	0.80	**Count** 2.00
Location	Both Ends			**Total Quantity**	28.98
Material	Cast-in-place Concrete		☐ Limited Inspection		
Element Type	Safety Shape without railing		**Environment**		
Protection System	None		☐ Benign		

Condition Data	**Units**	**Excell.**	**Good**	**Fair**	**Poor**
	sq.m	25.98	2.00	1.00	0.00

Environment: ☐ Benign ☐ Moderate ☑ Severe

Comments

- Light scaling

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments
None	yrs.	$0	

Abutments - Abutment Walls

Element Group	Abutments		**Length**		**Width** 25.00
Element Name	Abutment Walls		**Height**	1.50	**Count** 2.00
Location	North and South Sides			**Total Quantity**	75.00
Material	Precast Concrete		☐ Limited Inspection		
Element Type	Legs of rigid frame		**Environment**		
Protection System	None				

Condition Data	**Units**	**Excell.**	**Good**	**Fair**	**Poor**
	sq.m	75.00	0.00	0.00	0.00

Environment: ☑ Benign ☐ Moderate ☐ Severe

Comments

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments
None	yrs.	$0	

Foundation - Foundation (below ground level)

Element Group	Foundation	**Length**	**Width**
Element Name	Foundation (below ground level)	**Height**	**Count**
Location	Below Structure	**Total Quantity**	0.00
Material		☑ Limited Inspection	
Element Type		**Environment**	
Protection System	None	☐ Benign	

Condition Data

Units	Excell.	Good	Fair	Poor
	0.00	0.00	0.00	0.00

☐ Moderate
☐ Severe

Comments

Limited Inspection

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments
None			

Approaches - Approach Slab

Element Group	Approaches	**Length**	6.00	**Width**	16.57
Element Name	Approach Slab	**Height**	0.95	**Count**	2.00
Location	Both Ends			**Total Quantity**	198.84
Material	Cast-in-place Concrete	☐ Limited Inspection			
Element Type		**Environment**			
Protection System	Hot Rubberized asphalt membrane	☐ Benign			

Condition Data

Units	Excell.	Good	Fair	Poor
sq.m	198.84	0.00	0.00	0.00

☑ Moderate
☐ Severe

Comments

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments
None			

Decks - Deck Top (with Thick Slab)

Element Group	Decks	**Length**	6.11
Element Name	Deck Top (with Thick Slab)	**Width**	25.00
Location	Above structure	**Height**	0.00
Material	Precast Concrete	**Count**	
Element Type	Precast solid or void without concrete topping	**Total Quantity**	152.75
Protection System	Hot Rubberized asphalt membrane		

☐ Limited Inspection

Environment

☐ Benign
☑ Moderate
☐ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
sq.m	152.75	0.00	0.00	0.00

Comments

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments

Decks - Soffit - Thick Slab

Element Group	Decks	**Length**	5.20
Element Name	Soffit - Thick Slab / Exterior	**Width**	3.80
Location	Underside of Deck	**Height**	
Material	Precast Concrete	**Count**	
Element Type		**Total Quantity**	19.76
Protection System	None		

☐ Limited Inspection

Environment

☐ Benign
☑ Moderate
☐ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
sq.m	19.76	0.00	0.00	0.00

Comments

Performance Deficiencies	Maintenance Needs	Priority	Comments

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments

Decks - Soffit - Thick Slab

Element Group	Decks	**Length**	5.20
Element Name	Soffit - Thick Slab / Interior	**Width**	23.00
Location	Underside of deck	**Height**	
Material	Precast Concrete	**Count**	
Element Type		**Total Quantity**	119.60
Protection System	None		

☐ Limited Inspection

Environment

☑ Benign
☐ Moderate
☐ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
sq.m	119.60	0.00	0.00	0.00

Comments

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments
None			

Decks - Wearing Surface

Element Group	Decks	**Length**	18.10
Element Name	Wearing Surface	**Width**	16.57
Location	Above structure	**Height**	0.00
Material	Asphalt	**Count**	
Element Type		**Total Quantity**	299.92
Protection System	None		

☐ Limited Inspection

Environment

☐ Benign
☐ Moderate
☑ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
sq.m	274.92	25.00	0.00	0.00

Comments

Performance Deficiencies	Maintenance Needs	Priority	Comments

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments

Embankments & Streams - Embankments

Element Group	Embankments & Streams	**Length**	
Element Name	Embankments	**Width**	
Location	All Quadrants	**Height**	
Material	Vegetation	**Count**	4.00
Element Type		**Total Quantity**	4.00
Protection System	None		

☐ Limited Inspection

Environment

☐ Benign
☐ Moderate
☐ Severe

Condition Data	Units	Excell.	Good	Fair	Poor
	Each	0.00	4.00	0.00	0.00

Comments

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments

Embankments & Streams - Slope Protection

Element Group	Embankments & Streams	**Length**	
Element Name	Slope Protection	**Width**	
Location	All Quadrants	**Height**	
Material	Vegetation	**Count**	4.00
Element Type		**Total Quantity**	4.00
Protection System	None		

☐ Limited Inspection

Environment

☐ Benign
☐ Moderate
☐ Severe

Condition Data	Units	Excell.	Good	Fair	Poor
	Each	0.00	4.00	0.00	0.00

Comments

Performance Deficiencies	Maintenance Needs	Priority	Comments

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments

Region of Halton

Municipal Structure Inspection Form **Structure Number:** 19-1196390 BR03

Sidewalks/Curbs - Curbs

Element Group	Sidewalks/Curbs		
Element Name	Curbs	Headwalls	
Location	East and West sides		
Material	Cast-in-place Concrete		
Element Type			
Protection System	None		

Length	18.10	**Width**	0.55
Height	0.20	**Count**	1.00
		Total Quantity	13.58

☐ Limited Inspection

Environment

☐ Benign
☐ Moderate
☐ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
sq.m	0.00	13.58	0.00	0.00

Comments

- Light abrasions

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments

Embankments & Streams - Streams & Waterways

Element Group	Embankments & Streams		
Element Name	Streams & Waterways		
Location	Through Structure		
Material			
Element Type			
Protection System	None		

Length		**Width**	
Height		**Count**	1.00
		Total Quantity	1.00

☐ Limited Inspection

Environment

☐ Benign
☐ Moderate
☐ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
All	0.00	1.00	0.00	0.00

Comments

-Ponding at east corners of structure - Regrade to provide positive drainage

Performance Deficiencies	Maintenance Needs	Priority	Comments
	Bridge Deck Drainage	1-5 years	Drainage **through** structure needs to be regraded

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments

Abutments - Wingwalls

Element Group	Abutments	**Length**	1.10
		Width	
Element Name	Wingwalls	**Height**	2.30
		Count	2.00
Location	East Side	**Total Quantity**	5.06
Material	Cast-in-place Concrete		
Element Type			
Protection System	None		

☐ Limited Inspection

Environment

☐ Benign
☑ Moderate
☐ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
sq.m	5.06	0.00	0.00	0.00

Comments

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments

Retaining Walls - Walls

Element Group	Retaining Walls	**Length**	6.20
		Width	
Element Name	Walls	**Height**	1.40
		Count	2.00
Location	East Side	**Total Quantity**	17.40
Material	Precast Concrete		
Element Type	Retained soil systems		
Protection System	None		

☐ Limited Inspection

Environment

☐ Benign
☑ Moderate
☐ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
sq.m	17.40	0.00	0.00	0.00

Comments

Performance Deficiencies	Maintenance Needs	Priority	Comments

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments

Approaches - Approach Guiderail

Element Group	Approaches	**Length**	
Element Name	Approach Guiderail / Extruder End	**Height**	
Location	All Quadrants	**Width**	
Material	Steel	**Count**	4.00
Element Type		**Total Quantity**	4.00
Protection System	Hot dip galvanized		

☐ Limited Inspection

Environment

☐ Benign
☐ Moderate
☑ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
Each	0.00	4.00	0.00	0.00

Comments

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments

East Elevation

West Elevation

Looking North at Bridge

Looking South

South East Abutment

North East Abutment

Typical Soffit

Typical Joint and South Abutment Wall

Pounding (Typical on East Side)

Looking East Through the Structure

Deck Slab Joint (Typical)

Extension on West Side

Disintegrated Concrete at RSS Connection

Looking Downstream

Typical Joint on Barrier Wall

Typical Scaling on Barrier Wall

Hatch Mott
MacDonald

Region of Halton

OSIM Inspection Forms

For the Bridge on Winston Churchill Blvd
Located 0.5 km North of Steeles Avenue
Structure No. 19-1196390 BR05

Prepared by:

Hatch Mott MacDonald
2800 Speakman Drive
Mississauga, ON, Canada L5K 2R7
T: 905 403 4455 F: 905 855 2607
Project Number: 336921

	Name, Title	Signature	Date
Prepared By	J.Hallett, E.I.T.		MAY 27/15
Reviewed By	J.Luckai, P.Eng		May 27/15
Approved By	C.Pasqualino, P.Eng		MAY 28/15

Region of Halton

Municipal Structure Inspection Form **Structure Number:** 19-1196390 BR05

Inventory Data

Structure Name	Winston Churchill Blvd, Lot 1, Conc XI	**Hwy No.**	19
Cross. Type Over	☑ Road ☐ Rail ☐ Ped ☐ Nav. Water ☐ Non-Nav. Water ☐ Other		
Cross. Type Under	☐ Road ☐ Rail ☐ Ped ☐ Nav. Water ☑ Non-Nav. Water ☐ Other		
Road Name	Winston Churchill Blvd		
Structure Location	0.5 km North of Steeles Avenue		
Northing	596708.0	**Easting**	4829286.0
Cur.Rep.Value	*		

Key Photo

Owner(s) / % Shared	Region of Halton	50%	
	Regional Municipality of Peel	50%	
Heritage Status	Not Considered for Designation		
MTO Region	Central	**Road Side Env.**	Rural
MTO District	Central	**Road Class**	Arterial
County	Halton	**Lane Type**	
Geographic Twp.		**Posted Speed**	60
No. of Lanes	4		
Structure Category	Bridge	**AADT**	12,625
Pct. Trucks	2		
Struct.SubCategory	Frame		
Structure Type	Rigid Frame, Vertical Legs	**Interchange Number**	
Structure Material	Reinforced Precast Concrete	**Design Load Code**	CHBDC
Total Deck Length	11.30 m	**Road Width**	17.80 m
Interchange Structure Number			
Overall Width	25.14 m	**Vert. Clear**	0.00 m
Detour Length	0 km	**Skew Angle**	0 °
Total Deck Area	284.08 m^2	**No. of Spans**	1
Fill on Structure	0 m	**Struct. Dir.**	North/South
Special Routes	☐ Transit ☑ School ☐ Truck ☐ Bicycle	**Insp. Duration**	1 hr

*Current Replacement Value is based on in kind replacement of the existing structure and calculated using benchmark costs. Capital planning should consider site specific cost factors and requirements for widening or lengthening of the structure

Spans

Span Name	Span Lengths	Span Name	Span Lengths
Span 1	10.4 m		

Historical Data

Year Built	2011 yyyy	**Year of Last Major Rehab**	yyyy
Last OSIM Inspection	10/09/2012 mm/dd/yyyy	**Contract No. When Built**	
Last Enhanced OSIM	mm/dd/yyyy	**Last Evaluation**	mm/dd/yyyy
Last Enhanced Access	mm/dd/yyyy	**Current Load Limit**	t t t
Last Underwater Insp.	mm/dd/yyyy	**Load Limit By-Law No.**	mm/dd/yyyy
Last Condition Survey	mm/dd/yyyy	**By-Law Expiry Date**	mm/dd/yyyy

Rehab History

Region of Halton

Municipal Structure Inspection Form

Structure Number: 19-1196390 BR05

Field Inspection Information

Inspection Date	05/06/2015 mm/dd/yyyy	☐ Multi Day Inspection ☑ OSIM ☐ Enhanced OSIM	**BCI** 98.9
Inspector	C.Chan, E.I.T.	**Eng. Responsible**	J.Luckai, P.Eng
Others in Party	J.Hallett, E.I.T.		
Access Equip.	☐ Lift ☐ Ladder ☐ Boat ☐ Bridge Master	Other	
Other Equip.	Hammer, Camera, Measuring Tape		
Weather	Sunny	**Temperature**	20 °C

Additional Investigation Required:

Investigation	**None**	**Priority Normal**	**Urgent**	**Estimated Cost**
Detailed Deck Condition Survey	☑	☐	☐	$0
Delamination Survey of Asphalt-Covered Deck	☑	☐	☐	$0
Concrete Substructure Condition Survey	☑	☐	☐	$0
Detailed Coating Condition Survey	☑	☐	☐	$0
Post-Tensioned Strand Investigation	☑	☐	☐	$0
Underwater Investigation	☑	☐	☐	$0
Fatigue Investigation	☑	☐	☐	$0
Seismic Investigation	☑	☐	☐	$0
Structure Evaluation	☑	☐	☐	$0
Monitoring of Deformation, Movements and Settlements	☑	☐	☐	$0
Monitoring of Crack Widths	☑	☐	☐	$0

Investigation Notes **Total Cost** **$0**

Overall Structure Notes:

Recommended Work on Structure ☐ None ☑ Minor Rehab ☐ Major Rehab ☐ Replace ☐ Remove

Timing of Recommended Work ☑ 1 to 5 years ☐ 6 to 10 years

Overall Comments
- Patch repair at PVC outlet

BCI Change Justification

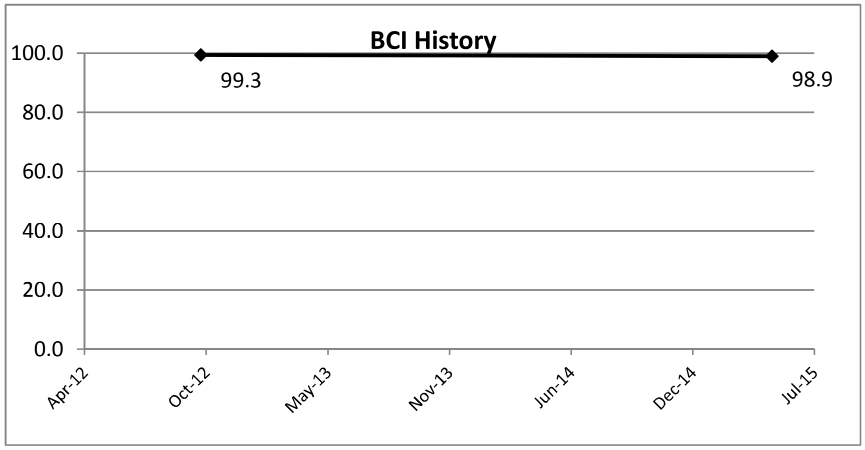
Next Inspection 05/06/2017 mm/dd/yyyy **Estimated Load Limit** t t t

Region of Halton

Municipal Structure Inspection Form **Structure Number:** 19-1196390 BR05

BCI History

Inspection Date	BCI	Inspector
9-Oct-12	99.3	D.Kelly
6-May-15	98.9	J.Luckai



All Bci values are based on the MTO BCI methodology published in April 2008. As a result, BCI values for 2007 and earlier are approximate only, with potential discrepancies resulting from changes (over time) in the way quantities for certain elements are calculated

Standard Codes

Suspected Performance Deficiencies

01 Load carrying capacity
02 Excessive deformations (deflections & rotations)
03 Continuing settlement
04 Continuing movements
05 Seized bearings
06 Bearing not uniformly loaded/unstable
07 Jammed expansion joint
08 Pedestrian/vehicular hazard
09 Rough riding surface
10 Surface ponding
11 Deck drainage
12 Slippery surfaces
13 Flooding/channel blockage
14 Undermining of foundation
15 Unstable embankments
16 Other

Maintenance Needs

01 Lift and Swing Bridge Maintenance
02 Bridge Cleaning
03 Bridge Handrail Maintenance
04 Painting Steel Bridge Structures
05 Bridge Deck Joint Repair
06 Bridge Bearing Maintenance
07 Repair to Structural Steel
08 Repair of Bridge Concrete
09 Repair of Bridge Timber
10 Bailey bridges - Maintenance
11 Animal/Pest Control
12 Bridge Surface Repair
13 Erosion Control at Bridges
14 Concrete Sealing
15 Rout and Seal
16 Bridge Deck Drainage
17 Scaling (Loose Concrete or ACR Steel)

Approaches - Wearing Surface (Approach)

Element Group	Approaches	**Length**	6.00
Element Name	Wearing Surface (Approach)	**Width**	17.80
Location	Both Sides	**Height**	0.00
Material	Asphalt	**Count**	2.00
Element Type		**Total Quantity**	213.60
Protection System	None		

☐ Limited Inspection

Environment

☐ Benign
☐ Moderate
☑ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
sq.m	174.60	39.00	0.00	0.00

Comments

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority		Cost	Comments
Minor Rehabilitation	1-5	yrs.	$1,000	Patch repair at round PVC outlet

Barriers - Barrier/Parapet Wall

Element Group	Barriers	**Length**	23.24
Element Name	Barrier/Parapet Wall — Interior	**Width**	0.00
Location	Both sides	**Height**	1.10
Material	Cast-in-place Concrete	**Count**	2.00
Element Type	Parapet Wall with single railing	**Total Quantity**	51.13
Protection System	None		

☐ Limited Inspection

Environment

☐ Benign
☐ Moderate
☑ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
sq.m	33.13	17.00	1.00	0.00

Comments

- Medium spall on North side --> 75mm dia., 30.7 m from NE corner of barrier
- Light scaling elsewhere
- Light hairline cracking

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority		Cost	Comments
None		yrs.	$0	

Barriers - Barrier/Parapet Wall

Element Group	Barriers	**Length**	23.24	**Width**	0.00
Element Name	Barrier/Parapet Wall / Exterior	**Height**	0.83	**Count**	2.00
Location	Both Sides			**Total Quantity**	38.58
Material	Cast-in-place Concrete	☐ Limited Inspection			
Element Type	Parapet Wall with single railing	**Environment**			
Protection System	None	☐ Benign			

Condition Data

Units	Excell.	Good	Fair	Poor
sq.m	36.58	2.00	0.00	0.00

☑ Moderate
☐ Severe

Comments

- Some light scaling

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments
None	yrs.	$0	

Abutments - Abutment Walls

Element Group	Abutments	**Length**	6.00	**Width**	25.14
Element Name	Abutment Walls	**Height**	1.50	**Count**	2.00
Location	North and south sides			**Total Quantity**	75.42
Material	Precast Concrete	☐ Limited Inspection			
Element Type	Legs of rigid frame	**Environment**			
Protection System	None	☑ Benign			

Condition Data

Units	Excell.	Good	Fair	Poor
sq.m	73.42	2.00	0.00	0.00

☐ Moderate
☐ Severe

Comments

- Spalling around PVC outlet on South Wall
- Staining on some joints

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments
Minor Rehabilitation	1-5 yrs.	$1,000	Patch repair at round PVC outlet

Foundation - Foundation (below ground level)

Element Group	Foundation	**Length**	0.00
Element Name	Foundation (below ground level)	**Width**	0.00
Location	Below structure	**Height**	0.00
Material		**Count**	0.00
Element Type		**Total Quantity**	0.00
Protection System	None		

☑ Limited Inspection

Environment

☐ Benign
☐ Moderate
☐ Severe

Condition Data	**Units**	**Excell.**	**Good**	**Fair**	**Poor**
	0	0.00	0.00	0.00	0.00

Comments

Limited inspection.

Performance Deficiencies	**Maintenance Needs**	**Priority**	**Comments**
None	None		

Rehab/Rehabilitation Recommendations	**Priority**	**Cost**	**Comments**
None	yrs.	$0	

Approaches - Approach Slab

Element Group	Approaches	**Length**	6.00
Element Name	Approach Slab	**Width**	17.80
Location	Both ends	**Height**	0.00
Material	Cast-in-place Concrete	**Count**	2.00
Element Type		**Total Quantity**	213.60
Protection System	Hot rubberized aphalt membrane		

☐ Limited Inspection

Environment

☐ Benign
☑ Moderate
☐ Severe

Condition Data	**Units**	**Excell.**	**Good**	**Fair**	**Poor**
	sq.m	213.60	0.00	0.00	0.00

Comments

Performance Deficiencies	**Maintenance Needs**	**Priority**	**Comments**
None	None		

Rehab/Rehabilitation Recommendations	**Priority**	**Cost**	**Comments**
None	yrs.	$0	

Decks - Deck Top (with Thick Slab)

Element Group	Decks		**Length**	11.30	**Width** 25.14
Element Name	Deck Top (with Thick Slab)		**Height**	0.00	**Count** 2.00
Location	Above structure			**Total Quantity**	284.08
Material	Precast Concrete		☐ Limited Inspection		
Element Type	Precast solid or void without concrete topping		**Environment**		
Protection System	Hot rubberized asphalt membrane		☐ Benign		

Condition Data

Units	Excell.	Good	Fair	Poor
sq.m	284.08	0.00	0.00	0.00

☑ Moderate
☐ Severe

Comments

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments
None	yrs.	$0	

Decks - Soffit - Thick Slab

Element Group	Decks		**Length**	10.40	**Width** 3.80
Element Name	Soffit - Thick Slab	Exterior	**Height**	0.00	**Count** 0.00
Location	Underside of Deck			**Total Quantity**	39.52
Material	Precast Concrete		☐ Limited Inspection		
Element Type			**Environment**		
Protection System	None		☐ Benign		

Condition Data

Units	Excell.	Good	Fair	Poor
sq.m	37.02	2.50	0.00	0.00

☑ Moderate
☐ Severe

Comments

- Honeycombing along edge
- Hairline cracks on vertical face
- Lighr scaling on vertical face

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments
None	yrs.	$0	

Decks - Soffit - Thick Slab

Element Group	Decks		**Length**	11.30	**Width** 23.14
Element Name	Soffit - Thick Slab	Interior	**Height**	0.00	**Count** 0.00
Location	Underside of deck		**Total Quantity**		261.48
Material	Precast Concrete		☐ Limited Inspection		
Element Type			**Environment**		
Protection System	None		☑ Benign		

Condition Data	**Units**	**Excell.**	**Good**	**Fair**	**Poor**
	sq.m	256.48	3.00	1.00	1.00

Environment: ☐ Moderate ☐ Severe

Comments

- Some joints with light honeycombing, scalling, spalling, and/or staining

Performance Deficiencies	**Maintenance Needs**	**Priority**	**Comments**
None	None		

Rehab/Rehabilitation Recommendations	**Priority**	**Cost**	**Comments**
None	yrs.	$0	

Decks - Wearing Surface

Element Group	Decks		**Length**	11.30	**Width** 17.80
Element Name	Wearing Surface		**Height**	0.00	**Count** 1.00
Location	Above structure		**Total Quantity**		201.14
Material	Asphalt		☐ Limited Inspection		
Element Type			**Environment**		
Protection System	None		☐ Benign		

Condition Data	**Units**	**Excell.**	**Good**	**Fair**	**Poor**
	sq.m	161.14	40.00	0.00	0.00

Environment: ☐ Moderate ☑ Severe

Comments

Performance Deficiencies	**Maintenance Needs**	**Priority**	**Comments**
None	None		

Rehab/Rehabilitation Recommendations	**Priority**	**Cost**	**Comments**
None	yrs.	$0	

Municipal Structure Inspection Form | **Structure Number:** 19-1196390 BR05

Embankments & Streams - Embankments

Element Group	Embankments & Streams	**Length**	0.00
Element Name	Embankments	**Width**	0.00
Location	All Quadrants	**Height**	0.00
Material	Vegetation	**Count**	4.00
Element Type		**Total Quantity**	4.00
Protection System	Vegetation		

☐ Limited Inspection

Environment

☐ Benign
☐ Moderate
☐ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
Each	0.00	4.00	0.00	0.00

Comments

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments
None	yrs.	$0	

Embankments & Streams - Slope Protection

Element Group	Embankments & Streams	**Length**	23.24
Element Name	Slope Protection	**Width**	0.00
Location	All Quadrants	**Height**	1.10
Material	Vegetation	**Count**	4.00
Element Type		**Total Quantity**	4.00
Protection System	None		

☐ Limited Inspection

Environment

☐ Benign
☐ Moderate
☐ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
Each	0.00	4.00	0.00	0.00

Comments

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments
None	yrs.	$0	

Sidewalks/Curbs - Curbs

Element Group	Sidewalks/Curbs	**Length**	6.00
Element Name	Curbs	**Width**	0.15
Location	Both Sides	**Height**	0.15
Material	Cast-in-place Concrete	**Count**	2.00
Element Type		**Total Quantity**	3.60
Protection System	None		

☐ Limited Inspection

Environment

☐ Benign
☐ Moderate
☑ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
sq.m	2.60	1.00	0.00	0.00

Comments

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments
None	yrs.	$0	

Embankments & Streams - Streams & Waterways

Element Group	Embankments & Streams	**Length**	0.00
Element Name	Streams & Waterways	**Width**	0.00
Location	Through Structure	**Height**	0.00
Material		**Count**	1.00
Element Type		**Total Quantity**	1.00
Protection System	None		

☐ Limited Inspection

Environment

☐ Benign
☐ Moderate
☐ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
All	0.00	1.00	0.00	0.00

Comments

- Ponding at east corners of structure - regrade to provide positive drainage

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	Bridge Deck Drainage	1- 5 yrs	Drainage **through** structure needs to be regraded

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments
None	yrs.	$0	

Abutments - Wingwalls

Element Group	Abutments	**Length**	1.60
Element Name	Wingwalls	**Width**	3.80
Location	All Quadrants	**Height**	3.10
Material	Cast-in-place Concrete	**Count**	4.00
Element Type	Reinforced Concrete	**Total Quantity**	19.84
Protection System	None		

☐ Limited Inspection

Environment

☐ Benign
☑ Moderate
☐ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
sq.m	17.84	1.00	1.00	0.00

Comments

- Hairline cracks
- Medium / Light scaling

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments
None	yrs.	$0	

Retaining Walls - Walls

Element Group	Retaining Walls	**Length**	6.00
Element Name	Walls	**Width**	23.14
Location	All Quadrants	**Height**	0.83
Material	Precast Concrete	**Count**	4.00
Element Type	Retained soil systems	**Total Quantity**	19.92
Protection System	None		

☐ Limited Inspection

Environment

☐ Benign
☐ Moderate
☐ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
sq.m	19.92	0.00	0.00	0.00

Comments

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments
None	yrs.	$0	

Approaches - Approach Guiderail

Element Group	Approaches	**Length**	6.00
Element Name	Approach Guiderail / Extruder End	**Width**	0.00
Location	South East Quadrant	**Height**	0.83
Material	Steel	**Count**	1.00
Element Type		**Total Quantity**	1.00
Protection System	Hot dip Galvanized		

☐ Limited Inspection

Environment

☐ Benign
☐ Moderate
☑ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
Each	0.00	1.00	0.00	0.00

Comments

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments
None	yrs.	$0	

Sidewalks/Curbs - Sidewalk and medians

Element Group	Sidewalks/Curbs	**Length**	11.24
Element Name	Sidewalk and medians / Sidewalk	**Width**	3.20
Location	Both sides	**Height**	0.15
Material	Cast-in-place Concrete	**Count**	2.00
Element Type		**Total Quantity**	75.31
Protection System	None		

☐ Limited Inspection

Environment

☐ Benign
☐ Moderate
☑ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
sq.m	60.31	15.00	0.00	0.00

Comments

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments
None	yrs.	$0	

Municipal Structure Inspection Form **Structure Number:** 19-1196390 BR05

Retaining Walls - Barrier Systems on Walls

Element Group	Retaining Walls		**Length**	6.00
Element Name	Barrier Systems on Walls	Exterior	**Width**	0.15
Location	All Quadrants		**Height**	0.83
Material	Cast-in-place Concrete		**Count**	4.00
Element Type	Parapet Wall with single railing		**Total Quantity**	19.92
Protection System	None			

☐ Limited Inspection

Environment

☐ Benign
☑ Moderate
☐ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
sq.m	19.92	0.00	0.00	0.00

Comments

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments
None	yrs.	$0	

Retaining Walls - Barrier Systems on Walls

Element Group	Retaining Walls		**Length**	6.00
Element Name	Barrier Systems on Walls	Interior	**Width**	3.20
Location	All Quadrants		**Height**	1.10
Material	Cast-in-place Concrete		**Count**	4.00
Element Type	Parapet Wall with single railing		**Total Quantity**	26.40
Protection System	None			

☐ Limited Inspection

Environment

☐ Benign
☐ Moderate
☑ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
sq.m	21.40	5.00	0.00	0.00

Comments

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments
None	yrs.	$0	

Barriers - Hand Railings

Element Group	Barriers		**Length**	23.24
Element Name	Hand Railings		**Width**	0.00
Location	Both Sides		**Height**	0.00
Material	Steel		**Count**	2.00
Element Type			**Total Quantity**	46.48
Protection System	Hot dip galvanized			

☐ Limited Inspection

Environment

☐ Benign
☐ Moderate
☑ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
m	37.28	9.20	0.00	0.00

Comments

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments
None	yrs.	$0	

Coatings - Barrier Systems / Hand Railings

Element Group	Coatings		**Length**	6.00
Element Name	Barrier Systems / Hand Railings		**Width**	0.00
Location	Both sides		**Height**	1.10
Material			**Count**	1.00
Element Type	Hot dip galvanized		**Total Quantity**	14.60
Protection System	None			

☐ Limited Inspection

Environment

☐ Benign
☐ Moderate
☑ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
m	11.60	3.00	0.00	0.00

Comments

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments
None	yrs.	$0	

Region of Halton

Municipal Structure Inspection Form — **Structure Number:** **19-1196390 BR05**

Approaches - Curbs and gutters

Element Group	Approaches	**Length**	6.00
Element Name	Curbs and gutters	**Width**	3.20
Location	All Quadrants	**Height**	0.15
Material	Cast-in-place Concrete	**Count**	4.00
Element Type		**Total Quantity**	24.00
Protection System	None		

☐ Limited Inspection

Environment

☐ Benign
☐ Moderate
☑ Severe

Condition Data

Units	Excell.	Good	Fair	Poor
m	17.50	6.50	0.00	0.00

Comments

Performance Deficiencies	Maintenance Needs	Priority	Comments
None	None		

Rehab/Rehabilitation Recommendations	Priority	Cost	Comments
None	yrs.	$0	

East Elevation

West Elevation

Looking South at Bridge

Looking North at Bridge

Looking West Under Structure

Typical Ponding at Abutment Corners

Typical Soffit

Typical Soffit Edge

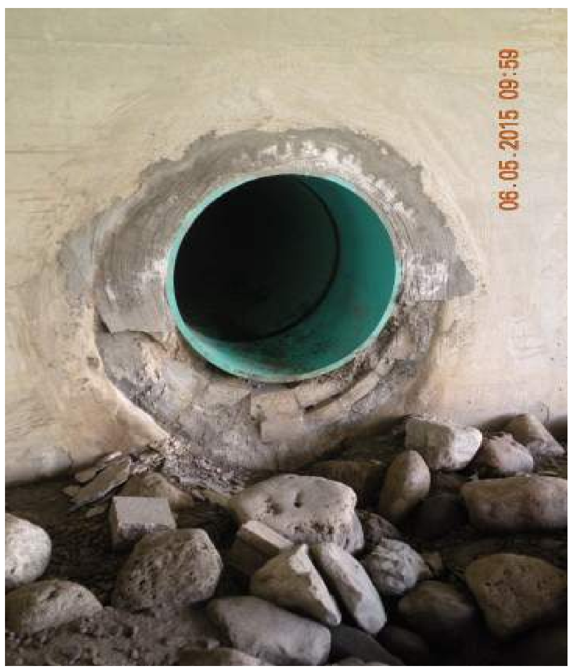
Honeycombing at Soffit

Typical Wingwall

Typical Joint

Joint with Staining and Scaling

Spall at Soffit Joint



Spalling around PVC Inlet

Narrow Crack on Interior Parapet Wall

Spall on Interior Parapet Wall

Appendix D

Fluvial Geomorphological Assessment Report

water's edge
ENVIRONMENTAL SOLUTIONS TEAM LTD.

Winston Churchill Boulevard
Mississauga, ON

Fluvial Geomorphological Assessment and Meander Beltwidth Assessment

May 10, 2016

May 10, 2016
WE 14036

Ms. Melissa Alexander, B.Sc., MCIP, RPP
Environmental Planner
Hatch Infrastructure
5035 South Service Road, Sixth Floor
Burlington, Ontario
L7L 6M9

Dear Ms. Alexander:

RE: Winston Churchill Blvd, Region of Peel, ON
Fluvial Geomorphological Assessment and Meander Beltwidth Assessment

Water's Edge was authorized by Hatch Mott MacDonald to complete a fluvial assessment and natural channel designs for three stream crossings – two tributaries of Levi's Creek and one tributary of Mullet Creek on Winston Churchill Blvd, in the Region of Peel.

We have completed our assessment of the creek in accordance with the approved project Terms of Reference. Data sources for the analysis include:

- Aerial Photography for 1954, 1994, 2000, 2002 and 2013 (TRCA);
- Maps of the study area (Google imagery);
- Physiography of Southern Ontario by Chapman & Putnam (digital data from MNDM);
- Site Surveys and Field Assessments; and,
- Discussions with Hatch Mott MacDonald staff.

Site inspections and a geomorphic survey of the study area were completed by Water's Edge staff in September 2015. The site inspection was undertaken after an initial review of the mapping and available literature was completed in order to confirm site and general system characteristics

The study area is located on Winston Churchill Blvd, just north of 5 Side Rd. /Embleton Rd. and continuing down to just south of Highway 401 (see Figure 1). In this report, we have outlined the results of our investigations and have provided recommendations related to any culvert replacements and to mitigate any impacts (Note: To Be Completed).

1.0 EXISTING CONDITIONS

1.1 Geology & Physiography

Reviewing the site area's surficial materials is important to evaluate active channel processes. Stream channel form and sediment supply are controlled by the region's physiography and surficial geology. This study area is located in the Peel Plain physiographic region and in the bevelled till plains landform. The geologic material underlying the plain is a till which is clay to silt textured and is generally derived from glaciolacustrine deposits.

Figure 1: Local Physiography (data from MNDM)

1.2 General Watershed Characteristics and Site Conditions

The creeks in this study are all tributaries of Levi Creek and Mullet Creek and are located in the Credit River watershed in Mississauga, which drains into Lake Ontario. The study area includes ten culverts (Cu-1 to Cu-10), all passing under Winston Churchill Blvd. Only Cu-3, Cu-8 and Cu-10 will be focused on in this report.

Levi Creek North which flows through Cu-3 is likely a 2nd order stream. Its contributing drainage area is 212.6 ha. The drainage area for Cu-8, which conveys Levi Creek South, is 98.53 ha and it is likely a 3rd order stream. Mullet Creek which is conveyed by Cu-10 has a contribution drainage area of 267.78 ha and is likely a 3rd order stream to the point of the study area. The land use of the contributing drainage areas at the study area is primarily agricultural as well as wetland.

Below is a description of the terrestrial conditions of the site from the 1996 Environmental Study Report completed by Paul Theil Associates Limited;

> “The first watercourse north of Steeles Avenue is identified as an intermittent watercourse with low fish habitat potential by the City of Brampton Official Plan Natural Environment database. East (downstream) of the roadway, the watercourse is only 0.25 to 0.50 metres in width with only 5.0 to 10.0 centimetres of water at the time of the field survey in November 1994. The primarily muck streambed and thick cattails reduce the fish habitat potential, although bait fish may utilize this watercourse during the spring and autumn. West of Winston Churchill Boulevard the watercourse consists only of a manicured grass swale with no stream cover or fish habitat potential.
>
> The remaining two tributaries located within the study area are part of the Levi’s Creek subwatershed. Although Levi’s Creek is classified as a warm water fishery

> with a cold migratory run, this habitat was not observed by E.S.P. staff during their field investigation. At the more southern tributary of Levi's Creek, east of the roadway, a 0.5 to 1.0 metre wide, grassed channel was observed among the vegetation with only about 5.0 centimetres of water in it. The upstream swale west of the roadway was grassed, with no stream cover. Horses have free access to the swale. As observed in the field, the Official plan review identified no fish habitat for this watercourse.
>
> The remaining watercourse crossing farthest to the north did not display a well-defined stream channel. The swale was completely grassed. The pools associated with the grassed swales may provide some amphibian habitat. Cattails were found east of Winston Churchill Boulevard, but no flow was observed toward the cattails."

The 2009 Addendum, completed by McCormick Rankin Corporation, reports no change from the original study report.

Figure 2: Locations of Levi Creek North and South and Mullet Creek

Culvert 3

This crossing is the closest crossing to Embleton Rd. and is the northern most crossing of the three. This culvert conveys Levi Creek North through Winston Churchill Blvd. The reach has little instream cover as the riparian buffer is comprised of tall grasses and no trees or shrubs. Some undercut banks were observed in this reach although flow appears to typically be low or intermittent. The majority of the banks and channel are stabilized only by the roots from the riparian grasses.

Approximately 200 metres were surveyed for this study. Four cross sections were surveyed in this reach, two on the east side and two on the west side. The channel showed low width-to-depth ratio (<12) and is slightly entrenched. The average bankfull slope is 0.015 m/m, and the bankfull width and average depth were noted to be 0.89 m and 0.09 m. The substrate in this reach is focused on sands and small gravels. A sieve sample was completed for the reach and the results show 96% sands and 3.5% gravels. No Rosgen classification will be given to this channel as 'field drainage' should suffice in conveying its general characteristics. Survey results can be seen in Table 1.

Figure 3: Aerial View of Cu-3 on Levi Creek North

Culvert 8

This crossing and reach are between Cu-3 and Cu-10 with approximately 1km separating each crossing. This culvert conveys Levi Creek South through Winston Churchill Blvd. The upstream and downstream sides of this reach are very different from one another. The upstream end (west side) is straightened grass channel with a small riparian buffer. The downstream end (east side) is a sinuous channel that has proper channel features and a wide riparian with large trees and shrubs.

Approximately 200 metres of channel were surveyed along with five cross sections to determine the typical channel geometry. The overall channel has a moderate width-to-depth ratio and is not entrenched. The average bankfull slope through the whole study area is 0.007 m/m, and the average bankfull width and depth were noted to be 1.37 m and 0.13 m.

The substrate in this reach ranges from silt to cobbles with small gravels and sand the dominant substrates. The sieve sample for this reach reveals that 85% of the substrate is gravel while 15% is sand. The banks are typically made up of highly erodible soils. Rosgen classification for this reach is determined to be an E4 channel type. Survey results can be seen in Table 1.

Figure 4: Aerial View of Cu-8 on Levi Creek South

Culvert 10

This crossing is the closest crossing to Steeles Ave. and is the southernmost crossing of the three. This culvert conveys Mullet Creek through Winston Churchill Blvd. The reach is similar to crossing Cu-8 in how it has a grassed upstream end (west side) and a forested downstream end (east side). The downstream end has some erosion occurring and also contains a fair amount of large woody debris. The majority of the banks and channel are stabilized only by the roots from the riparian grasses.

Approximately 215 metres of the channel at this crossing was surveyed for this study. Four cross sections were also surveyed in this reach, two on the east side and two on the west side. The channel has a high width-to-depth ratio (>12) and is slightly entrenched. The average bankfull slope is 0.006 m/m, and the bankfull width and average depth were noted to be 1.37 m and 0.12 m. The substrate in this reach contains sands and small gravels but also contains a larger percentage of cobbles. A sieve sample was completed for the reach and the results show 8% sands and 19% gravels and 72% cobbles. A Rosgen classification of B4 has been given to this channel. Survey results can be seen in Table 1.

Table 1: Summary of Survey Each Crossings Geomorphic Parameters

Parameter	Cu-3	Cu-8	Cu-10
Bankfull Width (m)	0.89	1.37	1.94
Bankfull Mean Depth (m)	0.09	0.13	0.12
Bankfull Max Depth (m)	0.14	0.20	0.21
Bankfull Area (m^2)	0.09	0.17	0.24
Wetted Perimeter (m)	0.97	1.47	9.09
Hydraulic Radius (m)	0.08	0.11	0.11
Width-Depth Ratio	10.74	13.30	21.24
Entrenchment Ratio	8.71	2.58	2.87
Bankfull Slope (m/m)	0.015	0.007	0.006
Channel Substrate D_{50} (mm)	0.17	23.22	137.97
Channel Substrate D_{84} (mm)	0.38	48.87	180.15
Rosgen Classification	N/A	E4	B4

Figure 5: Aerial View of Cu-10 on Mullet Creek

2.0 STREAM ASSESSMENT SCORES

In addition to classification of a stream system, various techniques for geomorphic assessments are used to better understand general stream conditions (stability, habitat, erosion/degradation, riparian, etc.). In our assessment of the tributaries of Levi's Creek and Mullet Creek, we used Rapid Geomorphic Assessment and Rapid Stream Assessment Technique. The raw worksheets for these assessments can be found in Appendix C.

3.1 Rapid Geomorphic Assessment (RGA)

Creek stability was assessed using a Rapid Geomorphic Assessment (MOE, 2003). The RGA assessment focuses entirely on the geomorphic component of a river system. The RGA method consists of four factors that summarize various components of channel adjustment, specifically: aggradation, degradation, channel widening and plan form adjustment. Each factor is assessed separately and the total score indicates the overall stability of the system. This methodology has been applied to numerous streams and rivers and the following table details the ranking criteria (see Table 3).

The score for the Levi's Creek crossings and Mullet Creek crossing were all determined to be low, from 0.01 to 0.05. All creeks in general can be considered to be "In Regime" and therefore relatively stable. The detailed RGA evaluation is presented in Appendix C. Score results are seen in Table 2.

Table 2: RGA and RSAT Scores

CULVERT	RGA	RSAT
Cu-3	0.03	19.5
Cu-8	0.01	16
Cu-10	0.05	13

Table 3: Interpretation of RGA Score

Stability Index (SI) Value	Classification	Interpretation
SI ≤ 0.20	In Regime	The channel morphology is within a range of variance for rivers of similar hydrographic characteristics and evidence of instability is isolated or associated with normal river meander processes.
0.21 ≤ SI ≤0.40	Transitional/Stressed	Channel morphology is within a range of variance for rivers of similar hydrographic characteristics but the evidence of instability is frequent.
SI ≥ 0.40	In Adjustment	Channel morphology is not within the range of variance and evidence of instability is wide spread.

2.2 Rapid Stream Assessment Technique (RSAT)

Rapid Stream Assessment Technique was developed by John Galli and other staff of the Metropolitan Washington (DC) Council of Governments (Galli et al, 1996). The RSAT systematically focuses on conditions reflecting aquatic-system response to watershed urbanization. It groups responses into six categories, presumed to adequately evaluate the conditions of the river system at the time of measurement on a reach-by-reach basis. The six categories are:

1. Channel stability;
2. Channel scouring and sediment deposition;
3. Physical in-stream habitat;
4. Water quality;
5. Riparian habitat conditions; and
6. Biological conditions.

River channel stability and cross-sectional characterization is a critical component of RSAT. The entire channel was inspected for signs of instability (such as bank sloughing, recently exposed non-woody tree roots, general absence of vegetation within bottom third of the bank, recent tree falls, etc.) and channel degradation or downcutting (such as high banks in small headwater streams and erosion around man-made structures). Observations were noted and cross-section measurements were made.

A rapid assessment of soil conditions along the river banks is also conducted to determine soil texture and potential erodibility of the watercourse bank. Qualitative water quality measurements were also made (temperature, turbidity, colour and odour) along with an indication of substrate fouling (i.e., the unwanted accumulation of sediment).

RSAT also typically involves a quantitative sampling and evaluation of benthic organisms. As no benthic sampling was undertaken, the score was based on site conditions and general observations of water quality.

Each category was assigned a value which was then summed to provide an overall score and ranking. Table 4 details the range of scores and rankings with a higher score suggesting a healthier system.

Within these broad categories, we evaluated the study area and determined an average RSAT score for Cu-3 at 19.5 which is a “Poor” verbal ranking, and Cu-8 and Cu-10 have scores of 16 and 13 respectively, also giving them a “Poor” evaluation. The results of the RSAT evaluation are included in Appendix C.

Table 4: Interpretation of RSAT Score

RSAT Score	Ranking
41-50	Excellent
31-40	Good
21-30	Fair
11-20	Poor
0-10	Degraded

3.0 CHANNEL FLOWS

An important concept in fluvial geomorphology is that of channel forming discharges or dominant discharges, also commonly referred to as bankfull flows. Dunne and Leopold (1978) define bankfull discharge as “*…the discharge at which channel maintenance is the most effective, that is, the discharge at which moving sediment, forming or removing bars, forming or changing bends and meander, and generally doing work results in the average morphologic characteristics of channels.*” The bankfull discharges typically have an average recurrence interval of 1.5 years. Although in some urban settings, the recurrence can be more frequent.

When re-naturalizing the channel, natural channel design concepts include the creation of a bankfull flow channel to accommodate the dominant discharge.

Using data from the geomorphic field work, and using an assumed 'n' methodology, bankfull flows in this system were determined. The results of the assumed 'n' approach were very similar to that of Limerinos' method and the Strickler method.

Bankfull flows were obtained for each channel where the bankfull indicators were obvious and reliable. The flows for Levi Creek North in the crossing area, when using a Manning's 'n' of 0.045 were averaged to be approximately 0.04 m^3/s. The flows for Levi Creek South in the crossing area were averaged to be approximately 0.06 m^3/s when using a Mannings 'n' of 0.050. The flows for Mullet Creek in the crossing area were averaged to be approximately 0.06 m^3/s when using a Mannings 'n' of 0.060. The flows for each reach seem relatively low when looking at the bankfull width but this is attributed to the low slope for each creek.

We also regressed the existing return period flows as obtained from the 2009 Addendum to the 1996 Environmental Study Report. The resultant 1:1.5 year return period flow is expected to be 6.84 m^3/s for Levi Creek North (Culvert-3), 3.27 m^3/s for Levi Creek South and 8.52 m^3/s for Mullet Creek (see Figure 6, 7, 8). Typically, bankfull return periods have been associated with 1:1.5 year return period. Seeing that there is little correlation between the Mannings 'n' methodology and return periods it is unlikely that the 1.5 year return period applies in this case.

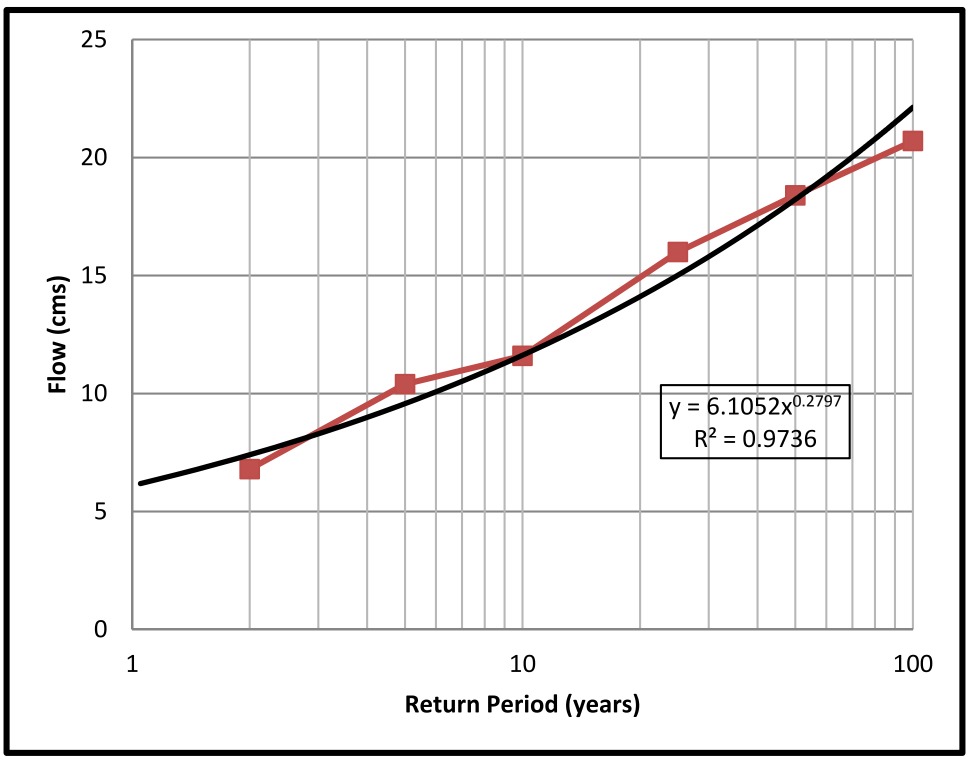


Figure 6: Flow Regression Analysis for Levi Creek North

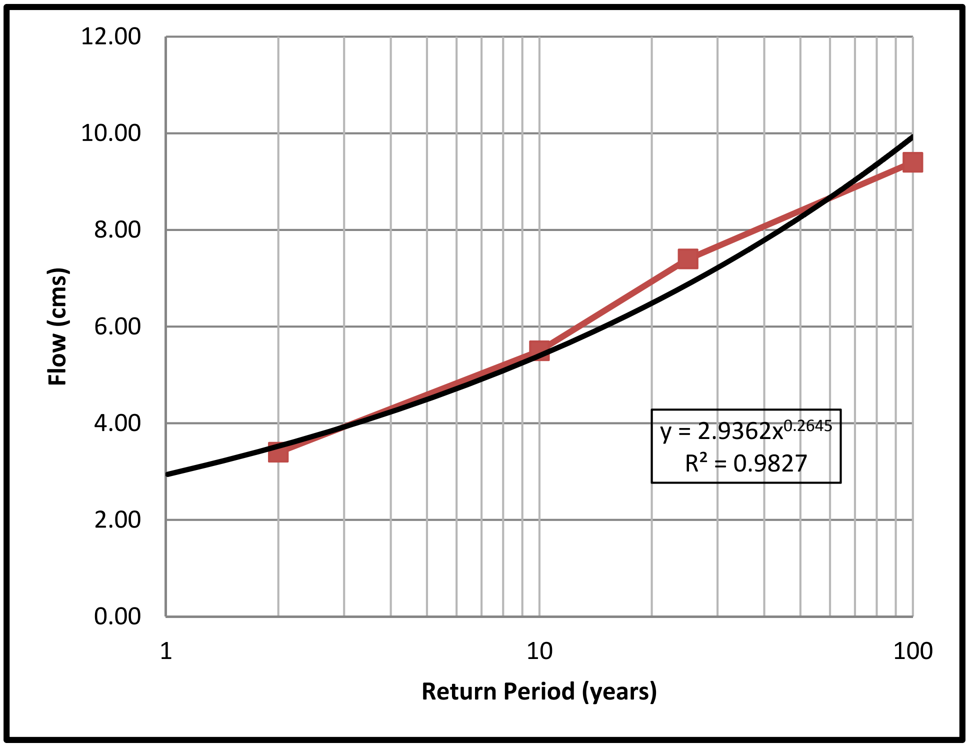


Figure 7: Flow Regression Analysis for Levi Creek South

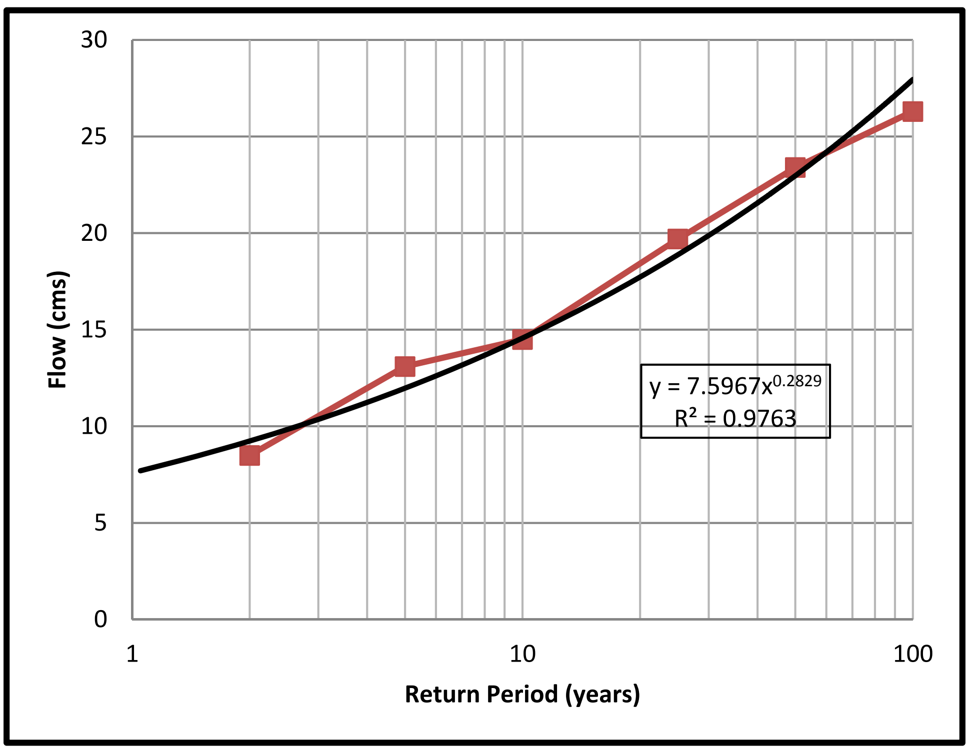


Figure 8: Flow Regression Analysis for Mullet Creek

In this case the bankfull flows for each creek in the vicinity of the crossings at Winston Churchill Blvd. are as follows; 0.04 m^3/s for Levi Creek North, 0.06 m^3/s for Levi Creek South and 0.06 m^3/s for Mullet Creek.

4.0 MEANDER BELTWIDTH AND 100 YEAR EROSION ASSESSMENTS

Assessment of the meander beltwidth is undertaken in accordance with commonly accepted standard meander beltwidth delineation procedures which are established for watercourses with well defined, meandering bankfull channels. In this study, parts of the watercourse are swales with intermittent flows. In such cases, we have used regime equations that are based on bankfull characteristics and aerial photo measurements.

Meander Beltwidths from Regime Equations

Inferences on meander beltwidths can also be made based on regime equations as per Williams (1986). These equations are based on bankfull dimensions of the channel such as cross sectional area, width and mean depth. In addition to the regime equations, measurements were also made from aerial photography. The measurements made resemble the regime equations based on cross sectional area. The meander beltwidths measured and calculated are listed in Table 5. At certain locations, and where measurements could not be made because of lack of clear channel delineation in aerial photography, we recommend that the empirical equations based on cross sectional width be used.

Aerial Photography Analysis

Air photos were collected from the years of 1994, 2000, 2002, 2013 and analyzed using GIS mapping. The photos are used to trace a centreline from each of the years to compare their change over the time period. Also used in the analysis is the alignment from the geomorphic survey completed by Water's Edge in 2015. When determining the preliminary beltwidths the belts are offset parallel to the channel's historical meander axis alignment. The preliminary beltwidths are at the widest extent of the channels meander pattern along each meander axis. These axes can be seen in the meander beltwidth figures; Figures 10, 11 and 12.

The characteristics of each of the channel crossings in the study area are different from the upstream side (west side) compared to the downstream side (east side). On the west side we see primarily straightened channels with little or no riparian buffer or cover. While on the east side we typically see a natural meandering channel with good riparian structure. The only exception to this is with Culvert 3 where both sides of the road have historically been straightened. It is because of this that in determining the preliminary beltwidth only the east side of each channel was taken into account. When determining the preliminary beltwidths the average width of each meander axis on the east side for approximately 125 - 200 metres was measured. The totals were then averaged to come up with the representative preliminary beltwidth for each crossing which can be seen in Table 5 and 6.

Table 5: Meander Beltwidth (m) based on Regime Equations and Aerial Photography

Culvert #	Regime Equations based on XS Area	Regime Equations based on Width	Regime Equations based on Mean Depth	Measured Preliminary Beltwidth
#3	4	4	4	4.42
#8	6	6	7	3.74
#10	7	9	6	5.92

Final Meander Beltwidths

Based on the calculated meander beltwidths using regime equation and those measured using aerial photographs, we have determined the final meander beltwidths. Table 6 presents a summary of the beltwidths from each of these methods and the final beltwidths. Locations where meander beltwidths were measurable, the final beltwidth was calculated to be the sum of the bankfull width and preliminary beltwidth and a 10% factor of safety added as no 100-year migration rates were calculated. As mentioned in the previous sub-section, the regime equations based on cross sectional width provided the most reliable estimate of meander beltwidth as they corroborated with the measured beltwidths. To provide a conservative estimate, the largest of the available beltwidths (measured or calculated) for a reach was chosen as the final beltwidth. Figures 10, 11 and 12 show the preliminary and final beltwidths for the channels.

Table 6: Summary of Beltwidths (m) at the Culvert Locations (Chosen beltwidth highlighted in grey)

Culvert #	MBW based on XS width Regime Equations (m)	Measured Prelim MBW (m)	Bankfull Width(m)	Final MBW from sum of Bkf width and Prelim MBW (m)	Final MBW (m)
#3	4.0	4.42	0.89	5.84	5.84
#8	6.0	3.74	1.37	5.62	6.0
#10	9.0	5.92	1.94	8.65	9.0

5.0 PROPOSED CONDITIONS / RECOMMENDATIONS

Culvert extensions are proposed for both sides of culverts 3, 8 and 10. As such the following recommendations should be considered during channel modification and culvert installation.

- All proposed channel dimensions should closely resemble existing geomorphic parameters laid out in Table 1, specifically bankfull width, depth and slope;
- Proper pool/riffle sequences should be laid with pools generally on the outside bend of a meander and riffles through the transitions;
- Stone sizing should take into account the existing substrate of each reach while at the same time protecting the road embankments and culverts;
- The channel at the upstream end of culvert 3 will require realignment due to its proximity to the existing roadway. Conceptual designs can be produced once delineation of the road right of way is complete;
- Channel realignment (culvert 3) should properly observe the final meander beltwidths as shown in Table 6 and;
- Low flow channels should be created through culverts using stone to form the banks.

6.0 CONCLUSIONS

Based on our desktop and field assessment, we conclude the following:

1. The surveyed reaches of Levi's Creek and Mullet Creek tributaries have different geomorphic characteristics as described in Tables 1 and 2;
2. RSAT scores show that all three creeks are currently in 'Poor' condition although the RGA scores determined that the channels are all relatively stable;
3. Bankfull flows for Levi Creek North, Levi Creek South and Mullet Creek are 0.04 m^3/s, 0.06 m^3/s and 0.06 m^3/s, respectively;
4. The final meander beltwidths at the Winston Churchill culvert crossings, as outlined in Table 6, are 5.8m for Cu-3, 6.0m for Cu-8 and 9.0m for Cu-10.

Respectfully submitted,

Ed Gazendam, M. Eng., P. Eng.,
President, Sr. Geomorphologist
Water's Edge Environmental Solutions Team Ltd.

ATTACHMENTS

Appendix A: Figures 10-13 Meander Beltwidths
Appendix B: Surveyed Profiles and Cross Sections
Appendix C: Photographs
Appendix D: Rapid Field Assessment Worksheets

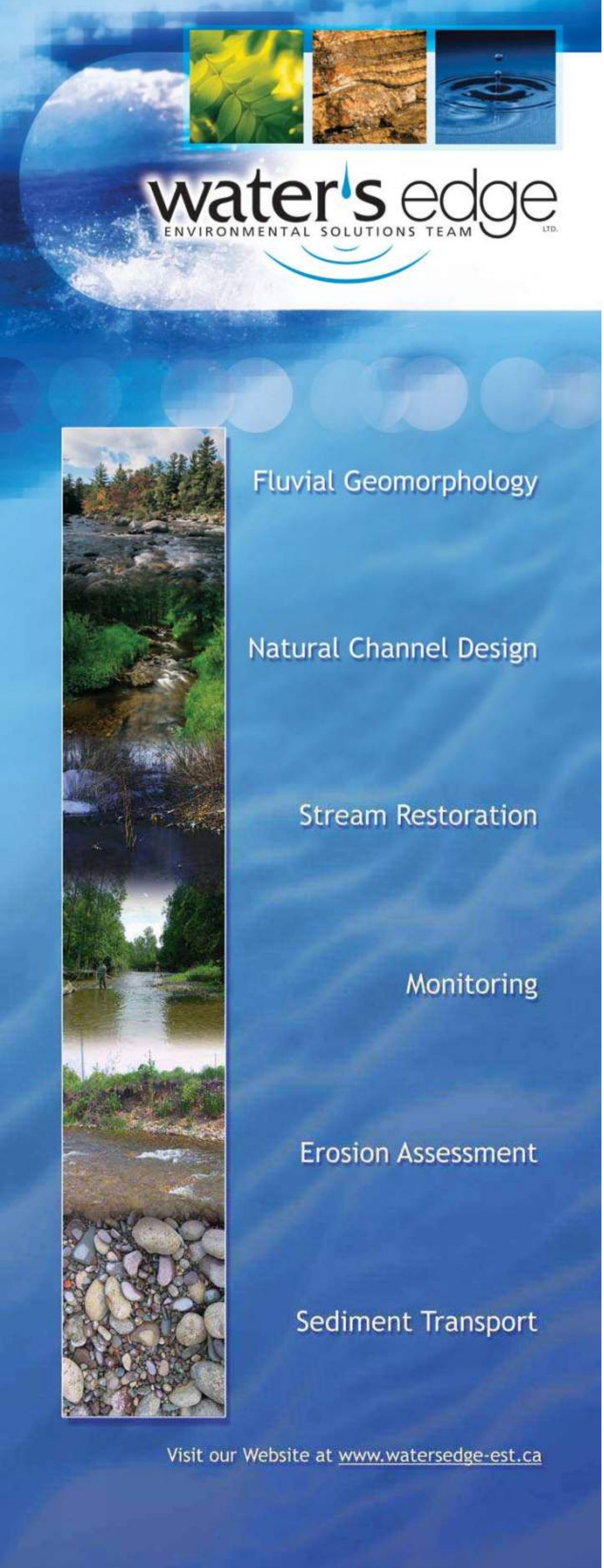
REFERENCES

Galli, J. 1996, *Rapid Stream Assessment Technique (RSAT) field methods*. 36 pp. Metropolitan Washington Council of Governments, Department of Environmental Programs, Washington, DC.

Dunne, T. and L.B. Leopold. 1978. Water in Environmental Planning. W.H. Freeman and Company, New York

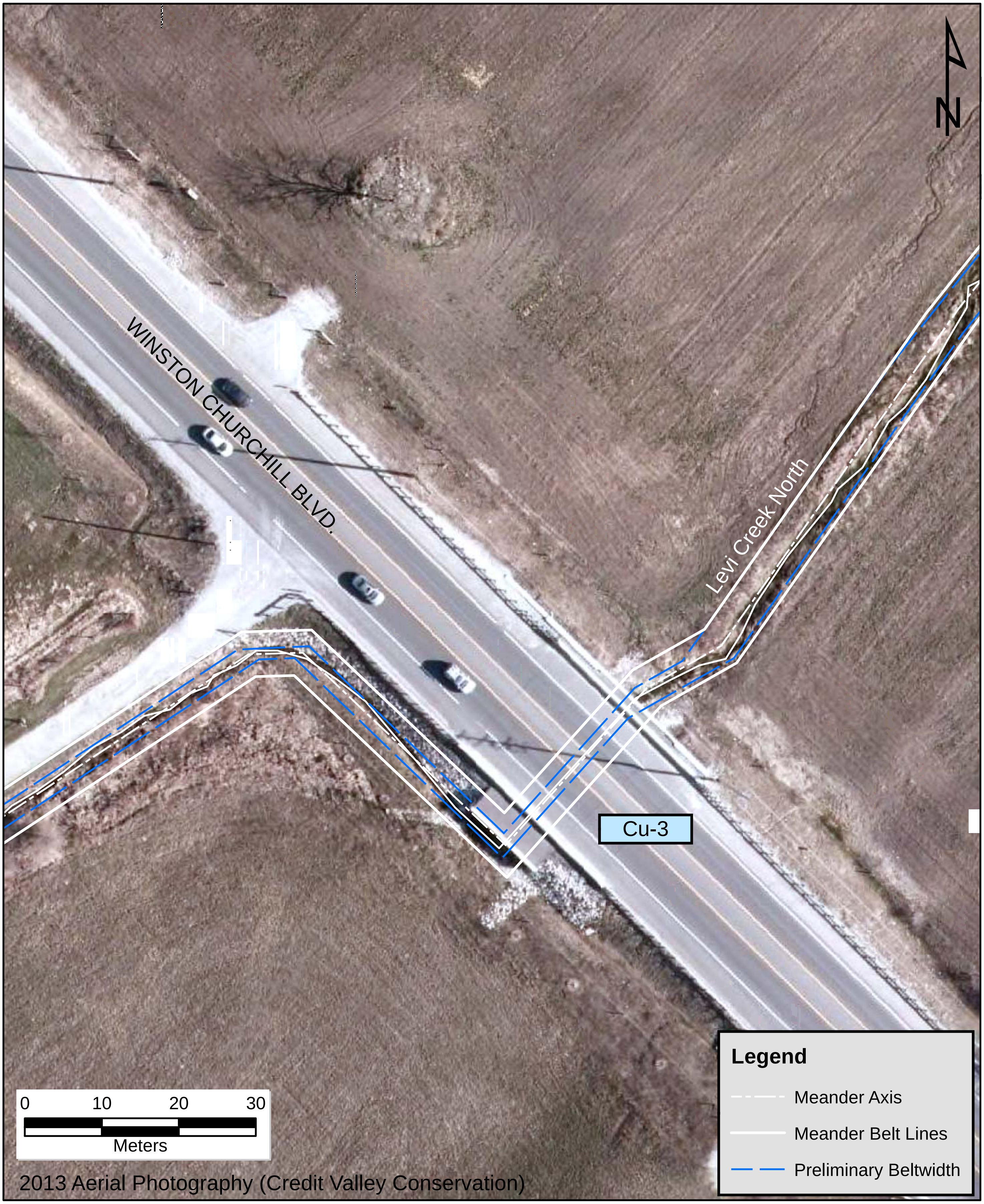
Winston Churchill Boulevard from Steeles Ave. to Embleton Rd. Class Environmental Assessment Study. March 1996. Regional Municipality of Peel. Paul Theil Associates Limited.

Reconstruction and Widening of Winston Churchill Boulevard from Steeles Avenue to Embleton Road Class Environmental Assessment Study, Addendum to the Environmental Study Report. February 2009. Regional Municipality of Peel. McCormick Rankin Corporation



APPENDIX A:

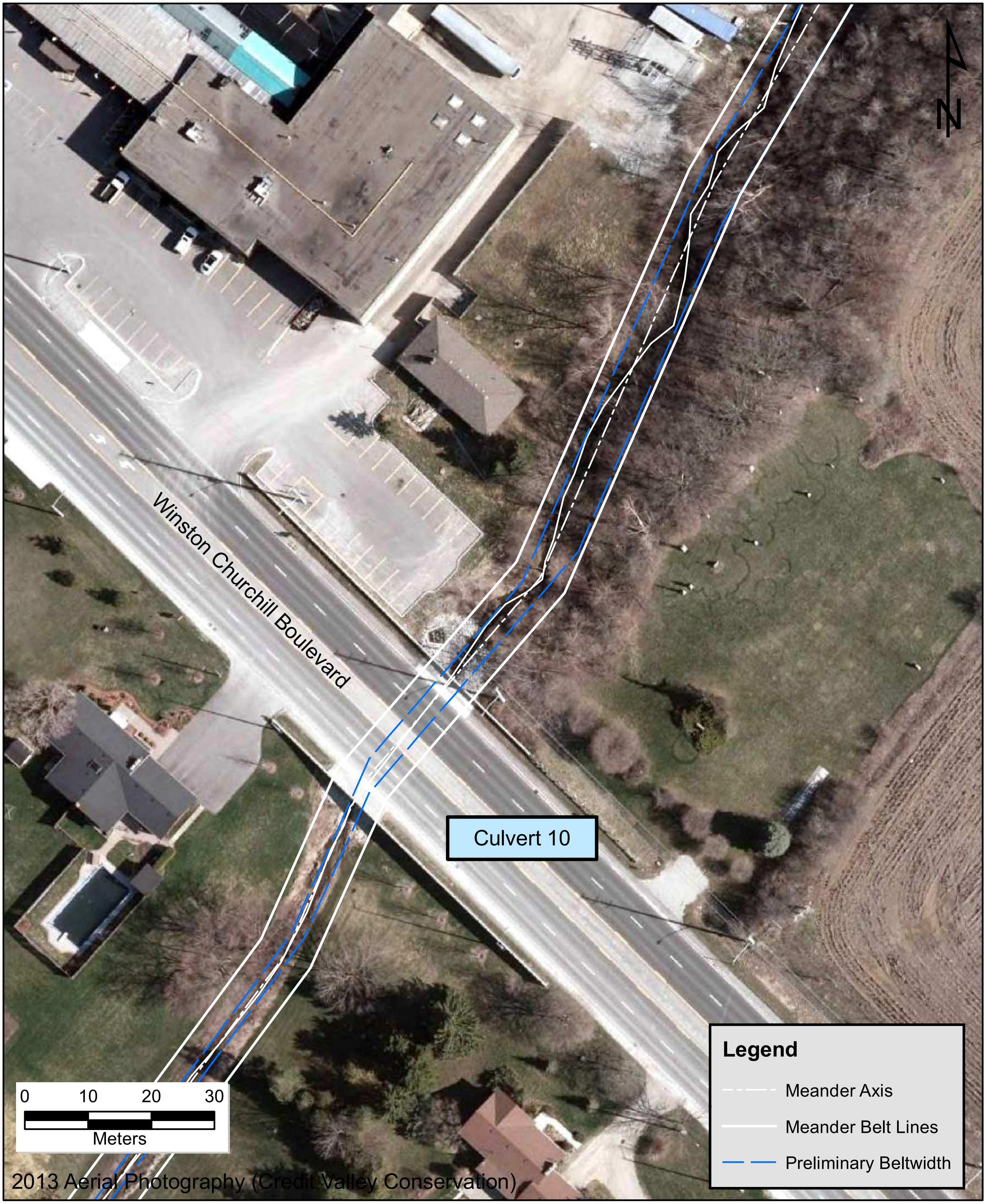
Meander Beltwidth Figures



water's edge ENVIRONMENTAL SOLUTIONS TEAM LTD.	Winston Churchill Meander Beltwidth Assessemnt	Figure No.: 10	Date: Dec. 23, 2015
	Culvert 3 Levi Creek North	Checked By: EG	Drawn By: NG

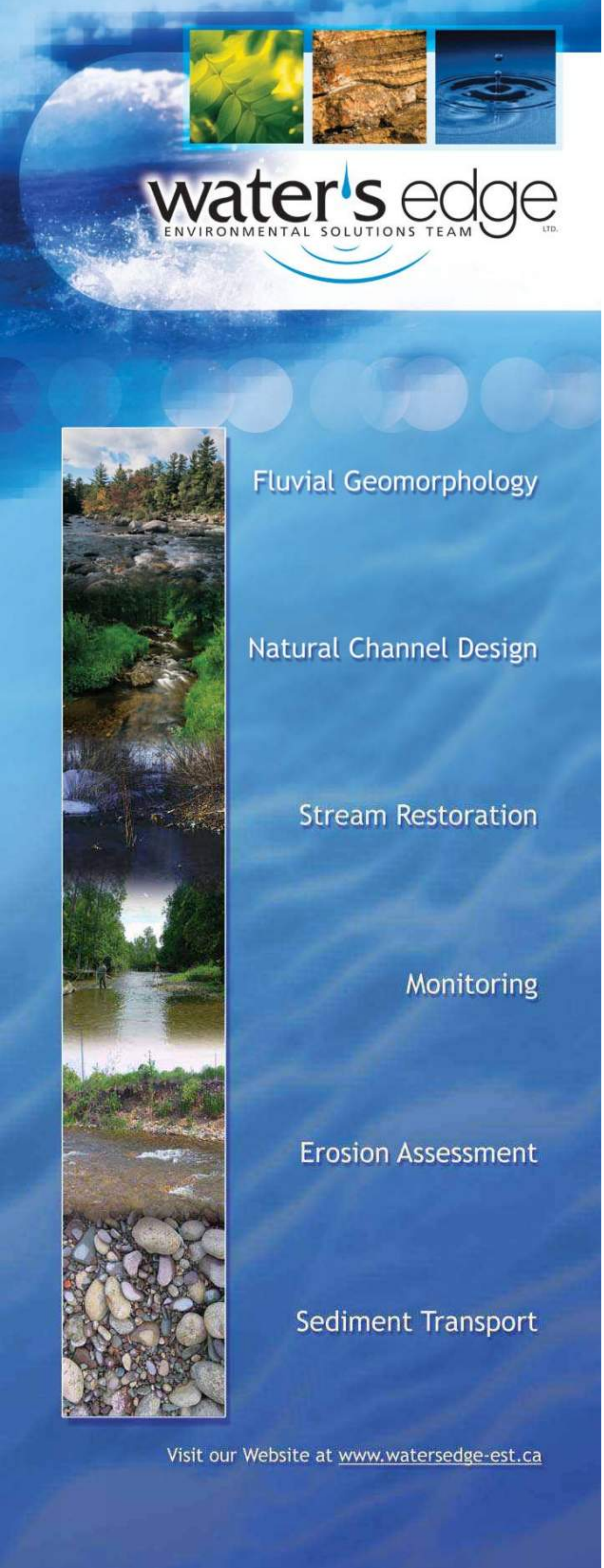
water's edge ENVIRONMENTAL SOLUTIONS TEAM LTD.

Winston Churchill Meander Beltwidth Assessemnt	Figure No.: 11	Date: Dec. 23, 2015
Culvert 8 Levi Creek South	Checked By: EG	Drawn By: NG



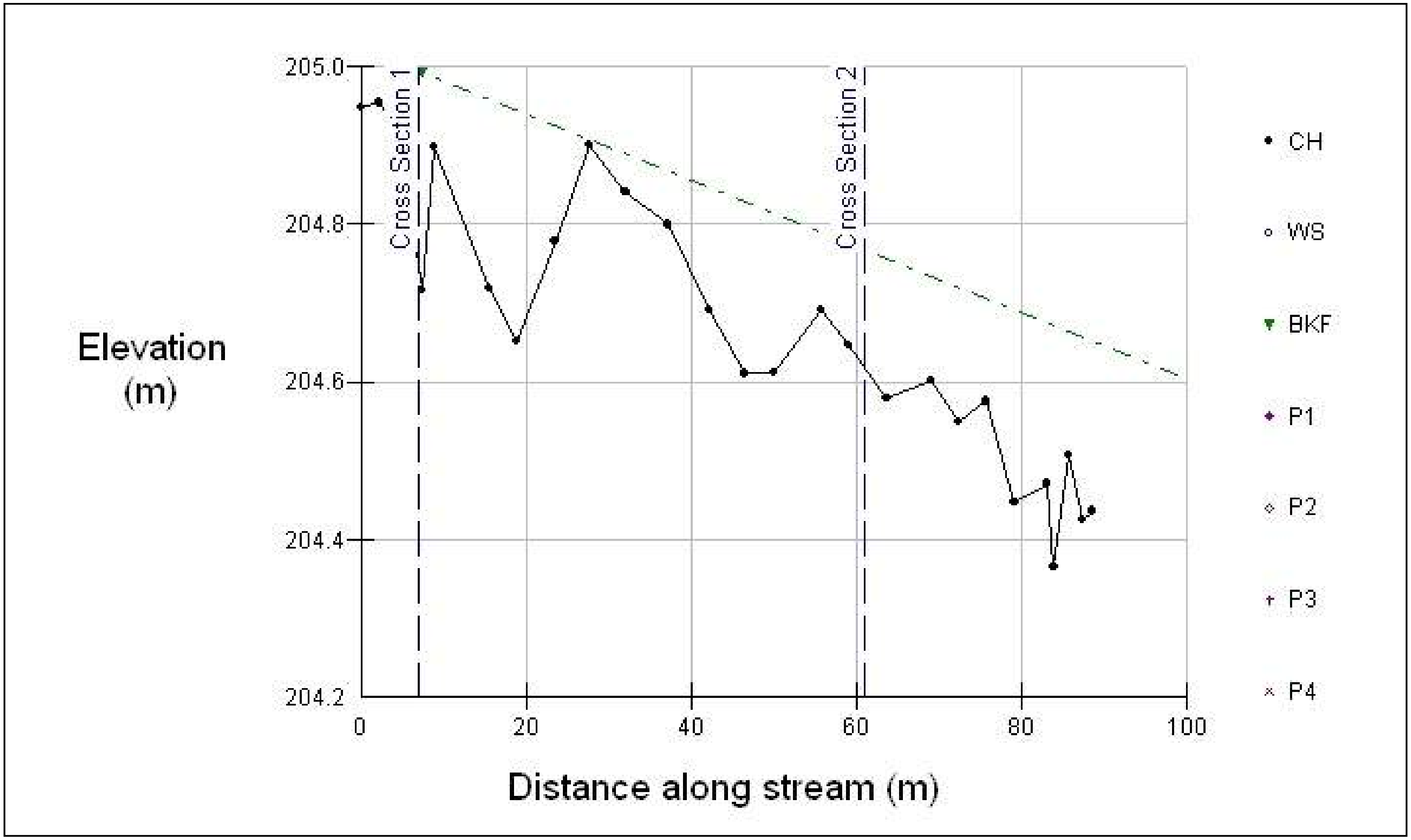
water's edge ENVIRONMENTAL SOLUTIONS TEAM LTD.

Winston Churchill Meander Beltwidth Assessemnt	Figure No.: 12	Date: May 10, 2016
Culvert 10 Mullet Creek	Checked By: EG	Drawn By: NG

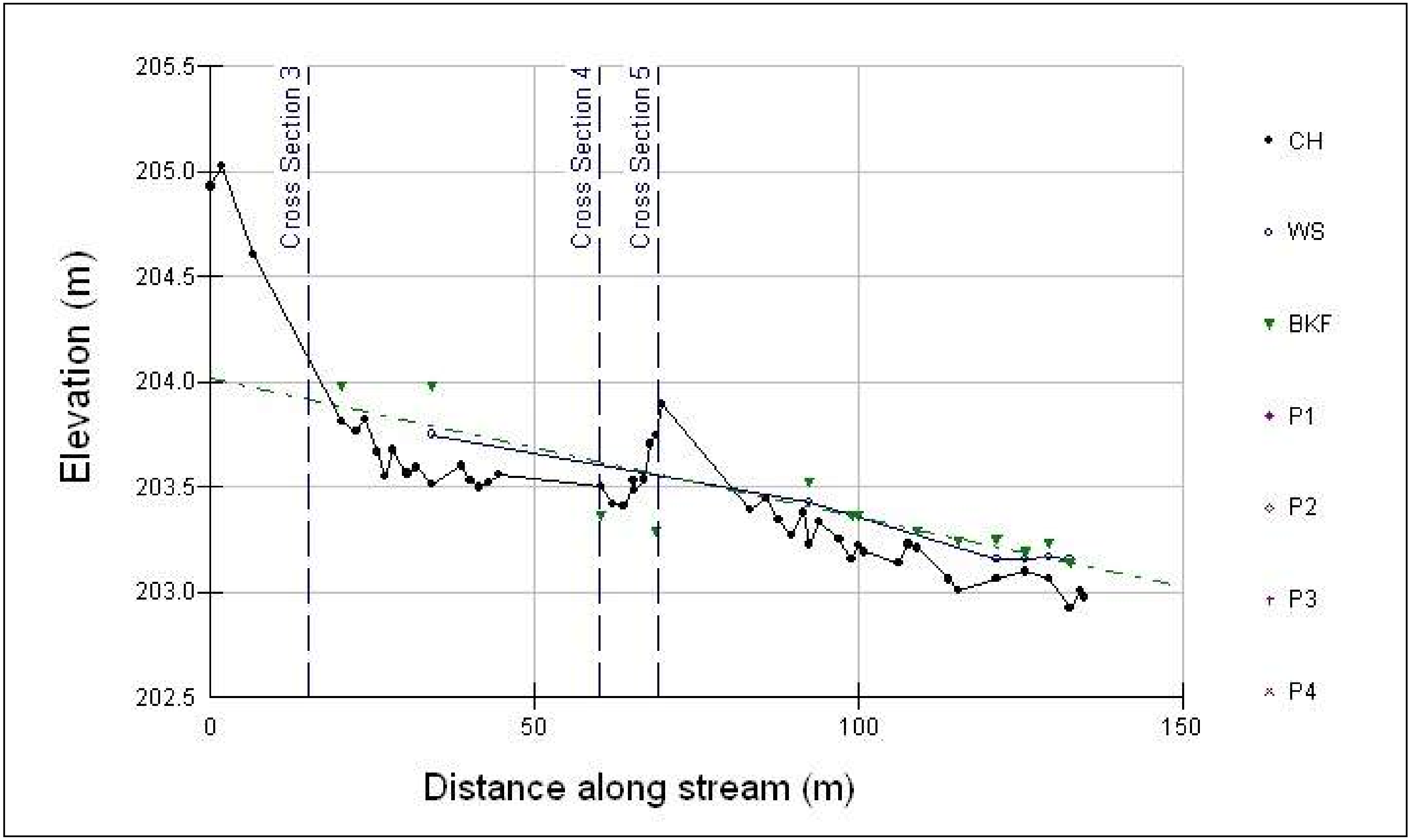


APPENDIX B:

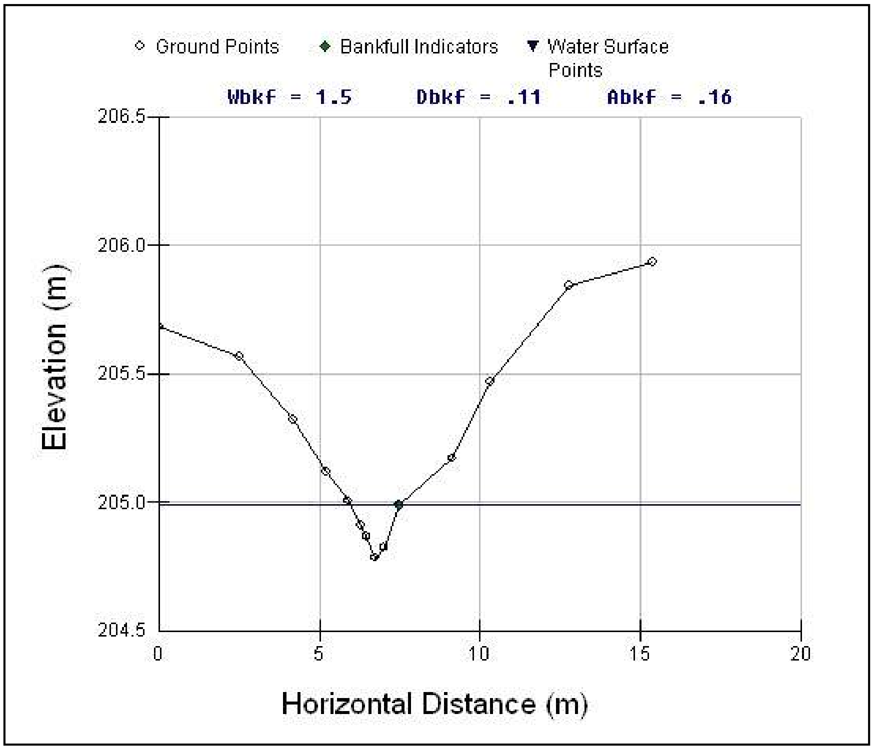
Surveyed Profiles and Cross Sections



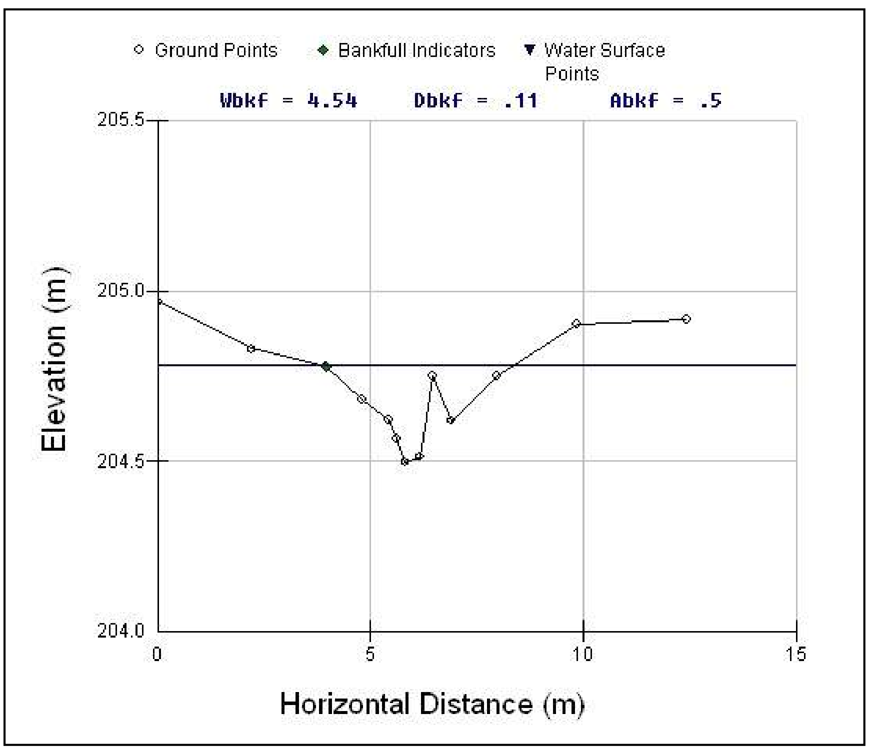
Levi Creek North Upstream Profile



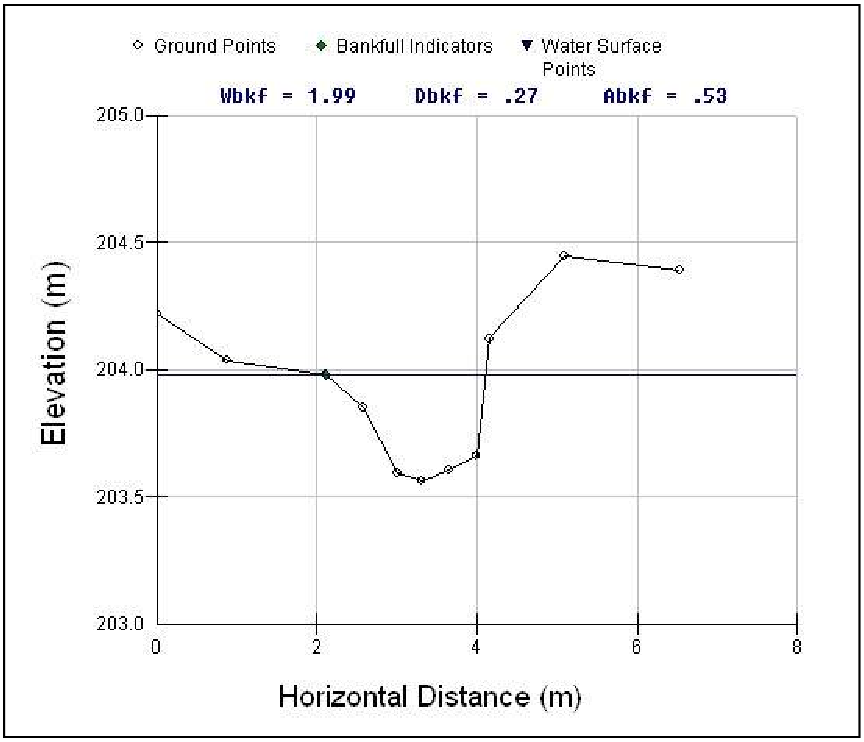
Levi Creek North Downstream Profile



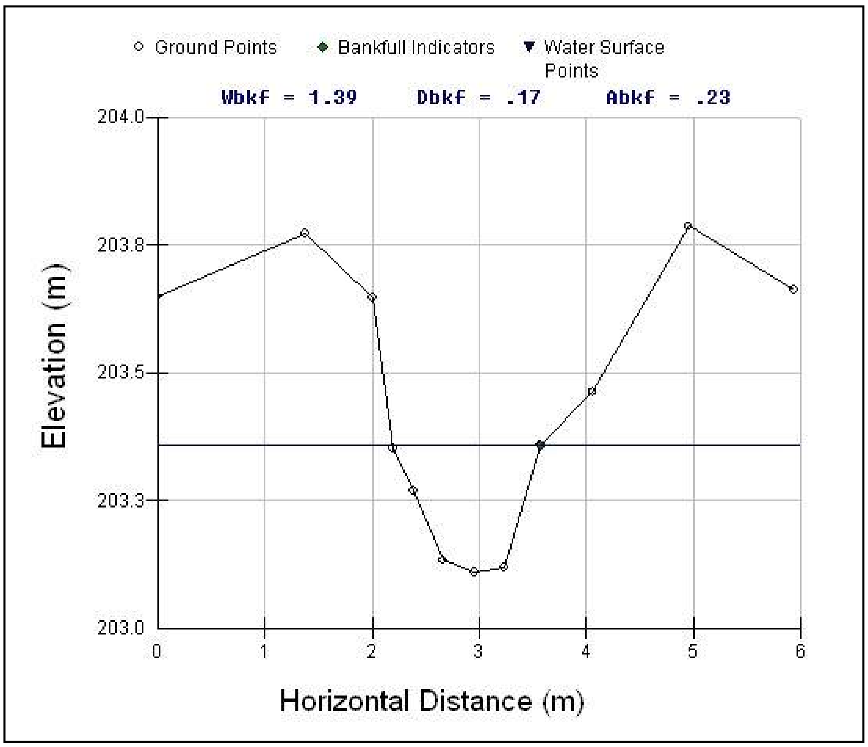
Levi Creek North Cross Section 1



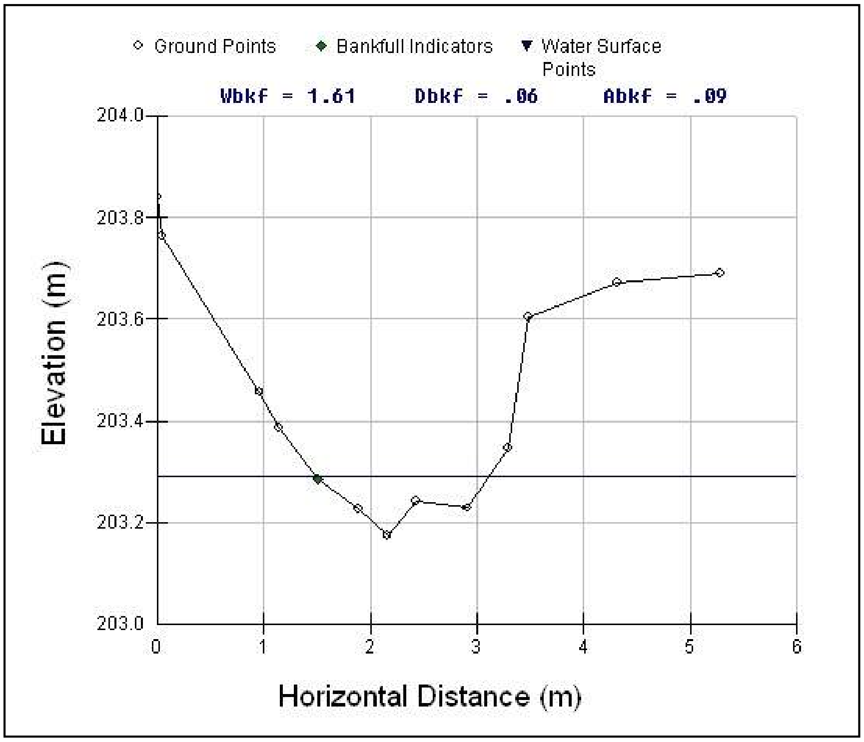
Levi Creek North Cross Section 2



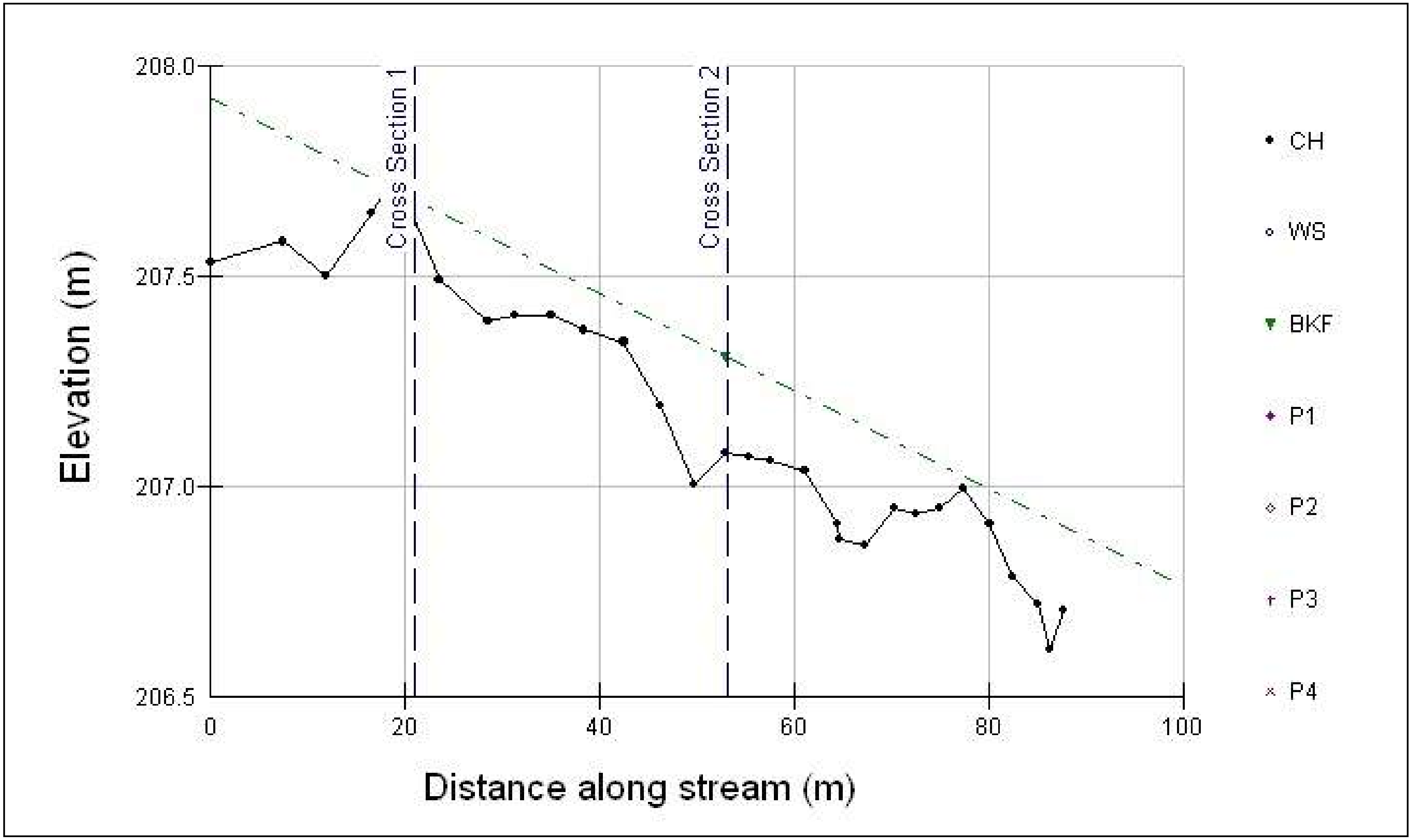
Levi Creek North Cross Section 3



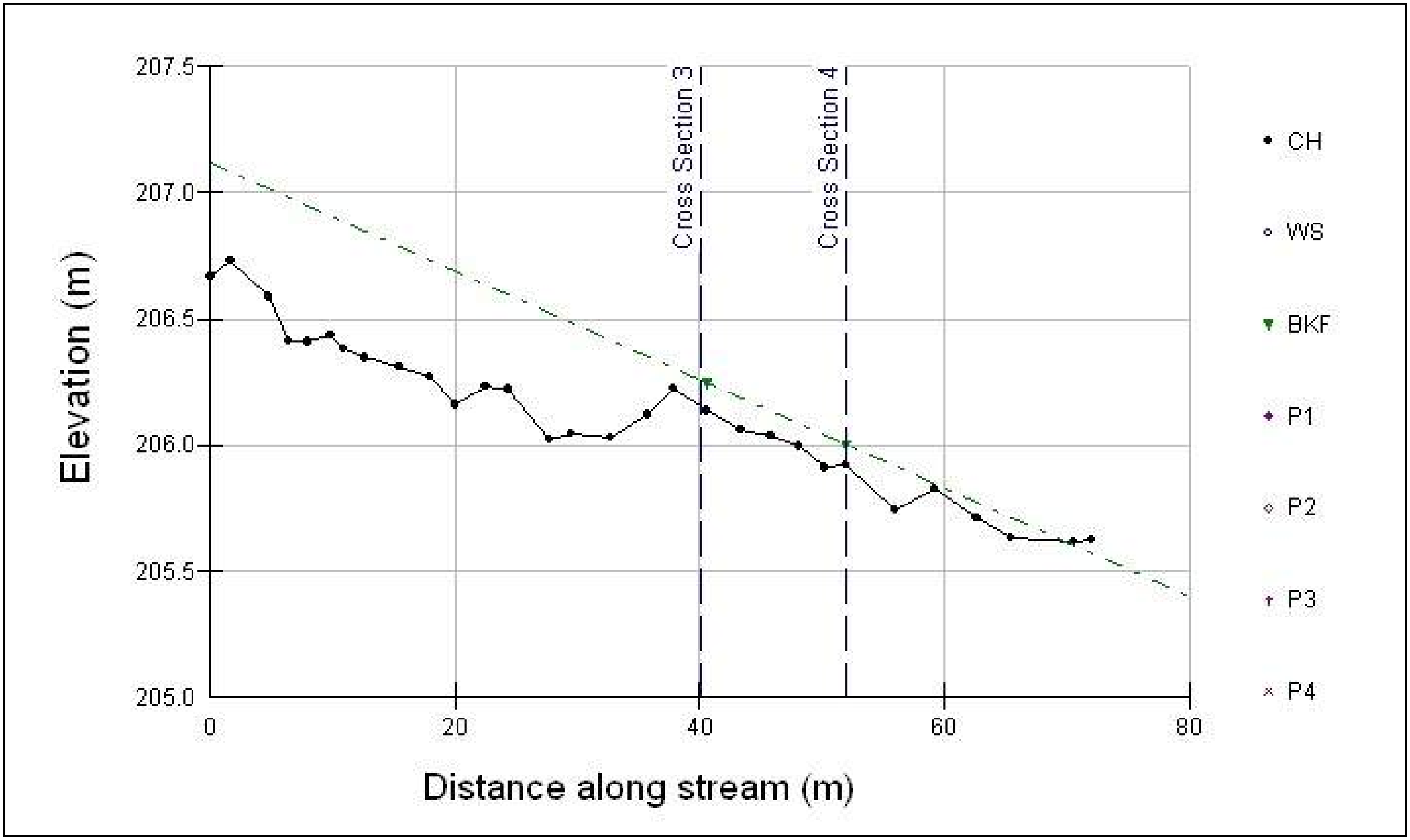
Levi Creek North Cross Section 4



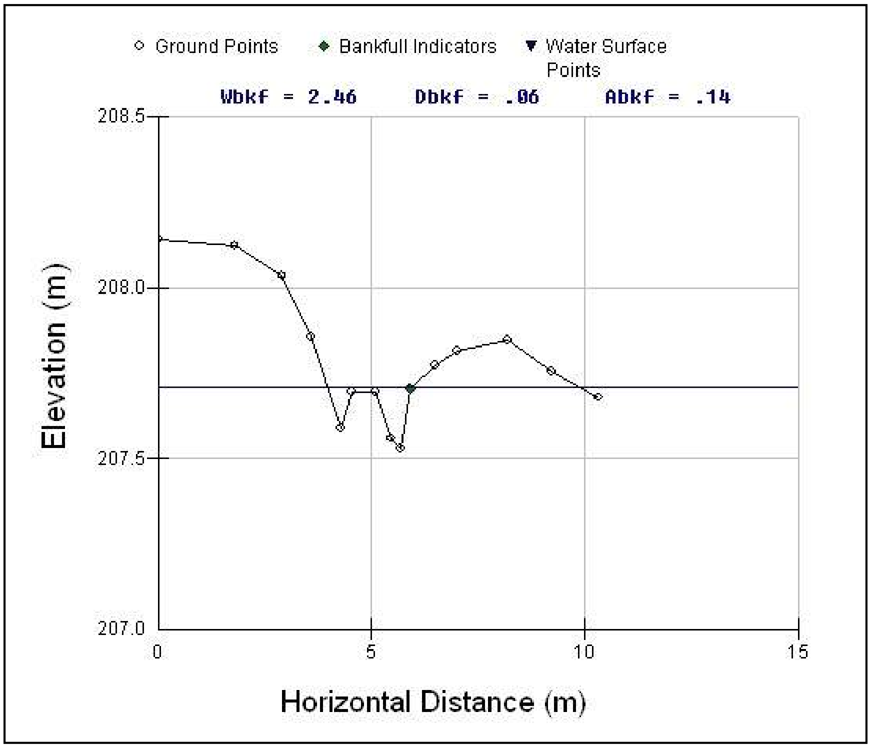
Levi Creek North Cross Section 5



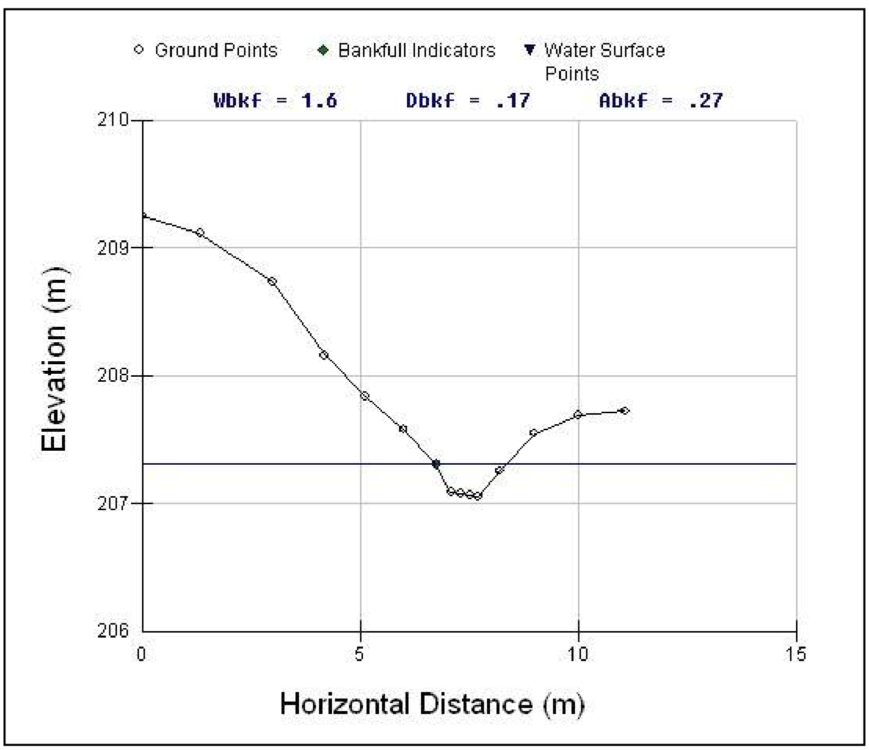
Levi Creek South Upstream Profile



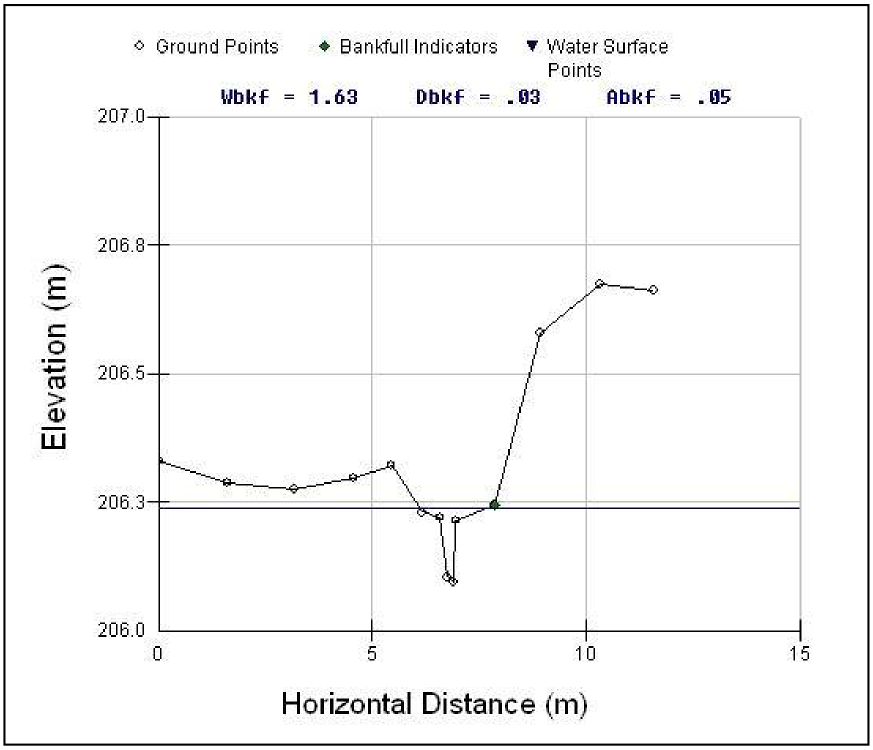
Levi Creek South Downstream Profile



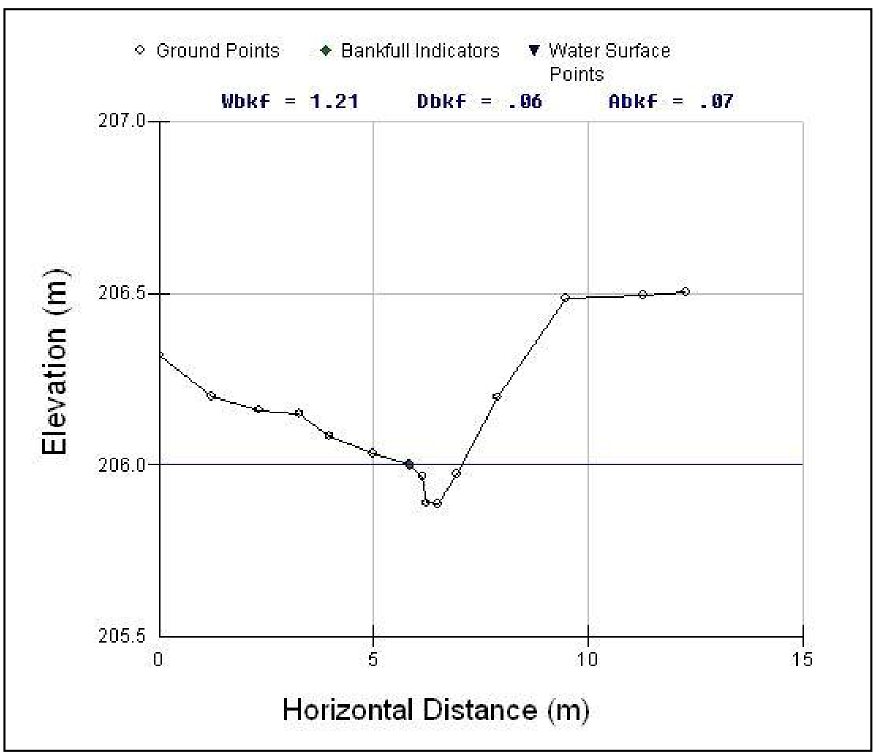
Levi Creek South Cross Section 1



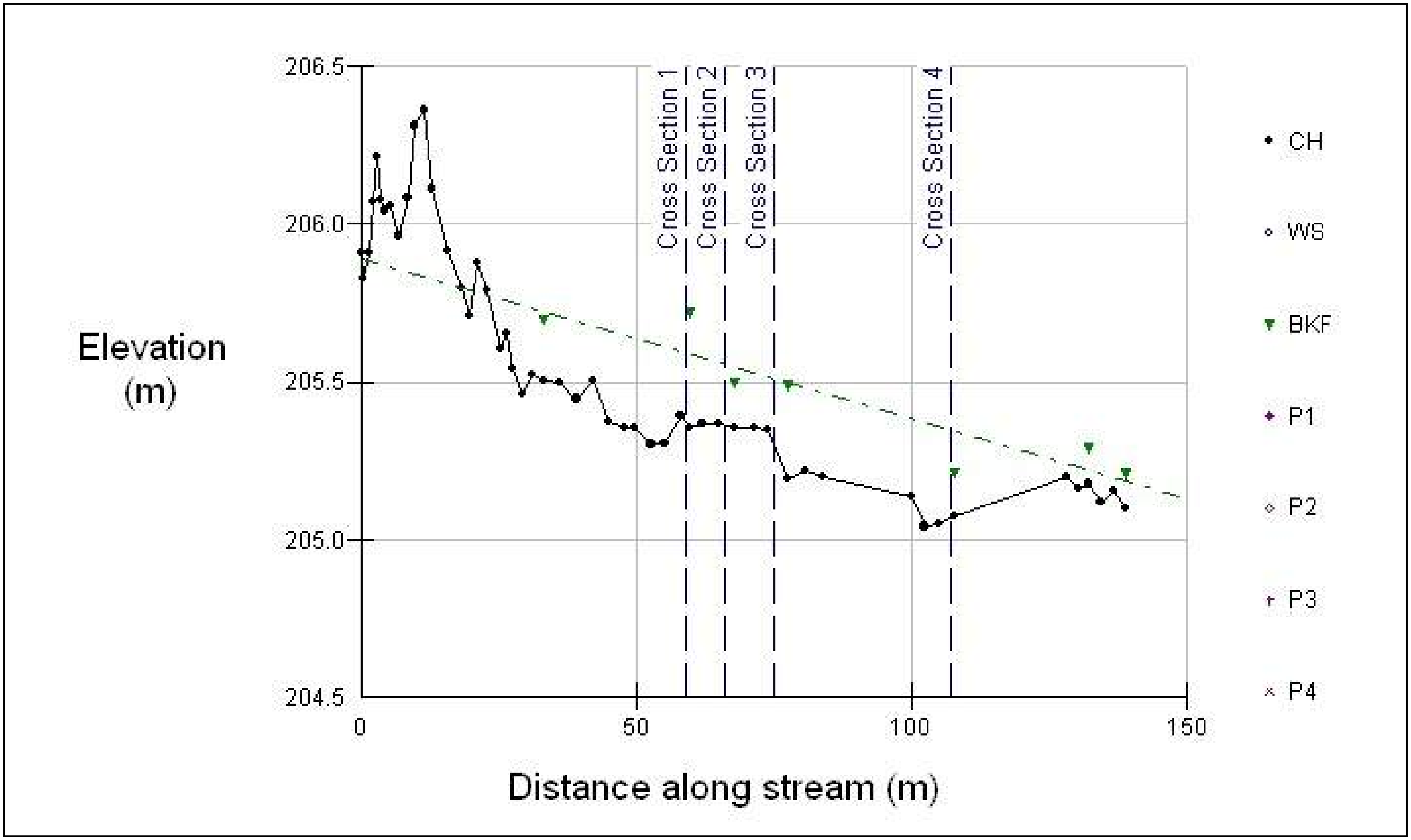
Levi Creek South Cross Section 2



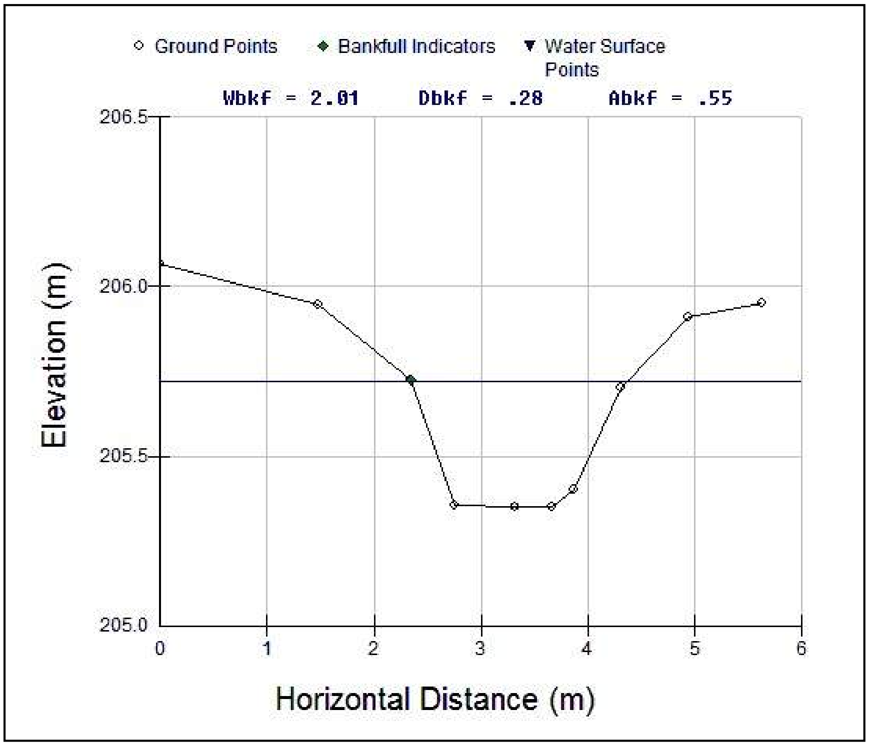
Levi Creek South Cross Section 3



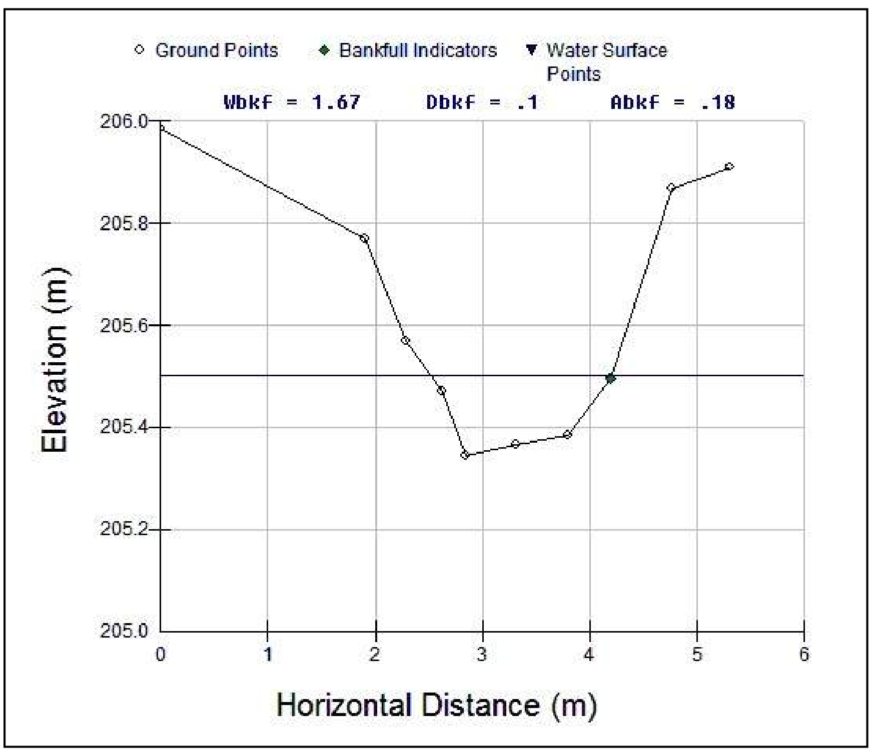
Levi Creek South Cross Section 4



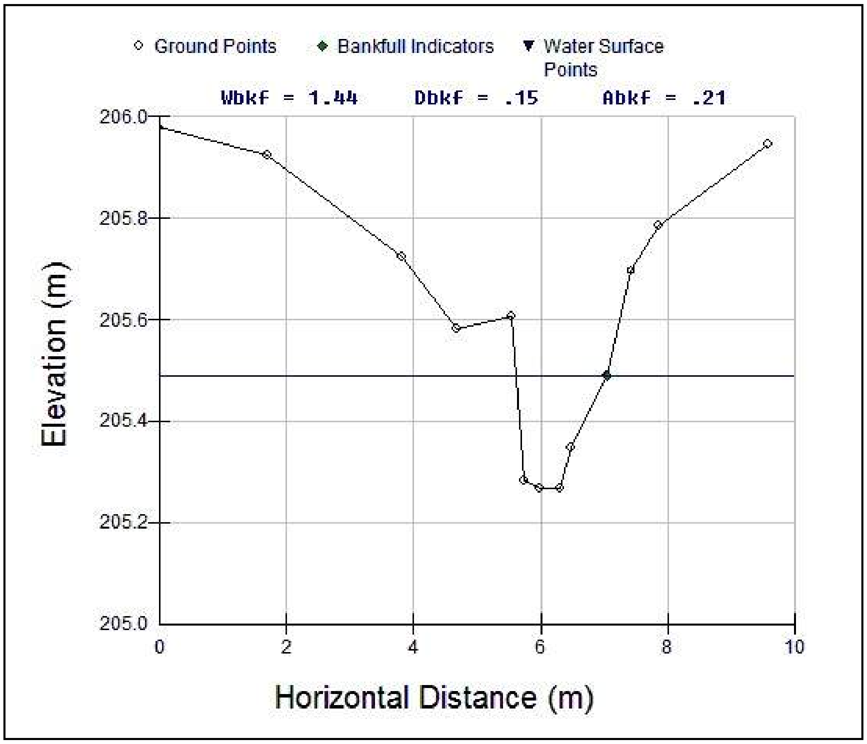
Mullet Creek Profile



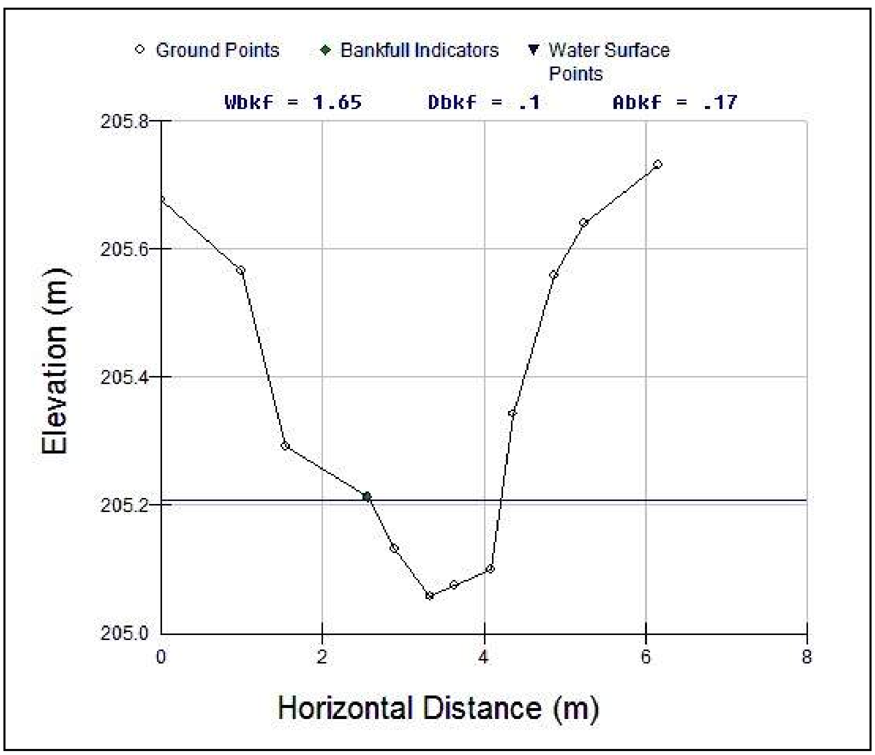
Mullet Creek Cross Section 1



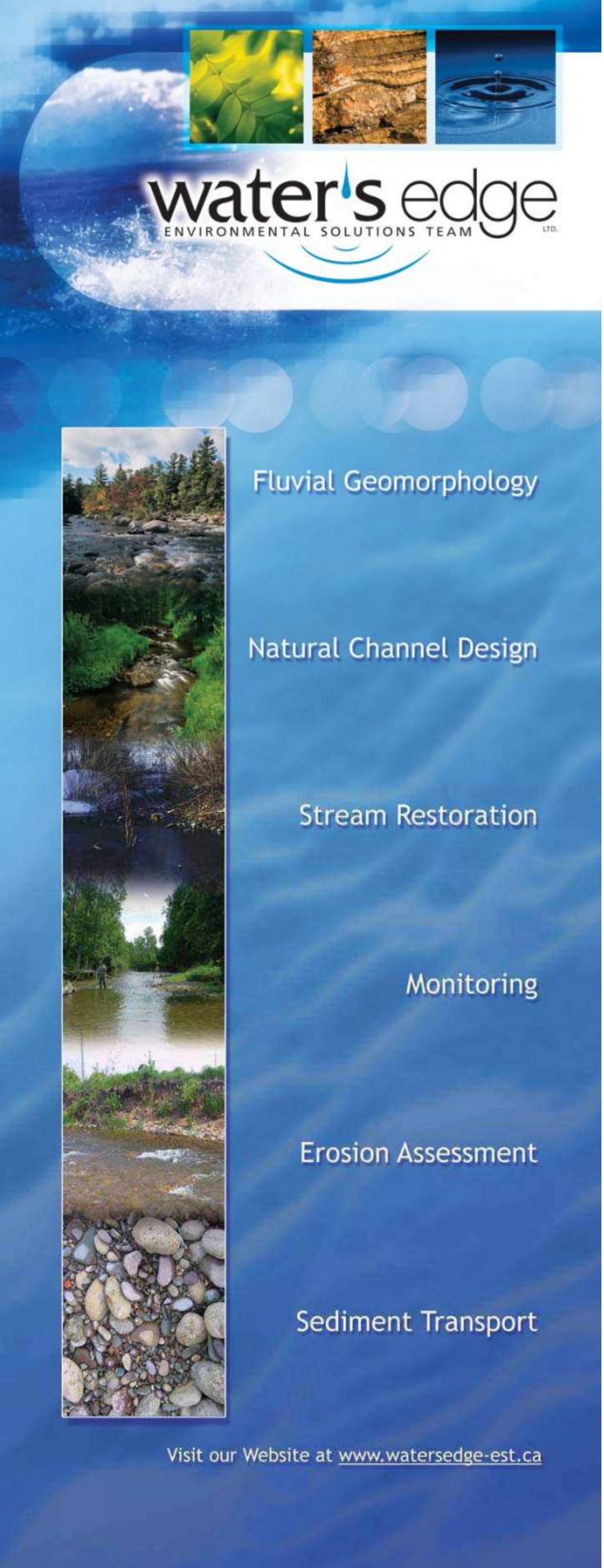
Mullet Creek Cross Section 2



Mullet Creek Cross Section 3



Mullet Creek Cross Section 4



APPENDIX C:

Photographs

PHOTOGRAPH NO.: 1 - Culvert 3
FROM: From road culvert
LOOKING: Downstream at channel
COMMENT:

PHOTOGRAPH NO.: 2 - Culvert 3
FROM: In Channel
LOOKING: Downstream at channel
COMMENT:

PHOTOGRAPH NO.: 3 - Culvert 3
FROM: In channel
LOOKING: At channel bed
COMMENT: Note lack of flows

PHOTOGRAPH NO.: 4 - Culvert 3
FROM: From road culvert
LOOKING: Upstream at channel
COMMENT:

PHOTOGRAPH NO.: 5 - Culvert 3
FROM: From road
LOOKING: At culvert 3
COMMENT:

PHOTOGRAPH NO.: 6 - Culvert 3
FROM: Road
LOOKING: Upstream at channel
COMMENT:

PHOTOGRAPH NO.: 7 - Culvert 8
FROM: In channel on downstream side
LOOKING: Downstream
COMMENT:

PHOTOGRAPH NO.: 8 - Culvert 8
FROM: From culvert on road
LOOKING: Downstream at channel
COMMENT:

File #:14036

PHOTOGRAPH NO.: 9 - Culvert 8
FROM: Downstream side of culvert
LOOKING: Through culvert
COMMENT:

PHOTOGRAPH NO.: 10 - Culvert 8
FROM: Upstream of culvert at road
LOOKING: Upstream at channel
COMMENT:

PHOTOGRAPH NO.: 11 - Culvert 8
FROM: From road culvert
LOOKING: Upstream at channel
COMMENT:

PHOTOGRAPH NO.: 12 - Culvert 10
FROM: In channel on downstream side
LOOKING: Upstream
COMMENT:

PHOTOGRAPH NO.: 13 - Culvert 10
FROM: In channel on downstream side
LOOKING: Downstream
COMMENT:

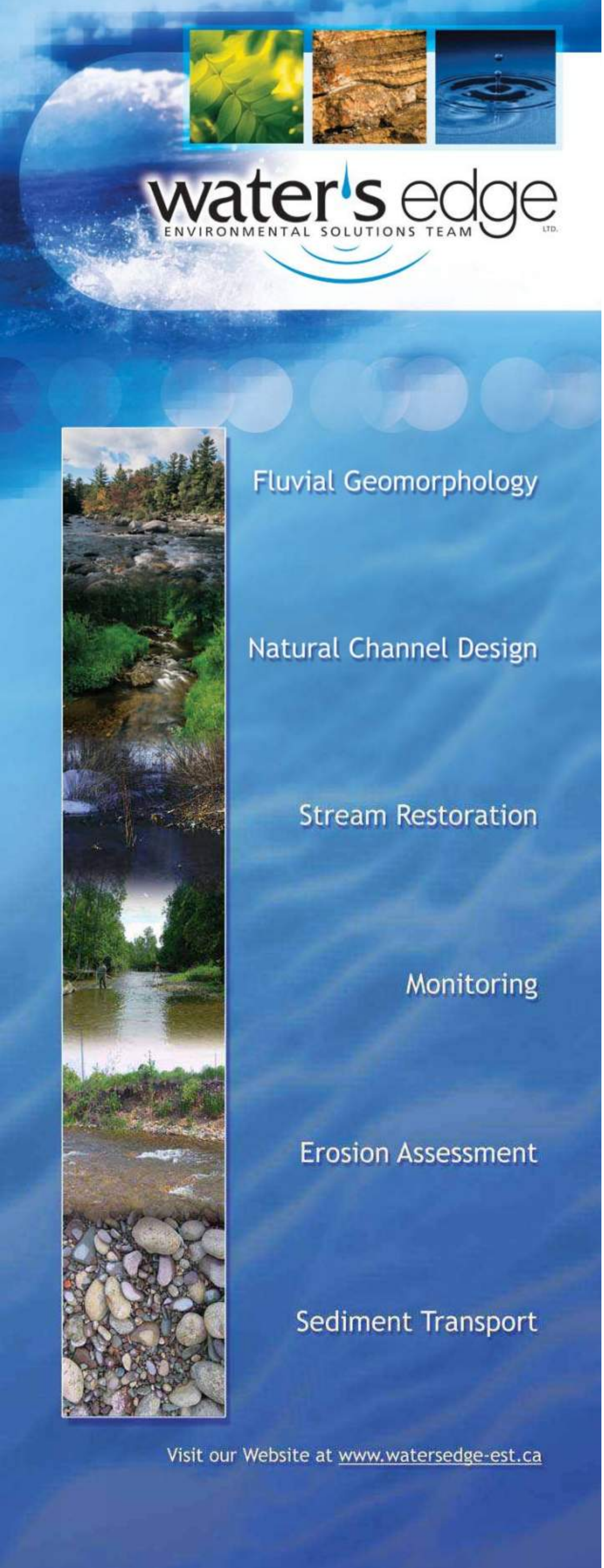
PHOTOGRAPH NO.: 14 - Culvert 10
FROM: In channel on downstream side
LOOKING: Downstream
COMMENT:

PHOTOGRAPH NO.: 15 - Culvert 10
FROM: Upstream of bridge
LOOKING: Through culvert
COMMENT:

PHOTOGRAPH NO.: 16 - Culvert 10
FROM: In channel on downstream side
LOOKING: Upstream
COMMENT:

PHOTOGRAPH NO.: 17 - Culvert 10
FROM: In channel on upstream side
LOOKING: Upstream at channel
COMMENT:

PHOTOGRAPH NO.: 18 - Culvert 10
FROM: In channel on upstream side
LOOKING: Channel
COMMENT:



APPENDIX D:

Rapid Field Assessment Worksheets

Rapid Geomorphic Assessment

Date: 21-Aug-15
Evaluator: EEG/NG
Stream: 14036 - Winston Churchill
Conditions: ____

	Geomorphic Indicator		**Reach Number:**											
Form / Process	**No**	**Description**	**Cul-3**		**Cul-8**		**Cul-10**							
Evidence of Aggradation (AI)	1	Lobate bar					1							
	2	Coarse material in riffles embedded	1				1							
	3	Siltation in pools	1		1									
	4	Medial bars	1				1							
	5	Accretion on point bars												
	6	Poor longitudinal sorting of bed materials												
	7	Deposition in the overbank zone												
		Sum of Indices												
Evidence of Degradation (DI)	1	Exposed bridge footing(s)												
	2	Exposed sanitary/storm sewer/pipeline/etc.												
	3	Elevated storm sewer outfall(s)												
	4	Undermined gabion baskets/concrete aprons/etc.												
	5	Scour pools d/s of culverts/storm sewer outlets												
	6	Cut face on bar forms												
	7	Head cutting due to knick point migration												
	8	Terrace cut through older bar material												
	9	Suspended armour layer visible in bank												
	10	Channel worn into undisturbed overburden/bedrock												
		Sum of Indices												
Evidence of Widening (WI)	1	Fallen/leaning trees/fence posts/etc.												
	2	Occurrence of large organic debris												
	3	Exposed tree roots												
	4	Basal scour on inside meander bends	1				1							
	5	Basal scour on both sides of channel through riffle	1				1							
	6	Gabion baskets/concrete walls/etc. out flanked												
	7	Length of basal scour >50% through subject reach												
	8	Exposed length of previously buried pipe/cable/etc.												
	9	Fracture lines along top of bank												
	10	Exposed building foundation												
		Sum of Indices												
Evidence of Planimetric Form Adjustment (PI)	1	Formation of cut (s)												
	2	Single thread channel to multiple channel												
	3	Evolution of pool-riffle form to low bed relief form												
	4	Cutoff channel(s)												
	5	Formation of island(s)												
	6	Thalweg alignment out of phase meander form												
	7	Bar forms poorly formed/reworked/removed												
		Sum of Indices												
Stability Index (SI) = (AI + DI+ WI+ PI) /m			0.03		0.01		0.05							

General Comments:

RAPID STREAM ASSESSMENT TECHNIQUE

water's edge
ENVIRONMENTAL SOLUTIONS TEAM

RSAT Evaluation Category	Excellent	Good	Fair	Poor	Points
	General Verbal Rating Categories and Associated Point Range				
1. Channel Stability	9-11	6-8	3-5	0-2	7
2. Channel Scouring/Deposition	7-8	5-6	3-4	0-2	4
3. Physical Instream Habitat	7-8	5-6	3-4	0-2	6
4. Water Quality	7-8	5-6	3-4	0-2	6
5. Riparian Habitat Conditions	6-7	4-5	2-3	0-2	5
6. Biological Indicators	7-8	5-6	3-4	0-2	8

RSAT Score	Ranking
41-50	Excellent
31-40	Good
21-30	Fair
11-20	Poor
0-10	Degraded

Creek Name: 14036 - Winston Churchill
Date: Aug 21, 2015
Assessor: EEG

Evaluation Category	Cul-3 US	Cul-3 DS		Cul-8		Cul-10					
1 Channel Stability	5	1		4		3					
2 Channel Scour and Sediment Deposition	4	0		4		4					
3 Physical In-stream Habitat	6	2		2		2					
4 Water Quality	6	1		1		1					
5 Riparian Habitat Conditions	6	1		3		2					
6 Biological Indicators	6	1		2		1					
Total Score:	**33**	**6**		**16**		**13**					
Verbal Ranking:	**good**	**degrad**		**poor**		**poor**					

Appendix E

Proposed Storm Sewer Analysis

Enter data "Design Storm" data in at least Section A.

A. Intensity-Duration-Frequency Curve

Source: Region of Peel IDF Curve

Coeff	Design Storm						
	25mm WQ	2	5	10	25	50	100
A	607.0	1070.0	1593.0	2221.0	3158.0	3886.0	4688.0
B	7.5	7.85	11.0	12.0	15.0	16.0	17.0
C	0.88	0.876	0.879	0.908	0.934	0.950	0.962

B. Intensity-Duration-Frequency Data

Intensity calculated based on IDF Curve Equation

td [min]	Calculated Intensity (mm/hr)						
	25mm WQ	2	5	10	25	50	100
5	66.6	114.3	139.3	169.6	192.7	215.8	239.4
10	49.6	85.7	109.7	134.2	156.5	176.2	196.5
15	39.8	69.0	90.9	111.4	132.0	149.1	166.9
20	33.4	58.1	77.9	95.5	114.3	129.4	145.1
25	28.9	50.2	68.3	83.7	100.9	114.3	128.5
30	25.5	44.4	60.9	74.6	90.4	102.5	115.3
35	22.8	39.8	55.1	67.3	81.9	92.9	104.6
40	20.7	36.1	50.3	61.4	75.0	85.0	95.7
45	19.0	33.1	46.3	56.5	69.1	78.4	88.3
50	17.5	30.6	43.0	52.4	64.1	72.8	82.0
55	16.3	28.5	40.1	48.8	59.8	67.9	76.5
60	15.2	26.6	37.6	45.7	56.1	63.6	71.7
120	8.7	15.3	21.9	26.4	32.4	36.6	41.2
180	6.2	10.9	15.8	18.8	23.0	25.9	29.0
240	4.9	8.6	12.4	14.7	17.9	20.1	22.5
300	4.0	7.1	10.3	12.1	14.7	16.4	18.4
360	3.5	6.1	8.8	10.3	12.5	13.9	15.5
480	2.7	4.7	6.9	8.0	9.6	10.7	11.9
600	2.2	3.9	5.7	6.5	7.9	8.7	9.7
720	1.9	3.3	4.8	5.6	6.7	7.4	8.2
1440	1.0	1.8	2.7	3.0	3.5	3.9	4.2

Assesses storm sewer sizing and capacity to convey flows from sub-catchments

A. Input Data (Apply for A <10 ha)

Specify "Design Storm" using drop-down (see "Rainfall Data" sheet for reference data) or manual IDF input; Set maximum inlet time and manning's roughness for pipe

Design Storm	IDF Coeff			
	Year	A	B	C
Return Period Storm	10	2221.00	12.00	0.91
[Optional] User Defined				

Sewer Characteristics	Input Value
Inlet Time [min]	10
Manning's "n"	0.013

B. Storm Sewer Calculation Sheet

At minimum, input "Length", "Diameter" and "Slope" of pipe

Sub-Catchment ID	MH Location			Runoff Calculations							Designed Pipe Characteristics					
	From	To	Distance [m]	A [ha]	C	A x C	Total AxC	Tin [min]	i [mm/hr]	Q [cms]	Diameter [mm]	Slope [%]	Q_Full [cms]	V_Full [cms]	Pipe Time [min]	Capacity [%]
Catchment R2-01																
R.2-01	R2-MH1	R2-MH2	86.5	0.408	0.850	0.347	0.347	10	134.162	0.129	375	1	0.176	1.589	0.907	74%
	R2-MH2	R2-MH3	90.5	0.377	0.850	0.320	0.667	10.91	134.162	0.248	600	1	0.615	2.174	0.694	40%
	R2-MH3	R2-MH4	68.5	0.332	0.850	0.282	0.949	11.60	134.162	0.354	600	1	0.615	2.174	0.525	58%
	R2-MH4	Stormtech Chamber	17				1.457	12.13	134.162	0.543	750	1	1.114	2.522	0.112	49%
	R2-MH5	R2-MH4	61.5	0.599	0.850	0.509	0.509	10	134.162	0.190	450	1	0.285	1.794	0.571	66%
Catchment R2-02																
R.2-02	R2-MH6	R2-MH7	124	0.772	0.850	0.657	0.657	10	134.162	0.245	525	1	0.430	1.989	1.039	57%
	R2-MH7	Stormtech Chamber	16				0.657	11.04	134.162	0.245	525	1	0.430	1.989	0.134	57%
Catchment R4-01																
R.4-01	R4-MH1	R4-MH2	42.1	0.200	0.850	0.170	0.170	10	134.162	0.063	300	1	0.097	1.369	0.512	65%
	R4-MH2	R4-MH3	43.5	0.212	0.850	0.180	0.350	10.51	134.162	0.130	450	1	0.285	1.794	0.404	46%
	R4-MH3	Stormtech Chamber	15				0.785	10.92	135.162	0.295	525	1	0.430	1.989	0.126	68%
	R4-MH4	R4-MH3	45.5	0.512	0.850	0.435	0.435	10.00	134.162	0.162	450	1	0.285	1.794	0.423	57%
Catchment R4-02																
R.4-02	R4-MH5	R4-MH6	42.1	0.240	0.850	0.204	0.204	10	134.162	0.076	300	1	0.097	1.369	0.512	79%
	R4-MH6	Stormtech Chamber	43.5				0.204	10.51	134.162	0.076	300	1	0.097	1.369	0.529	79%

Assesses storm sewer sizing and capacity to convey flows from sub-catchments

A. Input Data (Apply for A <10 ha)

Specify "Design Storm" using drop-down (see "Rainfall Data" sheet for reference data) or manual IDF input; Set maximum inlet time and manning's roughness for pipe

Design Storm	IDF Coeff			
	Year	A	B	C
Return Period Storm	10	2221.00	12.00	0.91
[Optional] User Defined				

Sewer Characteristics	Input Value
Inlet Time [min]	10
Manning's "n"	0.013

B. Storm Sewer Calculation Sheet

At minimum, input "Length", "Diameter" and "Slope" of pipe

Sub-Catchment ID	MH Location			Runoff Calculations							Designed Pipe Characteristics					
	From	To	Distance [m]	A [ha]	C	A x C	Total AxC	Tin [min]	i [mm/hr]	Q [cms]	Diameter [mm]	Slope [%]	Q_Full [cms]	V_Full [cms]	Pipe Time [min]	Capacity [%]
Catchment R5-01																
R.5-01	R5-MH1	R5-MH2	47.5	0.351	0.850	0.299	0.299	10	134.162	0.111	375	1	0.176	1.589	0.498	63%
	R5-MH2	Stormtech Chamber	14				0.299	10.50	134.162	0.111	375	1	0.176	1.589	0.147	63%
Catchment R5-02																
R.5-02	R5-MH3	R5-MH4	20.32	0.224	0.850	0.190	0.190	10	134.162	0.071	375	1	0.176	1.589	0.213	40%
	R5-MH4	Stormtech Chamber	16.5				0.558	10.21	134.162	0.208	450	1	0.285	1.794	0.153	73%
	R5-MH5	R5-MH4	27	0.432	0.850	0.368	0.368	11	134.162	0.137	375	1	0.176	1.589	0.283	78%
Catchment R6-01																
R.6-01	R6-MH1	Stormtech Chamber	20.6	0.248	0.850	0.210	0.403	10	134.162	0.150	450	1	0.285	1.794	0.191	53%
	R6-MH2	R6-MH1	41.5	0.227	0.850	0.193	0.193	10	134.162	0.072	300	1	0.097	1.369	0.505	74%
Catchment R6-02																
R.6-02	R6-MH3	R6-MH4	40.5	0.204	0.850	0.173	0.173	10	134.162	0.064	300	1	0.097	1.369	0.493	67%
	R6-MH4	Stormtech Chamber	18	0.221	0.850	0.188	0.361	10	134.162	0.134	450	1	0.285	1.794	0.167	47%

Assesses storm sewer sizing and capacity to convey flows from sub-catchments

A. Input Data (Apply for A <10 ha)

Specify "Design Storm" using drop-down (see "Rainfall Data" sheet for reference data) or manual IDF input; Set maximum inlet time and manning's roughness for pipe

Design Storm	IDF Coeff			
	Year	A	B	C
Return Period Storm	10	2221.00	12.00	0.91
[Optional] User Defined				

Sewer Characteristics	Input Value
Inlet Time [min]	10
Manning's "n"	0.013

B. Storm Sewer Calculation Sheet

At minimum, input "Length", "Diameter" and "Slope" of pipe

Sub-Catchment ID	MH Location			Runoff Calculations							Designed Pipe Characteristics					
	From	To	Distance [m]	A [ha]	C	A x C	Total AxC	Tin [min]	i [mm/hr]	Q [cms]	Diameter [mm]	Slope [%]	Q_Full [cms]	V_Full [cms]	Pipe Time [min]	Capacity [%]
Catchment R8-01																
R.8-01	R8-MH1	R8-MH2	98	0.777	0.850	0.660	0.660	10	134.162	0.246	525	1	0.430	1.989	0.821	57%
	R8-MH2	R8-MH3	71.5	0.319	0.850	0.271	0.932	10.82	134.162	0.347	600	1	0.615	2.174	0.548	56%
	R8-MH3	Stormtech Chamber	17		0.850		1.234	11.37	134.162	0.460	750	1	1.114	2.522	0.112	41%
	R8-MH4	R8-MH3	40	0.356	0.850	0.303	0.303		134.162	0.113	375	1	0.176	1.589	0.420	64%
Catchment R8-02																
R.8-02	R8-MH5	R8-MH6	47	0.570	0.850	0.485	0.485	10	134.162	0.181	525	1	0.430	1.989	0.394	42%
	R8-MH6	R8-MH7	90	0.445	0.850	0.378	0.863	10.39	134.162	0.321	600	1	0.615	2.174	0.690	52%
	R8-MH7	Stormtech Chamber	16		0.850		1.004	11.08	134.162	0.374	750	1	1.114	2.522	0.106	34%
	R8-MH8	R8-MH7	33	0.166	0.850	0.141	0.141	11	134.162	0.053	300	1	0.097	1.369	0.402	54%
Catchment R8-02																
R.8-02	R8-MH9	R8-MH10	79	0.515	0.850	0.437	0.437	10	134.162	0.163	450	1	0.285	1.794	0.734	57%
	R8-MH10	R8-MH11	68.5	0.398	0.850	0.338	0.775	10.73	134.162	0.289	600	1	0.615	2.174	0.525	47%
	R8-MH11	Stormtech Chamber	16.5		0.850		0.775	11.26	134.162	0.289	600	1	0.615	2.174	0.127	47%
Catchment R10-01																
R.10-01	R10-MH1	R10-MH2	86	0.327	0.850	0.278	0.278	10	134.162	0.104	450	1	0.285	1.794	0.799	36%
	R10-MH2	R10-MH3	102	0.691	0.850	0.587	0.865	10.80	134.162	0.322	600	1	0.615	2.174	0.782	52%
	R10-MH3	R10-MH4	99	0.441	0.850	0.375	1.240	11.58	134.162	0.462	750	1	1.114	2.522	0.654	41%
	R10-MH4	R10-MH5	97.5	0.441	0.850	0.375	1.615	12.23	134.162	0.602	750	1	1.114	2.522	0.644	54%
	R10-MH5	R10-MH6	101	0.464	0.850	0.394	2.009	12.88	134.162	0.749	750	1	1.114	2.522	0.667	67%
	R10-MH6	R10-MH7	106	0.463	0.850	0.394	2.402	13.55	134.162	0.895	825	1	1.437	2.688	0.657	62%
	R10-MH7	Stormtech Chamber	19		0.850		2.813	14.20	134.162	1.048	825	1	1.437	2.688	0.118	73%
	R10-MH8	R10-MH9	67	0.483	0.850	0.411	0.411	10	134.162	0.153	450	1	0.285	1.794	0.622	54%

Assesses storm sewer sizing and capacity to convey flows from sub-catchments

A. Input Data (Apply for A <10 ha)

Specify "Design Storm" using drop-down (see "Rainfall Data" sheet for reference data) or manual IDF input; Set maximum inlet time and manning's roughness for pipe

Design Storm	IDF Coeff			
	Year	A	B	C
Return Period Storm	10	2221.00	12.00	0.91
[Optional] User Defined				

Sewer Characteristics	Input Value
Inlet Time [min]	10
Manning's "n"	0.013

B. Storm Sewer Calculation Sheet

At minimum, input "Length", "Diameter" and "Slope" of pipe

Sub-Catchment ID	MH Location			Runoff Calculations							Designed Pipe Characteristics					
	From	To	Distance [m]	A [ha]	C	A x C	Total AxC	Tin [min]	i [mm/hr]	Q [cms]	Diameter [mm]	Slope [%]	Q_Full [cms]	V_Full [cms]	Pipe Time [min]	Capacity [%]
Catchment R10-02																
R.10-02	R10-MH10	R10-MH11	100	0.671	0.850	0.571	0.571	10	134.162	0.213	525	1	0.430	1.989	0.838	49%
	R10-MH11	Stormtech Chamber	15	0.095	0.850	0.080	0.651	10.84	134.162	0.243	525	1	0.430	1.989	0.126	56%
Catchment R11-01																
R.11-01	R11-MH1	R11-MH2	39.5	0.347	0.850	0.295	0.295	10	134.162	0.110	375	1	0.176	1.589	0.414	63%
	R11-MH2	Stormtech Chamber	14		0.850		0.295	10.41	134.162	0.110	375	1	0.176	1.589	0.147	63%
Catchment R11-02																
R.11-02	R11-MH3	R11-MH4	81	0.382	0.850	0.324	0.324	10	134.162	0.121	450	1	0.285	1.794	0.752	42%
	R11-MH4	Stormtech Chamber	14	0.375	0.850	0.319	0.643	10.75	134.162	0.240	525	1	0.430	1.989	0.117	56%
Catchment R12-01, 12-02																
R.12-02	R12-MH1	R12-MH2	50	0.453	0.850	0.385	0.385	10	134.162	0.144	450	1	0.285	1.794	0.464	50%
	R12-MH2	R12-MH3	90	0.397	0.850	0.337	0.722	10.46	134.162	0.269	600	1	0.615	2.174	0.690	44%
	R12-MH3	R12-MH4	90	0.383	0.850	0.325	1.048	11.15	134.162	0.390	600	1	0.615	2.174	0.690	64%
	R12-MH4	R12-MH5	67	0.400	0.850	0.340	1.387	11.84	134.162	0.517	750	1	1.114	2.522	0.443	46%
	R12-MH5	R12-MH6	65	0.205	0.850	0.174	1.561	12.29	134.162	0.582	750	1	1.114	2.522	0.429	52%
	R12-MH6	Stormtech Chamber	25		0.850		1.950	12.72	134.162	0.727	825	1	1.437	2.688	0.155	51%
	R12-MH7	R12-MH6	37	0.457	0.850	0.389	0.389	10	134.162	0.145	450	1	0.285	1.794	0.344	51%
Catchment R13-01, R13-02																
R.13-01	R13-MH1	R13-MH2	121	0.704	0.850	0.598	0.598	10	134.162	0.223	525	1	0.430	1.989	1.014	52%
	R13-MH2	R13-MH3	92.5	0.381	0.850	0.324	0.922	11.01	134.162	0.344	600	1	0.615	2.174	0.709	56%
	R13-MH3	R13-MH4	42.5	0.181	0.850	0.154	1.076	11.72	134.162	0.401	600	1	0.615	2.174	0.326	65%
	R13-MH4	Stormtech Chamber	15		0.850		1.526	12.05	134.162	0.569	750	1	1.114	2.522	0.099	51%
R.13-02	R12-MH5	R13-MH4	70	0.529	0.850	0.450	0.450	10	134.162	0.168	450	1	0.285	1.794	0.650	59%

Appendix F

Storage Requirement for Quantity Control

MRM - Storage requirement

A. Input Data (Apply for A <10 ha)

Catchment#	Subcatchment Attributes Area [ha] Pre	C (Pre)	Tc [min] (Pre)	Qr [L/s] (Pre)	Area [ha] Post	C (Post)
R.2-02	1.031	0.77	10.0	435.55	1.373	0.81

CC Factor	100%
Catchment	R.2-02

Volume Based on IDF Data

td [min]	Peak Inflow, Qp [L/s]						Desired Outflow [L/s]	MRM Volume Storage Required, Vstor [m3]					
	2	5	10	25	50	100		2	5	10	25	50	100
10	263.3	336.9	412.1	480.7	541.3	603.8	435.6	-	-	-	27.08	63.43	100.92
15	212.1	279.3	342.2	405.5	458.0	512.7	435.6	-	-	-	-	20.21	69.42
20	178.4	239.3	293.3	351.1	397.4	445.8	435.6	-	-	-	-	-	12.34
25	154.3	209.8	257.1	310.0	351.2	394.6	435.6	-	-	-	-	-	-
30	136.3	187.1	229.1	277.7	314.9	354.1	435.6	-	-	-	-	-	-
35	122.3	169.1	206.9	251.7	285.5	321.3	435.6	-	-	-	-	-	-
40	111.0	154.5	188.7	230.3	261.2	294.1	435.6	-	-	-	-	-	-
45	101.8	142.3	173.6	212.3	240.9	271.3	435.6	-	-	-	-	-	-
50	94.0	132.0	160.9	197.0	223.5	251.8	435.6	-	-	-	-	-	-
55	87.4	123.2	149.9	183.8	208.5	234.9	435.6	-	-	-	-	-	-
60	81.8	115.5	140.4	172.4	195.5	220.2	435.6	-	-	-	-	-	-
120	46.9	67.4	81.0	99.6	112.5	126.5	435.6	-	-	-	-	-	-
180	33.5	48.4	57.6	70.6	79.5	89.2	435.6	-	-	-	-	-	-
240	26.3	38.1	45.0	55.0	61.7	69.0	435.6	-	-	-	-	-	-
300	21.7	31.5	37.1	45.2	50.5	56.4	435.6	-	-	-	-	-	-
360	18.6	27.0	31.6	38.4	42.8	47.7	435.6	-	-	-	-	-	-
480	14.5	21.1	24.5	29.6	32.9	36.6	435.6	-	-	-	-	-	-
600	12.0	17.4	20.1	24.2	26.8	29.7	435.6	-	-	-	-	-	-
720	10.2	14.9	17.1	20.5	22.6	25.0	435.6	-	-	-	-	-	-
1440	5.6	8.1	9.2	10.8	11.8	13.0	435.6	-	-	-	-	-	-

MRM - Storage requirement

A. Input Data (Apply for A <10 ha)

Catchment#	Subcatchment Attributes					
	Area [ha] Pre	C (Pre)	Tc [min] (Pre)	Qr [L/s] (Pre)	Area [ha] Post	C (Post)
R.4-01	0.479	0.82	10.0	213.67	0.684	0.82

CC Factor	100%
Catchment	R.4-01

Volume Based on IDF Data

td [min]	Peak Inflow, Qp [L/s]						Desired Outflow [L/s]	MRM Volume Storage Required, Vstor [m3]					
	2	5	10	25	50	100		2	5	10	25	50	100
10	134.2	171.7	210.0	244.9	275.8	307.6	213.7	-	-	-	18.74	37.26	56.36
15	108.1	142.3	174.4	206.6	233.4	261.2	213.7	-	-	-	-	17.71	42.78
20	90.9	121.9	149.4	178.9	202.5	227.1	213.7	-	-	-	-	-	16.17
25	78.6	106.9	131.0	157.9	178.9	201.1	213.7	-	-	-	-	-	-
30	69.5	95.3	116.7	141.5	160.4	180.4	213.7	-	-	-	-	-	-
35	62.3	86.2	105.4	128.2	145.5	163.7	213.7	-	-	-	-	-	-
40	56.6	78.7	96.2	117.3	133.1	149.9	213.7	-	-	-	-	-	-
45	51.8	72.5	88.5	108.2	122.7	138.2	213.7	-	-	-	-	-	-
50	47.9	67.2	82.0	100.4	113.9	128.3	213.7	-	-	-	-	-	-
55	44.5	62.7	76.4	93.7	106.2	119.7	213.7	-	-	-	-	-	-
60	41.7	58.8	71.6	87.8	99.6	112.2	213.7	-	-	-	-	-	-
120	23.9	34.3	41.3	50.7	57.3	64.4	213.7	-	-	-	-	-	-
180	17.1	24.7	29.4	36.0	40.5	45.4	213.7	-	-	-	-	-	-
240	13.4	19.4	22.9	28.0	31.4	35.2	213.7	-	-	-	-	-	-
300	11.1	16.1	18.9	23.0	25.7	28.7	213.7	-	-	-	-	-	-
360	9.5	13.8	16.1	19.5	21.8	24.3	213.7	-	-	-	-	-	-
480	7.4	10.8	12.5	15.1	16.8	18.6	213.7	-	-	-	-	-	-
600	6.1	8.9	10.3	12.3	13.7	15.1	213.7	-	-	-	-	-	-
720	5.2	7.6	8.7	10.4	11.5	12.8	213.7	-	-	-	-	-	-
1440	2.9	4.1	4.7	5.5	6.0	6.6	213.7	-	-	-	-	-	-

MRM - Storage requirement

A. Input Data (Apply for A <10 ha)

Catchment#	Subcatchment Attributes					
	Area [ha] Pre	C (Pre)	Tc [min] (Pre)	Qr [L/s] (Pre)	Area [ha] Post	C (Post)
R.4-02	0.151	0.81	10.0	66.84	0.240	0.83

CC Factor	100%
Catchment	R.4-02

Volume Based on IDF Data

td [min]	Peak Inflow, Qp [L/s]						Desired Outflow [L/s]	MRM Volume Storage Required, Vstor [m3]					
	2	5	10	25	50	100		2	5	10	25	50	100
10	47.6	60.9	74.5	86.9	97.8	109.1	66.8	-	-	4.58	12.01	18.58	25.36
15	38.3	50.5	61.8	73.3	82.8	92.6	66.8	-	-	-	5.78	14.33	23.22
20	32.2	43.2	53.0	63.4	71.8	80.6	66.8	-	-	-	-	5.96	16.47
25	27.9	37.9	46.5	56.0	63.5	71.3	66.8	-	-	-	-	-	6.71
30	24.6	33.8	41.4	50.2	56.9	64.0	66.8	-	-	-	-	-	-
35	22.1	30.6	37.4	45.5	51.6	58.1	66.8	-	-	-	-	-	-
40	20.1	27.9	34.1	41.6	47.2	53.2	66.8	-	-	-	-	-	-
45	18.4	25.7	31.4	38.4	43.5	49.0	66.8	-	-	-	-	-	-
50	17.0	23.8	29.1	35.6	40.4	45.5	66.8	-	-	-	-	-	-
55	15.8	22.3	27.1	33.2	37.7	42.5	66.8	-	-	-	-	-	-
60	14.8	20.9	25.4	31.1	35.3	39.8	66.8	-	-	-	-	-	-
120	8.5	12.2	14.6	18.0	20.3	22.9	66.8	-	-	-	-	-	-
180	6.1	8.7	10.4	12.8	14.4	16.1	66.8	-	-	-	-	-	-
240	4.8	6.9	8.1	9.9	11.1	12.5	66.8	-	-	-	-	-	-
300	3.9	5.7	6.7	8.2	9.1	10.2	66.8	-	-	-	-	-	-
360	3.4	4.9	5.7	6.9	7.7	8.6	66.8	-	-	-	-	-	-
480	2.6	3.8	4.4	5.4	6.0	6.6	66.8	-	-	-	-	-	-
600	2.2	3.1	3.6	4.4	4.8	5.4	66.8	-	-	-	-	-	-
720	1.8	2.7	3.1	3.7	4.1	4.5	66.8	-	-	-	-	-	-
1440	1.0	1.5	1.7	2.0	2.1	2.3	66.8	-	-	-	-	-	-

MRM - Storage requirement

A. Input Data (Apply for A <10 ha)

Catchment#	Subcatchment Attributes: Area [ha] Pre	C (Pre)	Tc [min] (Pre)	Qr [L/s] (Pre)	Area [ha] Post	C (Post)
R.5-01	0.426	0.79	10.0	183.78	0.590	0.82

CC Factor	100%
Catchment	R.5-01

Volume Based on IDF Data

td [min]	Peak Inflow, Qp [L/s] 2	5	10	25	50	100	Desired Outflow [L/s]	MRM Volume Storage Required, Vstor [m3] 2	5	10	25	50	100
10	115.6	147.9	180.9	211.0	237.6	265.0	183.8	-	-	-	16.34	32.29	48.75
15	93.1	122.6	150.2	178.0	201.1	225.1	183.8	-	-	-	-	15.55	37.15
20	78.3	105.0	128.7	154.1	174.4	195.7	183.8	-	-	-	-	-	14.32
25	67.8	92.1	112.8	136.1	154.2	173.2	183.8	-	-	-	-	-	-
30	59.8	82.2	100.6	121.9	138.2	155.5	183.8	-	-	-	-	-	-
35	53.7	74.2	90.8	110.5	125.3	141.1	183.8	-	-	-	-	-	-
40	48.7	67.8	82.8	101.1	114.7	129.1	183.8	-	-	-	-	-	-
45	44.7	62.5	76.2	93.2	105.7	119.1	183.8	-	-	-	-	-	-
50	41.3	57.9	70.6	86.5	98.1	110.5	183.8	-	-	-	-	-	-
55	38.4	54.1	65.8	80.7	91.5	103.1	183.8	-	-	-	-	-	-
60	35.9	50.7	61.7	75.7	85.8	96.7	183.8	-	-	-	-	-	-
120	20.6	29.6	35.6	43.7	49.4	55.5	183.8	-	-	-	-	-	-
180	14.7	21.2	25.3	31.0	34.9	39.1	183.8	-	-	-	-	-	-
240	11.5	16.7	19.8	24.1	27.1	30.3	183.8	-	-	-	-	-	-
300	9.5	13.8	16.3	19.8	22.2	24.8	183.8	-	-	-	-	-	-
360	8.2	11.9	13.9	16.8	18.8	21.0	183.8	-	-	-	-	-	-
480	6.4	9.3	10.8	13.0	14.5	16.1	183.8	-	-	-	-	-	-
600	5.3	7.6	8.8	10.6	11.8	13.0	183.8	-	-	-	-	-	-
720	4.5	6.5	7.5	9.0	9.9	11.0	183.8	-	-	-	-	-	-
1440	2.5	3.6	4.0	4.8	5.2	5.7	183.8	-	-	-	-	-	-

MRM - Storage requirement

A. Input Data (Apply for A <10 ha)

Catchment#	Subcatchment Attributes					
	Area [ha] Pre	C (Pre)	Tc [min] (Pre)	Qr [L/s] (Pre)	Area [ha] Post	C (Post)
R.5-02	0.342	0.78	10.0	144.92	0.432	0.81

CC Factor	100%
Catchment	R.5-02

Volume Based on IDF Data

td [min]	Peak Inflow, Qp [L/s]						Desired Outflow [L/s]	MRM Volume Storage Required, Vstor [m3]					
	2	5	10	25	50	100		2	5	10	25	50	100
10	83.7	107.1	131.0	152.8	172.1	192.0	144.9	-	-	-	4.75	16.30	28.23
15	67.4	88.8	108.8	128.9	145.6	163.0	144.9	-	-	-	-	0.63	16.28
20	56.7	76.1	93.3	111.6	126.4	141.8	144.9	-	-	-	-	-	-
25	49.1	66.7	81.7	98.6	111.7	125.5	144.9	-	-	-	-	-	-
30	43.3	59.5	72.8	88.3	100.1	112.6	144.9	-	-	-	-	-	-
35	38.9	53.8	65.8	80.0	90.8	102.2	144.9	-	-	-	-	-	-
40	35.3	49.1	60.0	73.2	83.1	93.5	144.9	-	-	-	-	-	-
45	32.4	45.2	55.2	67.5	76.6	86.3	144.9	-	-	-	-	-	-
50	29.9	42.0	51.1	62.6	71.1	80.0	144.9	-	-	-	-	-	-
55	27.8	39.2	47.7	58.5	66.3	74.7	144.9	-	-	-	-	-	-
60	26.0	36.7	44.7	54.8	62.2	70.0	144.9	-	-	-	-	-	-
120	14.9	21.4	25.8	31.7	35.8	40.2	144.9	-	-	-	-	-	-
180	10.7	15.4	18.3	22.5	25.3	28.4	144.9	-	-	-	-	-	-
240	8.4	12.1	14.3	17.5	19.6	22.0	144.9	-	-	-	-	-	-
300	6.9	10.0	11.8	14.4	16.1	17.9	144.9	-	-	-	-	-	-
360	5.9	8.6	10.1	12.2	13.6	15.2	144.9	-	-	-	-	-	-
480	4.6	6.7	7.8	9.4	10.5	11.6	144.9	-	-	-	-	-	-
600	3.8	5.5	6.4	7.7	8.5	9.4	144.9	-	-	-	-	-	-
720	3.3	4.7	5.4	6.5	7.2	8.0	144.9	-	-	-	-	-	-
1440	1.8	2.6	2.9	3.4	3.8	4.1	144.9	-	-	-	-	-	-

MRM - Storage requirement

A. Input Data (Apply for A <10 ha)

Catchment#	Area [ha] Pre	C (Pre)	Tc [min] (Pre)	Qr [L/s] (Pre)	Area [ha] Post	C (Post)
	Subcatchment Attributes					
R.6-01	0.372	0.80	10.0	162.46	0.471	0.84

CC Factor	100%
Catchment	R.6-01

Volume Based on IDF Data

td [min]	Peak Inflow, Qp [L/s]						Desired Outflow [L/s]	MRM Volume Storage Required, Vstor [m3]					
	2	5	10	25	50	100		2	5	10	25	50	100
10	94.3	120.6	147.6	172.1	193.8	216.2	162.5	-	-	-	5.79	18.81	32.24
15	75.9	100.0	122.5	145.2	164.0	183.6	162.5	-	-	-	-	1.38	19.00
20	63.9	85.7	105.0	125.7	142.3	159.6	162.5	-	-	-	-	-	-
25	55.3	75.1	92.0	111.0	125.8	141.3	162.5	-	-	-	-	-	-
30	48.8	67.0	82.0	99.4	112.7	126.8	162.5	-	-	-	-	-	-
35	43.8	60.6	74.1	90.1	102.2	115.0	162.5	-	-	-	-	-	-
40	39.8	55.3	67.6	82.4	93.5	105.3	162.5	-	-	-	-	-	-
45	36.4	50.9	62.2	76.0	86.2	97.1	162.5	-	-	-	-	-	-
50	33.7	47.3	57.6	70.5	80.0	90.1	162.5	-	-	-	-	-	-
55	31.3	44.1	53.7	65.8	74.7	84.1	162.5	-	-	-	-	-	-
60	29.3	41.4	50.3	61.7	70.0	78.9	162.5	-	-	-	-	-	-
120	16.8	24.1	29.0	35.7	40.3	45.3	162.5	-	-	-	-	-	-
180	12.0	17.3	20.6	25.3	28.5	31.9	162.5	-	-	-	-	-	-
240	9.4	13.6	16.1	19.7	22.1	24.7	162.5	-	-	-	-	-	-
300	7.8	11.3	13.3	16.2	18.1	20.2	162.5	-	-	-	-	-	-
360	6.7	9.7	11.3	13.7	15.3	17.1	162.5	-	-	-	-	-	-
480	5.2	7.6	8.8	10.6	11.8	13.1	162.5	-	-	-	-	-	-
600	4.3	6.2	7.2	8.7	9.6	10.6	162.5	-	-	-	-	-	-
720	3.7	5.3	6.1	7.3	8.1	9.0	162.5	-	-	-	-	-	-
1440	2.0	2.9	3.3	3.9	4.2	4.7	162.5	-	-	-	-	-	-

MRM - Storage requirement

A. Input Data (Apply for A <10 ha)

Catchment#	Area [ha] Pre	C (Pre)	Tc [min] (Pre)	Qr [L/s] (Pre)	Area [ha] Post	C (Post)
	Subcatchment Attributes					
R.6-02	0.339	0.75	10.0	139.39	0.428	0.83

CC Factor	100%
Catchment	R.6-02

Volume Based on IDF Data

td [min]	Peak Inflow, Qp [L/s]						Desired Outflow [L/s]	MRM Volume Storage Required, Vstor [m3]					
	2	5	10	25	50	100		2	5	10	25	50	100
10	85.0	108.7	133.0	155.1	174.6	194.8	139.4	-	-	-	9.43	21.16	33.26
15	68.4	90.1	110.4	130.8	147.8	165.4	139.4	-	-	-	-	7.56	23.44
20	57.5	77.2	94.6	113.3	128.2	143.9	139.4	-	-	-	-	-	5.36
25	49.8	67.7	82.9	100.0	113.3	127.3	139.4	-	-	-	-	-	-
30	44.0	60.4	73.9	89.6	101.6	114.3	139.4	-	-	-	-	-	-
35	39.5	54.6	66.8	81.2	92.1	103.7	139.4	-	-	-	-	-	-
40	35.8	49.8	60.9	74.3	84.3	94.9	139.4	-	-	-	-	-	-
45	32.8	45.9	56.0	68.5	77.7	87.5	139.4	-	-	-	-	-	-
50	30.3	42.6	51.9	63.6	72.1	81.2	139.4	-	-	-	-	-	-
55	28.2	39.7	48.4	59.3	67.3	75.8	139.4	-	-	-	-	-	-
60	26.4	37.3	45.3	55.6	63.1	71.1	139.4	-	-	-	-	-	-
120	15.1	21.8	26.1	32.1	36.3	40.8	139.4	-	-	-	-	-	-
180	10.8	15.6	18.6	22.8	25.7	28.8	139.4	-	-	-	-	-	-
240	8.5	12.3	14.5	17.7	19.9	22.3	139.4	-	-	-	-	-	-
300	7.0	10.2	12.0	14.6	16.3	18.2	139.4	-	-	-	-	-	-
360	6.0	8.7	10.2	12.4	13.8	15.4	139.4	-	-	-	-	-	-
480	4.7	6.8	7.9	9.6	10.6	11.8	139.4	-	-	-	-	-	-
600	3.9	5.6	6.5	7.8	8.6	9.6	139.4	-	-	-	-	-	-
720	3.3	4.8	5.5	6.6	7.3	8.1	139.4	-	-	-	-	-	-
1440	1.8	2.6	3.0	3.5	3.8	4.2	139.4	-	-	-	-	-	-

MRM - Storage requirement

A. Input Data (Apply for A <10 ha)

Catchment#	Subcatchment Attributes					
	Area [ha] Pre	C (Pre)	Tc [min] (Pre)	Qr [L/s] (Pre)	Area [ha] Post	C (Post)
R.8-01	1.018	0.78	10.0	433.84	1.274	0.83

CC Factor	100%
Catchment	R.8-01

Volume Based on IDF Data

td [min]	Peak Inflow, Qp [L/s]						Desired Outflow [L/s]	MRM Volume Storage Required, Vstor [m3]					
	2	5	10	25	50	100		2	5	10	25	50	100
10	251.1	321.3	393.0	458.4	516.1	575.7	433.8	-	-	-	14.72	49.38	85.14
15	202.3	266.3	326.3	386.6	436.8	488.9	433.8	-	-	-	-	2.62	49.55
20	170.1	228.2	279.7	334.8	378.9	425.1	433.8	-	-	-	-	-	-
25	147.2	200.1	245.1	295.6	334.9	376.3	433.8	-	-	-	-	-	-
30	130.0	178.5	218.5	264.8	300.3	337.7	433.8	-	-	-	-	-	-
35	116.6	161.3	197.3	240.0	272.2	306.4	433.8	-	-	-	-	-	-
40	105.9	147.3	180.0	219.6	249.1	280.5	433.8	-	-	-	-	-	-
45	97.0	135.7	165.6	202.4	229.7	258.7	433.8	-	-	-	-	-	-
50	89.7	125.9	153.4	187.9	213.1	240.1	433.8	-	-	-	-	-	-
55	83.4	117.4	143.0	175.3	198.8	224.0	433.8	-	-	-	-	-	-
60	78.0	110.1	133.9	164.4	186.4	210.0	433.8	-	-	-	-	-	-
120	44.8	64.3	77.2	95.0	107.3	120.6	433.8	-	-	-	-	-	-
180	32.0	46.2	55.0	67.4	75.8	85.0	433.8	-	-	-	-	-	-
240	25.1	36.3	42.9	52.4	58.8	65.8	433.8	-	-	-	-	-	-
300	20.7	30.1	35.4	43.1	48.2	53.8	433.8	-	-	-	-	-	-
360	17.7	25.8	30.1	36.6	40.8	45.5	433.8	-	-	-	-	-	-
480	13.9	20.1	23.4	28.2	31.4	34.9	433.8	-	-	-	-	-	-
600	11.4	16.6	19.2	23.1	25.6	28.3	433.8	-	-	-	-	-	-
720	9.8	14.2	16.3	19.5	21.6	23.9	433.8	-	-	-	-	-	-
1440	5.3	7.8	8.8	10.3	11.3	12.4	433.8	-	-	-	-	-	-

MRM - Storage requirement

A. Input Data (Apply for A <10 ha)

CC Factor	100%
Catchment	R.8-02

Catchment#	Subcatchment Attributes					
	Area [ha] Pre	C (Pre)	Tc [min] (Pre)	Qr [L/s] (Pre)	Area [ha] Post	C (Post)
R.8-02	2.015	0.77	10.0	844.00	2.269	0.82

Volume Based on IDF Data

td [min]	Peak Inflow, Qp [L/s]						Desired Outflow [L/s]	MRM Volume Storage Required, Vstor [m3]					
	2	5	10	25	50	100		2	5	10	25	50	100
10	442.5	566.2	692.6	807.8	909.6	1014.7	844.0	-	-	-	-	39.38	102.40
15	356.5	469.3	575.1	681.4	769.7	861.6	844.0	-	-	-	-	-	15.85
20	299.7	402.1	492.9	590.1	667.8	749.3	844.0	-	-	-	-	-	-
25	259.4	352.6	432.0	520.9	590.3	663.2	844.0	-	-	-	-	-	-
30	229.1	314.5	385.1	466.7	529.2	595.2	844.0	-	-	-	-	-	-
35	205.5	284.3	347.7	423.0	479.8	540.0	844.0	-	-	-	-	-	-
40	186.6	259.6	317.2	387.0	439.0	494.3	844.0	-	-	-	-	-	-
45	171.0	239.1	291.8	356.8	404.8	455.9	844.0	-	-	-	-	-	-
50	158.0	221.8	270.4	331.1	375.6	423.1	844.0	-	-	-	-	-	-
55	146.9	207.0	252.0	309.0	350.4	394.8	844.0	-	-	-	-	-	-
60	137.4	194.1	236.0	289.7	328.5	370.1	844.0	-	-	-	-	-	-
120	78.9	113.3	136.1	167.4	189.1	212.6	844.0	-	-	-	-	-	-
180	56.3	81.3	96.9	118.7	133.6	149.9	844.0	-	-	-	-	-	-
240	44.2	64.0	75.7	92.4	103.7	116.0	844.0	-	-	-	-	-	-
300	36.5	53.0	62.3	75.9	84.9	94.8	844.0	-	-	-	-	-	-
360	31.3	45.4	53.1	64.5	72.0	80.2	844.0	-	-	-	-	-	-
480	24.4	35.5	41.2	49.8	55.3	61.5	844.0	-	-	-	-	-	-
600	20.1	29.3	33.8	40.6	45.0	49.9	844.0	-	-	-	-	-	-
720	17.2	25.0	28.7	34.4	38.0	42.1	844.0	-	-	-	-	-	-
1440	9.4	13.7	15.4	18.2	19.9	21.8	844.0	-	-	-	-	-	-

MRM - Storage requirement

A. Input Data (Apply for A <10 ha)

Catchment#	Area [ha] Pre	C (Pre)	Tc [min] (Pre)	Qr [L/s] (Pre)	Area [ha] Post	C (Post)
	Subcatchment Attributes					
R.10-01	2.582	0.80	10.0	1125.86	3.068	0.82

CC Factor	100%
Catchment	R.10-01

Volume Based on IDF Data

td [min]	Peak Inflow, Qp [L/s]						Desired Outflow [L/s]	MRM Volume Storage Required, Vstor [m3]					
	2	5	10	25	50	100		2	5	10	25	50	100
10	601.0	769.0	940.6	1097.1	1235.3	1378.0	1125.9	-	-	-	-	65.68	151.27
15	484.1	637.4	781.0	925.4	1045.3	1170.1	1125.9	-	-	-	-	-	39.83
20	407.1	546.1	669.4	801.4	907.0	1017.5	1125.9	-	-	-	-	-	-
25	352.2	478.8	586.7	707.4	801.6	900.7	1125.9	-	-	-	-	-	-
30	311.1	427.1	522.9	633.8	718.6	808.3	1125.9	-	-	-	-	-	-
35	279.1	386.0	472.2	574.4	651.6	733.3	1125.9	-	-	-	-	-	-
40	253.4	352.6	430.7	525.5	596.2	671.3	1125.9	-	-	-	-	-	-
45	232.3	324.7	396.3	484.5	549.7	619.1	1125.9	-	-	-	-	-	-
50	214.6	301.2	367.2	449.6	510.1	574.6	1125.9	-	-	-	-	-	-
55	199.5	281.1	342.2	419.6	475.9	536.2	1125.9	-	-	-	-	-	-
60	186.6	263.6	320.5	393.4	446.1	502.6	1125.9	-	-	-	-	-	-
120	107.1	153.9	184.9	227.3	256.7	288.7	1125.9	-	-	-	-	-	-
180	76.5	110.5	131.6	161.2	181.5	203.5	1125.9	-	-	-	-	-	-
240	60.0	86.9	102.8	125.5	140.8	157.6	1125.9	-	-	-	-	-	-
300	49.6	72.0	84.7	103.0	115.3	128.8	1125.9	-	-	-	-	-	-
360	42.5	61.6	72.2	87.6	97.8	109.0	1125.9	-	-	-	-	-	-
480	33.2	48.2	56.0	67.6	75.2	83.5	1125.9	-	-	-	-	-	-
600	27.3	39.8	45.9	55.2	61.2	67.8	1125.9	-	-	-	-	-	-
720	23.4	34.0	39.0	46.7	51.7	57.2	1125.9	-	-	-	-	-	-
1440	12.8	18.6	21.0	24.7	27.0	29.7	1125.9	-	-	-	-	-	-

MRM - Storage requirement

A. Input Data (Apply for A <10 ha)

Catchment#	Subcatchment Attributes					
	Area [ha] Pre	C (Pre)	Tc [min] (Pre)	Qr [L/s] (Pre)	Area [ha] Post	C (Post)
R.10-02	0.684	0.82	10.0	305.92	0.995	0.82

CC Factor	100%
Catchment	R.10-02

Volume Based on IDF Data

td [min]	Peak Inflow, Qp [L/s]						Desired Outflow [L/s]	MRM Volume Storage Required, Vstor [m3]					
	2	5	10	25	50	100		2	5	10	25	50	100
10	195.5	250.2	306.0	356.9	401.9	448.3	305.9	-	-	0.05	30.58	57.57	85.41
15	157.5	207.3	254.1	301.0	340.1	380.7	305.9	-	-	-	-	30.72	67.26
20	132.4	177.6	217.8	260.7	295.0	331.0	305.9	-	-	-	-	-	30.11
25	114.6	155.8	190.9	230.1	260.8	293.0	305.9	-	-	-	-	-	-
30	101.2	138.9	170.1	206.2	233.8	262.9	305.9	-	-	-	-	-	-
35	90.8	125.6	153.6	186.9	212.0	238.6	305.9	-	-	-	-	-	-
40	82.4	114.7	140.1	171.0	194.0	218.4	305.9	-	-	-	-	-	-
45	75.6	105.6	128.9	157.6	178.8	201.4	305.9	-	-	-	-	-	-
50	69.8	98.0	119.4	146.3	165.9	186.9	305.9	-	-	-	-	-	-
55	64.9	91.4	111.3	136.5	154.8	174.4	305.9	-	-	-	-	-	-
60	60.7	85.8	104.3	128.0	145.1	163.5	305.9	-	-	-	-	-	-
120	34.9	50.1	60.1	73.9	83.5	93.9	305.9	-	-	-	-	-	-
180	24.9	35.9	42.8	52.5	59.0	66.2	305.9	-	-	-	-	-	-
240	19.5	28.3	33.4	40.8	45.8	51.3	305.9	-	-	-	-	-	-
300	16.1	23.4	27.5	33.5	37.5	41.9	305.9	-	-	-	-	-	-
360	13.8	20.0	23.5	28.5	31.8	35.5	305.9	-	-	-	-	-	-
480	10.8	15.7	18.2	22.0	24.4	27.2	305.9	-	-	-	-	-	-
600	8.9	12.9	14.9	18.0	19.9	22.1	305.9	-	-	-	-	-	-
720	7.6	11.0	12.7	15.2	16.8	18.6	305.9	-	-	-	-	-	-
1440	4.2	6.0	6.8	8.0	8.8	9.7	305.9	-	-	-	-	-	-

MRM - Storage requirement

A. Input Data (Apply for A <10 ha)

Catchment#	Area [ha] Pre	C (Pre)	Tc [min] (Pre)	Qr [L/s] (Pre)	Area [ha] Post	C (Post)
	Subcatchment Attributes					
R.11-01	0.455	0.81	10.0	200.29	0.522	0.82

CC Factor	100%
Catchment	R.11-01

Volume Based on IDF Data

td [min]	Peak Inflow, Qp [L/s]						Desired Outflow [L/s]	MRM Volume Storage Required, Vstor [m3]					
	2	5	10	25	50	100		2	5	10	25	50	100
10	101.8	130.2	159.3	185.8	209.2	233.4	200.3	-	-	-	-	5.37	19.86
15	82.0	108.0	132.3	156.7	177.1	198.2	200.3	-	-	-	-	-	-
20	68.9	92.5	113.4	135.7	153.6	172.3	200.3	-	-	-	-	-	-
25	59.7	81.1	99.4	119.8	135.8	152.6	200.3	-	-	-	-	-	-
30	52.7	72.3	88.6	107.3	121.7	136.9	200.3	-	-	-	-	-	-
35	47.3	65.4	80.0	97.3	110.4	124.2	200.3	-	-	-	-	-	-
40	42.9	59.7	73.0	89.0	101.0	113.7	200.3	-	-	-	-	-	-
45	39.3	55.0	67.1	82.1	93.1	104.9	200.3	-	-	-	-	-	-
50	36.3	51.0	62.2	76.2	86.4	97.3	200.3	-	-	-	-	-	-
55	33.8	47.6	58.0	71.1	80.6	90.8	200.3	-	-	-	-	-	-
60	31.6	44.6	54.3	66.6	75.6	85.1	200.3	-	-	-	-	-	-
120	18.1	26.1	31.3	38.5	43.5	48.9	200.3	-	-	-	-	-	-
180	13.0	18.7	22.3	27.3	30.7	34.5	200.3	-	-	-	-	-	-
240	10.2	14.7	17.4	21.3	23.9	26.7	200.3	-	-	-	-	-	-
300	8.4	12.2	14.3	17.5	19.5	21.8	200.3	-	-	-	-	-	-
360	7.2	10.4	12.2	14.8	16.6	18.5	200.3	-	-	-	-	-	-
480	5.6	8.2	9.5	11.4	12.7	14.1	200.3	-	-	-	-	-	-
600	4.6	6.7	7.8	9.3	10.4	11.5	200.3	-	-	-	-	-	-
720	4.0	5.8	6.6	7.9	8.8	9.7	200.3	-	-	-	-	-	-
1440	2.2	3.1	3.5	4.2	4.6	5.0	200.3	-	-	-	-	-	-

MRM - Storage requirement

A. Input Data (Apply for A <10 ha)

Catchment#	Subcatchment Attributes					
	Area [ha] Pre	C (Pre)	Tc [min] (Pre)	Qr [L/s] (Pre)	Area [ha] Post	C (Post)
R.11-02	0.590	0.84	10.0	270.83	0.590	0.88

CC Factor	100%
Catchment	R.11-02

Volume Based on IDF Data

td [min]	Peak Inflow, Qp [L/s]						Desired Outflow [L/s]	MRM Volume Storage Required, Vstor [m3]					
	2	5	10	25	50	100		2	5	10	25	50	100
10	123.0	157.3	192.5	224.5	252.8	281.9	270.8	-	-	-	-	-	6.67
15	99.1	130.4	159.8	189.3	213.9	239.4	270.8	-	-	-	-	-	-
20	83.3	111.7	137.0	164.0	185.6	208.2	270.8	-	-	-	-	-	-
25	72.1	98.0	120.0	144.7	164.0	184.3	270.8	-	-	-	-	-	-
30	63.7	87.4	107.0	129.7	147.0	165.4	270.8	-	-	-	-	-	-
35	57.1	79.0	96.6	117.5	133.3	150.0	270.8	-	-	-	-	-	-
40	51.8	72.1	88.1	107.5	122.0	137.4	270.8	-	-	-	-	-	-
45	47.5	66.4	81.1	99.1	112.5	126.7	270.8	-	-	-	-	-	-
50	43.9	61.6	75.1	92.0	104.4	117.6	270.8	-	-	-	-	-	-
55	40.8	57.5	70.0	85.8	97.4	109.7	270.8	-	-	-	-	-	-
60	38.2	53.9	65.6	80.5	91.3	102.8	270.8	-	-	-	-	-	-
120	21.9	31.5	37.8	46.5	52.5	59.1	270.8	-	-	-	-	-	-
180	15.6	22.6	26.9	33.0	37.1	41.6	270.8	-	-	-	-	-	-
240	12.3	17.8	21.0	25.7	28.8	32.2	270.8	-	-	-	-	-	-
300	10.2	14.7	17.3	21.1	23.6	26.3	270.8	-	-	-	-	-	-
360	8.7	12.6	14.8	17.9	20.0	22.3	270.8	-	-	-	-	-	-
480	6.8	9.9	11.5	13.8	15.4	17.1	270.8	-	-	-	-	-	-
600	5.6	8.1	9.4	11.3	12.5	13.9	270.8	-	-	-	-	-	-
720	4.8	6.9	8.0	9.6	10.6	11.7	270.8	-	-	-	-	-	-
1440	2.6	3.8	4.3	5.1	5.5	6.1	270.8	-	-	-	-	-	-

MRM - Storage requirement

A. Input Data (Apply for A <10 ha)

Catchment#	Subcatchment Attributes					
	Area [ha] Pre	C (Pre)	Tc [min] (Pre)	Qr [L/s] (Pre)	Area [ha] Post	C (Post)
R.12-01	0.690	0.81	10.0	307.06	0.690	0.87

CC Factor	100%
Catchment	R.12-01

Volume Based on IDF Data

td [min]	Peak Inflow, Qp [L/s]						Desired Outflow [L/s]	MRM Volume Storage Required, Vstor [m3]					
	2	5	10	25	50	100		2	5	10	25	50	100
10	143.3	183.3	224.3	261.5	294.5	328.5	307.1	-	-	-	-	-	12.87
15	115.4	152.0	186.2	220.6	249.2	279.0	307.1	-	-	-	-	-	-
20	97.0	130.2	159.6	191.0	216.2	242.6	307.1	-	-	-	-	-	-
25	84.0	114.2	139.9	168.7	191.1	214.7	307.1	-	-	-	-	-	-
30	74.2	101.8	124.7	151.1	171.3	192.7	307.1	-	-	-	-	-	-
35	66.5	92.0	112.6	136.9	155.3	174.8	307.1	-	-	-	-	-	-
40	60.4	84.1	102.7	125.3	142.1	160.0	307.1	-	-	-	-	-	-
45	55.4	77.4	94.5	115.5	131.1	147.6	307.1	-	-	-	-	-	-
50	51.2	71.8	87.5	107.2	121.6	137.0	307.1	-	-	-	-	-	-
55	47.6	67.0	81.6	100.0	113.5	127.8	307.1	-	-	-	-	-	-
60	44.5	62.8	76.4	93.8	106.4	119.8	307.1	-	-	-	-	-	-
120	25.5	36.7	44.1	54.2	61.2	68.8	307.1	-	-	-	-	-	-
180	18.2	26.3	31.4	38.4	43.3	48.5	307.1	-	-	-	-	-	-
240	14.3	20.7	24.5	29.9	33.6	37.6	307.1	-	-	-	-	-	-
300	11.8	17.2	20.2	24.6	27.5	30.7	307.1	-	-	-	-	-	-
360	10.1	14.7	17.2	20.9	23.3	26.0	307.1	-	-	-	-	-	-
480	7.9	11.5	13.3	16.1	17.9	19.9	307.1	-	-	-	-	-	-
600	6.5	9.5	10.9	13.2	14.6	16.2	307.1	-	-	-	-	-	-
720	5.6	8.1	9.3	11.1	12.3	13.6	307.1	-	-	-	-	-	-
1440	3.0	4.4	5.0	5.9	6.4	7.1	307.1	-	-	-	-	-	-

MRM - Storage requirement

A. Input Data (Apply for A <10 ha)

Catchment#	Area [ha] Pre	C (Pre)	Tc [min] (Pre)	Qr [L/s] (Pre)	Area [ha] Post	C (Post)
	Subcatchment Attributes					
R.12-02	1.787	0.79	10.0	773.99	1.835	0.84

CC Factor	100%
Catchment	R.12-02

Volume Based on IDF Data

td [min]	Peak Inflow, Qp [L/s]						Desired Outflow [L/s]	MRM Volume Storage Required, Vstor [m3]					
	2	5	10	25	50	100		2	5	10	25	50	100
10	368.1	470.9	576.1	671.9	756.6	843.9	774.0	-	-	-	-	-	41.96
15	296.5	390.3	478.3	566.7	640.2	716.6	774.0	-	-	-	-	-	-
20	249.3	334.4	409.9	490.8	555.5	623.2	774.0	-	-	-	-	-	-
25	215.7	293.2	359.3	433.3	490.9	551.6	774.0	-	-	-	-	-	-
30	190.6	261.6	320.3	388.1	440.1	495.0	774.0	-	-	-	-	-	-
35	170.9	236.4	289.2	351.8	399.0	449.1	774.0	-	-	-	-	-	-
40	155.2	215.9	263.8	321.8	365.1	411.1	774.0	-	-	-	-	-	-
45	142.2	198.9	242.7	296.7	336.7	379.2	774.0	-	-	-	-	-	-
50	131.4	184.5	224.9	275.4	312.4	351.9	774.0	-	-	-	-	-	-
55	122.2	172.1	209.6	257.0	291.5	328.4	774.0	-	-	-	-	-	-
60	114.3	161.4	196.3	240.9	273.2	307.8	774.0	-	-	-	-	-	-
120	65.6	94.2	113.2	139.2	157.2	176.8	774.0	-	-	-	-	-	-
180	46.8	67.7	80.6	98.7	111.1	124.6	774.0	-	-	-	-	-	-
240	36.7	53.2	62.9	76.9	86.2	96.5	774.0	-	-	-	-	-	-
300	30.4	44.1	51.8	63.1	70.6	78.9	774.0	-	-	-	-	-	-
360	26.0	37.7	44.2	53.6	59.9	66.7	774.0	-	-	-	-	-	-
480	20.3	29.5	34.3	41.4	46.0	51.2	774.0	-	-	-	-	-	-
600	16.7	24.3	28.1	33.8	37.5	41.5	774.0	-	-	-	-	-	-
720	14.3	20.8	23.9	28.6	31.6	35.0	774.0	-	-	-	-	-	-
1440	7.8	11.4	12.8	15.1	16.6	18.2	774.0	-	-	-	-	-	-

MRM - Storage requirement

A. Input Data (Apply for A <10 ha)

Catchment#	Subcatchment Attributes					
	Area [ha] Pre	C (Pre)	Tc [min] (Pre)	Qr [L/s] (Pre)	Area [ha] Post	C (Post)
R.13-01	1.324	0.82	10.0	591.77	1.456	0.86

CC Factor	100%
Catchment	R.13-01

Volume Based on IDF Data

td [min]	Peak Inflow, Qp [L/s]						Desired Outflow [L/s]	MRM Volume Storage Required, Vstor [m3]					
	2	5	10	25	50	100		2	5	10	25	50	100
10	297.7	381.0	466.0	543.5	612.0	682.7	591.8	-	-	-	-	12.13	54.53
15	239.8	315.8	386.9	458.4	517.9	579.7	591.8	-	-	-	-	-	-
20	201.7	270.5	331.6	397.0	449.3	504.1	591.8	-	-	-	-	-	-
25	174.5	237.2	290.7	350.5	397.1	446.2	591.8	-	-	-	-	-	-
30	154.1	211.6	259.1	314.0	356.0	400.4	591.8	-	-	-	-	-	-
35	138.3	191.2	233.9	284.6	322.8	363.3	591.8	-	-	-	-	-	-
40	125.5	174.7	213.4	260.3	295.4	332.6	591.8	-	-	-	-	-	-
45	115.1	160.9	196.3	240.0	272.3	306.7	591.8	-	-	-	-	-	-
50	106.3	149.2	181.9	222.8	252.7	284.7	591.8	-	-	-	-	-	-
55	98.9	139.2	169.5	207.9	235.8	265.6	591.8	-	-	-	-	-	-
60	92.4	130.6	158.8	194.9	221.0	249.0	591.8	-	-	-	-	-	-
120	53.1	76.2	91.6	112.6	127.2	143.0	591.8	-	-	-	-	-	-
180	37.9	54.7	65.2	79.9	89.9	100.8	591.8	-	-	-	-	-	-
240	29.7	43.0	50.9	62.2	69.8	78.1	591.8	-	-	-	-	-	-
300	24.6	35.7	41.9	51.1	57.1	63.8	591.8	-	-	-	-	-	-
360	21.0	30.5	35.7	43.4	48.4	54.0	591.8	-	-	-	-	-	-
480	16.4	23.9	27.7	33.5	37.2	41.4	591.8	-	-	-	-	-	-
600	13.5	19.7	22.7	27.3	30.3	33.6	591.8	-	-	-	-	-	-
720	11.6	16.8	19.3	23.1	25.6	28.3	591.8	-	-	-	-	-	-
1440	6.3	9.2	10.4	12.2	13.4	14.7	591.8	-	-	-	-	-	-

MRM - Storage requirement

A. Input Data (Apply for A <10 ha)

Catchment#	Subcatchment Attributes					
	Area [ha] Pre	C (Pre)	Tc [min] (Pre)	Qr [L/s] (Pre)	Area [ha] Post	C (Post)
R.13-02	0.282	0.82	10.0	126.75	0.339	0.82

CC Factor	100%
Catchment	R.13-02

Volume Based on IDF Data

td [min]	Peak Inflow, Qp [L/s]						Desired Outflow [L/s]	MRM Volume Storage Required, Vstor [m3]					
	2	5	10	25	50	100		2	5	10	25	50	100
10	66.5	85.1	104.0	121.3	136.6	152.4	126.8	-	-	-	-	5.93	15.40
15	53.5	70.5	86.4	102.4	115.6	129.4	126.8	-	-	-	-	-	2.40
20	45.0	60.4	74.0	88.6	100.3	112.5	126.8	-	-	-	-	-	-
25	39.0	53.0	64.9	78.2	88.7	99.6	126.8	-	-	-	-	-	-
30	34.4	47.2	57.8	70.1	79.5	89.4	126.8	-	-	-	-	-	-
35	30.9	42.7	52.2	63.5	72.1	81.1	126.8	-	-	-	-	-	-
40	28.0	39.0	47.6	58.1	65.9	74.3	126.8	-	-	-	-	-	-
45	25.7	35.9	43.8	53.6	60.8	68.5	126.8	-	-	-	-	-	-
50	23.7	33.3	40.6	49.7	56.4	63.6	126.8	-	-	-	-	-	-
55	22.1	31.1	37.8	46.4	52.6	59.3	126.8	-	-	-	-	-	-
60	20.6	29.2	35.5	43.5	49.3	55.6	126.8	-	-	-	-	-	-
120	11.8	17.0	20.4	25.1	28.4	31.9	126.8	-	-	-	-	-	-
180	8.5	12.2	14.6	17.8	20.1	22.5	126.8	-	-	-	-	-	-
240	6.6	9.6	11.4	13.9	15.6	17.4	126.8	-	-	-	-	-	-
300	5.5	8.0	9.4	11.4	12.8	14.2	126.8	-	-	-	-	-	-
360	4.7	6.8	8.0	9.7	10.8	12.1	126.8	-	-	-	-	-	-
480	3.7	5.3	6.2	7.5	8.3	9.2	126.8	-	-	-	-	-	-
600	3.0	4.4	5.1	6.1	6.8	7.5	126.8	-	-	-	-	-	-
720	2.6	3.8	4.3	5.2	5.7	6.3	126.8	-	-	-	-	-	-
1440	1.4	2.1	2.3	2.7	3.0	3.3	126.8	-	-	-	-	-	-

Appendix G

Preliminary Sizing of Underground Chambers

PROJECT INFORMATION	
ENGINEERED PRODUCT MANAGER:	HAIDER NASRULLAH 647-850-9417 HAIDER.NASRULLAH@ADS-PIPE.COM
ADS SALES REP:	HASSAN ELMI 416-985-9757 HASSAN.ELMI@ADS-PIPE.COM
PROJECT NO:	S237433
ADS SITE COORDINATOR:	MATTHEW BEGHIN 519-710-3687 MATTHEW.BEGHIN@ADS-PIPE.COM

Advanced Drainage Systems, Inc.

FOR STORMTECH INSTRUCTIONS, DOWNLOAD THE INSTALLATION APP

WINSTON CHURCHILL BLVD. WIDENING

MISSISSAUGA, ON.

SC-740 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH SC-740.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBERS SHALL BE CERTIFIED TO CSA B184, "POLYMERIC SUB-SURFACE STORMWATER MANAGEMENT STRUCTURES", AND MEET THE REQUIREMENTS OF ASTM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE CSA S6 CL-625 TRUCK AND THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 50 mm (2").
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 550 LBS/IN/IN. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 23° C / 73° F), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
   - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
   - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
   - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2418 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF THE SC-740 SYSTEM

1. STORMTECH SC-740 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH SC-740 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR AN EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM - 150 mm (6") SPACING BETWEEN THE CHAMBER ROWS.
7. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE 20-50 mm (3/4-2").
8. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIALS BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
9. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH SC-740 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
2. THE USE OF CONSTRUCTION EQUIPMENT OVER SC-740 CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADERS, DUMP TRUCKS, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
3. FULL 900 mm (36") OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO THE CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.

CONTACT STORMTECH AT 1-888-892-2694 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

SiteASSIST™ by StormTech

FOR STORMTECH INSTRUCTIONS, DOWNLOAD THE INSTALLATION APP

SC-310 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH SC-310.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE OR POLYETHYLENE COPOLYMERS.
3. CHAMBERS SHALL BE CERTIFIED TO CSA B184, "POLYMERIC SUB-SURFACE STORMWATER MANAGEMENT STRUCTURES", AND MEET THE REQUIREMENTS OF ASTM F2922 (POLETHYLENE) OR ASTM F2418-16a (POLYPROPYLENE), "STANDARD SPECIFICATION FOR CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE CSA S6 CL-625 TRUCK AND THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 50 mm (2").
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2922 SHALL BE GREATER THAN OR EQUAL TO 400 LBS/IN/IN. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 23° C / 73° F), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
   - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
   - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
   - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2922 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF THE SC-310 SYSTEM

1. STORMTECH SC-310 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH SC-310 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR AN EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM - 150 mm (6") SPACING BETWEEN THE CHAMBER ROWS.
7. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE 20-50 mm (3/4-2").
8. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIALS BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
9. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH SC-310 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
2. THE USE OF CONSTRUCTION EQUIPMENT OVER SC-310 & SC-740 CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADERS, DUMP TRUCKS, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
3. FULL 900 mm (36") OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO THE CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.

CONTACT STORMTECH AT 1-888-892-2694 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

FOR STORMTECH INSTRUCTIONS, DOWNLOAD THE INSTALLATION APP

MC-3500 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH MC-3500.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBERS SHALL BE CERTIFIED TO CSA B184, "POLYMERIC SUB-SURFACE STORMWATER MANAGEMENT STRUCTURES", AND MEET THE REQUIREMENTS OF ASTM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 45x76 DESIGNATION SS.
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE CSA S6 CL-625 TRUCK AND THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 75 mm (3").
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 450 LBS/IN/IN. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 23° C / 73° F), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
   - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
   - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
   - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2418 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF MC-3500 CHAMBER SYSTEM

1. STORMTECH MC-3500 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH MC-3500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR AN EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM - 150 mm (6") SPACING BETWEEN THE CHAMBER ROWS.
7. INLET AND OUTLET MANIFOLDS MUST BE INSERTED A MINIMUM OF 300 mm (12") INTO CHAMBER END CAPS.
8. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE WELL GRADED BETWEEN ¾" AND 2" (20-50 mm).
9. STONE MUST BE PLACED ON THE TOP CENTER OF THE CHAMBER TO ANCHOR THE CHAMBERS IN PLACE AND PRESERVE ROW SPACING.
10. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIALS BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
11. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH MC-3500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
2. THE USE OF EQUIPMENT OVER MC-3500 CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADER, DUMP TRUCK, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. FULL 900 mm (36") OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY USING THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.

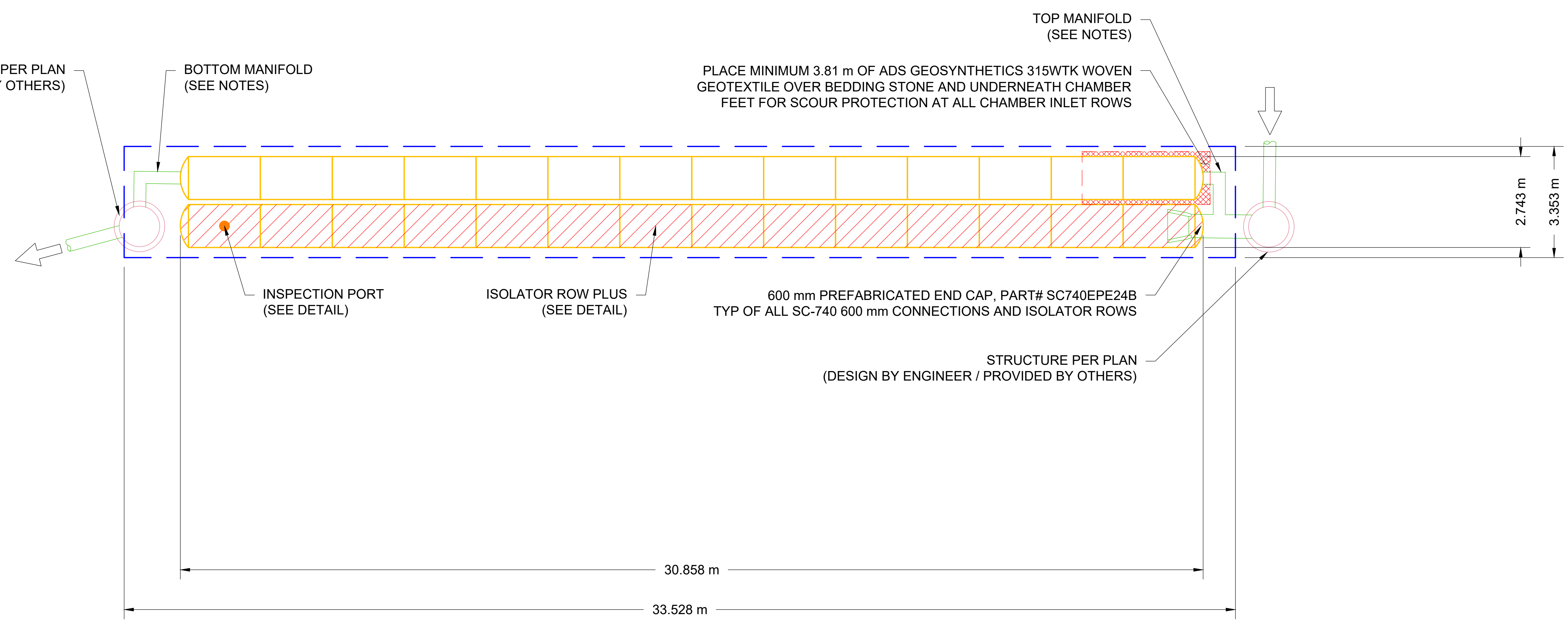
CONTACT STORMTECH AT 1-888-892-2694 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

PROPOSED LAYOUT - SYSTEM R2.01

28	STORMTECH SC-740 CHAMBERS
4	STORMTECH SC-740 END CAPS
152	STONE ABOVE (mm)
152	STONE BELOW (mm)
40	% STONE VOID
69.8	**INSTALLED SYSTEM VOLUME (m³) (PERIMETER STONE INCLUDED)**
112.4	SYSTEM AREA (m²)
73.7	SYSTEM PERIMETER (m)

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECHNICAL NOTE 6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION:** THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.



WINSTON CHURCHILL BLVD. WIDENING
MISSISSAUGA, ON.

DATE: 05/05/21 | DRAWN: RCT
PROJECT #: S237433 | CHECKED: JMQ

DATE	DRWN	CHKD	DESCRIPTION

StormTech® Detention • Retention • Water Quality
520 CROMWELL AVENUE | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026

SCALE = 1 : 150

SHEET 2 OF 28

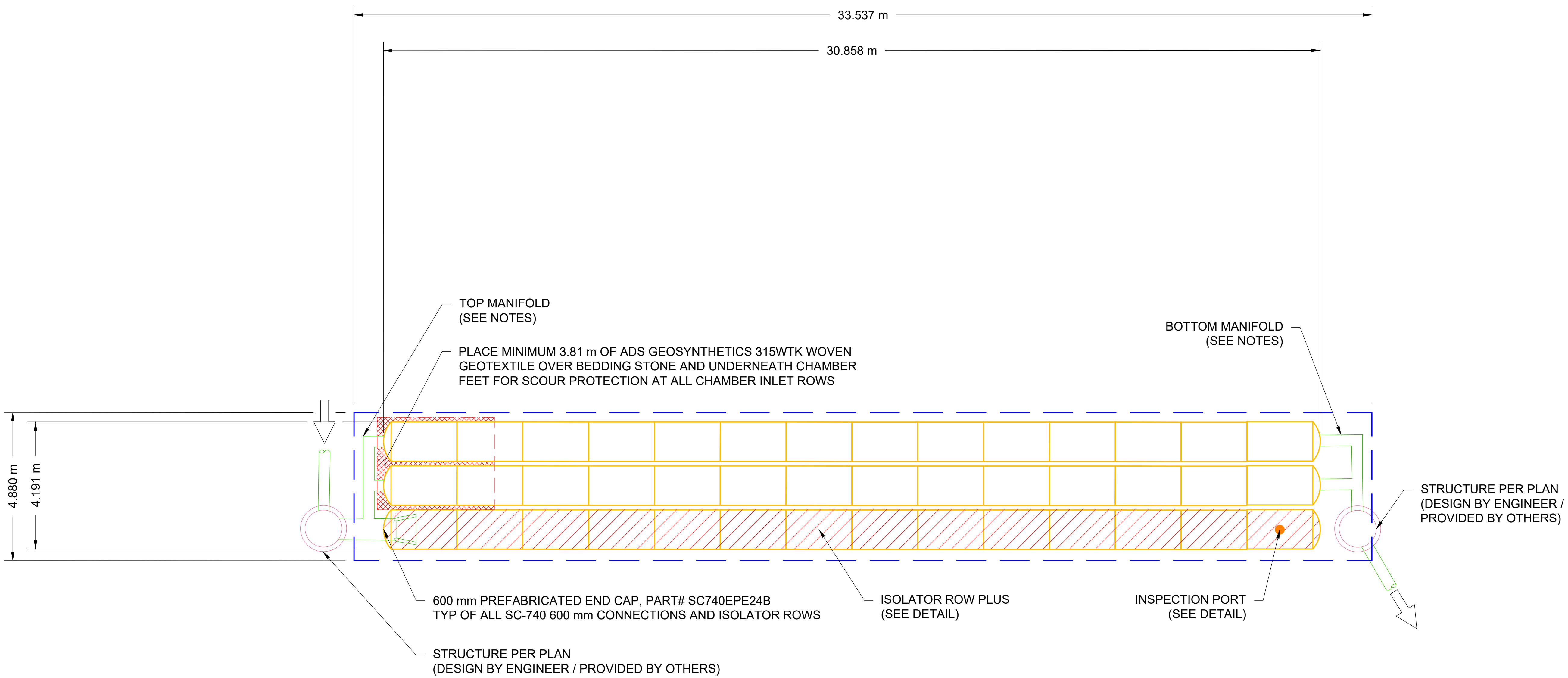
THIS DRAWING HAS BEEN PREPARED BASED ON INFORMATION PROVIDED TO ADS UNDER THE DIRECTION OF THE SITE DESIGN ENGINEER OR OTHER PROJECT REPRESENTATIVE. THE SITE DESIGN ENGINEER SHALL REVIEW THIS DRAWING PRIOR TO CONSTRUCTION. IT IS THE ULTIMATE RESPONSIBILITY OF THE SITE DESIGN ENGINEER TO ENSURE THAT THE PRODUCT(S) DEPICTED AND ALL ASSOCIATED DETAILS MEET ALL APPLICABLE LAWS, REGULATIONS, AND PROJECT REQUIREMENTS.

PROPOSED LAYOUT - SYSTEM R2.02

42	STORMTECH SC-740 CHAMBERS
6	STORMTECH SC-740 END CAPS
152	STONE ABOVE (mm)
152	STONE BELOW (mm)
40	% STONE VOID
102.5	**INSTALLED SYSTEM VOLUME (m^3) (PERIMETER STONE INCLUDED)**
163.6	SYSTEM AREA (m^2)
76.8	SYSTEM PERIMETER (m)

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECHNICAL NOTE 6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION**: THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.



WINSTON CHURCHILL BLVD. WIDENING
MISSISSAUGA, ON.

DATE: 05/05/21 DRAWN: RCT
PROJECT #: S237433 CHECKED: JMQ

DATE	DRWN	CHKD	DESCRIPTION

StormTech® Detention • Retention • Water Quality
520 CROMWELL AVENUE | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026

SCALE = 1 : 150

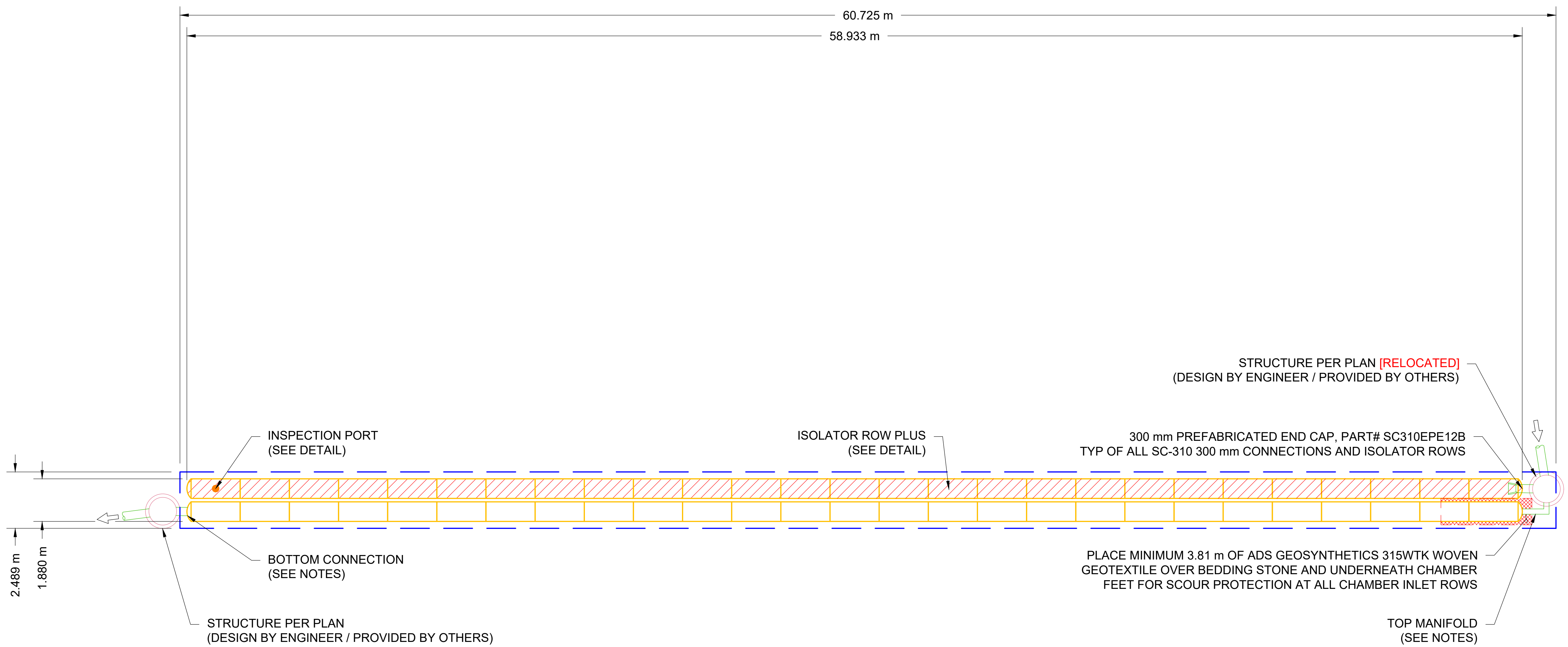
SHEET 3 OF 28

PROPOSED LAYOUT - SYSTEM R4.01

54	STORMTECH SC-310 CHAMBERS
4	STORMTECH SC-310 END CAPS
152	STONE ABOVE (mm)
152	STONE BELOW (mm)
40	% STONE VOID
56.5	**INSTALLED SYSTEM VOLUME (m³) (PERIMETER STONE INCLUDED)**
151.1	SYSTEM AREA (m²)
126.4	SYSTEM PERIMETER (m)

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECHNICAL NOTE 6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION**: THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.



WINSTON CHURCHILL BLVD. WIDENING
MISSISSAUGA, ON.

DATE: 05/05/21 DRAWN: RCT
PROJECT #: S237433 CHECKED: JMQ

DATE	DRWN	CHKD	DESCRIPTION

StormTech® Detention•Retention•Water Quality
520 CROMWELL AVENUE | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026

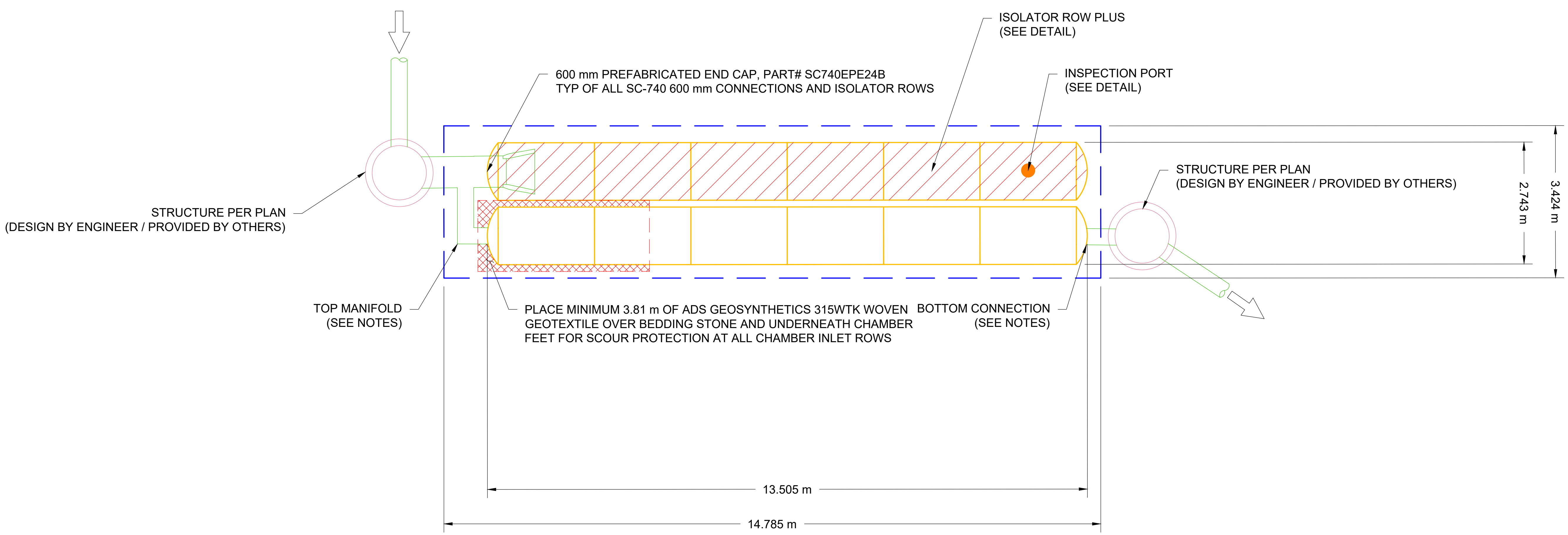
SCALE = 1 : 200

PROPOSED LAYOUT - SYSTEM R4.02

12	STORMTECH SC-740 CHAMBERS
4	STORMTECH SC-740 END CAPS
152	STONE ABOVE (mm)
152	STONE BELOW (mm)
40	% STONE VOID
30.9	**INSTALLED SYSTEM VOLUME (m³) (PERIMETER STONE INCLUDED)**
50.6	SYSTEM AREA (m²)
36.4	SYSTEM PERIMETER (m)

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECHNICAL NOTE 6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION:** THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.



WINSTON CHURCHILL BLVD. WIDENING
MISSISSAUGA, ON.

DATE:	05/05/21	DRAWN:	RCT
PROJECT #:	S237433	CHECKED:	JMQ

DATE	DRWN	CHKD	DESCRIPTION

StormTech
Detention • Retention • Water Quality
520 CROMWELL AVENUE | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026

SCALE = 1 : 100

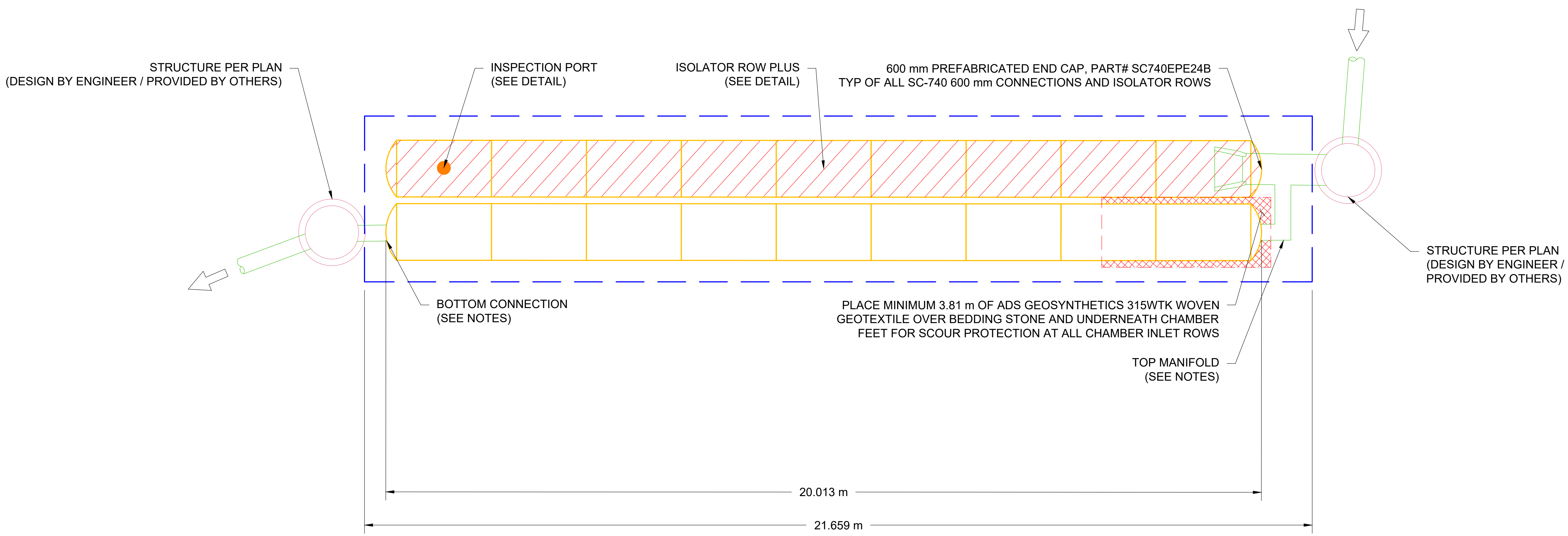
SHEET 5 OF 28

PROPOSED LAYOUT - SYSTEM R5.01

18	STORMTECH SC-740 CHAMBERS
4	STORMTECH SC-740 END CAPS
152	STONE ABOVE (mm)
152	STONE BELOW (mm)
40	% STONE VOID
49.0	**INSTALLED SYSTEM VOLUME (m³) (PERIMETER STONE INCLUDED)**
82.0	SYSTEM AREA (m²)
50.8	SYSTEM PERIMETER (m)

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECHNICAL NOTE 6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION:** THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.



WINSTON CHURCHILL BLVD. WIDENING
MISSISSAUGA, ON.

DATE: 05/05/21 DRAWN: RCT
PROJECT #: S237433 CHECKED: JMQ

DATE	DRWN	CHKD	DESCRIPTION

StormTech
Detention • Retention • Water Quality
520 CROMWELL AVENUE | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026

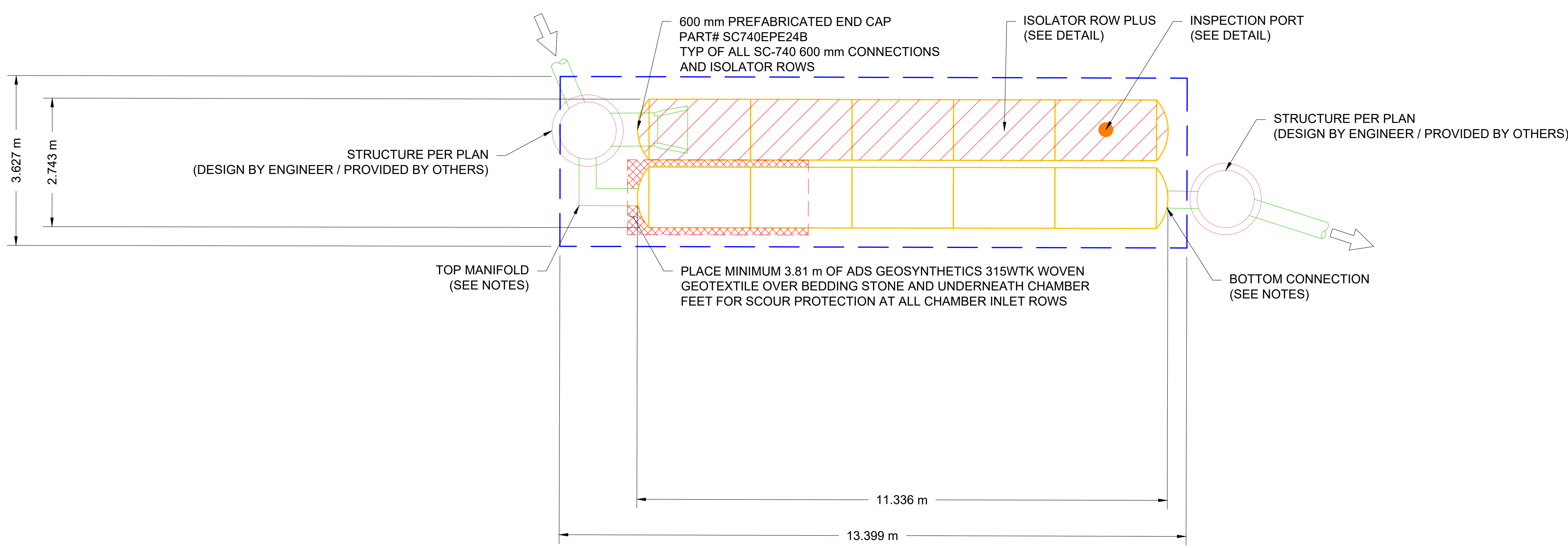
SCALE = 1 : 100

PROPOSED LAYOUT - SYSTEM R5.02

10	STORMTECH SC-740 CHAMBERS
4	STORMTECH SC-740 END CAPS
152	STONE ABOVE (mm)
152	STONE BELOW (mm)
40	% STONE VOID
28.5	**INSTALLED SYSTEM VOLUME (m³) (PERIMETER STONE INCLUDED)**
48.5	SYSTEM AREA (m²)
34.0	SYSTEM PERIMETER (m)

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECHNICAL NOTE 6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION:** THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.



WINSTON CHURCHILL BLVD. WIDENING
MISSISSAUGA, ON.

DATE: 05/05/21
DRAWN: RCT
PROJECT #: S237433
CHECKED: JMQ

DATE	DRWN	CHKD	DESCRIPTION

StormTech®
Detention • Retention • Water Quality
520 CROMWELL AVENUE | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026

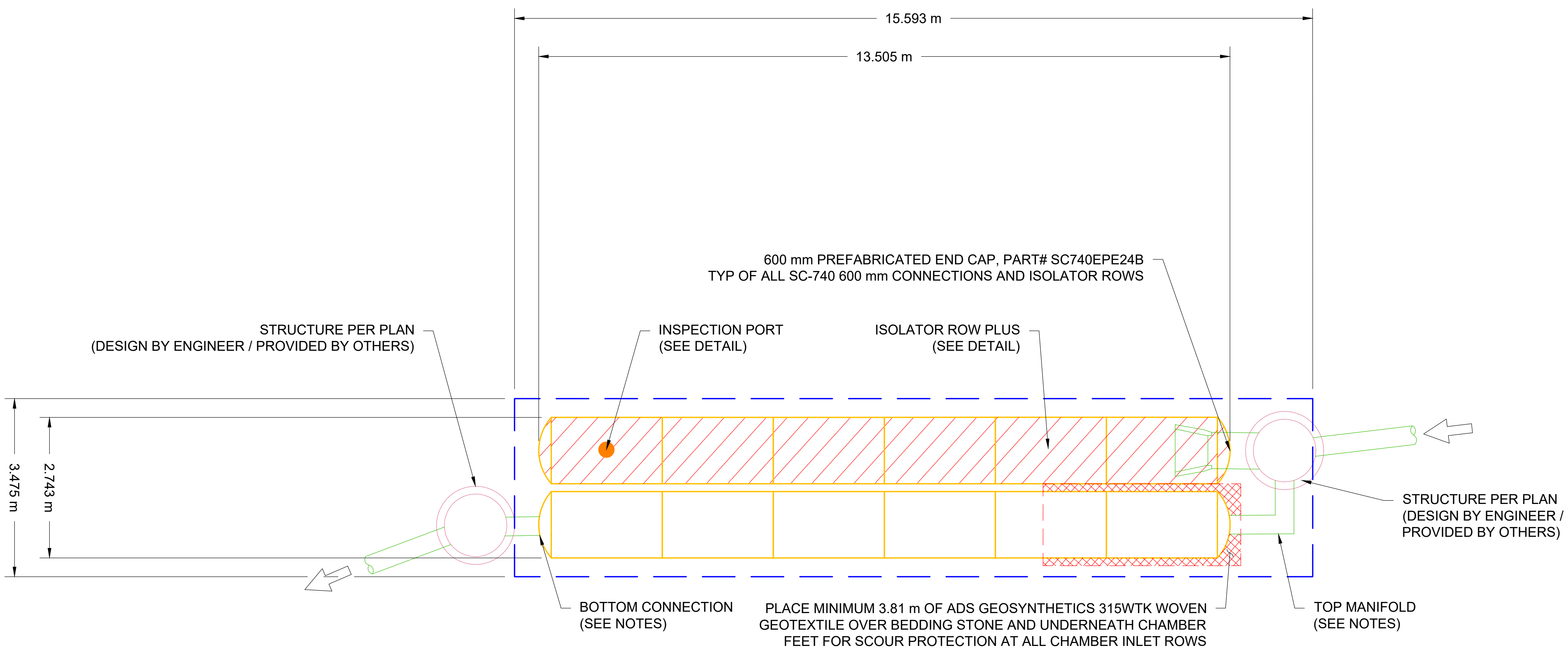
SCALE = 1 : 100

PROPOSED LAYOUT - SYSTEM R6.01

12	STORMTECH SC-740 CHAMBERS
4	STORMTECH SC-740 END CAPS
152	STONE ABOVE (mm)
152	STONE BELOW (mm)
40	% STONE VOID
32.4	**INSTALLED SYSTEM VOLUME (m³) (PERIMETER STONE INCLUDED)**
54.1	SYSTEM AREA (m²)
38.1	SYSTEM PERIMETER (m)

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECHNICAL NOTE 6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION**: THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.



WINSTON CHURCHILL BLVD. WIDENING
MISSISSAUGA, ON.

DATE: 05/05/21 DRAWN: RCT
PROJECT #: S237433 CHECKED: JMQ

DATE	DRWN	CHKD	DESCRIPTION

StormTech
Detention • Retention • Water Quality
520 CROMWELL AVENUE | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026

SCALE = 1 : 100

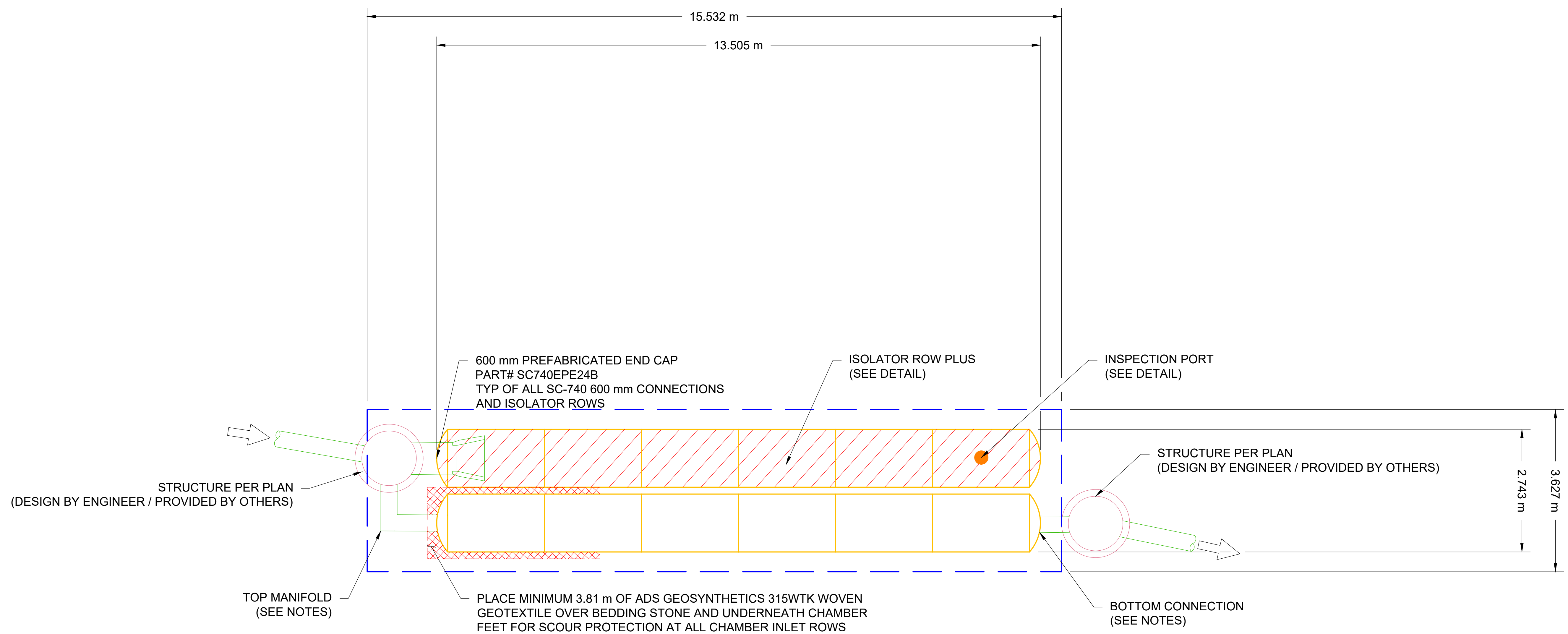
SHEET 8 OF 28

PROPOSED LAYOUT - SYSTEM R6.02

12	STORMTECH SC-740 CHAMBERS
4	STORMTECH SC-740 END CAPS
152	STONE ABOVE (mm)
152	STONE BELOW (mm)
40	% STONE VOID
33.4	**INSTALLED SYSTEM VOLUME (m³) (PERIMETER STONE INCLUDED)**
56.3	SYSTEM AREA (m²)
38.3	SYSTEM PERIMETER (m)

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECHNICAL NOTE 6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION:** THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.



WINSTON CHURCHILL BLVD. WIDENING
MISSISSAUGA, ON.

DATE: 05/05/21 DRAWN: RCT
PROJECT #: S237433 CHECKED: JMQ

DATE	DRWN	CHKD	DESCRIPTION

StormTech
Detention•Retention•Water Quality
520 CROMWELL AVENUE | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026

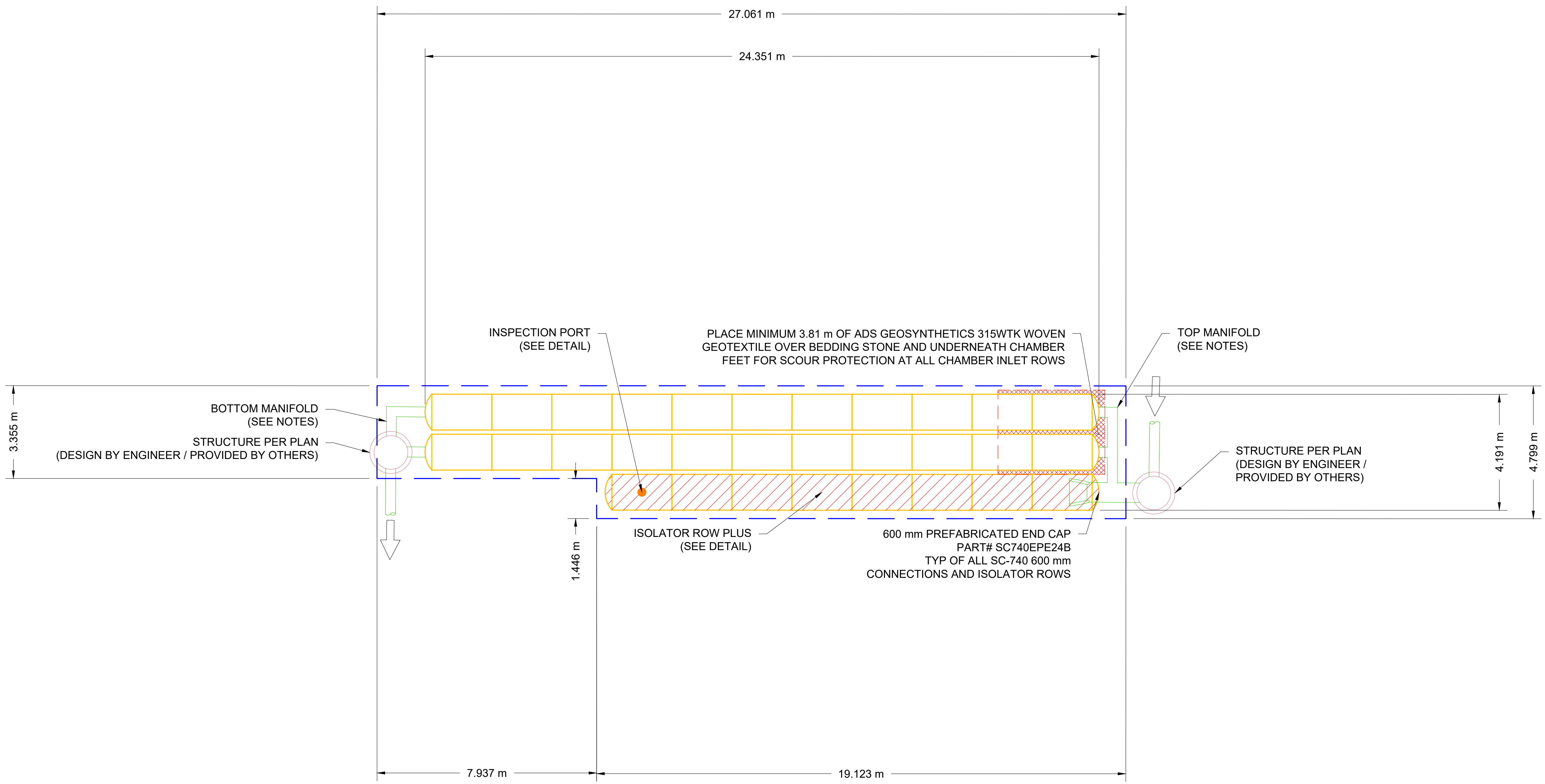
SCALE = 1 : 100

PROPOSED LAYOUT - SYSTEM R8.01

30	STORMTECH SC-740 CHAMBERS
6	STORMTECH SC-740 END CAPS
305	STONE ABOVE (mm)
250	STONE BELOW (mm)
40	% STONE VOID
85.7	**INSTALLED SYSTEM VOLUME (m^3) (PERIMETER STONE INCLUDED)**
118.3	SYSTEM AREA (m^2)
63.7	SYSTEM PERIMETER (m)

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECHNICAL NOTE 6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION:** THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.



WINSTON CHURCHILL BLVD. WIDENING
MISSISSAUGA, ON.

DATE: 05/05/21 | DRAWN: RCT
PROJECT #: S237433 | CHECKED: JMQ

DATE	DRWN	CHKD	DESCRIPTION

StormTech® Detention • Retention • Water Quality
520 CROMWELL AVENUE | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026

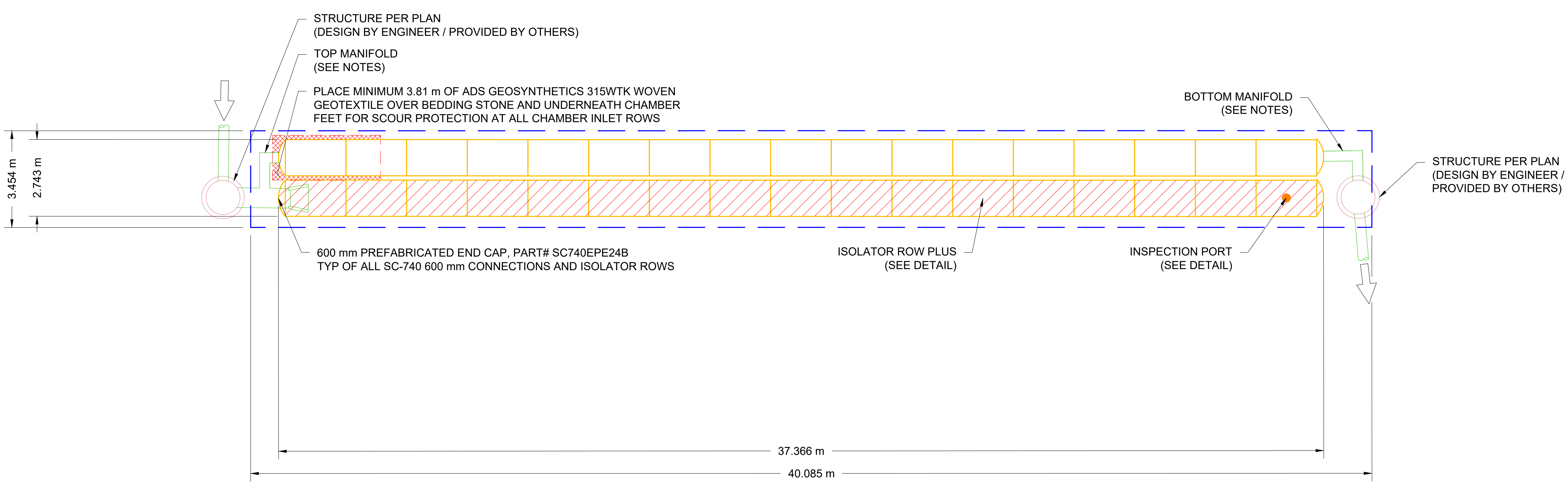
SCALE = 1 : 150

PROPOSED LAYOUT - SYSTEM R8.02

34	STORMTECH SC-740 CHAMBERS
4	STORMTECH SC-740 END CAPS
305	STONE ABOVE (mm)
305	STONE BELOW (mm)
40	% STONE VOID
102.5	**INSTALLED SYSTEM VOLUME (m³) (PERIMETER STONE INCLUDED)**
138.4	SYSTEM AREA (m²)
87.0	SYSTEM PERIMETER (m)

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECHNICAL NOTE 6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION**: THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.



WINSTON CHURCHILL BLVD. WIDENING
MISSISSAUGA, ON.

DATE: 05/05/21 DRAWN: RCT
PROJECT #: S237433 CHECKED: JMQ

DATE	DRWN	CHKD	DESCRIPTION

StormTech® Detention • Retention • Water Quality

520 CROMWELL AVENUE | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

ADS®
4640 TRUEMAN BLVD
HILLIARD, OH 43026

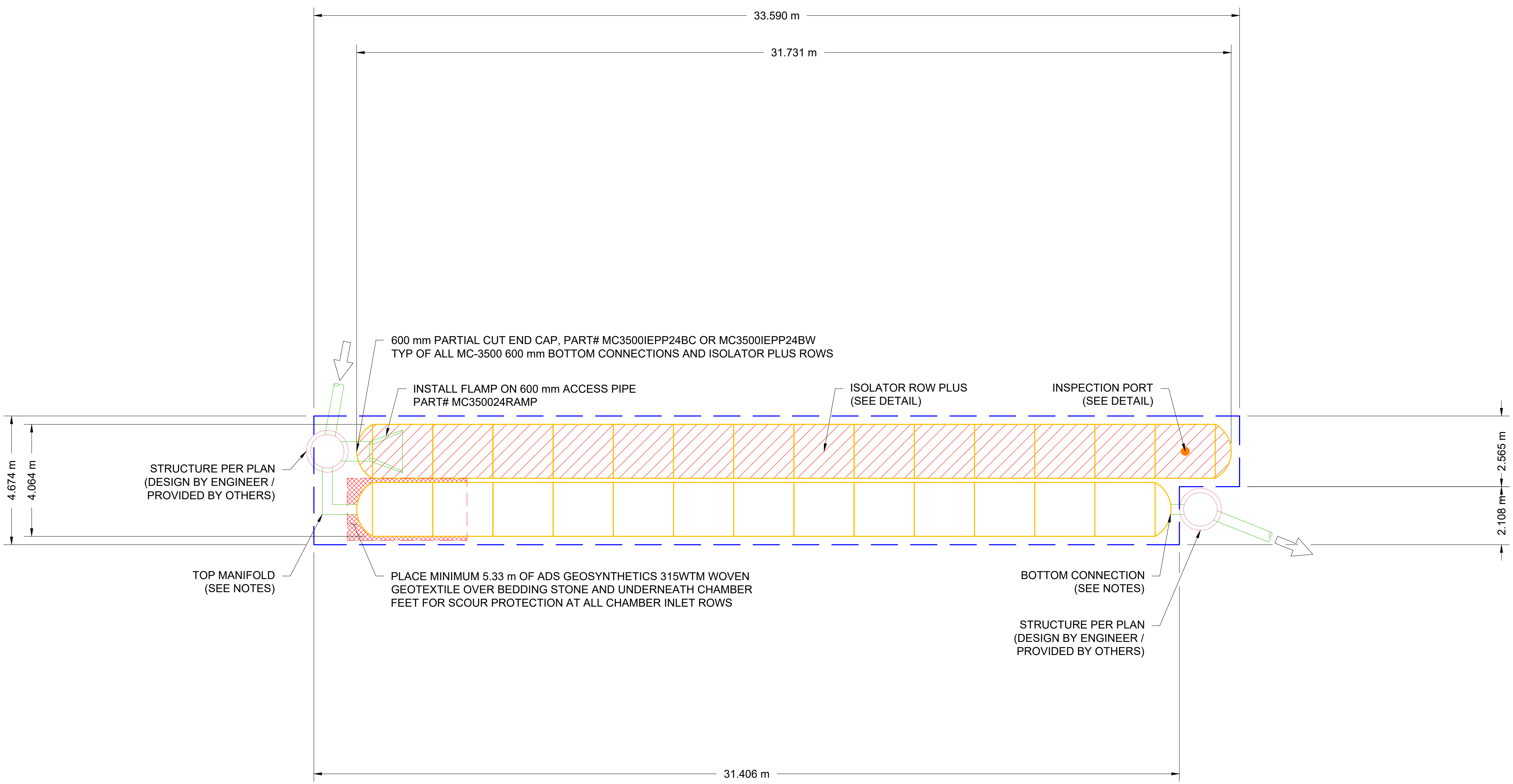
SCALE = 1 : 150

PROPOSED LAYOUT - R10.01

27	STORMTECH MC-3500 CHAMBERS
4	STORMTECH MC-3500 END CAPS
305	STONE ABOVE (mm)
229	STONE BELOW (mm)
40	% STONE VOID
153.6	**INSTALLED SYSTEM VOLUME (m³) (PERIMETER STONE INCLUDED)**
152.3	SYSTEM AREA (m²)
76.5	SYSTEM PERIMETER (m)

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECHNICAL NOTE 6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION**: THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.



WINSTON CHURCHILL BLVD. WIDENING
MISSISSAUGA, ON.

DATE: 05/05/21 DRAWN: RCT
PROJECT #: S237433 CHECKED: JMQ

DATE	DRWN	CHKD	DESCRIPTION

StormTech® Detention•Retention•Water Quality
520 CROMWELL AVENUE | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026

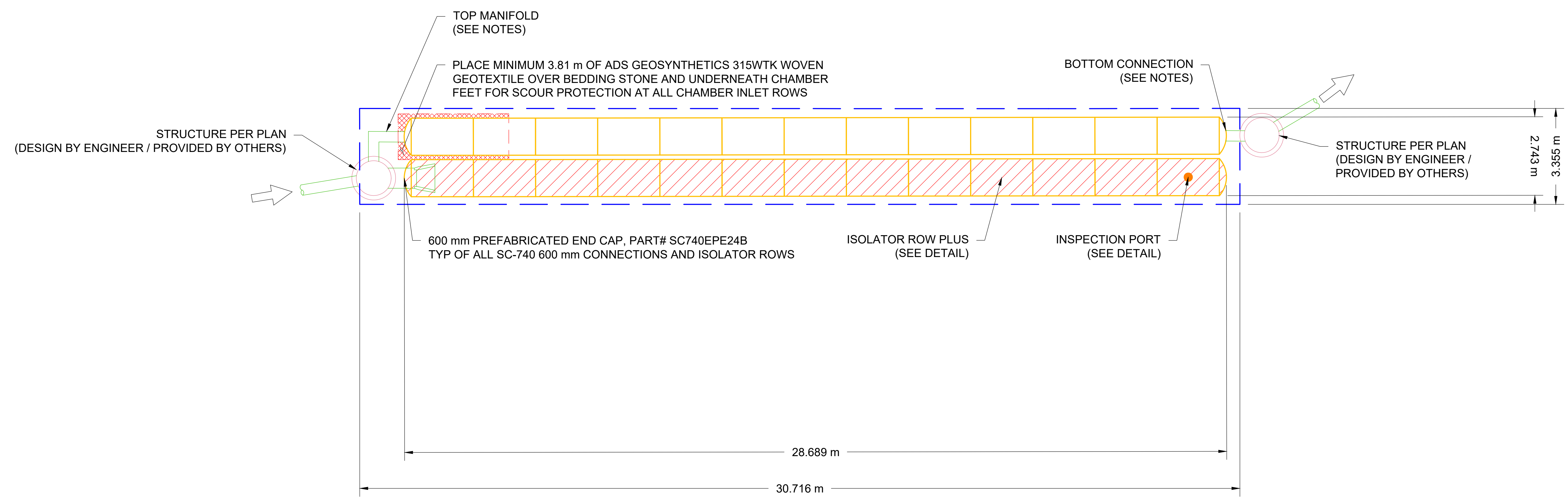
SCALE = 1 : 150

PROPOSED LAYOUT - SYSTEM C10.01

26	STORMTECH SC-740 CHAMBERS
4	STORMTECH SC-740 END CAPS
305	STONE ABOVE (mm)
250	STONE BELOW (mm)
40	% STONE VOID
85.5	**INSTALLED SYSTEM VOLUME (m^3) (PERIMETER STONE INCLUDED)**
102.8	SYSTEM AREA (m^2)
68.1	SYSTEM PERIMETER (m)

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECHNICAL NOTE 6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION**: THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.



WINSTON CHURCHILL BLVD. WIDENING
MISSISSAUGA, ON.

DATE: 05/05/21 DRAWN: RCT
PROJECT #: S237433 CHECKED: JMQ

DATE	DRWN	CHKD	DESCRIPTION

StormTech® Detention • Retention • Water Quality
520 CROMWELL AVENUE | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026

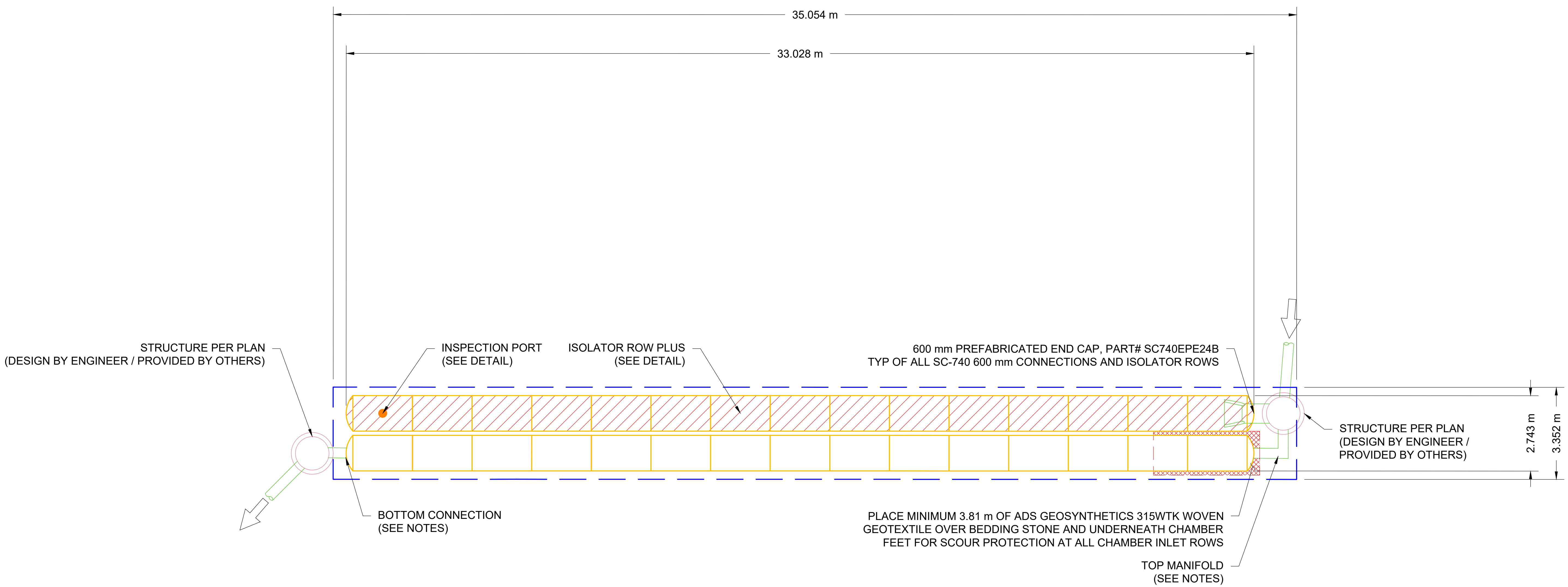
SCALE = 1 : 150

PROPOSED LAYOUT - SYSTEM R10.02

30	STORMTECH SC-740 CHAMBERS
4	STORMTECH SC-740 END CAPS
305	STONE ABOVE (mm)
250	STONE BELOW (mm)
40	% STONE VOID
85.5	**INSTALLED SYSTEM VOLUME (m³) (PERIMETER STONE INCLUDED)**
117.5	SYSTEM AREA (m²)
76.8	SYSTEM PERIMETER (m)

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECHNICAL NOTE 6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION:** THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.



WINSTON CHURCHILL BLVD. WIDENING
MISSISSAUGA, ON.

DATE: 05/05/21 DRAWN: RCT
PROJECT #: S237433 CHECKED: JMQ

DATE	DRWN	CHKD	DESCRIPTION

StormTech® Detention • Retention • Water Quality
520 CROMWELL AVENUE | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026

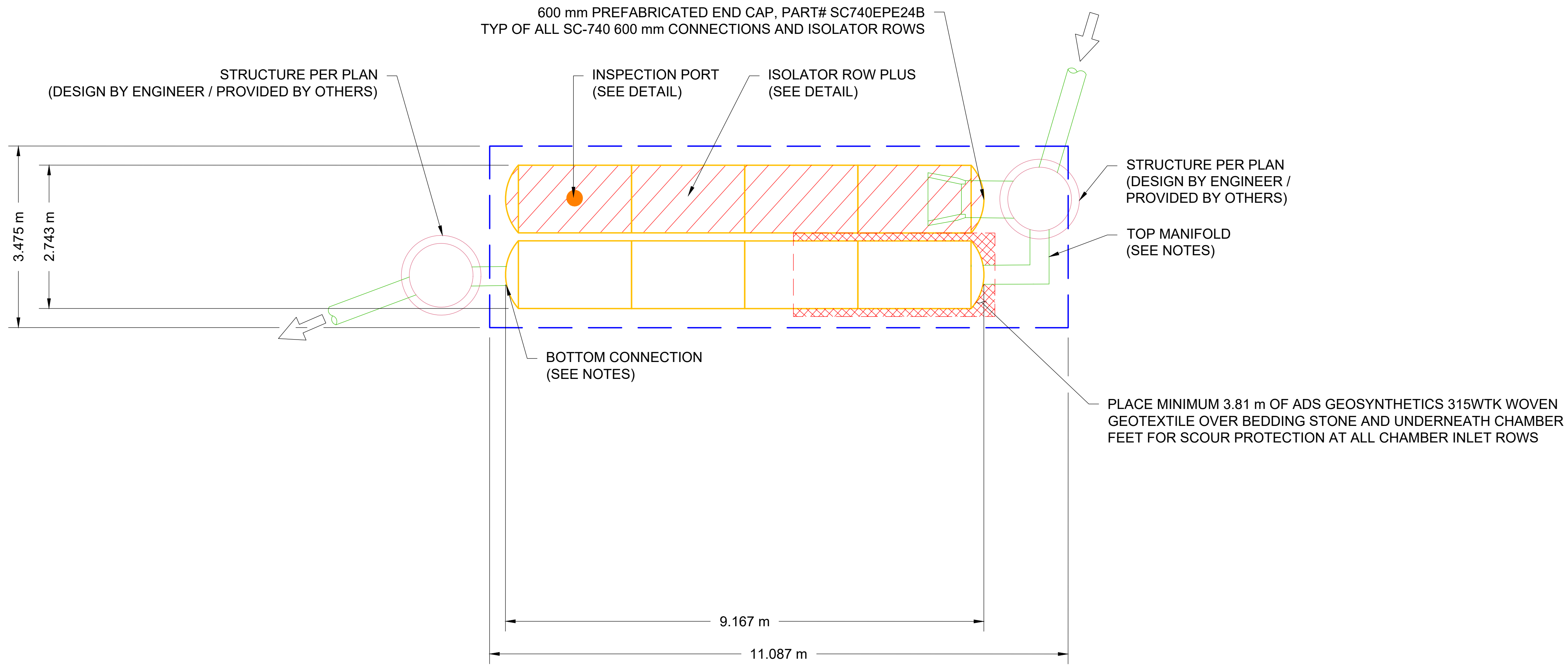
SCALE = 1 : 150

PROPOSED LAYOUT - SYSTEM R11.01

8	STORMTECH SC-740 CHAMBERS
4	STORMTECH SC-740 END CAPS
152	STONE ABOVE (mm)
152	STONE BELOW (mm)
40	% STONE VOID
22.7	**INSTALLED SYSTEM VOLUME (m^3) (PERIMETER STONE INCLUDED)**
38.5	SYSTEM AREA (m^2)
29.1	SYSTEM PERIMETER (m)

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECHNICAL NOTE 6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION:** THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.



WINSTON CHURCHILL BLVD. WIDENING
MISSISSAUGA, ON.

DATE: 05/05/21 DRAWN: RCT
PROJECT #: S237433 CHECKED: JMQ

DATE	DRWN	CHKD	DESCRIPTION

StormTech
Detention • Retention • Water Quality
520 CROMWELL AVENUE | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026

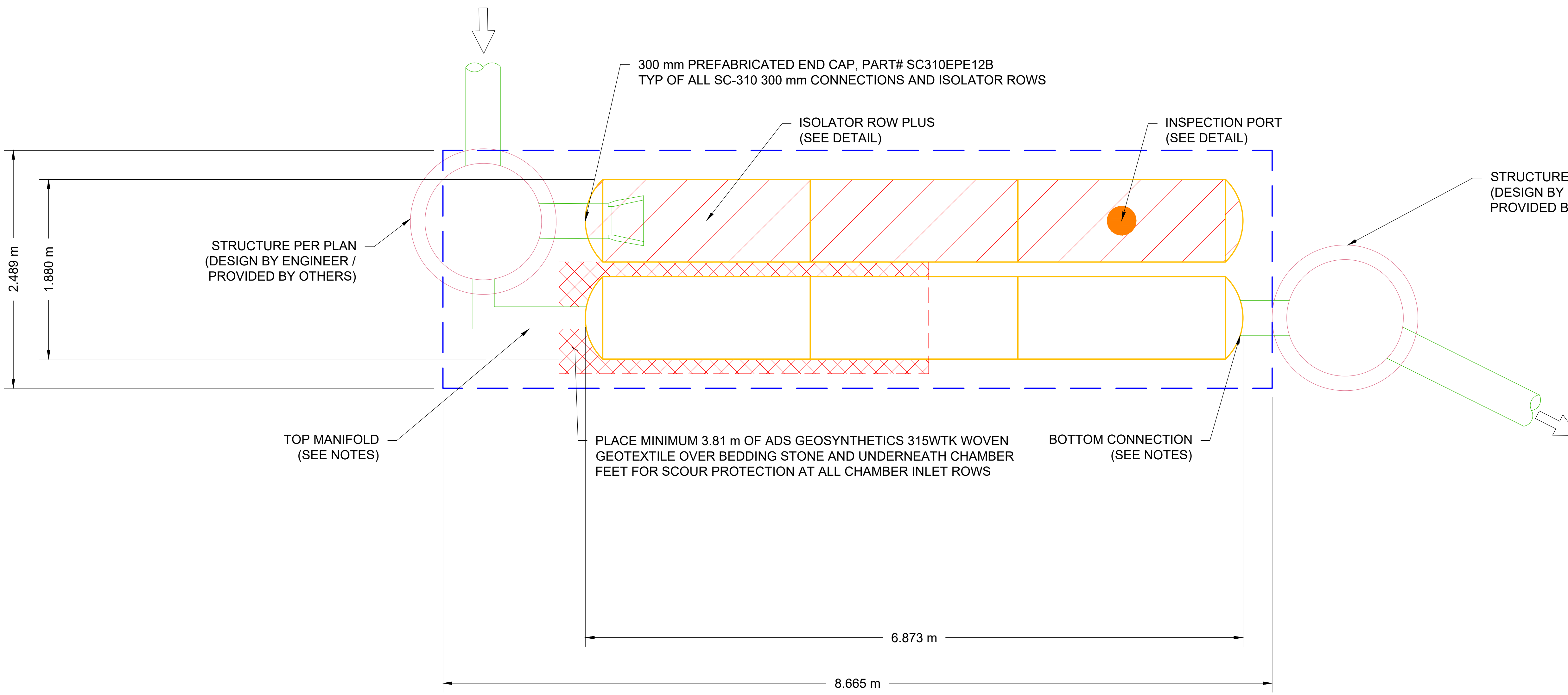
SCALE = 1 : 100

PROPOSED LAYOUT - SYSTEM R11.02

6	STORMTECH SC-310 CHAMBERS
4	STORMTECH SC-310 END CAPS
152	STONE ABOVE (mm)
152	STONE BELOW (mm)
40	% STONE VOID
7.6	**INSTALLED SYSTEM VOLUME (m³) (PERIMETER STONE INCLUDED)**
21.5	SYSTEM AREA (m²)
22.3	SYSTEM PERIMETER (m)

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECHNICAL NOTE 6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION**: THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.



WINSTON CHURCHILL BLVD. WIDENING
MISSISSAUGA, ON.

DATE: 05/05/21 | DRAWN: RCT
PROJECT #: S237433 | CHECKED: JMQ

DATE	DRWN	CHKD	DESCRIPTION

StormTech® Detention • Retention • Water Quality
520 CROMWELL AVENUE | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026

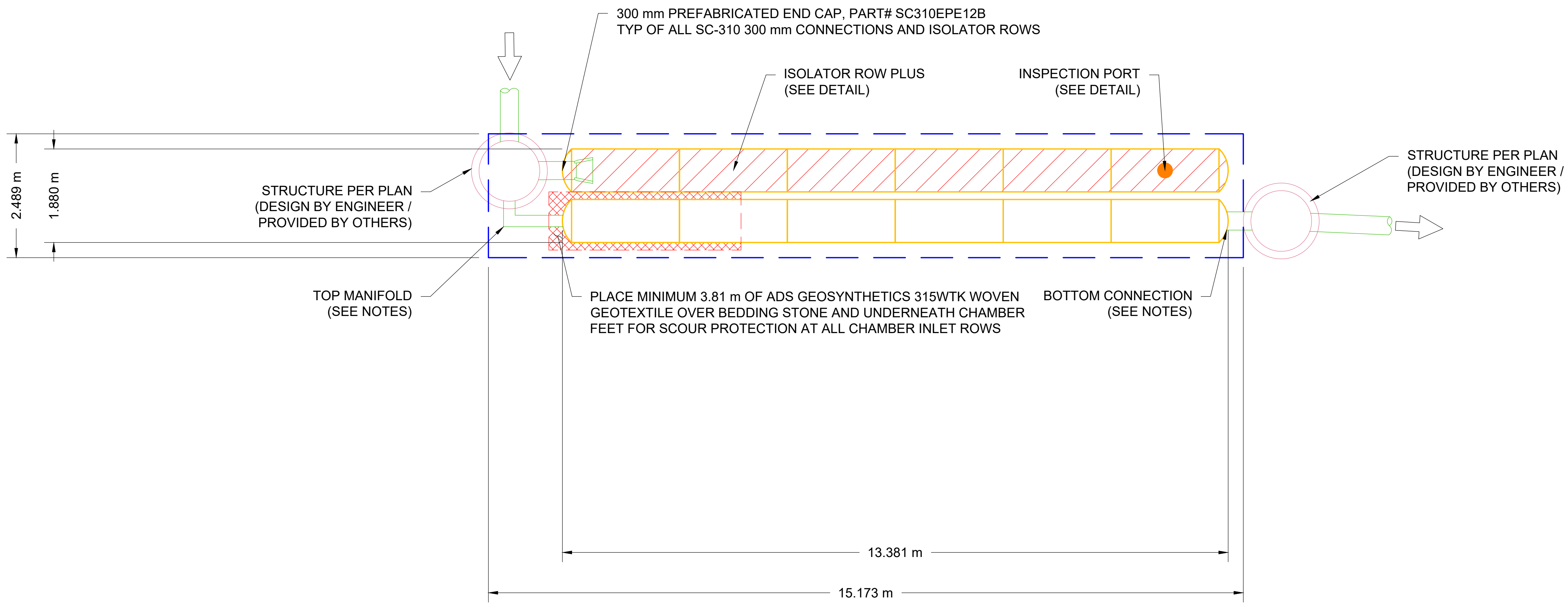
SCALE = 1 : 50

PROPOSED LAYOUT - SYSTEM R12.01

12	STORMTECH SC-310 CHAMBERS
4	STORMTECH SC-310 END CAPS
152	STONE ABOVE (mm)
152	STONE BELOW (mm)
40	% STONE VOID
13.7	**INSTALLED SYSTEM VOLUME (m³) (PERIMETER STONE INCLUDED)**
37.7	SYSTEM AREA (m²)
35.3	SYSTEM PERIMETER (m)

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECHNICAL NOTE 6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION:** THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.



WINSTON CHURCHILL BLVD. WIDENING
MISSISSAUGA, ON.

DATE: 05/05/21 | DRAWN: RCT
PROJECT #: S237433 | CHECKED: JMQ

DATE	DRWN	CHKD	DESCRIPTION

StormTech® Detention • Retention • Water Quality
520 CROMWELL AVENUE | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026

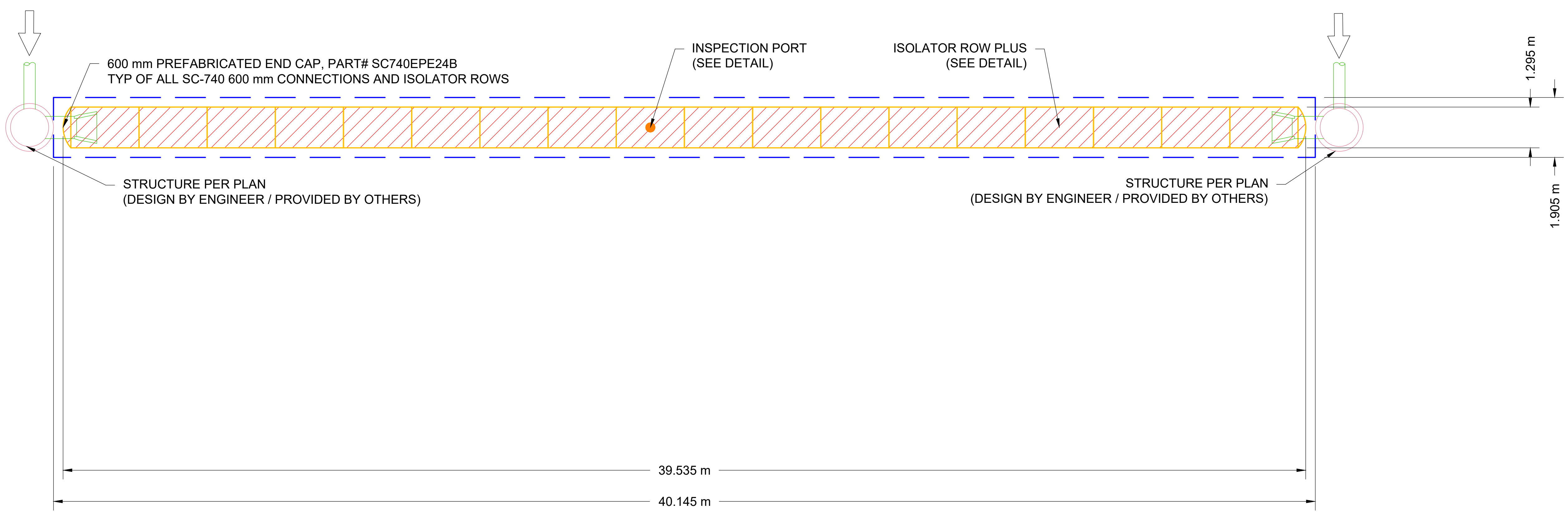
SCALE = 1 : 100

PROPOSED LAYOUT - SYSTEM R12.02

18	STORMTECH SC-740 CHAMBERS
2	STORMTECH SC-740 END CAPS
152	STONE ABOVE (mm)
152	STONE BELOW (mm)
40	% STONE VOID
46.6	**INSTALLED SYSTEM VOLUME (m^3) (PERIMETER STONE INCLUDED)**
76.4	SYSTEM AREA (m^2)
84.0	SYSTEM PERIMETER (m)

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECHNICAL NOTE 6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION:** THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.



WINSTON CHURCHILL BLVD. WIDENING
MISSISSAUGA, ON.

DATE: 05/05/21 | DRAWN: RCT
PROJECT #: S237433 | CHECKED: JMQ

DATE	DRWN	CHKD	DESCRIPTION

StormTech®
Detention • Retention • Water Quality
520 CROMWELL AVENUE | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026

SCALE = 1 : 150

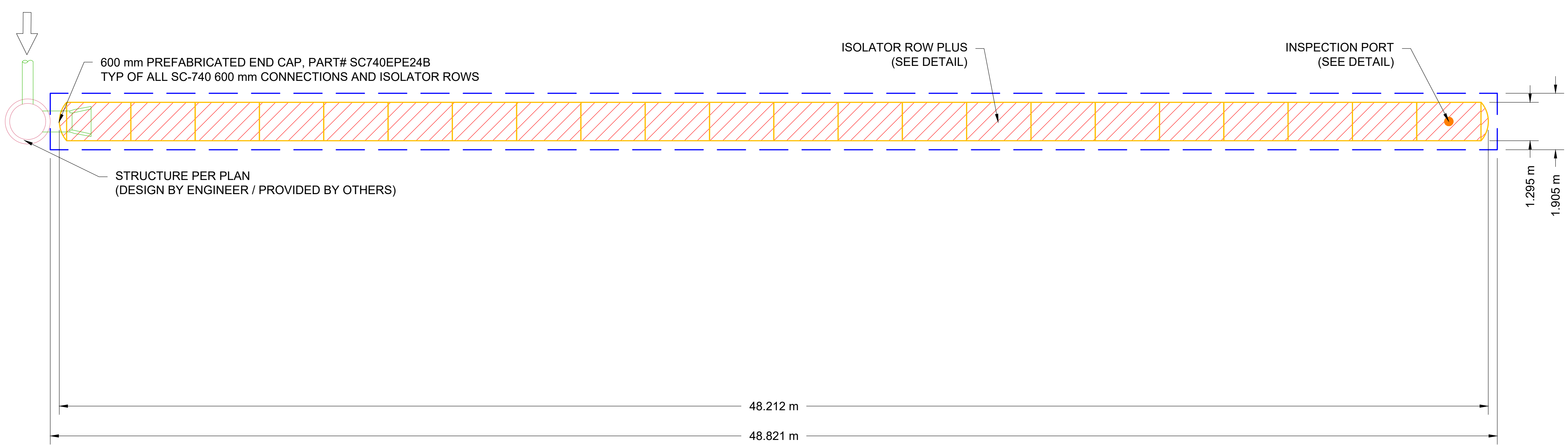
SHEET 18 OF 28

PROPOSED LAYOUT - SYSTEM R13.01

18	STORMTECH SC-740 CHAMBERS
2	STORMTECH SC-740 END CAPS
152	STONE ABOVE (mm)
152	STONE BELOW (mm)
40	% STONE VOID
46.6	**INSTALLED SYSTEM VOLUME (m^3) (PERIMETER STONE INCLUDED)**
76.4	SYSTEM AREA (m^2)
84.0	SYSTEM PERIMETER (m)

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECHNICAL NOTE 6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION**: THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.



WINSTON CHURCHILL BLVD. WIDENING
MISSISSAUGA, ON.

DATE: 05/05/21
DRAWN: RCT
PROJECT #: S237433
CHECKED: JMQ

DATE	DRWN	CHKD	DESCRIPTION

StormTech®
Detention•Retention•Water Quality
520 CROMWELL AVENUE | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026

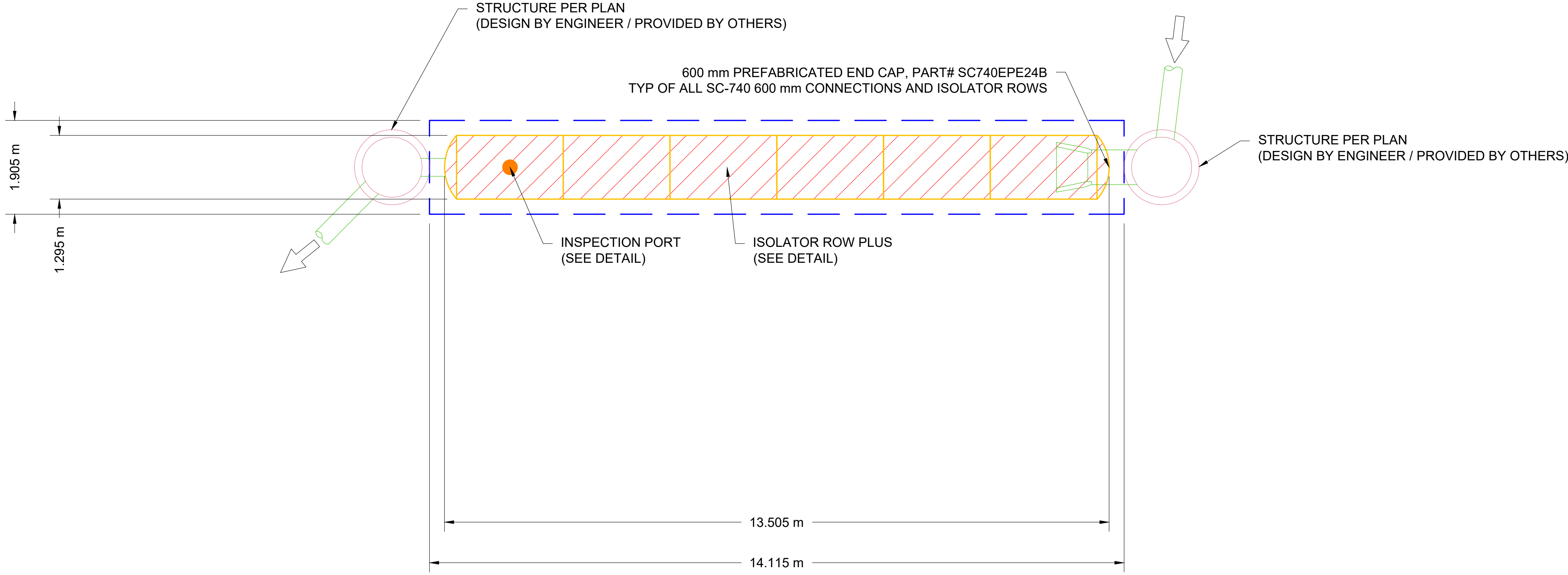
SCALE = 1 : 150

PROPOSED LAYOUT - SYSTEM R13.02

6	STORMTECH SC-740 CHAMBERS
2	STORMTECH SC-740 END CAPS
152	STONE ABOVE (mm)
152	STONE BELOW (mm)
40	% STONE VOID
16.1	**INSTALLED SYSTEM VOLUME (m³) (PERIMETER STONE INCLUDED)**
26.8	SYSTEM AREA (m²)
32.0	SYSTEM PERIMETER (m)

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECHNICAL NOTE 6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION**: THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.



WINSTON CHURCHILL BLVD. WIDENING
MISSISSAUGA, ON.

DATE: 05/05/21 DRAWN: RCT
PROJECT #: S237433 CHECKED: JMQ

DATE	DRWN	CHKD	DESCRIPTION

StormTech® Detention • Retention • Water Quality
520 CROMWELL AVENUE | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026

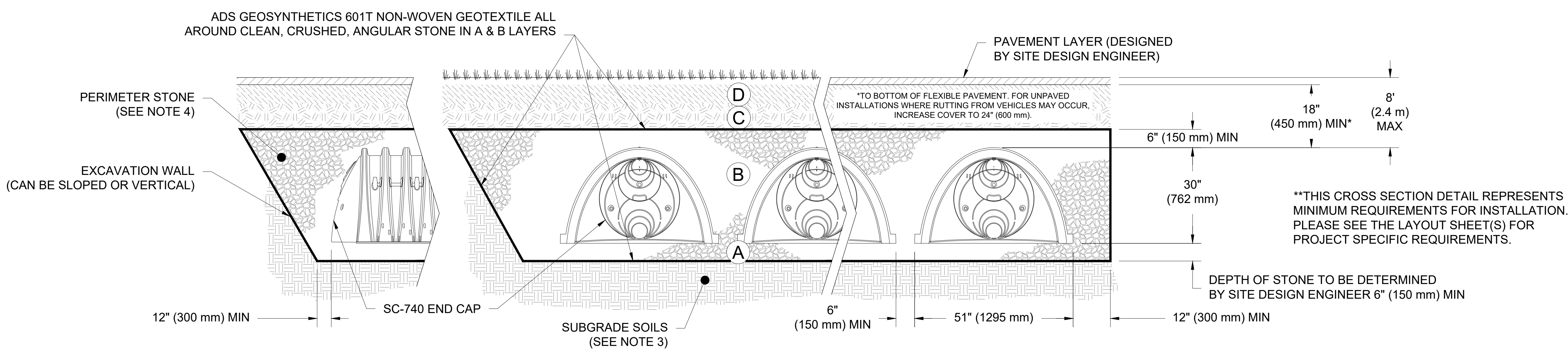
SCALE = 1 : 150

ACCEPTABLE FILL MATERIALS: STORMTECH SC-740 CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER.	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 18" (450 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 12" (300 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 6" (150 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS. ROLLER GROSS VEHICLE WEIGHT NOT TO EXCEED 12,000 lbs (53 kN). DYNAMIC FORCE NOT TO EXCEED 20,000 lbs (89 kN).
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:

1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 6" (150 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.



NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
2. SC-740 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 2".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 550 LBS/IN/IN. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

WINSTON CHURCHILL BLVD. WIDENING
MISSISSAUGA, ON.

DATE: 05/05/21 DRAWN: RCT
PROJECT #: S237433 CHECKED: JMQ

DATE	DRWN	CHKD	DESCRIPTION

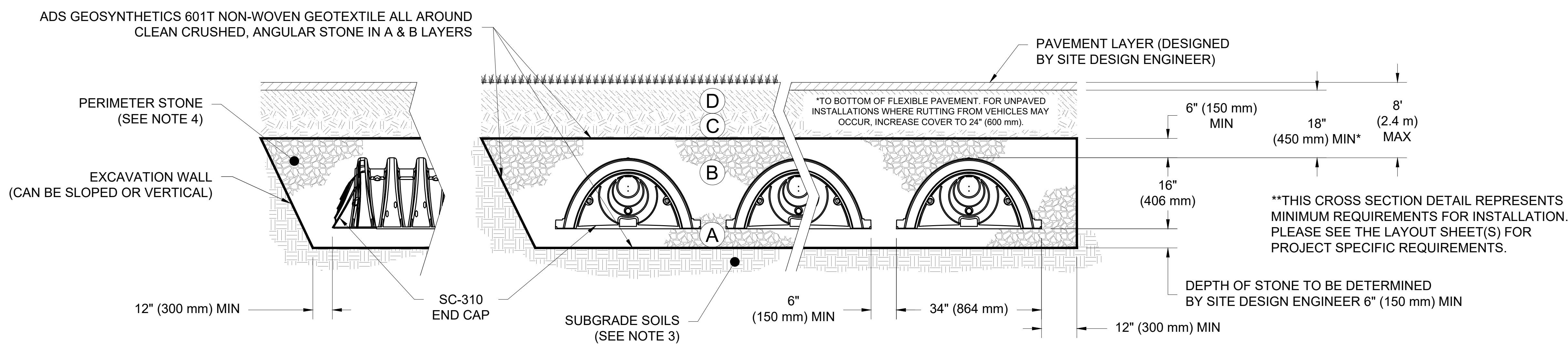
StormTech® Detention • Retention • Water Quality
520 CROMWELL AVENUE | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026

ACCEPTABLE FILL MATERIALS: STORMTECH SC-310 CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER.	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 18" (450 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 12" (300 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 6" (150 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS. ROLLER GROSS VEHICLE WEIGHT NOT TO EXCEED 12,000 lbs (53 kN). DYNAMIC FORCE NOT TO EXCEED 20,000 lbs (89 kN).
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 6" (150 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.



NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2922 (POLETHYLENE) OR ASTM F2418-16a (POLYPROPYLENE), "STANDARD SPECIFICATION FOR CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
2. SC-310 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 2".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2922 SHALL BE GREATER THAN OR EQUAL TO 400 LBS/IN/IN. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

WINSTON CHURCHILL BLVD. WIDENING
MISSISSAUGA, ON.

DATE: 05/05/21 DRAWN: RCT
PROJECT #: S237433 CHECKED: JMQ

DATE	DRWN	CHKD	DESCRIPTION

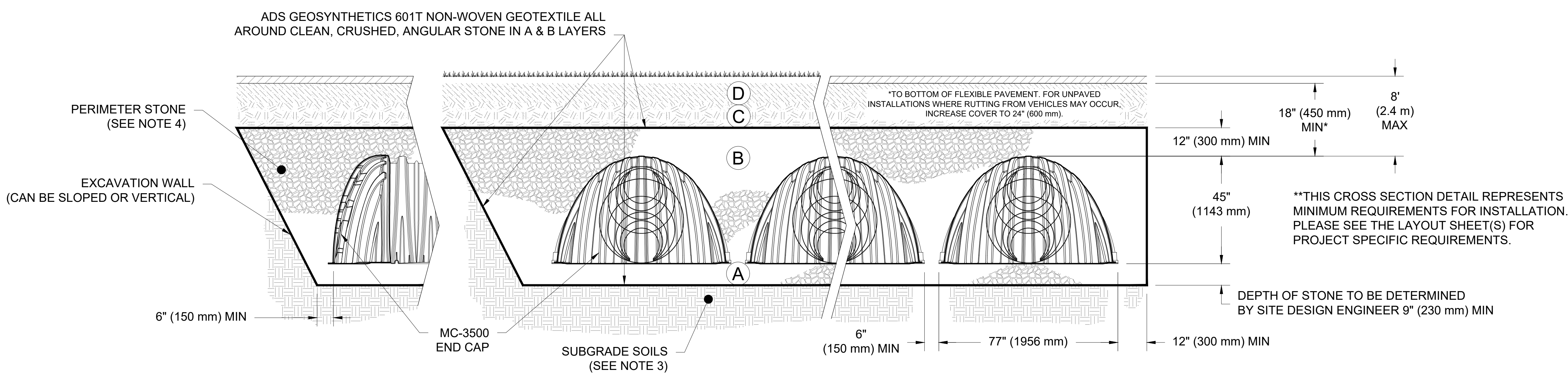
StormTech Detention • Retention • Water Quality
520 CROMWELL AVENUE | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026

ACCEPTABLE FILL MATERIALS: STORMTECH MC-3500 CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 24" (600 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 24" (600 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 12" (300 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS.
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 9" (230 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.



NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 45x76 DESIGNATION SS.
2. MC-3500 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 500 LBS/IN/IN. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

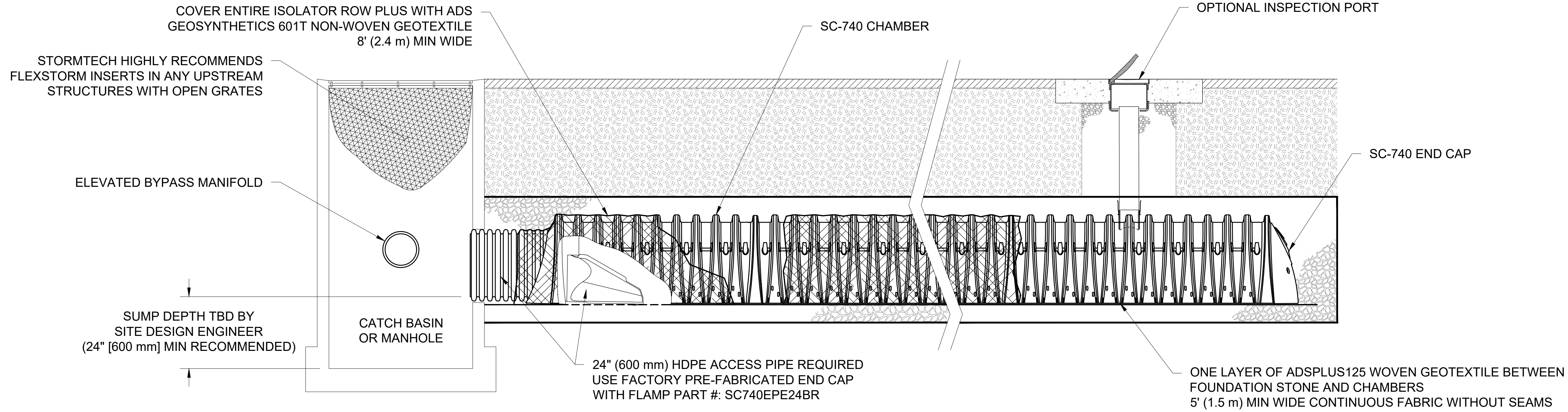
WINSTON CHURCHILL BLVD. WIDENING
MISSISSAUGA, ON.

DATE: 05/05/21 DRAWN: RCT
PROJECT #: S237433 CHECKED: JMQ

DATE	DRWN	CHKD	DESCRIPTION

StormTech
Detention • Retention • Water Quality
520 CROMWELL AVENUE | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026



SC-740 ISOLATOR ROW PLUS DETAIL

NTS

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW PLUS FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
  - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
  - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
  - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
  - A.4. LOWER A CAMERA INTO ISOLATOR ROW PLUS FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
  - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- B. ALL ISOLATOR PLUS ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW PLUS
  - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW PLUS THROUGH OUTLET PIPE
    - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
    - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
  - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

STEP 2) CLEAN OUT ISOLATOR ROW PLUS USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

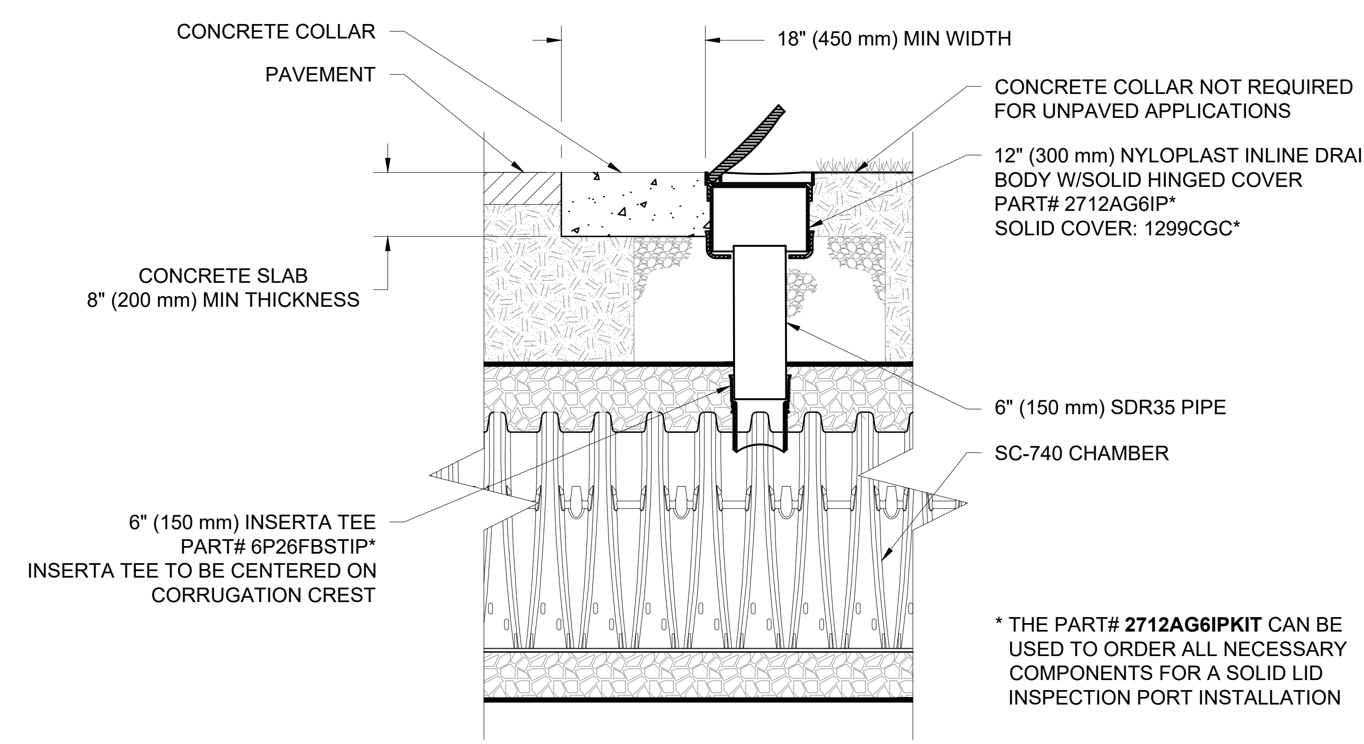
STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.

2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.



* THE PART# **2712AG6IPKIT** CAN BE USED TO ORDER ALL NECESSARY COMPONENTS FOR A SOLID LID INSPECTION PORT INSTALLATION

SC-740 6" (150 mm) INSPECTION PORT DETAIL

NTS

WINSTON CHURCHILL BLVD. WIDENING
MISSISSAUGA, ON.

DATE: 05/05/21 DRAWN: RCT
PROJECT #: S237433 CHECKED: JMQ

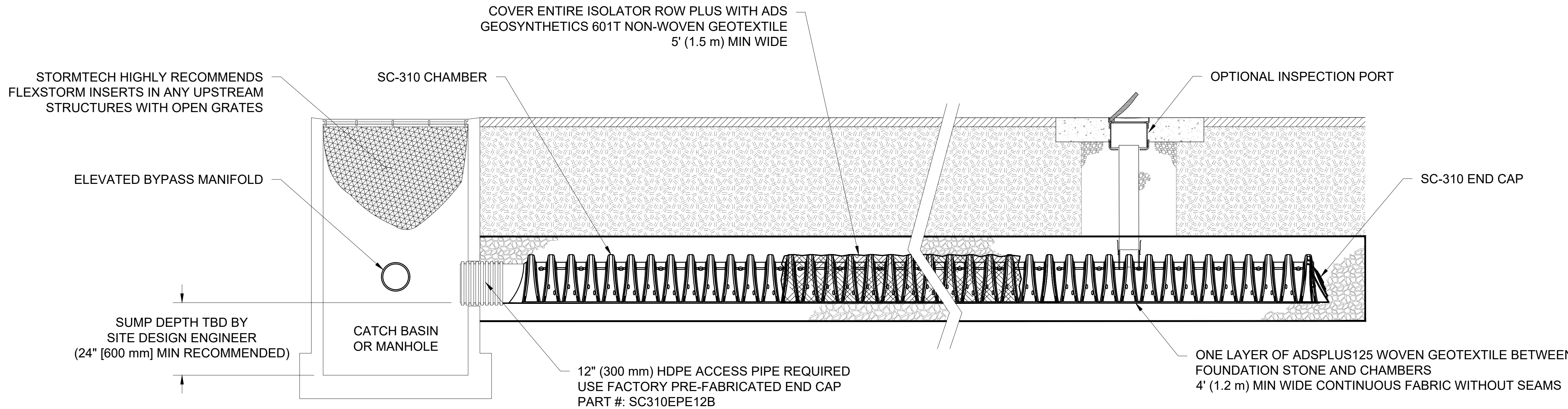
THIS DRAWING HAS BEEN PREPARED BASED ON INFORMATION PROVIDED TO ADS UNDER THE DIRECTION OF THE SITE DESIGN ENGINEER OR OTHER PROJECT REPRESENTATIVE. THE SITE DESIGN ENGINEER SHALL REVIEW THIS DRAWING PRIOR TO CONSTRUCTION. IT IS THE ULTIMATE RESPONSIBILITY OF THE SITE DESIGN ENGINEER TO ENSURE THAT THE PRODUCT(S) DEPICTED AND ALL ASSOCIATED DETAILS MEET ALL APPLICABLE LAWS, REGULATIONS, AND PROJECT REQUIREMENTS.

DATE	DRWN	CHKD	DESCRIPTION

StormTech
Detention • Retention • Water Quality
520 CROMWELL AVENUE | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026

SHEET 24 OF 28



SC-310 ISOLATOR ROW PLUS DETAIL

NTS

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW PLUS FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
  - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
  - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
  - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
  - A.4. LOWER A CAMERA INTO ISOLATOR ROW PLUS FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
  - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- B. ALL ISOLATOR PLUS ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW PLUS
  - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW PLUS THROUGH OUTLET PIPE
    - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
    - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
  - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

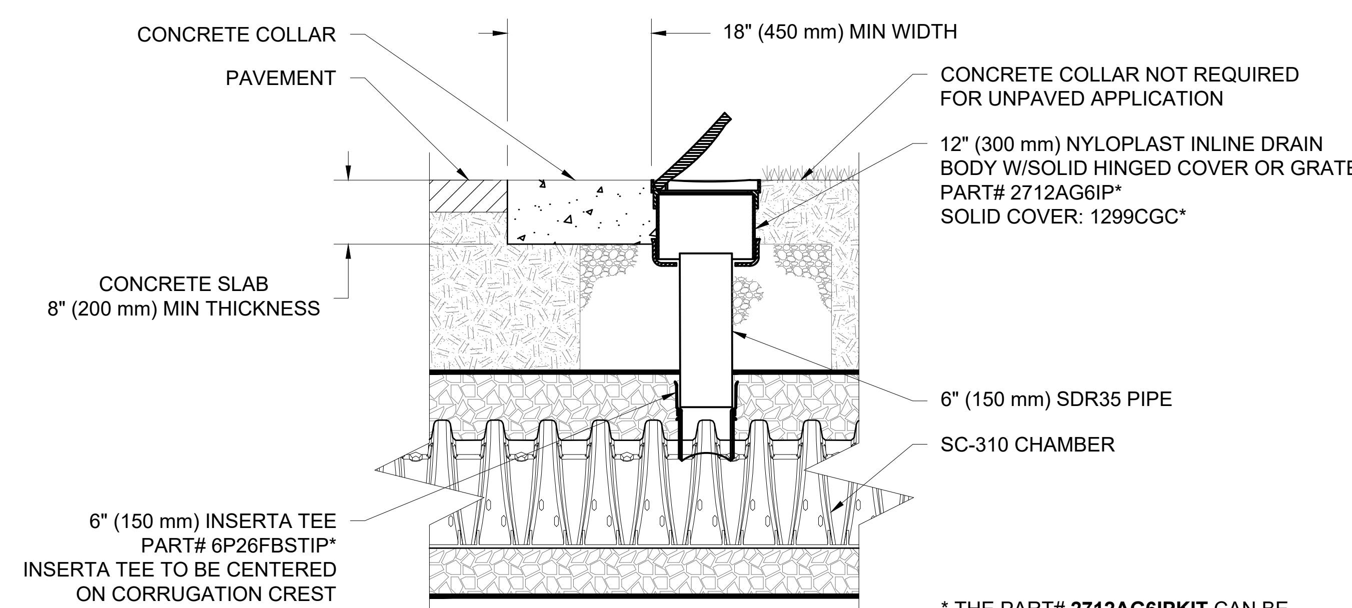
STEP 2) CLEAN OUT ISOLATOR ROW PLUS USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.
2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.



* THE PART# **2712AG6IPKIT** CAN BE USED TO ORDER ALL NECESSARY COMPONENTS FOR A SOLID LID INSPECTION PORT INSTALLATION

SC-310 6" (150 mm) INSPECTION PORT DETAIL

NTS

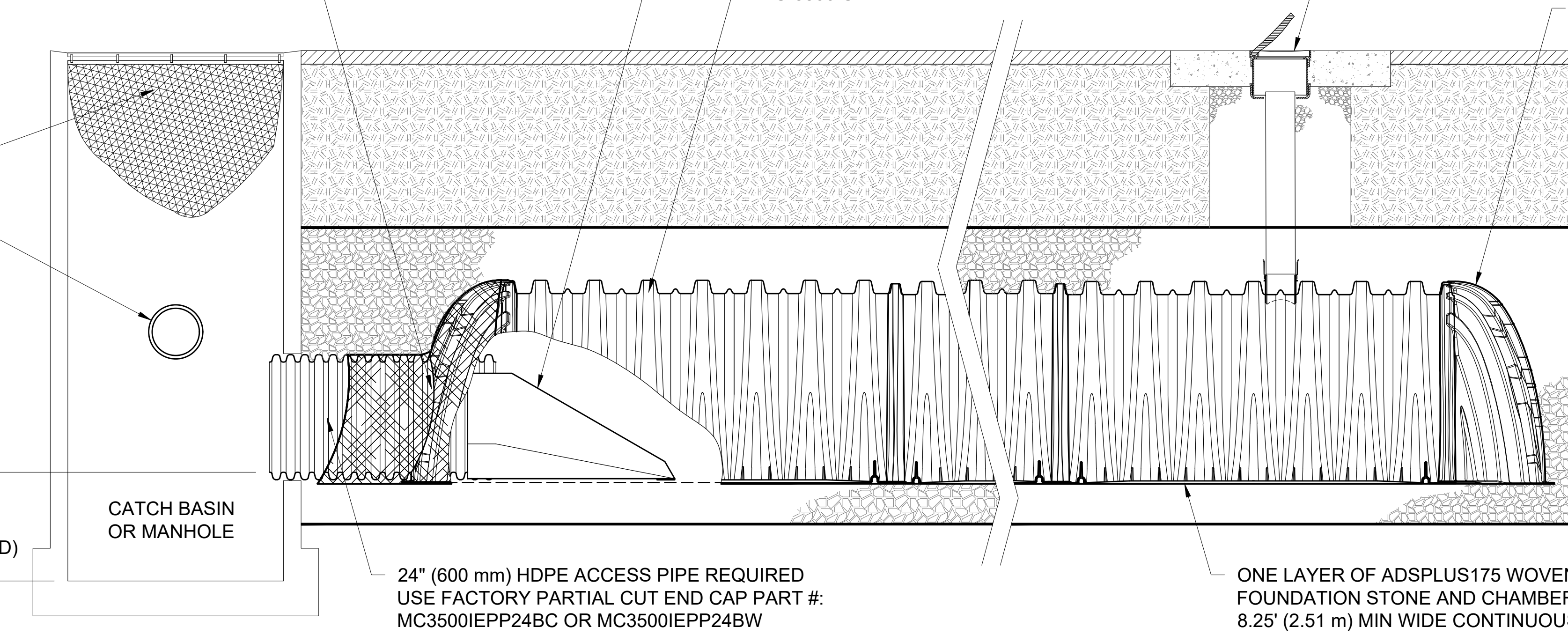
WINSTON CHURCHILL BLVD. WIDENING
MISSISSAUGA, ON.

DATE: 05/05/21 DRAWN: RCT
PROJECT #: S237433 CHECKED: JMQ

DATE	DRWN	CHKD	DESCRIPTION

StormTech
Detention • Retention • Water Quality
520 CROMWELL AVENUE | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026



MC-3500 ISOLATOR ROW PLUS DETAIL
NTS

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW PLUS FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
  - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
  - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
  - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
  - A.4. LOWER A CAMERA INTO ISOLATOR ROW PLUS FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
  - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- B. ALL ISOLATOR PLUS ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW PLUS
  - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW PLUS THROUGH OUTLET PIPE
    - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
    - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
  - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

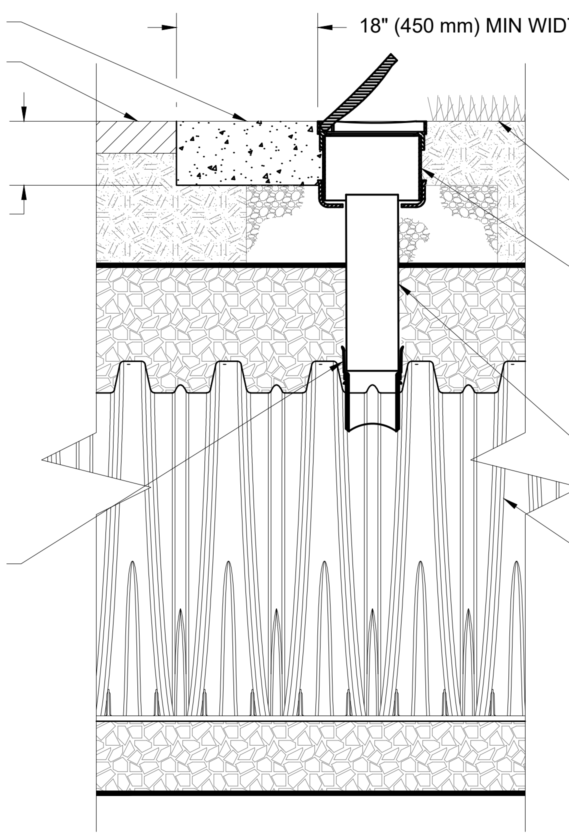
STEP 2) CLEAN OUT ISOLATOR ROW PLUS USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.
2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.



* THE PART# **2712AG6IPKIT** CAN BE USED TO ORDER ALL NECESSARY COMPONENTS FOR A SOLID LID INSPECTION PORT INSTALLATION

MC-3500 6" (150 mm) INSPECTION PORT DETAIL
NTS

WINSTON CHURCHILL BLVD. WIDENING
MISSISSAUGA, ON.

DATE: 05/05/21 | DRAWN: RCT
PROJECT #: S237433 | CHECKED: JMQ

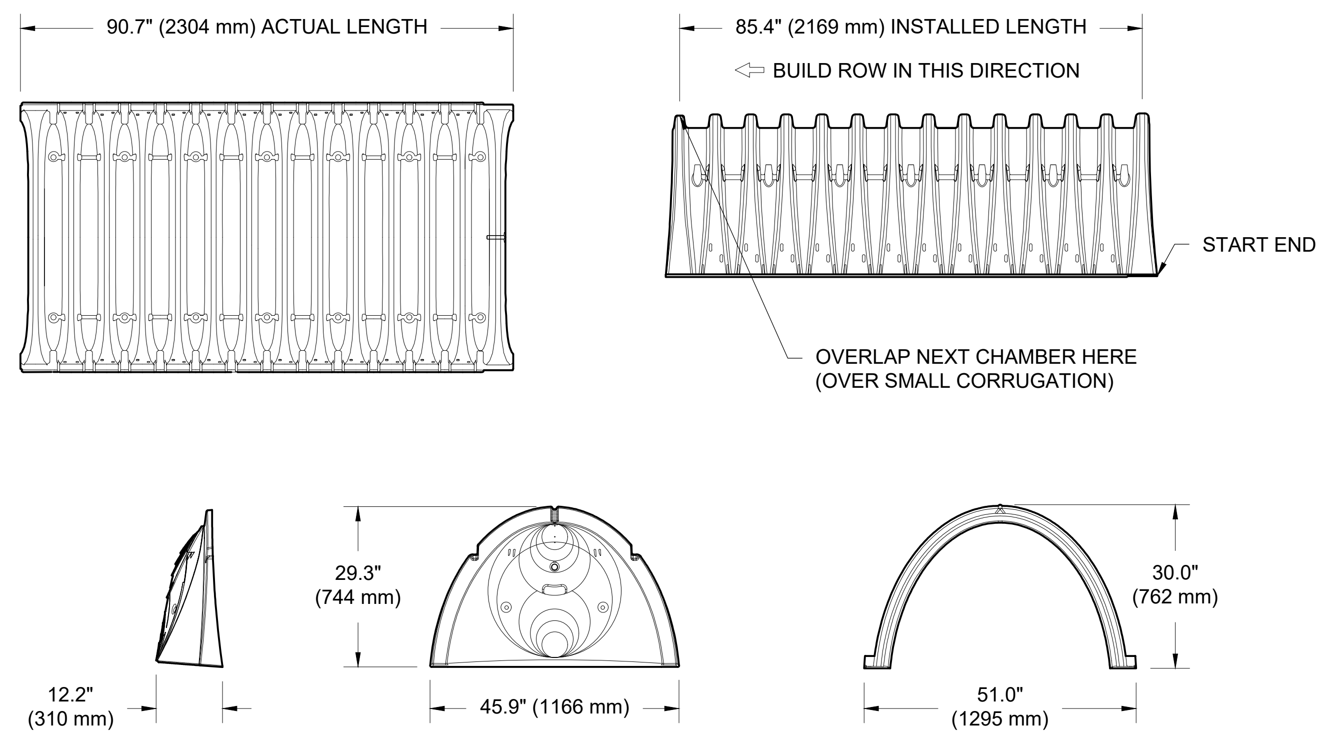
DATE	DRWN	CHKD	DESCRIPTION

StormTech® Detention•Retention•Water Quality
520 CROMWELL AVENUE | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026

SC-740 TECHNICAL SPECIFICATION

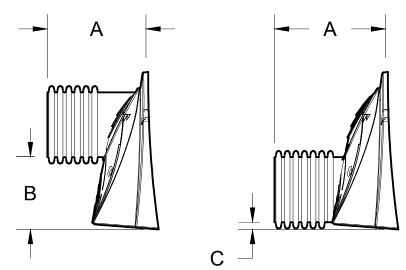
NTS



NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	51.0" X 30.0" X 85.4"	(1295 mm X 762 mm X 2169 mm)
CHAMBER STORAGE	45.9 CUBIC FEET	(1.30 m³)
MINIMUM INSTALLED STORAGE*	74.9 CUBIC FEET	(2.12 m³)
WEIGHT	75.0 lbs.	(33.6 kg)

*ASSUMES 6" (152 mm) STONE ABOVE, BELOW, AND BETWEEN CHAMBERS



PRE-FAB STUB AT BOTTOM OF END CAP WITH FLAMP END WITH "BR"
PRE-FAB STUBS AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
PRE-FAB STUBS AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
PRE-CORED END CAPS END WITH "PC"

PART #	STUB	A	B	C
SC740EPE06T / SC740EPE06TPC	6" (150 mm)	10.9" (277 mm)	18.5" (470 mm)	---
SC740EPE06B / SC740EPE06BPC			---	0.5" (13 mm)
SC740EPE08T /SC740EPE08TPC	8" (200 mm)	12.2" (310 mm)	16.5" (419 mm)	---
SC740EPE08B / SC740EPE08BPC			---	0.6" (15 mm)
SC740EPE10T / SC740EPE10TPC	10" (250 mm)	13.4" (340 mm)	14.5" (368 mm)	---
SC740EPE10B / SC740EPE10BPC			---	0.7" (18 mm)
SC740EPE12T / SC740EPE12TPC	12" (300 mm)	14.7" (373 mm)	12.5" (318 mm)	---
SC740EPE12B / SC740EPE12BPC			---	1.2" (30 mm)
SC740EPE15T / SC740EPE15TPC	15" (375 mm)	18.4" (467 mm)	9.0" (229 mm)	---
SC740EPE15B / SC740EPE15BPC			---	1.3" (33 mm)
SC740EPE18T / SC740EPE18TPC	18" (450 mm)	19.7" (500 mm)	5.0" (127 mm)	---
SC740EPE18B / SC740EPE18BPC			---	1.6" (41 mm)
SC740EPE24B*	24" (600 mm)	18.5" (470 mm)	---	0.1" (3 mm)
SC740EPE24BR*	24" (600 mm)	18.5" (470 mm)	---	0.1" (3 mm)

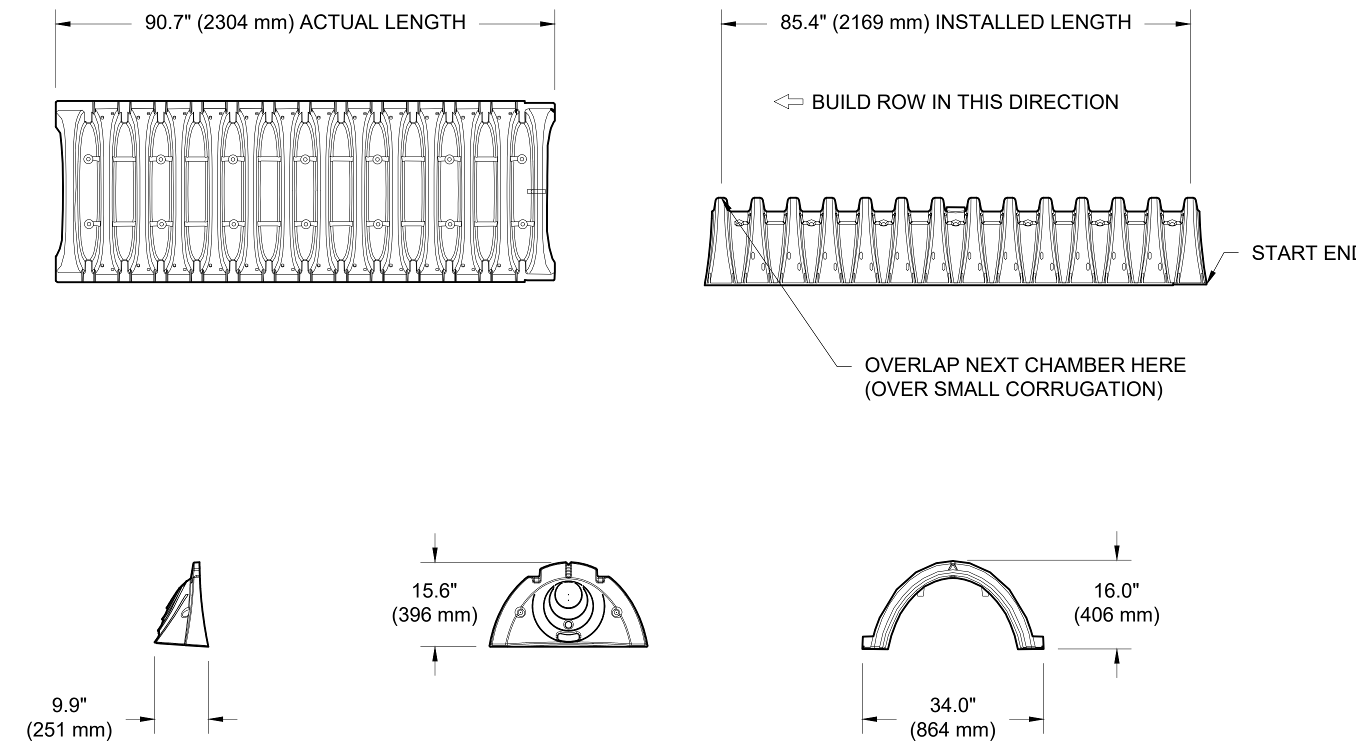
ALL STUBS, EXCEPT FOR THE SC740EPE24B/SC740EPE24BR ARE PLACED AT BOTTOM OF END CAP SUCH THAT THE OUTSIDE DIAMETER OF THE STUB IS FLUSH WITH THE BOTTOM OF THE END CAP. FOR ADDITIONAL INFORMATION CONTACT STORMTECH AT 1-888-892-2694.

* FOR THE SC740EPE24B/SC740EPE24BR THE 24" (600 mm) STUB LIES BELOW THE BOTTOM OF THE END CAP APPROXIMATELY 1.75" (44 mm). BACKFILL MATERIAL SHOULD BE REMOVED FROM BELOW THE N-12 STUB SO THAT THE FITTING SITS LEVEL.

NOTE: ALL DIMENSIONS ARE NOMINAL

SC-310 TECHNICAL SPECIFICATION

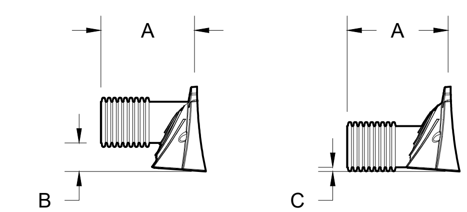
NTS



NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	34.0" X 16.0" X 85.4"	(864 mm X 406 mm X 2169 mm)
CHAMBER STORAGE	14.7 CUBIC FEET	(0.42 m³)
MINIMUM INSTALLED STORAGE*	31.0 CUBIC FEET	(0.88 m³)
WEIGHT	35.0 lbs.	(16.8 kg)

*ASSUMES 6" (152 mm) ABOVE, BELOW, AND BETWEEN CHAMBERS



PRE-FAB STUBS AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
PRE-FAB STUBS AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
PRE CORED END CAPS END WITH "PC"

PART #	STUB	A	B	C
SC310EPE06T / SC310EPE06TPC	6" (150 mm)	9.6" (244 mm)	5.8" (147 mm)	---
SC310EPE06B / SC310EPE06BPC			---	0.5" (13 mm)
SC310EPE08T / SC310EPE08TPC	8" (200 mm)	11.9" (302 mm)	3.5" (89 mm)	---
SC310EPE08B / SC310EPE08BPC			---	0.6" (15 mm)
SC310EPE10T / SC310EPE10TPC	10" (250 mm)	12.7" (323 mm)	1.4" (36 mm)	---
SC310EPE10B / SC310EPE10BPC			---	0.7" (18 mm)
SC310EPE12B	12" (300 mm)	13.5" (343 mm)	---	0.9" (23 mm)

ALL STUBS, EXCEPT FOR THE SC310EPE12B ARE PLACED AT BOTTOM OF END CAP SUCH THAT THE OUTSIDE DIAMETER OF THE STUB IS FLUSH WITH THE BOTTOM OF THE END CAP. FOR ADDITIONAL INFORMATION CONTACT STORMTECH AT 1-888-892-2694.

* FOR THE SC310EPE12B THE 12" (300 mm) STUB LIES BELOW THE BOTTOM OF THE END CAP APPROXIMATELY 0.25" (6 mm). BACKFILL MATERIAL SHOULD BE REMOVED FROM BELOW THE N-12 STUB SO THAT THE FITTING SITS LEVEL.

NOTE: ALL DIMENSIONS ARE NOMINAL

WINSTON CHURCHILL BLVD. WIDENING
MISSISSAUGA, ON.

DATE: 05/05/21 DRAWN: RCT
PROJECT #: S237433 CHECKED: JMQ

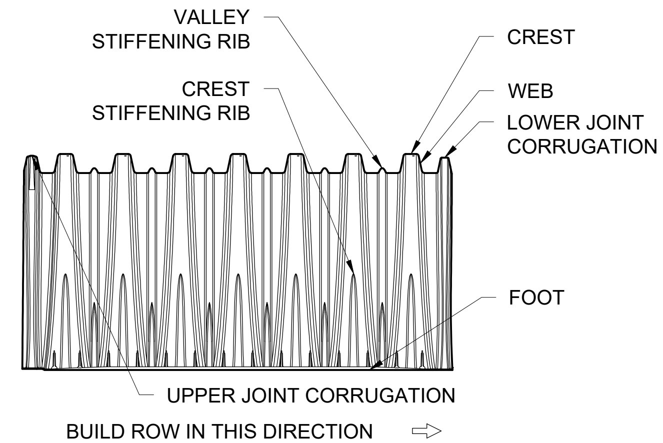
DATE	DRWN	CHKD	DESCRIPTION

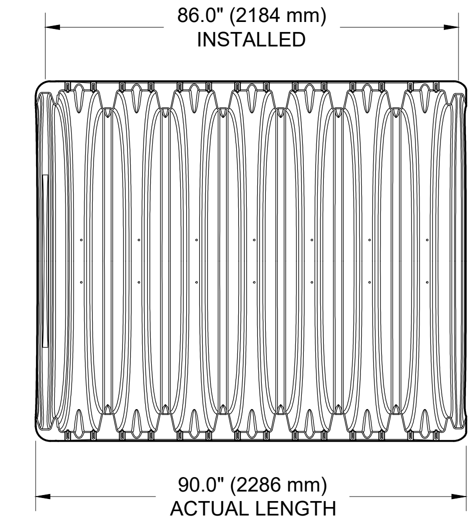
StormTech
Detention • Retention • Water Quality
520 CROMWELL AVENUE | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

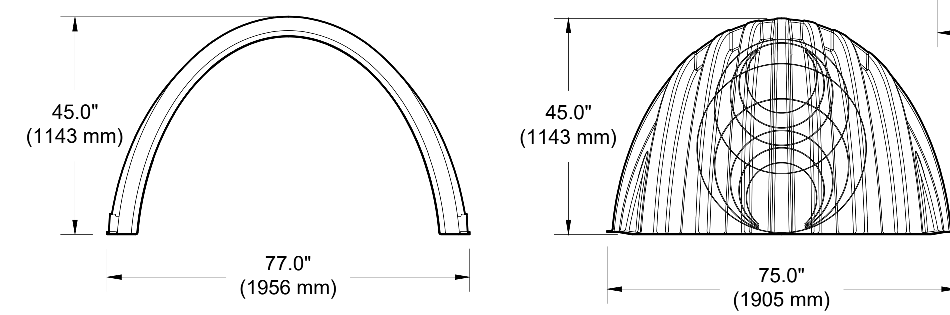
ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026

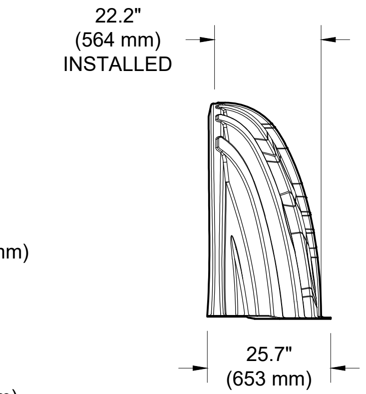
MC-3500 TECHNICAL SPECIFICATION

NTS









NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	77.0" X 45.0" X 86.0"	(1956 mm X 1143 mm X 2184 mm)
CHAMBER STORAGE	109.9 CUBIC FEET	(3.11 m³)
MINIMUM INSTALLED STORAGE*	175.0 CUBIC FEET	(4.96 m³)
WEIGHT	134 lbs.	(60.8 kg)

NOMINAL END CAP SPECIFICATIONS

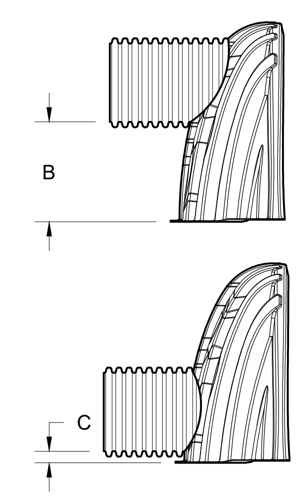
SIZE (W X H X INSTALLED LENGTH)	75.0" X 45.0" X 22.2"	(1905 mm X 1143 mm X 564 mm)
END CAP STORAGE	14.9 CUBIC FEET	(0.42 m³)
MINIMUM INSTALLED STORAGE*	45.1 CUBIC FEET	(1.28 m³)
WEIGHT	49 lbs.	(22.2 kg)

*ASSUMES 12" (305 mm) STONE ABOVE, 9" (229 mm) STONE FOUNDATION, 6" (152 mm) STONE BETWEEN CHAMBERS, 6" (152 mm) STONE PERIMETER IN FRONT OF END CAPS AND 40% STONE POROSITY.

PARTIAL CUT HOLES AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
PARTIAL CUT HOLES AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
END CAPS WITH A PREFABRICATED WELDED STUB END WITH "W"
END CAPS WITH A WELDED CROWN PLATE END WITH "C"

PART #	STUB	B	C
MC3500IEPP06T	6" (150 mm)	33.21" (844 mm)	---
MC3500IEPP06B		---	0.66" (17 mm)
MC3500IEPP08T	8" (200 mm)	31.16" (791 mm)	---
MC3500IEPP08B		---	0.81" (21 mm)
MC3500IEPP10T	10" (250 mm)	29.04" (738 mm)	---
MC3500IEPP10B		---	0.93" (24 mm)
MC3500IEPP12T	12" (300 mm)	26.36" (670 mm)	---
MC3500IEPP12B		---	1.35" (34 mm)
MC3500IEPP15T	15" (375 mm)	23.39" (594 mm)	---
MC3500IEPP15B		---	1.50" (38 mm)
MC3500IEPP18TC	18" (450 mm)	20.03" (509 mm)	---
MC3500IEPP18TW			
MC3500IEPP18BC		---	1.77" (45 mm)
MC3500IEPP18BW			
MC3500IEPP24TC	24" (600 mm)	14.48" (368 mm)	---
MC3500IEPP24TW			
MC3500IEPP24BC		---	2.06" (52 mm)
MC3500IEPP24BW			
MC3500IEPP30BC	30" (750 mm)	---	2.75" (70 mm)

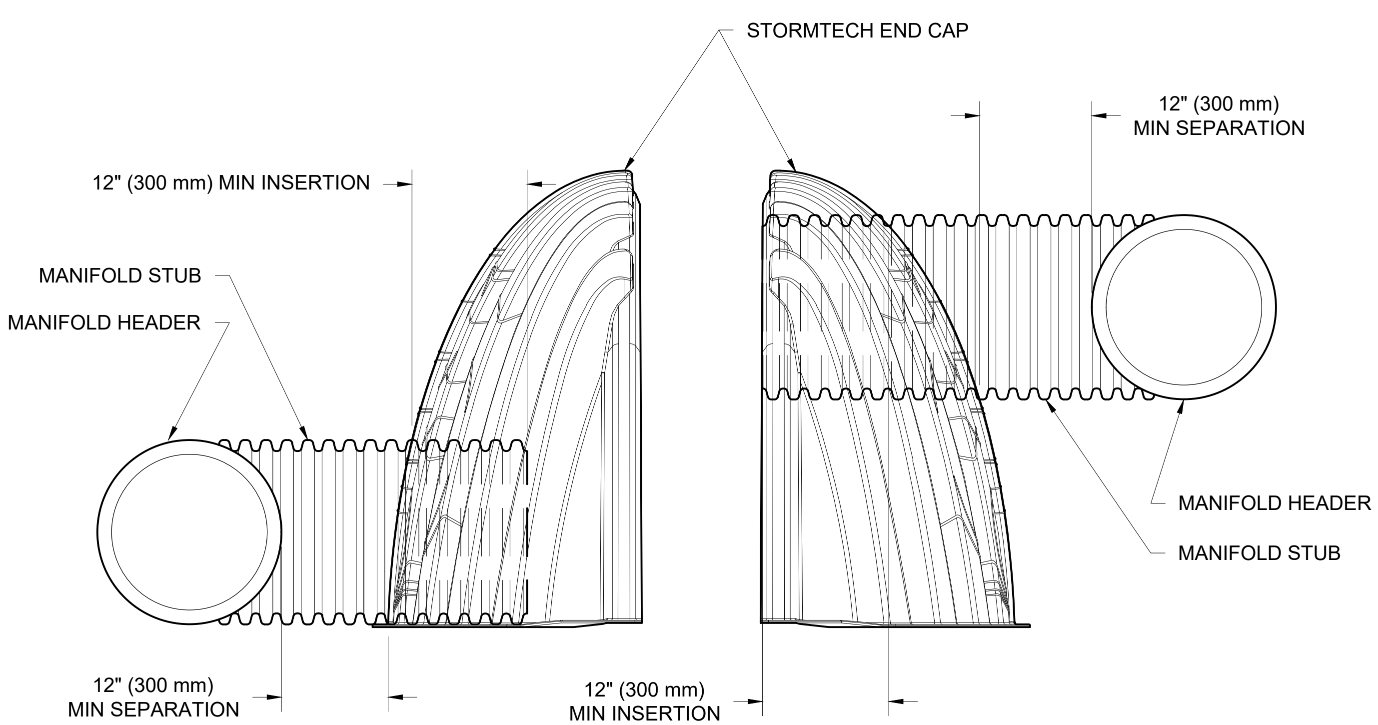
NOTE: ALL DIMENSIONS ARE NOMINAL



CUSTOM PARTIAL CUT INVERTS ARE AVAILABLE UPON REQUEST. INVENTORIED MANIFOLDS INCLUDE 12-24" (300-600 mm) SIZE ON SIZE AND 15-48" (375-1200 mm) ECCENTRIC MANIFOLDS. CUSTOM INVERT LOCATIONS ON THE MC-3500 END CAP CUT IN THE FIELD ARE NOT RECOMMENDED FOR PIPE SIZES GREATER THAN 10" (250 mm). THE INVERT LOCATION IN COLUMN 'B' ARE THE HIGHEST POSSIBLE FOR THE PIPE SIZE.

MC-SERIES END CAP INSERTION DETAIL

NTS



NOTE: MANIFOLD STUB MUST BE LAID HORIZONTAL FOR A PROPER FIT IN END CAP OPENING.

WINSTON CHURCHILL BLVD. WIDENING
MISSISSAUGA, ON.

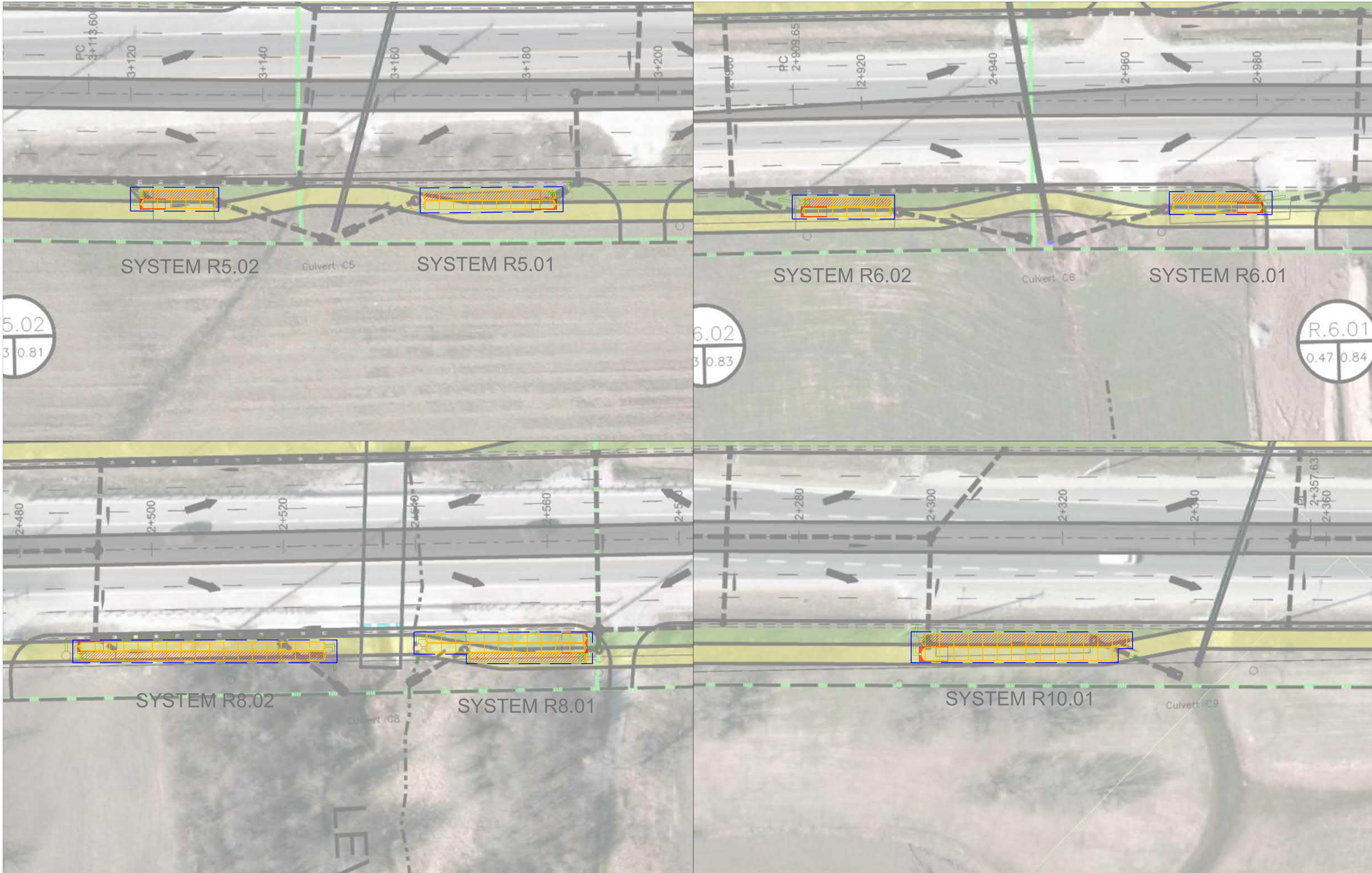
DATE: 05/05/21 | DRAWN: RCT
PROJECT #: S237433 | CHECKED: JMQ

DATE	DRWN	CHKD	DESCRIPTION

StormTech® Detention•Retention•Water Quality
520 CROMWELL AVENUE | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026

3+680
3+700
3+720
3+740
PT 3+746.84
3+760
STORMTECH CHAMBERS
WITH ISOLATOR ROW (TYP.)
SYSTEM R2.01
Culvert C2
3+600
3+630.22
3+640
3+660
3+680
3+700
SYSTEM R2.02
Culvert C2
3+320
3+340
3+360
3+380
3+400
SYSTEM R4.01
R.4.01
0.68
0.82
PT 3+230.22
3+240
3+260
3+280
3+320
SYSTEM R4.02
R.4.02
0.24
0.83


PC 3+113.60
3+120
3+140
3+160
3+180
3+200
SYSTEM R5.02
Culvert C5
SYSTEM R5.01
PC 2+909.65
2+920
2+940
2+960
2+980
SYSTEM R6.02
Culvert C6
SYSTEM R6.01
R.6.01
0.47
0.84
2+480
2+500
2+520
2+560
SYSTEM R8.02
Culvert C8
SYSTEM R8.01
2+280
2+300
2+320
2+357.63
2+360
SYSTEM R10.01
Culvert C9


C10
SYSTEM C10.01
1+320
1+340
1+360
1+380
1+400
SYSTEM R10.02
Culvert C10
1+060
1+080
1+100
SYSTEM R11.02
SYSTEM R11.01
R.11.01
0.52
0.82
0+780
0+800
CB
SYSTEM R12.01
R.12.01
0.69
0.87
0+560
PT 0+578.762
0+600
PC 0+616.166
0+620
0+640
SYSTEM R12.02
R.12.02
1.84
0.84


0+060
0+080
0+100
0+120
0+140
0+160
PC
0+200
0+220
0+240
0+260
SYSTEM R13.02
Discharge to Existing Ditch
SYSTEM R13.01
ASSUMED
PROPERTY LINE
R.13.01
1.46
0.86

Project: **Winston Chuchill Blvd System R2.01**

Chamber Model - SC-740
Units - **Metric** Click Here for Imperial

Number of chambers - 28
Voids in the stone (porosity) - 40 %
Base of Stone Elevation - 0.00 m
Amount of Stone Above Chambers - 152 mm
Amount of Stone Below Chambers - 152 mm

☑ Include Perimeter Stone in Calculations

112.4 sq.meters Min. Area - 87.92 sq.meters

Height of System *(mm)*	Incremental Single Chamber *(cubic meters)*	Incremental Total Chamber *(cubic meters)*	Incremental Stone *(cubic meters)*	Incremental Ch & St *(cubic meters)*	Cumulative Chamber *(cubic meters)*	Elevation *(meters)*
1067	0.00	0.00	1.14	1.14	69.829	1.07
1041	0.00	0.00	1.14	1.14	68.687	1.04
1016	0.00	0.00	1.14	1.14	67.544	1.02
991	0.00	0.00	1.14	1.14	66.402	0.99
965	0.00	0.00	1.14	1.14	65.260	0.97
940	0.00	0.00	1.14	1.14	64.118	0.94
914	0.00	0.04	1.12	1.17	62.976	0.91
889	0.00	0.13	1.09	1.22	61.808	0.89
864	0.01	0.22	1.05	1.28	60.588	0.86
838	0.02	0.48	0.95	1.43	59.312	0.84
813	0.02	0.64	0.89	1.52	57.882	0.81
787	0.03	0.75	0.84	1.59	56.359	0.79
762	0.03	0.85	0.80	1.65	54.765	0.76
737	0.03	0.94	0.77	1.70	53.111	0.74
711	0.04	1.00	0.74	1.74	51.408	0.71
686	0.04	1.07	0.71	1.79	49.663	0.69
660	0.04	1.15	0.68	1.83	47.877	0.66
635	0.04	1.21	0.66	1.87	46.043	0.64
610	0.04	1.25	0.64	1.89	44.175	0.61
584	0.05	1.30	0.62	1.92	42.280	0.58
559	0.05	1.35	0.60	1.95	40.357	0.56
533	0.05	1.39	0.59	1.98	38.406	0.53
508	0.05	1.43	0.57	2.00	36.430	0.51
483	0.05	1.47	0.55	2.02	34.431	0.48
457	0.05	1.50	0.54	2.04	32.406	0.46
432	0.05	1.53	0.53	2.06	30.363	0.43
406	0.06	1.57	0.52	2.08	28.301	0.41
381	0.06	1.59	0.50	2.10	26.220	0.38
356	0.06	1.62	0.49	2.11	24.121	0.36
330	0.06	1.65	0.48	2.13	22.006	0.33
305	0.06	1.67	0.47	2.14	19.877	0.30
279	0.06	1.69	0.47	2.16	17.734	0.28
254	0.06	1.71	0.46	2.17	15.577	0.25
229	0.06	1.73	0.45	2.18	13.411	0.23
203	0.06	1.74	0.44	2.19	11.233	0.20
178	0.06	1.75	0.44	2.19	9.045	0.18
152	0.00	0.00	1.14	1.14	6.853	0.15
127	0.00	0.00	1.14	1.14	5.711	0.13
102	0.00	0.00	1.14	1.14	4.568	0.10
76	0.00	0.00	1.14	1.14	3.426	0.08
51	0.00	0.00	1.14	1.14	2.284	0.05
25	0.00	0.00	1.14	1.14	1.142	0.03

Project: Winston Chuchill Blvd System R2.02

Chamber Model -	SC-740
Units -	Metric

Click Here for Imperial

Number of chambers -	42	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	0.00	m
Amount of Stone Above Chambers -	152	mm
Amount of Stone Below Chambers -	152	mm

☑ Include Perimeter Stone in Calculations

163.6 sq.meters Min. Area - 131.88 sq.meters

Height of System *(mm)*	Incremental Single Chamber *(cubic meters)*	Incremental Total Chamber *(cubic meters)*	Incremental Stone *(cubic meters)*	Incremental Ch & St *(cubic meters)*	Cumulative Chamber *(cubic meters)*	Elevation *(meters)*
1067	0.00	0.00	1.66	1.66	102.602	1.07
1041	0.00	0.00	1.66	1.66	100.940	1.04
1016	0.00	0.00	1.66	1.66	99.278	1.02
991	0.00	0.00	1.66	1.66	97.616	0.99
965	0.00	0.00	1.66	1.66	95.953	0.97
940	0.00	0.00	1.66	1.66	94.291	0.94
914	0.00	0.07	1.64	1.70	92.629	0.91
889	0.00	0.19	1.58	1.78	90.928	0.89
864	0.01	0.34	1.53	1.86	89.149	0.86
838	0.02	0.72	1.37	2.09	87.286	0.84
813	0.02	0.95	1.28	2.23	85.193	0.81
787	0.03	1.13	1.21	2.34	82.958	0.79
762	0.03	1.28	1.15	2.43	80.618	0.76
737	0.03	1.40	1.10	2.50	78.189	0.74
711	0.04	1.51	1.06	2.57	75.684	0.71
686	0.04	1.61	1.02	2.63	73.119	0.69
660	0.04	1.73	0.97	2.70	70.490	0.66
635	0.04	1.81	0.94	2.75	67.790	0.64
610	0.04	1.88	0.91	2.79	65.040	0.61
584	0.05	1.95	0.88	2.83	62.248	0.58
559	0.05	2.02	0.85	2.87	59.414	0.56
533	0.05	2.08	0.83	2.91	56.539	0.53
508	0.05	2.14	0.80	2.95	53.626	0.51
483	0.05	2.21	0.78	2.99	50.678	0.48
457	0.05	2.25	0.76	3.01	47.692	0.46
432	0.05	2.30	0.74	3.04	44.679	0.43
406	0.06	2.35	0.72	3.07	41.636	0.41
381	0.06	2.39	0.71	3.10	38.565	0.38
356	0.06	2.43	0.69	3.12	35.468	0.36
330	0.06	2.47	0.68	3.14	32.347	0.33
305	0.06	2.50	0.66	3.16	29.204	0.30
279	0.06	2.54	0.65	3.18	26.040	0.28
254	0.06	2.56	0.64	3.20	22.856	0.25
229	0.06	2.59	0.63	3.22	19.657	0.23
203	0.06	2.61	0.62	3.23	16.441	0.20
178	0.06	2.63	0.61	3.24	13.211	0.18
152	0.00	0.00	1.66	1.66	9.973	0.15
127	0.00	0.00	1.66	1.66	8.311	0.13
102	0.00	0.00	1.66	1.66	6.649	0.10
76	0.00	0.00	1.66	1.66	4.987	0.08
51	0.00	0.00	1.66	1.66	3.324	0.05
25	0.00	0.00	1.66	1.66	1.662	0.03

Project: **Winston Chuchill Blvd System R4.01**

Chamber Model - SC-310
Units - **Metric** Click Here for Imperial

StormTech

Number of chambers - 54
Voids in the stone (porosity) - 40 %
Base of Stone Elevation - 0.00 m
Amount of Stone Above Chambers - 152 mm
Amount of Stone Below Chambers - 152 mm

☑ Include Perimeter Stone in Calculations

151.1 sq.meters Min. Area - 119.055 sq.meters

Height of System *(mm)*	Incremental Single Chamber *(cubic meters)*	Incremental Total Chamber *(cubic meters)*	Incremental Stone *(cubic meters)*	Incremental Ch & St *(cubic meters)*	Cumulative Chamber *(cubic meters)*	Elevation *(meters)*
711	0.00	0.00	1.54	1.54	56.548	0.71
686	0.00	0.00	1.54	1.54	55.013	0.69
660	0.00	0.00	1.54	1.54	53.477	0.66
635	0.00	0.00	1.54	1.54	51.942	0.64
610	0.00	0.00	1.54	1.54	50.406	0.61
584	0.00	0.00	1.54	1.54	48.870	0.58
559	0.00	0.09	1.50	1.59	47.335	0.56
533	0.00	0.24	1.44	1.68	45.745	0.53
508	0.01	0.41	1.37	1.78	44.068	0.51
483	0.02	0.83	1.20	2.04	42.288	0.48
457	0.02	1.08	1.10	2.18	40.252	0.46
432	0.02	1.26	1.03	2.29	38.070	0.43
406	0.03	1.41	0.97	2.38	35.778	0.41
381	0.03	1.55	0.91	2.47	33.393	0.38
356	0.03	1.67	0.87	2.54	30.926	0.36
330	0.03	1.77	0.83	2.60	28.385	0.33
305	0.03	1.86	0.79	2.65	25.790	0.30
279	0.04	1.95	0.76	2.71	23.139	0.28
254	0.04	2.03	0.72	2.75	20.432	0.25
229	0.04	2.09	0.70	2.79	17.681	0.23
203	0.04	2.15	0.68	2.83	14.892	0.20
178	0.04	2.20	0.66	2.85	12.066	0.18
152	0.00	0.00	1.54	1.54	9.213	0.15
127	0.00	0.00	1.54	1.54	7.678	0.13
102	0.00	0.00	1.54	1.54	6.142	0.10
76	0.00	0.00	1.54	1.54	4.607	0.08
51	0.00	0.00	1.54	1.54	3.071	0.05
25	0.00	0.00	1.54	1.54	1.536	0.03

Project: **Winston Chuchill Blvd System R4.02**

Chamber Model -	SC-740	
Units -	**Metric**	Click Here for Imperial
Number of chambers -	12	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	0.00	m
Amount of Stone Above Chambers -	152	mm
Amount of Stone Below Chambers -	152	mm

☑ Include Perimeter Stone in Calculations

50.6 sq.meters   Min. Area - 37.68 sq.meters

Height of System *(mm)*	Incremental Single Chamber *(cubic meters)*	Incremental Total Chamber *(cubic meters)*	Incremental Stone *(cubic meters)*	Incremental Ch & St *(cubic meters)*	Cumulative Chamber *(cubic meters)*	Elevation *(meters)*
1067	0.00	0.00	0.51	0.51	30.974	1.07
1041	0.00	0.00	0.51	0.51	30.460	1.04
1016	0.00	0.00	0.51	0.51	29.945	1.02
991	0.00	0.00	0.51	0.51	29.431	0.99
965	0.00	0.00	0.51	0.51	28.917	0.97
940	0.00	0.00	0.51	0.51	28.402	0.94
914	0.00	0.02	0.51	0.53	27.888	0.91
889	0.00	0.06	0.49	0.55	27.362	0.89
864	0.01	0.10	0.48	0.57	26.814	0.86
838	0.02	0.21	0.43	0.64	26.243	0.84
813	0.02	0.27	0.41	0.68	25.605	0.81
787	0.03	0.32	0.39	0.71	24.927	0.79
762	0.03	0.37	0.37	0.73	24.219	0.76
737	0.03	0.40	0.35	0.76	23.485	0.74
711	0.04	0.43	0.34	0.77	22.730	0.71
686	0.04	0.46	0.33	0.79	21.958	0.69
660	0.04	0.49	0.32	0.81	21.167	0.66
635	0.04	0.52	0.31	0.83	20.356	0.64
610	0.04	0.54	0.30	0.84	19.531	0.61
584	0.05	0.56	0.29	0.85	18.694	0.58
559	0.05	0.58	0.28	0.86	17.845	0.56
533	0.05	0.60	0.28	0.87	16.984	0.53
508	0.05	0.61	0.27	0.88	16.112	0.51
483	0.05	0.63	0.26	0.89	15.230	0.48
457	0.05	0.64	0.26	0.90	14.337	0.46
432	0.05	0.66	0.25	0.91	13.437	0.43
406	0.06	0.67	0.25	0.92	12.528	0.41
381	0.06	0.68	0.24	0.92	11.611	0.38
356	0.06	0.69	0.24	0.93	10.687	0.36
330	0.06	0.71	0.23	0.94	9.756	0.33
305	0.06	0.72	0.23	0.94	8.818	0.30
279	0.06	0.72	0.22	0.95	7.875	0.28
254	0.06	0.73	0.22	0.95	6.925	0.25
229	0.06	0.74	0.22	0.96	5.972	0.23
203	0.06	0.75	0.22	0.96	5.014	0.20
178	0.06	0.75	0.21	0.96	4.051	0.18
152	0.00	0.00	0.51	0.51	3.087	0.15
127	0.00	0.00	0.51	0.51	2.572	0.13
102	0.00	0.00	0.51	0.51	2.058	0.10
76	0.00	0.00	0.51	0.51	1.543	0.08
51	0.00	0.00	0.51	0.51	1.029	0.05
25	0.00	0.00	0.51	0.51	0.514	0.03

Project: Winston Churchill Blvd System R5.01

Chamber Model -	SC-740	
Units -	**Metric**	Click Here for Imperial
Number of chambers -	18	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	0.00	m
Amount of Stone Above Chambers -	152	mm
Amount of Stone Below Chambers -	152	mm

☑ Include Perimeter Stone in Calculations

82 sq.meters Min. Area - 56.52 sq.meters

Height of System *(mm)*	Incremental Single Chamber *(cubic meters)*	Incremental Total Chamber *(cubic meters)*	Incremental Stone *(cubic meters)*	Incremental Ch & St *(cubic meters)*	Cumulative Chamber *(cubic meters)*	Elevation *(meters)*
1067	0.00	0.00	0.83	0.83	49.058	1.07
1041	0.00	0.00	0.83	0.83	48.225	1.04
1016	0.00	0.00	0.83	0.83	47.391	1.02
991	0.00	0.00	0.83	0.83	46.558	0.99
965	0.00	0.00	0.83	0.83	45.724	0.97
940	0.00	0.00	0.83	0.83	44.891	0.94
914	0.00	0.03	0.82	0.85	44.057	0.91
889	0.00	0.08	0.80	0.88	43.207	0.89
864	0.01	0.14	0.78	0.92	42.324	0.86
838	0.02	0.31	0.71	1.02	41.404	0.84
813	0.02	0.41	0.67	1.08	40.386	0.81
787	0.03	0.48	0.64	1.12	39.307	0.79
762	0.03	0.55	0.61	1.16	38.183	0.76
737	0.03	0.60	0.59	1.19	37.021	0.74
711	0.04	0.65	0.58	1.22	35.827	0.71
686	0.04	0.69	0.56	1.25	34.606	0.69
660	0.04	0.74	0.54	1.28	33.358	0.66
635	0.04	0.78	0.52	1.30	32.080	0.64
610	0.04	0.81	0.51	1.32	30.780	0.61
584	0.05	0.84	0.50	1.34	29.463	0.58
559	0.05	0.87	0.49	1.35	28.127	0.56
533	0.05	0.89	0.48	1.37	26.774	0.53
508	0.05	0.92	0.47	1.38	25.404	0.51
483	0.05	0.95	0.46	1.40	24.020	0.48
457	0.05	0.96	0.45	1.41	22.619	0.46
432	0.05	0.99	0.44	1.42	21.206	0.43
406	0.06	1.01	0.43	1.44	19.782	0.41
381	0.06	1.02	0.42	1.45	18.344	0.38
356	0.06	1.04	0.42	1.46	16.896	0.36
330	0.06	1.06	0.41	1.47	15.437	0.33
305	0.06	1.07	0.40	1.48	13.969	0.30
279	0.06	1.09	0.40	1.49	12.492	0.28
254	0.06	1.10	0.39	1.49	11.006	0.25
229	0.06	1.11	0.39	1.50	9.514	0.23
203	0.06	1.12	0.39	1.51	8.015	0.20
178	0.06	1.13	0.38	1.51	6.509	0.18
152	0.00	0.00	0.83	0.83	5.001	0.15
127	0.00	0.00	0.83	0.83	4.167	0.13
102	0.00	0.00	0.83	0.83	3.334	0.10
76	0.00	0.00	0.83	0.83	2.500	0.08
51	0.00	0.00	0.83	0.83	1.667	0.05
25	0.00	0.00	0.83	0.83	0.833	0.03

Project: **Winston Churchill Blvd System R5.02**

Chamber Model - SC-740
Units - **Metric** Click Here for Imperial

Number of chambers - 10
Voids in the stone (porosity) - 40 %
Base of Stone Elevation - 0.00 m
Amount of Stone Above Chambers - 152 mm
Amount of Stone Below Chambers - 152 mm

☑ Include Perimeter Stone in Calculations

48.5 sq.meters Min. Area - 31.4 sq.meters

Height of System *(mm)*	Incremental Single Chamber *(cubic meters)*	Incremental Total Chamber *(cubic meters)*	Incremental Stone *(cubic meters)*	Incremental Ch & St *(cubic meters)*	Cumulative Chamber *(cubic meters)*	Elevation *(meters)*
1067	0.00	0.00	0.49	0.49	28.501	1.07
1041	0.00	0.00	0.49	0.49	28.008	1.04
1016	0.00	0.00	0.49	0.49	27.516	1.02
991	0.00	0.00	0.49	0.49	27.023	0.99
965	0.00	0.00	0.49	0.49	26.530	0.97
940	0.00	0.00	0.49	0.49	26.037	0.94
914	0.00	0.02	0.49	0.50	25.545	0.91
889	0.00	0.05	0.47	0.52	25.043	0.89
864	0.01	0.08	0.46	0.54	24.522	0.86
838	0.02	0.17	0.42	0.60	23.982	0.84
813	0.02	0.23	0.40	0.63	23.386	0.81
787	0.03	0.27	0.39	0.65	22.757	0.79
762	0.03	0.30	0.37	0.68	22.103	0.76
737	0.03	0.33	0.36	0.69	21.428	0.74
711	0.04	0.36	0.35	0.71	20.735	0.71
686	0.04	0.38	0.34	0.72	20.027	0.69
660	0.04	0.41	0.33	0.74	19.304	0.66
635	0.04	0.43	0.32	0.75	18.564	0.64
610	0.04	0.45	0.31	0.76	17.812	0.61
584	0.05	0.47	0.31	0.77	17.051	0.58
559	0.05	0.48	0.30	0.78	16.279	0.56
533	0.05	0.50	0.29	0.79	15.498	0.53
508	0.05	0.51	0.29	0.80	14.707	0.51
483	0.05	0.53	0.28	0.81	13.908	0.48
457	0.05	0.54	0.28	0.81	13.100	0.46
432	0.05	0.55	0.27	0.82	12.286	0.43
406	0.06	0.56	0.27	0.83	11.465	0.41
381	0.06	0.57	0.27	0.83	10.636	0.38
356	0.06	0.58	0.26	0.84	9.802	0.36
330	0.06	0.59	0.26	0.85	8.962	0.33
305	0.06	0.60	0.25	0.85	8.117	0.30
279	0.06	0.60	0.25	0.85	7.266	0.28
254	0.06	0.61	0.25	0.86	6.411	0.25
229	0.06	0.62	0.25	0.86	5.553	0.23
203	0.06	0.62	0.24	0.87	4.690	0.20
178	0.06	0.63	0.24	0.87	3.824	0.18
152	0.00	0.00	0.49	0.49	2.956	0.15
127	0.00	0.00	0.49	0.49	2.464	0.13
102	0.00	0.00	0.49	0.49	1.971	0.10
76	0.00	0.00	0.49	0.49	1.478	0.08
51	0.00	0.00	0.49	0.49	0.985	0.05
25	0.00	0.00	0.49	0.49	0.493	0.03

Project: **Winston Churchill Blvd System R6.01**

Chamber Model -	SC-740	
Units -	**Metric**	Click Here for Imperial
Number of chambers -	12	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	0.00	m
Amount of Stone Above Chambers -	152	mm
Amount of Stone Below Chambers -	152	mm

☑ Include Perimeter Stone in Calculations

54.1 sq.meters Min. Area - 37.68 sq.meters

Height of System *(mm)*	Incremental Single Chamber *(cubic meters)*	Incremental Total Chamber *(cubic meters)*	Incremental Stone *(cubic meters)*	Incremental Ch & St *(cubic meters)*	Cumulative Chamber *(cubic meters)*	Elevation *(meters)*
1067	0.00	0.00	0.55	0.55	32.441	1.07
1041	0.00	0.00	0.55	0.55	31.892	1.04
1016	0.00	0.00	0.55	0.55	31.342	1.02
991	0.00	0.00	0.55	0.55	30.793	0.99
965	0.00	0.00	0.55	0.55	30.244	0.97
940	0.00	0.00	0.55	0.55	29.694	0.94
914	0.00	0.02	0.54	0.56	29.145	0.91
889	0.00	0.06	0.53	0.58	28.584	0.89
864	0.01	0.10	0.51	0.61	28.002	0.86
838	0.02	0.21	0.47	0.67	27.395	0.84
813	0.02	0.27	0.44	0.71	26.723	0.81
787	0.03	0.32	0.42	0.74	26.010	0.79
762	0.03	0.37	0.40	0.77	25.267	0.76
737	0.03	0.40	0.39	0.79	24.498	0.74
711	0.04	0.43	0.38	0.81	23.708	0.71
686	0.04	0.46	0.37	0.83	22.901	0.69
660	0.04	0.49	0.35	0.85	22.075	0.66
635	0.04	0.52	0.34	0.86	21.229	0.64
610	0.04	0.54	0.33	0.87	20.369	0.61
584	0.05	0.56	0.33	0.88	19.497	0.58
559	0.05	0.58	0.32	0.90	18.613	0.56
533	0.05	0.60	0.31	0.91	17.717	0.53
508	0.05	0.61	0.30	0.92	16.810	0.51
483	0.05	0.63	0.30	0.93	15.894	0.48
457	0.05	0.64	0.29	0.94	14.966	0.46
432	0.05	0.66	0.29	0.94	14.031	0.43
406	0.06	0.67	0.28	0.95	13.087	0.41
381	0.06	0.68	0.28	0.96	12.135	0.38
356	0.06	0.69	0.27	0.97	11.176	0.36
330	0.06	0.71	0.27	0.97	10.210	0.33
305	0.06	0.72	0.26	0.98	9.237	0.30
279	0.06	0.72	0.26	0.98	8.259	0.28
254	0.06	0.73	0.26	0.99	7.275	0.25
229	0.06	0.74	0.25	0.99	6.286	0.23
203	0.06	0.75	0.25	1.00	5.293	0.20
178	0.06	0.75	0.25	1.00	4.295	0.18
152	0.00	0.00	0.55	0.55	3.296	0.15
127	0.00	0.00	0.55	0.55	2.747	0.13
102	0.00	0.00	0.55	0.55	2.197	0.10
76	0.00	0.00	0.55	0.55	1.648	0.08
51	0.00	0.00	0.55	0.55	1.099	0.05
25	0.00	0.00	0.55	0.55	0.549	0.03

Project: **Winston Churchill Blvd System R6.02**

Chamber Model -	SC-740	
Units -	**Metric**	Click Here for Imperial
Number of chambers -	12	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	0.00	m
Amount of Stone Above Chambers -	152	mm
Amount of Stone Below Chambers -	152	mm

☑ Include Perimeter Stone in Calculations

56.3 sq.meters Min. Area - 37.68 sq.meters

Height of System *(mm)*	Incremental Single Chamber *(cubic meters)*	Incremental Total Chamber *(cubic meters)*	Incremental Stone *(cubic meters)*	Incremental Ch & St *(cubic meters)*	Cumulative Chamber *(cubic meters)*	Elevation *(meters)*
1067	0.00	0.00	0.57	0.57	33.393	1.07
1041	0.00	0.00	0.57	0.57	32.821	1.04
1016	0.00	0.00	0.57	0.57	32.249	1.02
991	0.00	0.00	0.57	0.57	31.677	0.99
965	0.00	0.00	0.57	0.57	31.105	0.97
940	0.00	0.00	0.57	0.57	30.533	0.94
914	0.00	0.02	0.56	0.58	29.961	0.91
889	0.00	0.06	0.55	0.61	29.377	0.89
864	0.01	0.10	0.53	0.63	28.772	0.86
838	0.02	0.21	0.49	0.70	28.143	0.84
813	0.02	0.27	0.46	0.74	27.447	0.81
787	0.03	0.32	0.44	0.77	26.712	0.79
762	0.03	0.37	0.43	0.79	25.946	0.76
737	0.03	0.40	0.41	0.81	25.155	0.74
711	0.04	0.43	0.40	0.83	24.342	0.71
686	0.04	0.46	0.39	0.85	23.512	0.69
660	0.04	0.49	0.37	0.87	22.664	0.66
635	0.04	0.52	0.36	0.88	21.796	0.64
610	0.04	0.54	0.36	0.89	20.913	0.61
584	0.05	0.56	0.35	0.91	20.018	0.58
559	0.05	0.58	0.34	0.92	19.111	0.56
533	0.05	0.60	0.33	0.93	18.193	0.53
508	0.05	0.61	0.33	0.94	17.263	0.51
483	0.05	0.63	0.32	0.95	16.324	0.48
457	0.05	0.64	0.31	0.96	15.374	0.46
432	0.05	0.66	0.31	0.97	14.416	0.43
406	0.06	0.67	0.30	0.97	13.449	0.41
381	0.06	0.68	0.30	0.98	12.475	0.38
356	0.06	0.69	0.29	0.99	11.493	0.36
330	0.06	0.71	0.29	1.00	10.504	0.33
305	0.06	0.72	0.29	1.00	9.509	0.30
279	0.06	0.72	0.28	1.01	8.508	0.28
254	0.06	0.73	0.28	1.01	7.501	0.25
229	0.06	0.74	0.28	1.02	6.490	0.23
203	0.06	0.75	0.27	1.02	5.474	0.20
178	0.06	0.75	0.27	1.02	4.454	0.18
152	0.00	0.00	0.57	0.57	3.432	0.15
127	0.00	0.00	0.57	0.57	2.860	0.13
102	0.00	0.00	0.57	0.57	2.288	0.10
76	0.00	0.00	0.57	0.57	1.716	0.08
51	0.00	0.00	0.57	0.57	1.144	0.05
25	0.00	0.00	0.57	0.57	0.572	0.03

Project: **Winston Churchill Blvd System R8.01**

Chamber Model -	SC-740	
Units -	**Metric**	Click Here for Imperial
Number of chambers -	30	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	0.00	m
Amount of Stone Above Chambers -	305	mm
Amount of Stone Below Chambers -	250	mm

☑ Include Perimeter Stone in Calculations

118.3 sq.meters   Min. Area - 94.2 sq.meters

Height of System *(mm)*	Incremental Single Chamber *(cubic meters)*	Incremental Total Chamber *(cubic meters)*	Incremental Stone *(cubic meters)*	Incremental Ch & St *(cubic meters)*	Cumulative Chamber *(cubic meters)*	Elevation *(meters)*
1321	0.00	0.00	1.20	1.20	85.903	1.32
1295	0.00	0.00	1.20	1.20	84.702	1.30
1270	0.00	0.00	1.20	1.20	83.500	1.27
1245	0.00	0.00	1.20	1.20	82.299	1.24
1219	0.00	0.00	1.20	1.20	81.097	1.22
1194	0.00	0.00	1.20	1.20	79.895	1.19
1168	0.00	0.00	1.20	1.20	78.694	1.17
1143	0.00	0.00	1.20	1.20	77.492	1.14
1118	0.00	0.00	1.20	1.20	76.291	1.12
1092	0.00	0.00	1.20	1.20	75.089	1.09
1067	0.00	0.00	1.20	1.20	73.888	1.07
1041	0.00	0.00	1.20	1.20	72.686	1.04
1016	0.00	0.05	1.18	1.23	71.484	1.02
991	0.00	0.14	1.15	1.28	70.255	0.99
965	0.01	0.24	1.11	1.35	68.970	0.97
940	0.02	0.51	1.00	1.51	67.625	0.94
914	0.02	0.68	0.93	1.61	66.115	0.91
889	0.03	0.81	0.88	1.69	64.505	0.89
864	0.03	0.91	0.84	1.75	62.819	0.86
838	0.03	1.00	0.80	1.80	61.070	0.84
813	0.04	1.08	0.77	1.85	59.267	0.81
787	0.04	1.15	0.74	1.89	57.420	0.79
762	0.04	1.24	0.71	1.94	55.528	0.76
737	0.04	1.30	0.68	1.98	53.585	0.74
711	0.04	1.34	0.66	2.01	51.606	0.71
686	0.05	1.40	0.64	2.04	49.598	0.69
660	0.05	1.44	0.62	2.07	47.559	0.66
635	0.05	1.49	0.61	2.10	45.492	0.64
610	0.05	1.53	0.59	2.12	43.397	0.61
584	0.05	1.58	0.57	2.15	41.276	0.58
559	0.05	1.61	0.56	2.17	39.129	0.56
533	0.05	1.64	0.54	2.19	36.963	0.53
508	0.06	1.68	0.53	2.21	34.775	0.51
483	0.06	1.71	0.52	2.23	32.567	0.48
457	0.06	1.74	0.51	2.24	30.341	0.46
432	0.06	1.76	0.50	2.26	28.097	0.43
406	0.06	1.79	0.49	2.27	25.838	0.41
381	0.06	1.81	0.48	2.29	23.563	0.38
356	0.06	1.83	0.47	2.30	21.275	0.36
330	0.06	1.85	0.46	2.31	18.976	0.33
305	0.06	1.87	0.45	2.32	16.665	0.30
279	0.06	1.88	0.45	2.33	14.342	0.28
254	0.00	0.00	1.20	1.20	12.016	0.25
229	0.00	0.00	1.20	1.20	10.814	0.23
203	0.00	0.00	1.20	1.20	9.613	0.20
178	0.00	0.00	1.20	1.20	8.411	0.18
152	0.00	0.00	1.20	1.20	7.209	0.15
127	0.00	0.00	1.20	1.20	6.008	0.13
102	0.00	0.00	1.20	1.20	4.806	0.10
76	0.00	0.00	1.20	1.20	3.605	0.08
51	0.00	0.00	1.20	1.20	2.403	0.05
25	0.00	0.00	1.20	1.20	1.202	0.03

Project: Winston Churchill Blvd System R8.02

StormTech® Detention • Retention • Water Quality
A division of ADS

Chamber Model -	SC-740	
Units -	**Metric**	Click Here for Imperial
Number of chambers -	34	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	0.00	m
Amount of Stone Above Chambers -	305	mm
Amount of Stone Below Chambers -	305	mm

☑ Include Perimeter Stone in Calculations

138.4 sq.meters Min. Area - 106.76 sq.meters

Height of System *(mm)*	Incremental Single Chamber *(cubic meters)*	Incremental Total Chamber *(cubic meters)*	Incremental Stone *(cubic meters)*	Incremental Ch & St *(cubic meters)*	Cumulative Chamber *(cubic meters)*	Elevation *(meters)*
1372	0.00	0.00	1.41	1.41	102.490	1.37
1346	0.00	0.00	1.41	1.41	101.084	1.35
1321	0.00	0.00	1.41	1.41	99.677	1.32
1295	0.00	0.00	1.41	1.41	98.271	1.30
1270	0.00	0.00	1.41	1.41	96.864	1.27
1245	0.00	0.00	1.41	1.41	95.458	1.24
1219	0.00	0.00	1.41	1.41	94.052	1.22
1194	0.00	0.00	1.41	1.41	92.645	1.19
1168	0.00	0.00	1.41	1.41	91.239	1.17
1143	0.00	0.00	1.41	1.41	89.832	1.14
1118	0.00	0.00	1.41	1.41	88.426	1.12
1092	0.00	0.00	1.41	1.41	87.019	1.09
1067	0.00	0.05	1.39	1.44	85.613	1.07
1041	0.00	0.16	1.34	1.50	84.175	1.04
1016	0.01	0.27	1.30	1.57	82.674	1.02
991	0.02	0.58	1.17	1.76	81.105	0.99
965	0.02	0.77	1.10	1.87	79.350	0.97
940	0.03	0.92	1.04	1.96	77.480	0.94
914	0.03	1.03	0.99	2.03	75.525	0.91
889	0.03	1.14	0.95	2.09	73.498	0.89
864	0.04	1.22	0.92	2.14	71.409	0.86
838	0.04	1.30	0.88	2.19	69.272	0.84
813	0.04	1.40	0.85	2.25	67.083	0.81
787	0.04	1.47	0.82	2.29	64.836	0.79
762	0.04	1.52	0.80	2.32	62.549	0.76
737	0.05	1.58	0.77	2.36	60.229	0.74
711	0.05	1.64	0.75	2.39	57.874	0.71
686	0.05	1.69	0.73	2.42	55.485	0.69
660	0.05	1.74	0.71	2.45	53.066	0.66
635	0.05	1.79	0.69	2.48	50.619	0.64
610	0.05	1.82	0.68	2.50	48.141	0.61
584	0.05	1.86	0.66	2.52	45.641	0.58
559	0.06	1.90	0.65	2.55	43.117	0.56
533	0.06	1.94	0.63	2.57	40.570	0.53
508	0.06	1.97	0.62	2.59	38.002	0.51
483	0.06	2.00	0.61	2.61	35.415	0.48
457	0.06	2.03	0.60	2.62	32.809	0.46
432	0.06	2.05	0.59	2.64	30.187	0.43
406	0.06	2.07	0.58	2.65	27.549	0.41
381	0.06	2.10	0.57	2.66	24.899	0.38
356	0.06	2.12	0.56	2.68	22.235	0.36
330	0.06	2.13	0.56	2.68	19.558	0.33
305	0.00	0.00	1.41	1.41	16.877	0.30
279	0.00	0.00	1.41	1.41	15.470	0.28
254	0.00	0.00	1.41	1.41	14.064	0.25
229	0.00	0.00	1.41	1.41	12.658	0.23
203	0.00	0.00	1.41	1.41	11.251	0.20
178	0.00	0.00	1.41	1.41	9.845	0.18
152	0.00	0.00	1.41	1.41	8.438	0.15
127	0.00	0.00	1.41	1.41	7.032	0.13
102	0.00	0.00	1.41	1.41	5.626	0.10
76	0.00	0.00	1.41	1.41	4.219	0.08
51	0.00	0.00	1.41	1.41	2.813	0.05
25	0.00	0.00	1.41	1.41	1.406	0.03

Project: Winston Churchill Blvd System R10.01

Chamber Model -	MC-3500	
Units -	Metric	Click Here for Imperial
Number of Chambers -	27	
Number of End Caps -	4	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	0.00	m
Amount of Stone Above Chambers -	305	mm
Amount of Stone Below Chambers -	229	mm
Amount of Stone Between Chambers -	152	mm
	152.3	sq.meters

☑ Include Perimeter Stone in Calculations

Min. Area - 130.342 sq.meters

ADS StormTech

Height of System (mm)	Incremental Single Chamber (cubic meters)	Incremental Single End Cap (cubic meters)	Incremental Chambers (cubic meters)	Incremental End Cap (cubic meters)	Incremental Stone (cubic meters)	Chamber, End Cap and Stone (cubic meters)	Cumulative System (cubic meters)	Elevation (meters)
1676	0.00	0.00	0.00	0.00	1.547	1.55	153.53	1.68
1651	0.00	0.00	0.00	0.00	1.547	1.55	151.98	1.65
1626	0.00	0.00	0.00	0.00	1.547	1.55	150.44	1.63
1600	0.00	0.00	0.00	0.00	1.547	1.55	148.89	1.60
1575	0.00	0.00	0.00	0.00	1.547	1.55	147.34	1.57
1549	0.00	0.00	0.00	0.00	1.547	1.55	145.80	1.55
1524	0.00	0.00	0.00	0.00	1.547	1.55	144.25	1.52
1499	0.00	0.00	0.00	0.00	1.547	1.55	142.70	1.50
1473	0.00	0.00	0.00	0.00	1.547	1.55	141.16	1.47
1448	0.00	0.00	0.00	0.00	1.547	1.55	139.61	1.45
1422	0.00	0.00	0.00	0.00	1.547	1.55	138.06	1.42
1397	0.00	0.00	0.00	0.00	1.547	1.55	136.52	1.40
1372	0.00	0.00	0.04	0.00	1.529	1.57	134.97	1.37
1346	0.01	0.00	0.15	0.00	1.486	1.64	133.40	1.35
1321	0.01	0.00	0.22	0.00	1.455	1.68	131.76	1.32
1295	0.01	0.00	0.31	0.01	1.421	1.74	130.07	1.30
1270	0.02	0.00	0.53	0.01	1.333	1.87	128.34	1.27
1245	0.03	0.00	0.79	0.01	1.228	2.02	126.47	1.24
1219	0.04	0.00	0.96	0.01	1.160	2.13	124.45	1.22
1194	0.04	0.00	1.09	0.01	1.106	2.21	122.32	1.19
1168	0.04	0.00	1.20	0.02	1.059	2.28	120.11	1.17
1143	0.05	0.00	1.31	0.02	1.017	2.34	117.84	1.14
1118	0.05	0.01	1.40	0.02	0.979	2.40	115.50	1.12
1092	0.05	0.01	1.48	0.02	0.945	2.45	113.10	1.09
1067	0.06	0.01	1.56	0.02	0.913	2.50	110.65	1.07
1041	0.06	0.01	1.63	0.03	0.883	2.54	108.15	1.04
1016	0.06	0.01	1.70	0.03	0.855	2.58	105.61	1.02
991	0.07	0.01	1.76	0.03	0.829	2.62	103.02	0.99
965	0.07	0.01	1.82	0.03	0.805	2.66	100.40	0.97
940	0.07	0.01	1.88	0.03	0.781	2.69	97.74	0.94
914	0.07	0.01	1.93	0.03	0.759	2.73	95.05	0.91
889	0.07	0.01	1.98	0.04	0.739	2.76	92.32	0.89
864	0.08	0.01	2.03	0.04	0.719	2.79	89.56	0.86
838	0.08	0.01	2.08	0.04	0.701	2.82	86.77	0.84
813	0.08	0.01	2.12	0.04	0.683	2.84	83.96	0.81
787	0.08	0.01	2.16	0.04	0.666	2.87	81.12	0.79
762	0.08	0.01	2.20	0.04	0.650	2.89	78.25	0.76
737	0.08	0.01	2.24	0.04	0.634	2.91	75.36	0.74
711	0.08	0.01	2.27	0.05	0.620	2.94	72.44	0.71
686	0.09	0.01	2.30	0.05	0.606	2.96	69.51	0.69
660	0.09	0.01	2.33	0.05	0.593	2.98	66.55	0.66
635	0.09	0.01	2.37	0.05	0.580	3.00	63.57	0.64
610	0.09	0.01	2.39	0.05	0.569	3.01	60.58	0.61
584	0.09	0.01	2.42	0.05	0.558	3.03	57.56	0.58
559	0.09	0.01	2.45	0.05	0.547	3.05	54.53	0.56
533	0.09	0.01	2.47	0.05	0.537	3.06	51.49	0.53
508	0.09	0.01	2.49	0.06	0.527	3.08	48.42	0.51
483	0.09	0.01	2.52	0.06	0.518	3.09	45.35	0.48
457	0.09	0.01	2.54	0.06	0.509	3.10	42.26	0.46
432	0.09	0.01	2.56	0.06	0.501	3.12	39.16	0.43
406	0.10	0.01	2.58	0.06	0.493	3.13	36.04	0.41
381	0.10	0.01	2.59	0.06	0.485	3.14	32.91	0.38
356	0.10	0.02	2.61	0.06	0.478	3.15	29.77	0.36
330	0.10	0.02	2.63	0.06	0.471	3.16	26.62	0.33
305	0.10	0.02	2.64	0.06	0.464	3.17	23.46	0.30
279	0.10	0.02	2.66	0.06	0.458	3.18	20.29	0.28
254	0.10	0.02	2.68	0.07	0.448	3.19	17.11	0.25
229	0.00	0.00	0.00	0.00	1.547	1.55	13.92	0.23
203	0.00	0.00	0.00	0.00	1.547	1.55	12.37	0.20
178	0.00	0.00	0.00	0.00	1.547	1.55	10.83	0.18
152	0.00	0.00	0.00	0.00	1.547	1.55	9.28	0.15
127	0.00	0.00	0.00	0.00	1.547	1.55	7.73	0.13
102	0.00	0.00	0.00	0.00	1.547	1.55	6.19	0.10
76	0.00	0.00	0.00	0.00	1.547	1.55	4.64	0.08
51	0.00	0.00	0.00	0.00	1.547	1.55	3.09	0.05
25	0.00	0.00	0.00	0.00	1.547	1.55	1.55	0.03

Project: Winston Churchill Blvd System R10.02

StormTech

Chamber Model -	SC-740	
Units -	**Metric**	Click Here for Imperial
Number of chambers -	30	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	0.00	m
Amount of Stone Above Chambers -	305	mm
Amount of Stone Below Chambers -	250	mm

☑ Include Perimeter Stone in Calculations

117.5 sq.meters Min. Area - 94.2 sq.meters

Height of System (mm)	Incremental Single Chamber (cubic meters)	Incremental Total Chamber (cubic meters)	Incremental Stone (cubic meters)	Incremental Ch & St (cubic meters)	Cumulative Chamber (cubic meters)	Elevation (meters)
1321	0.00	0.00	1.19	1.19	85.511	1.32
1295	0.00	0.00	1.19	1.19	84.317	1.30
1270	0.00	0.00	1.19	1.19	83.123	1.27
1245	0.00	0.00	1.19	1.19	81.929	1.24
1219	0.00	0.00	1.19	1.19	80.735	1.22
1194	0.00	0.00	1.19	1.19	79.541	1.19
1168	0.00	0.00	1.19	1.19	78.347	1.17
1143	0.00	0.00	1.19	1.19	77.153	1.14
1118	0.00	0.00	1.19	1.19	75.958	1.12
1092	0.00	0.00	1.19	1.19	74.764	1.09
1067	0.00	0.00	1.19	1.19	73.570	1.07
1041	0.00	0.00	1.19	1.19	72.376	1.04
1016	0.00	0.05	1.18	1.22	71.182	1.02
991	0.00	0.14	1.14	1.28	69.960	0.99
965	0.01	0.24	1.10	1.34	68.683	0.97
940	0.02	0.51	0.99	1.50	67.346	0.94
914	0.02	0.68	0.92	1.60	65.844	0.91
889	0.03	0.81	0.87	1.68	64.241	0.89
864	0.03	0.91	0.83	1.74	62.562	0.86
838	0.03	1.00	0.79	1.80	60.821	0.84
813	0.04	1.08	0.76	1.84	59.025	0.81
787	0.04	1.15	0.73	1.88	57.186	0.79
762	0.04	1.24	0.70	1.94	55.301	0.76
737	0.04	1.30	0.68	1.97	53.366	0.74
711	0.04	1.34	0.66	2.00	51.395	0.71
686	0.05	1.40	0.64	2.03	49.394	0.69
660	0.05	1.44	0.62	2.06	47.363	0.66
635	0.05	1.49	0.60	2.09	45.303	0.64
610	0.05	1.53	0.58	2.11	43.215	0.61
584	0.05	1.58	0.56	2.14	41.102	0.58
559	0.05	1.61	0.55	2.16	38.963	0.56
533	0.05	1.64	0.54	2.18	36.804	0.53
508	0.06	1.68	0.52	2.20	34.624	0.51
483	0.06	1.71	0.51	2.22	32.423	0.48
457	0.06	1.74	0.50	2.24	30.205	0.46
432	0.06	1.76	0.49	2.25	27.969	0.43
406	0.06	1.79	0.48	2.27	25.717	0.41
381	0.06	1.81	0.47	2.28	23.450	0.38
356	0.06	1.83	0.46	2.29	21.169	0.36
330	0.06	1.85	0.45	2.30	18.878	0.33
305	0.06	1.87	0.45	2.31	16.574	0.30
279	0.06	1.88	0.44	2.32	14.259	0.28
254	0.00	0.00	1.19	1.19	11.940	0.25
229	0.00	0.00	1.19	1.19	10.746	0.23
203	0.00	0.00	1.19	1.19	9.552	0.20
178	0.00	0.00	1.19	1.19	8.358	0.18
152	0.00	0.00	1.19	1.19	7.164	0.15
127	0.00	0.00	1.19	1.19	5.970	0.13
102	0.00	0.00	1.19	1.19	4.776	0.10
76	0.00	0.00	1.19	1.19	3.582	0.08
51	0.00	0.00	1.19	1.19	2.388	0.05
25	0.00	0.00	1.19	1.19	1.194	0.03

Project: **Winston Churchill Blvd System R11.01**

Chamber Model -	SC-740	
Units -	**Metric**	Click Here for Imperial
Number of chambers -	8	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	0.00	m
Amount of Stone Above Chambers -	152	mm
Amount of Stone Below Chambers -	152	mm

☑ Include Perimeter Stone in Calculations

38.5 sq.meters Min. Area - 25.12 sq.meters

Height of System *(mm)*	Incremental Single Chamber *(cubic meters)*	Incremental Total Chamber *(cubic meters)*	Incremental Stone *(cubic meters)*	Incremental Ch & St *(cubic meters)*	Cumulative Chamber *(cubic meters)*	Elevation *(meters)*
1067	0.00	0.00	0.39	0.39	22.658	1.07
1041	0.00	0.00	0.39	0.39	22.267	1.04
1016	0.00	0.00	0.39	0.39	21.877	1.02
991	0.00	0.00	0.39	0.39	21.486	0.99
965	0.00	0.00	0.39	0.39	21.095	0.97
940	0.00	0.00	0.39	0.39	20.704	0.94
914	0.00	0.01	0.39	0.40	20.313	0.91
889	0.00	0.04	0.38	0.41	19.915	0.89
864	0.01	0.06	0.37	0.43	19.502	0.86
838	0.02	0.14	0.34	0.47	19.073	0.84
813	0.02	0.18	0.32	0.50	18.600	0.81
787	0.03	0.22	0.30	0.52	18.101	0.79
762	0.03	0.24	0.29	0.54	17.581	0.76
737	0.03	0.27	0.28	0.55	17.044	0.74
711	0.04	0.29	0.28	0.56	16.493	0.71
686	0.04	0.31	0.27	0.57	15.930	0.69
660	0.04	0.33	0.26	0.59	15.355	0.66
635	0.04	0.35	0.25	0.60	14.766	0.64
610	0.04	0.36	0.25	0.61	14.168	0.61
584	0.05	0.37	0.24	0.61	13.563	0.58
559	0.05	0.38	0.24	0.62	12.949	0.56
533	0.05	0.40	0.23	0.63	12.327	0.53
508	0.05	0.41	0.23	0.64	11.698	0.51
483	0.05	0.42	0.22	0.64	11.062	0.48
457	0.05	0.43	0.22	0.65	10.419	0.46
432	0.05	0.44	0.22	0.65	9.771	0.43
406	0.06	0.45	0.21	0.66	9.117	0.41
381	0.06	0.46	0.21	0.66	8.458	0.38
356	0.06	0.46	0.21	0.67	7.794	0.36
330	0.06	0.47	0.20	0.67	7.125	0.33
305	0.06	0.48	0.20	0.68	6.453	0.30
279	0.06	0.48	0.20	0.68	5.776	0.28
254	0.06	0.49	0.20	0.68	5.095	0.25
229	0.06	0.49	0.19	0.69	4.412	0.23
203	0.06	0.50	0.19	0.69	3.725	0.20
178	0.06	0.50	0.19	0.69	3.035	0.18
152	0.00	0.00	0.39	0.39	2.345	0.15
127	0.00	0.00	0.39	0.39	1.954	0.13
102	0.00	0.00	0.39	0.39	1.563	0.10
76	0.00	0.00	0.39	0.39	1.172	0.08
51	0.00	0.00	0.39	0.39	0.782	0.05
25	0.00	0.00	0.39	0.39	0.391	0.03

Project: **Winston Churchill Blvd System R11.02**

Chamber Model -	SC-310	
Units -	**Metric**	Click Here for Imperial
Number of chambers -	6	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	0.00	m
Amount of Stone Above Chambers -	152	mm
Amount of Stone Below Chambers -	152	mm

☑ Include Perimeter Stone in Calculations

21.5 sq.meters Min. Area - 13.228 sq.meters

Height of System *(mm)*	Incremental Single Chamber *(cubic meters)*	Incremental Total Chamber *(cubic meters)*	Incremental Stone *(cubic meters)*	Incremental Ch & St *(cubic meters)*	Cumulative Chamber *(cubic meters)*	Elevation *(meters)*
711	0.00	0.00	0.22	0.22	7.624	0.71
686	0.00	0.00	0.22	0.22	7.405	0.69
660	0.00	0.00	0.22	0.22	7.187	0.66
635	0.00	0.00	0.22	0.22	6.968	0.64
610	0.00	0.00	0.22	0.22	6.750	0.61
584	0.00	0.00	0.22	0.22	6.531	0.58
559	0.00	0.01	0.21	0.22	6.313	0.56
533	0.00	0.03	0.21	0.23	6.088	0.53
508	0.01	0.05	0.20	0.25	5.854	0.51
483	0.02	0.09	0.18	0.27	5.608	0.48
457	0.02	0.12	0.17	0.29	5.334	0.46
432	0.02	0.14	0.16	0.30	5.044	0.43
406	0.03	0.16	0.16	0.31	4.741	0.41
381	0.03	0.17	0.15	0.32	4.429	0.38
356	0.03	0.19	0.14	0.33	4.106	0.36
330	0.03	0.20	0.14	0.34	3.776	0.33
305	0.03	0.21	0.14	0.34	3.440	0.30
279	0.04	0.22	0.13	0.35	3.098	0.28
254	0.04	0.23	0.13	0.35	2.749	0.25
229	0.04	0.23	0.13	0.36	2.395	0.23
203	0.04	0.24	0.12	0.36	2.038	0.20
178	0.04	0.24	0.12	0.36	1.676	0.18
152	0.00	0.00	0.22	0.22	1.311	0.15
127	0.00	0.00	0.22	0.22	1.092	0.13
102	0.00	0.00	0.22	0.22	0.874	0.10
76	0.00	0.00	0.22	0.22	0.655	0.08
51	0.00	0.00	0.22	0.22	0.437	0.05
25	0.00	0.00	0.22	0.22	0.218	0.03

Project: Winston Churchill Blvd System R12.01

StormTech

Detention • Retention • Water Quality

A division of ADS

Chamber Model -	SC-310	
Units -	**Metric**	Click Here for Imperial
	12	
Number of chambers -	10	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	0.00	m
Amount of Stone Above Chambers -	152	mm
Amount of Stone Below Chambers -	152	mm

☑ Include Perimeter Stone in Calculations

37.7 sq.meters Min. Area - 22.047 sq.meters

Height of System *(mm)*	Incremental Single Chamber *(cubic meters)*	Incremental Total Chamber *(cubic meters)*	Incremental Stone *(cubic meters)*	Incremental Ch & St *(cubic meters)*	Cumulative Chamber *(cubic meters)*	Elevation *(meters)*
711	0.00	0.00	0.38	0.38	13.237	0.71
686	0.00	0.00	0.38	0.38	12.854	0.69
660	0.00	0.00	0.38	0.38	12.471	0.66
635	0.00	0.00	0.38	0.38	12.088	0.64
610	0.00	0.00	0.38	0.38	11.705	0.61
584	0.00	0.00	0.38	0.38	11.322	0.58
559	0.00	0.02	0.38	0.39	10.939	0.56
533	0.00	0.04	0.37	0.41	10.545	0.53
508	0.01	0.08	0.35	0.43	10.136	0.51
483	0.02	0.15	0.32	0.48	9.708	0.48
457	0.02	0.20	0.30	0.50	9.232	0.46
432	0.02	0.23	0.29	0.52	8.729	0.43
406	0.03	0.26	0.28	0.54	8.206	0.41
381	0.03	0.29	0.27	0.56	7.665	0.38
356	0.03	0.31	0.26	0.57	7.110	0.36
330	0.03	0.33	0.25	0.58	6.540	0.33
305	0.03	0.34	0.25	0.59	5.961	0.30
279	0.04	0.36	0.24	0.60	5.371	0.28
254	0.04	0.38	0.23	0.61	4.771	0.25
229	0.04	0.39	0.23	0.62	4.163	0.23
203	0.04	0.40	0.22	0.62	3.548	0.20
178	0.04	0.41	0.22	0.63	2.926	0.18
152	0.00	0.00	0.38	0.38	2.299	0.15
127	0.00	0.00	0.38	0.38	1.916	0.13
102	0.00	0.00	0.38	0.38	1.533	0.10
76	0.00	0.00	0.38	0.38	1.149	0.08
51	0.00	0.00	0.38	0.38	0.766	0.05
25	0.00	0.00	0.38	0.38	0.383	0.03

Project: Winston Churchill Blvd System R12.02

Chamber Model -	SC-740	
Units -	**Metric**	Click Here for Imperial
Number of chambers -	18	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	0.00	m
Amount of Stone Above Chambers -	152	mm
Amount of Stone Below Chambers -	152	mm

☑ Include Perimeter Stone in Calculations

76.4 sq.meters   Min. Area - 56.52 sq.meters

Height of System *(mm)*	Incremental Single Chamber *(cubic meters)*	Incremental Total Chamber *(cubic meters)*	Incremental Stone *(cubic meters)*	Incremental Ch & St *(cubic meters)*	Cumulative Chamber *(cubic meters)*	Elevation *(meters)*
1067	0.00	0.00	0.78	0.78	46.640	1.07
1041	0.00	0.00	0.78	0.78	45.864	1.04
1016	0.00	0.00	0.78	0.78	45.088	1.02
991	0.00	0.00	0.78	0.78	44.312	0.99
965	0.00	0.00	0.78	0.78	43.536	0.97
940	0.00	0.00	0.78	0.78	42.760	0.94
914	0.00	0.03	0.76	0.79	41.985	0.91
889	0.00	0.08	0.74	0.83	41.192	0.89
864	0.01	0.14	0.72	0.86	40.366	0.86
838	0.02	0.31	0.65	0.96	39.504	0.84
813	0.02	0.41	0.61	1.02	38.543	0.81
787	0.03	0.48	0.58	1.07	37.522	0.79
762	0.03	0.55	0.56	1.10	36.456	0.76
737	0.03	0.60	0.54	1.14	35.351	0.74
711	0.04	0.65	0.52	1.16	34.214	0.71
686	0.04	0.69	0.50	1.19	33.051	0.69
660	0.04	0.74	0.48	1.22	31.861	0.66
635	0.04	0.78	0.47	1.24	30.641	0.64
610	0.04	0.81	0.45	1.26	29.398	0.61
584	0.05	0.84	0.44	1.28	28.139	0.58
559	0.05	0.87	0.43	1.30	26.860	0.56
533	0.05	0.89	0.42	1.31	25.565	0.53
508	0.05	0.92	0.41	1.33	24.253	0.51
483	0.05	0.95	0.40	1.34	22.926	0.48
457	0.05	0.96	0.39	1.35	21.582	0.46
432	0.05	0.99	0.38	1.37	20.228	0.43
406	0.06	1.01	0.37	1.38	18.860	0.41
381	0.06	1.02	0.37	1.39	17.480	0.38
356	0.06	1.04	0.36	1.40	16.090	0.36
330	0.06	1.06	0.35	1.41	14.689	0.33
305	0.06	1.07	0.35	1.42	13.278	0.30
279	0.06	1.09	0.34	1.43	11.858	0.28
254	0.06	1.10	0.34	1.43	10.431	0.25
229	0.06	1.11	0.33	1.44	8.996	0.23
203	0.06	1.12	0.33	1.45	7.554	0.20
178	0.06	1.13	0.33	1.45	6.106	0.18
152	0.00	0.00	0.78	0.78	4.655	0.15
127	0.00	0.00	0.78	0.78	3.879	0.13
102	0.00	0.00	0.78	0.78	3.104	0.10
76	0.00	0.00	0.78	0.78	2.328	0.08
51	0.00	0.00	0.78	0.78	1.552	0.05
25	0.00	0.00	0.78	0.78	0.776	0.03

Project: Winston Churchill Blvd System R13.01

Chamber Model -	SC-740	
Units -	**Metric**	Click Here for Imperial
Number of chambers -	22	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	0.00	m
Amount of Stone Above Chambers -	152	mm
Amount of Stone Below Chambers -	152	mm

☑ Include Perimeter Stone in Calculations

93 sq.meters Min. Area - 69.08 sq.meters

Height of System *(mm)*	Incremental Single Chamber *(cubic meters)*	Incremental Total Chamber *(cubic meters)*	Incremental Stone *(cubic meters)*	Incremental Ch & St *(cubic meters)*	Cumulative Chamber *(cubic meters)*	Elevation *(meters)*
1067	0.00	0.00	0.94	0.94	56.859	1.07
1041	0.00	0.00	0.94	0.94	55.914	1.04
1016	0.00	0.00	0.94	0.94	54.969	1.02
991	0.00	0.00	0.94	0.94	54.024	0.99
965	0.00	0.00	0.94	0.94	53.079	0.97
940	0.00	0.00	0.94	0.94	52.135	0.94
914	0.00	0.03	0.93	0.97	51.190	0.91
889	0.00	0.10	0.90	1.01	50.224	0.89
864	0.01	0.18	0.87	1.05	49.219	0.86
838	0.02	0.38	0.79	1.17	48.168	0.84
813	0.02	0.50	0.75	1.24	46.998	0.81
787	0.03	0.59	0.71	1.30	45.753	0.79
762	0.03	0.67	0.68	1.35	44.453	0.76
737	0.03	0.74	0.65	1.39	43.107	0.74
711	0.04	0.79	0.63	1.42	41.721	0.71
686	0.04	0.84	0.61	1.45	40.303	0.69
660	0.04	0.91	0.58	1.49	38.851	0.66
635	0.04	0.95	0.56	1.51	37.363	0.64
610	0.04	0.99	0.55	1.54	35.848	0.61
584	0.05	1.02	0.54	1.56	34.312	0.58
559	0.05	1.06	0.52	1.58	32.753	0.56
533	0.05	1.09	0.51	1.60	31.173	0.53
508	0.05	1.12	0.50	1.62	29.573	0.51
483	0.05	1.16	0.48	1.64	27.954	0.48
457	0.05	1.18	0.47	1.65	26.316	0.46
432	0.05	1.20	0.46	1.67	24.664	0.43
406	0.06	1.23	0.45	1.68	22.996	0.41
381	0.06	1.25	0.44	1.70	21.313	0.38
356	0.06	1.27	0.44	1.71	19.617	0.36
330	0.06	1.29	0.43	1.72	17.908	0.33
305	0.06	1.31	0.42	1.73	16.187	0.30
279	0.06	1.33	0.41	1.74	14.456	0.28
254	0.06	1.34	0.41	1.75	12.714	0.25
229	0.06	1.36	0.40	1.76	10.964	0.23
203	0.06	1.37	0.40	1.77	9.205	0.20
178	0.06	1.38	0.39	1.77	7.439	0.18
152	0.00	0.00	0.94	0.94	5.669	0.15
127	0.00	0.00	0.94	0.94	4.724	0.13
102	0.00	0.00	0.94	0.94	3.779	0.10
76	0.00	0.00	0.94	0.94	2.835	0.08
51	0.00	0.00	0.94	0.94	1.890	0.05
25	0.00	0.00	0.94	0.94	0.945	0.03

Project: **Winston Churchill Blvd System R13.02**

StormTech
Detention • Retention • Water Quality
A division of ADS

Chamber Model -	SC-740	
Units -	**Metric**	Click Here for Imperial
Number of chambers -	6	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	0.00	m
Amount of Stone Above Chambers -	152	mm
Amount of Stone Below Chambers -	152	mm

☑ Include Perimeter Stone in Calculations

26.8 sq.meters Min. Area - 18.84 sq.meters

Height of System *(mm)*	Incremental Single Chamber *(cubic meters)*	Incremental Total Chamber *(cubic meters)*	Incremental Stone *(cubic meters)*	Incremental Ch & St *(cubic meters)*	Cumulative Chamber *(cubic meters)*	Elevation *(meters)*
1067	0.00	0.00	0.27	0.27	16.102	1.07
1041	0.00	0.00	0.27	0.27	15.830	1.04
1016	0.00	0.00	0.27	0.27	15.558	1.02
991	0.00	0.00	0.27	0.27	15.286	0.99
965	0.00	0.00	0.27	0.27	15.014	0.97
940	0.00	0.00	0.27	0.27	14.742	0.94
914	0.00	0.01	0.27	0.28	14.471	0.91
889	0.00	0.03	0.26	0.29	14.193	0.89
864	0.01	0.05	0.25	0.30	13.905	0.86
838	0.02	0.10	0.23	0.33	13.604	0.84
813	0.02	0.14	0.22	0.35	13.271	0.81
787	0.03	0.16	0.21	0.37	12.917	0.79
762	0.03	0.18	0.20	0.38	12.548	0.76
737	0.03	0.20	0.19	0.39	12.167	0.74
711	0.04	0.22	0.19	0.40	11.775	0.71
686	0.04	0.23	0.18	0.41	11.374	0.69
660	0.04	0.25	0.17	0.42	10.964	0.66
635	0.04	0.26	0.17	0.43	10.544	0.64
610	0.04	0.27	0.16	0.43	10.117	0.61
584	0.05	0.28	0.16	0.44	9.683	0.58
559	0.05	0.29	0.16	0.45	9.244	0.56
533	0.05	0.30	0.15	0.45	8.799	0.53
508	0.05	0.31	0.15	0.46	8.349	0.51
483	0.05	0.32	0.15	0.46	7.893	0.48
457	0.05	0.32	0.14	0.46	7.432	0.46
432	0.05	0.33	0.14	0.47	6.967	0.43
406	0.06	0.34	0.14	0.47	6.498	0.41
381	0.06	0.34	0.14	0.48	6.025	0.38
356	0.06	0.35	0.13	0.48	5.548	0.36
330	0.06	0.35	0.13	0.48	5.068	0.33
305	0.06	0.36	0.13	0.49	4.585	0.30
279	0.06	0.36	0.13	0.49	4.098	0.28
254	0.06	0.37	0.13	0.49	3.609	0.25
229	0.06	0.37	0.12	0.49	3.118	0.23
203	0.06	0.37	0.12	0.50	2.624	0.20
178	0.06	0.38	0.12	0.50	2.128	0.18
152	0.00	0.00	0.27	0.27	1.631	0.15
127	0.00	0.00	0.27	0.27	1.359	0.13
102	0.00	0.00	0.27	0.27	1.087	0.10
76	0.00	0.00	0.27	0.27	0.816	0.08
51	0.00	0.00	0.27	0.27	0.544	0.05
25	0.00	0.00	0.27	0.27	0.272	0.03

Project: Winston Churchill Blvd System C10.01

StormTech
Detention • Retention • Water Quality
A division of ADS

Chamber Model -	SC-740	
Units -	**Metric**	Click Here for Imperial
Number of chambers -	26	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	0.00	m
Amount of Stone Above Chambers -	152	mm
Amount of Stone Below Chambers -	152	mm

☑ Include Perimeter Stone in Calculations

102.8 sq.meters Min. Area - 81.64 sq.meters

Height of System *(mm)*	Incremental Single Chamber *(cubic meters)*	Incremental Total Chamber *(cubic meters)*	Incremental Stone *(cubic meters)*	Incremental Ch & St *(cubic meters)*	Cumulative Chamber *(cubic meters)*	Elevation *(meters)*
1067	0.00	0.00	1.04	1.04	64.184	1.07
1041	0.00	0.00	1.04	1.04	63.139	1.04
1016	0.00	0.00	1.04	1.04	62.094	1.02
991	0.00	0.00	1.04	1.04	61.049	0.99
965	0.00	0.00	1.04	1.04	60.004	0.97
940	0.00	0.00	1.04	1.04	58.959	0.94
914	0.00	0.04	1.03	1.07	57.915	0.91
889	0.00	0.12	1.00	1.12	56.845	0.89
864	0.01	0.21	0.96	1.17	55.729	0.86
838	0.02	0.44	0.87	1.31	54.559	0.84
813	0.02	0.59	0.81	1.40	53.247	0.81
787	0.03	0.70	0.76	1.46	51.848	0.79
762	0.03	0.79	0.73	1.52	50.384	0.76
737	0.03	0.87	0.70	1.57	48.864	0.74
711	0.04	0.93	0.67	1.60	47.298	0.71
686	0.04	1.00	0.65	1.64	45.694	0.69
660	0.04	1.07	0.62	1.69	44.050	0.66
635	0.04	1.12	0.60	1.72	42.363	0.64
610	0.04	1.16	0.58	1.74	40.644	0.61
584	0.05	1.21	0.56	1.77	38.901	0.58
559	0.05	1.25	0.54	1.80	37.130	0.56
533	0.05	1.29	0.53	1.82	35.335	0.53
508	0.05	1.33	0.51	1.84	33.515	0.51
483	0.05	1.37	0.50	1.86	31.674	0.48
457	0.05	1.39	0.49	1.88	29.810	0.46
432	0.05	1.42	0.48	1.90	27.929	0.43
406	0.06	1.45	0.46	1.92	26.029	0.41
381	0.06	1.48	0.45	1.93	24.112	0.38
356	0.06	1.51	0.44	1.95	22.179	0.36
330	0.06	1.53	0.43	1.96	20.231	0.33
305	0.06	1.55	0.43	1.97	18.270	0.30
279	0.06	1.57	0.42	1.99	16.295	0.28
254	0.06	1.59	0.41	2.00	14.308	0.25
229	0.06	1.60	0.40	2.01	12.312	0.23
203	0.06	1.62	0.40	2.02	10.305	0.20
178	0.06	1.63	0.39	2.02	8.289	0.18
152	0.00	0.00	1.04	1.04	6.269	0.15
127	0.00	0.00	1.04	1.04	5.224	0.13
102	0.00	0.00	1.04	1.04	4.180	0.10
76	0.00	0.00	1.04	1.04	3.135	0.08
51	0.00	0.00	1.04	1.04	2.090	0.05
25	0.00	0.00	1.04	1.04	1.045	0.03