TERTIARY PLAN – PHASE 1
FUNCTIONAL SERVICING REPORT

ALLOA CALEDON

TOWN OF CALEDON
REGION OF PEEL

PREPARED FOR
ALLOA LANDOWNERS GROUP INC.

Urbantech File No.: 20-665

1ST SUBMISSION – SEPTEMBER 2024

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1 INTRODUCTION

1.1. PROJECT BACKGROUND

Urbantech Consulting has been retained by the Alloa Landowners Group to prepare a Functional Servicing Report (FSR) in support of Phase 1 of the Alloa Community Secondary Plan. The Phase 1 Study Area is shown in **Figure 1.2**. The Phase 1 lands are referred to herein as the Subject Lands or the Tertiary Plan Area.

This report should be read in conjunction with the Alloa Local Subwatershed Study, Alloa Secondary Plan Scoped Servicing Report and the Alloa Phase 1 Environmental Implementation Report (EIR, Crozier). This report has been prepared to satisfy the following:

- Town of Caledon Development Standards Manual (2019)
- Peel Public Works Stormwater Design Criteria and Procedures Manual (June, 2019)
- Consolidated Linear Infrastructure Environmental Compliance Approval (CLI ECA) Stormwater Management Criteria (September, 2022)
- Region of Peel Public Works Watermain Design Criteria (June, 2010)
- Region of Peel Public Works Linear Wastewater Standards (March, 2023)
- Toronto and Region Conservation Authority (TRCA) and Credit Valley Conservation (CVC) Authority Guidelines

Applicable site-specific background information, guidelines, policies, and design criteria have been considered in the development of this report.

The scope of this FSR addresses all matters applicable to the Subject Lands in support of the Tertiary Plan and will provide input to the preparation/submission of Draft Plans of Subdivision on the participating lands.

1.2. STUDY AREA

The Tertiary Plan study area (as shown in **Figure 1.2**) comprises approximately 255.5 hectares (ha) of developable area (net of SWM Ponds and NHS). The study area is bounded by Mayfield Road to the south, Chinguacousy Road to the east and the preferred route of the future Highway 413 to the north. The western boundary generally follows Creditview Road but extends further west as it approaches Mayfield Road. Under existing conditions, the land is predominantly agricultural with a few small farm and residence structures.

The Phase 1 Tertiary Plan is situated at a drainage divide between the Etobicoke Creek watershed and Fletcher's Creek watershed. As such, the lands fall within the jurisdiction of both Toronto and Region Conservation Authority (TRCA) and Credit Valley Conservation (CVC). The TRCA boundary includes the Etobicoke Creek watershed (northern portion of the site), and the CVC jurisdiction includes the Fletcher's Creek watershed (southern portion of the site). The adjacent watersheds are shown in **Figure 1.1**. **Table 1-1** summarizes the total area of the Tertiary Plan within each watershed.

Table 1-1: Watershed Drainage Divide (Alloa Phase 1 Tertiary Plan)

Description	Area (ha)	Percent of Total
Etobicoke Creek	194.0	59%
Fletcher's Creek	132.4	41%

There is a small area in the northeast corner of the Study Area designated as Greenbelt Outer Boundary. In addition, there are woodland and wetland features across the landscape. The Tertiary Plan concept maintains these natural features and associated connectivity where required. Wetlands within re-aligned watercourses (i.e., Wetland #6 and Wetland #7) are proposed to be removed and replicated in situ. The Alloa Municipal Drain has an existing associated floodplain. **Drawing 2.1** provides information on Tertiary Plan features and constraint limits.

1.3. BACKGROUND DOCUMENTATION

In preparation of the Phase 1 Tertiary Plan, the following reports and documents were referenced:

- Huttonville and Fletcher's Creeks Subwatershed Study (AMEC, 2011)
- Etobicoke Creek Hydrology Update Study (MMM Group, 2013)
- Etobicoke Creek Synthesis Study (AMEC, December 2014)
- Mount Pleasant Sub-Area 51-2 EIR/FSR (2016)
- Region of Peel SABE Scoped Subwatershed Study (2022)
- Region of Peel Development Charges Background Study – Consolidated Report (November, 2020)
- Region of Peel Water and Wastewater Master Plan for the Lake-Based System (2020)
- Region of Peel Settlement Area Boundary Expansion Water and Wastewater Service Analysis (August, 2021)
- Region of Peel Wastewater Development Charges 2024 (Mapping)
- Region of Peel Water Development Charges 2024 (Mapping)
- Alloa Local Subwatershed Study (Crozier, 2024)
- Alloa Secondary Plan Scoped Servicing Study (Urbantech, 2024)
- Fluvial Geomorphology Assessment and Conceptual Natural Corridor Designs, Alloa Secondary Plan Area – Phase 1 Lands (GeoMorphix, 2024)
- Erosion Mitigation Assessment, Alloa Secondary Plan Area – Phase 1 Lands (GeoMorphix)

1.4. LAND USE and POPULATION PROJECTIONS

The Tertiary Plan Land Use is shown in **Figure 1.4**, provided by Glen Schnarr & Associates. The proposed land use structure includes a collector road network which provides connectivity within the Tertiary Plan, to surrounding development areas, and to the future planned interchange of Highway 413 at Chinguacousy Road. The Land Use Schedule shows mixed-use areas along the Mayfield Road corridor from Chinguacousy to Creditview and two large commercial blocks east of Creditview Road, along Mayfield Road. The highest density areas are located at the intersection of Mayfield

Road and Chinguacousy, with additional medium-high density blocks proposed along Chinguacousy Road and in the northeast corner of the plan close to the Highway 413 interchange. The remainder of the plan is shown as neighbourhoods of low and medium density development. The Tertiary Plan includes four (4) neighbourhood parks, one (1) community park and a significant NHS block associated with the naturalized channel and buffer. There are seven (7) SWM ponds and three (3) elementary school blocks.

Residential and employment population forecasts have been prepared by Urbantech based on the Tertiary Plan Land Use (**Figure 1.4**) and Region of Peel population density targets (as outlined in the Linear Wastewater Standards, 2023). Population estimates are used for the purposes of calculating servicing needs (i.e., water demand and wastewater generation rates). **Table 1-2** summarizes the Tertiary Plan land use categories and associated area and population projections.

Table 1-2: Alloa Phase 1 Tertiary Plan – Projected Area and Population

Description	Area (ha)	Population Density [1]	Residential (People)	Employment (Jobs)
Low Density Residential	110.4	70 ppl/ha	7,730	-
Medium Density Residential	84.4	175 ppl/ha	14,780	-
Medium – High Density Mixed Use (Apartments)	24.4	475 ppl/ha	11,610	-
Elementary School	8.9	450 ppl / school	1,350	-
Major Commercial	12.5	50 jobs/ha	-	625
Parks	14.9	n/a	0	-
Total	**255.5**		**35,470**	**625**

[1] *Population density targets per Table 2-1 and Section 2.1.2 (Peel Region Linear Wastewater Standards, March 2023)*

2 STORMWATER MANAGEMENT STRATEGY

2.1. BACKGROUND

The Alloa Secondary Plan Local Subwatershed Study (Scoped SWS, under separate cover) provides guidance for the management of stormwater under post-development land use conditions. The guidelines established in the Local SWS form the foundation for the integrated stormwater management strategy proposed for the Phase 1 Tertiary Plan area.

2.2. EXISTING CONDITIONS

Existing (pre-development) overland flow is split between the Fletcher's Creek and Etobicoke Creek subwatersheds (see **Figure 1.1**). The north portion of the site drains to the Alloa Municipal Drain, which discharges to Etobicoke Creek east of Chinguacousy Road. Municipal drains, while naturalized, are man-made municipal infrastructure constructed to improve drainage and reduce flooding of agricultural lands. The Alloa Municipal Drain is currently owned and maintained by the municipality. The future requirements and ownership of the municipal drain will be discussed with the Town of Caledon as work proceeds.

The south portion of the site drains to Mayfield Road. Adjacent to the site, Mayfield Road consists of a rural road right-of-way, which drains via existing roadside ditches and culverts to a storm sewer system in the neighbourhood to the south. This sewer network ultimately outlets to Fletcher's Creek.

A large portion of the site currently has tile drains. For the most part, the tile drain system directs flow to the Alloa Municipal Drain.

Pre-development drainage catchments, overland flow direction and ultimate discharge locations are shown in **Figure 2.2**.

TRCA updated the 2013 Etobicoke Creek Hydrology model in 2022 and provided the calibrated Visual OTTHYMO model for the study area to the Alloa study team (Urbantech Consulting) in 2024. This model forms the basis of the Tertiary Plan hydrologic analysis, including flow estimation, continuous modelling, and water balance assessments for the north portion of the site draining to Etobicoke Creek. This model uses the 2-year to 100-year 12-hour AES storm distribution (AMC II conditions), as well as the final 12 hours of Hurricane Hazel for the Regional event (AMC III conditions).

2.3. STORMWATER MANAGEMENT DESIGN CRITERIA

The stormwater management requirements for the Tertiary Plan Area are based on the criteria as specified in the Etobicoke Creek Hydrology Update (April 2013), the Subwatershed Study for the Huttonville and Fletcher's Creeks (June 2011) and the Heritage Heights Subwatershed Study Phase 2 Report (March 2022). The Scoped Subwatershed Study for the Settlement Area Boundary Expansion in the Region of Peel (January 2022) was also referenced to confirm that SWM criteria proposed in this report align with the SABE study.

The following sections outline the specific SWM criteria for the various outlets from the subject area to Etobicoke Creek, Huttonville Creek and Fletchers Creek, as per the applicable studies.

2.3.1. Quality Control Requirements

Etobicoke Creek and Fletcher's Creek require Enhanced (Level 1) Quality Control for the removal of 80% Total Suspended Solids (TSS), based on the MOE (2003) SWMF & Design Guidelines. This is required for the Subject Lands through the implementation of end-of-pipe SWM facilities and/or LID measures (also see **Section 2.6.2**).

2.3.2. Erosion Control Requirements

Settlement Area Boundary Expansion

The SABE Scoped Subwatershed Study provided recommended ranges of unit volumes for Extended Detention erosion control for Fletcher's Creek and Etobicoke Creek. The erosion control recommendations from the SABE study are summarized in **Table 2-1** below.

Table 2-1: Erosion Criteria, Unit Volumes (SABE)

	Unit Volume (Ranges) (m^3/impervious ha)	
	Fletcher's Creek	**Etobicoke Creek**
Extended Detention	250	325

A summary of the erosion control recommendations from the SABE Scoped Subwatershed Study is provided in **Appendix F**. The SABE report targets have been further confirmed / refined based on the studies completed for the respective watersheds including the Mayfield West Comprehensive EIS, the Huttonville-Fletchers Subwatershed Study, the Block 51-1 / East Huttonville Creek EIR/FSR and the Block 51-2 / Fletchers Creek EIR/FSR studies.

Etobicoke Creek

Erosion targets for Etobicoke Creek were established in the Mayfield West Comprehensive Environmental Impact Study and Management Plan (December 2014). As per the Mayfield West EIS, the erosion unitary target flow to be applied to the Tertiary Plan within the Etobicoke Creek subwatershed is 0.00031 m^3/s/ha, and the target unitary storage for erosion control is 325 m^3/ impervious ha.

The exceedance of the downstream erosion thresholds in Etobicoke Creek was evaluated under pre- and post-development conditions, as discussed further in **Section 2.5.8**. This analysis was completed in order to confirm that in applying the erosion control targets for the subject area, erosive impacts are not increased downstream in Etobicoke Creek, as a result of the Alloa development.

Fletchers Creek

As per the Subwatershed Study for the Huttonville and Fletcher's Creeks (June 2011), the Tertiary Plan outlets to Flow Nodes F2 and F3 of Fletcher's Creek. **Table 2-2** below summarizes the unit target rate and unit target volume for the required erosion control for the portion of the subject site draining to Fletcher's Creek, as per the HFSWS.

It should be noted that the erosion threshold for Fletcher's Creek was subsequently updated and further refined, based on discussions with CVC as part of the Mount Pleasant Sub-Area 51-1 and 51-2 EIR-FSR (August 2016). The agreed-upon erosion target unit flow rate for Fletcher's Creek was revised to 0.00041 m^3/s/ha. The updated unit flow rate for erosion control is to be applied to the Tertiary Plan area discharging Fletcher's Creek.

Table 2-2: Erosion Control Criteria (Fletcher's Creek)

Subwatershed	Unit Flow Rates (m^3/s/ha)	Unit Volume (m^3/impervious ha)
Fletcher's Creek	0.00025 (HFWS – superseded) 0.00041 (EIR/FSS – approved)	250

The proposed SWM plan for the Tertiary Plan area will be designed according to the erosion control criteria outlined in the subwatershed studies for Etobicoke Creek and Fletcher's Creek (as discussed above).

2.3.3. Quantity Control Requirements

Settlement Area Boundary Expansion

The Settlement Area Boundary Expansion (SABE) Scoped Subwatershed Study provided recommended ranges of unit volumes for 100-year and Regional level quantity control for Fletcher's Creek and Etobicoke Creek. The quantity control recommendations from the SABE study are summarized in **Table 2-3** below.

Table 2-3: Quantity Control Criteria, Unit Volumes (SABE)

Design Storm	Unit Flow Rates (Ranges) (m^3/impervious ha)	
	Fletcher's Creek	Etobicoke Creek
100-Year Storm	600 - 1250	400 – 1250
Regional Storm	0 - 1225	0 - 1200

The SABE report targets have been further confirmed / refined based on the studies completed for the respective watersheds including the Mayfield West Comprehensive EIS, the Huttonville-Fletchers Subwatershed Study, the Block 51-1 / East Huttonville Creek EIR/FSR and the Block 51-2 / Fletchers Creek EIR/FSR studies as described below.

Etobicoke Creek

As per the Etobicoke Creek Hydrology Update (MMM Group, April 2013), the subject area falls within the Etobicoke Creek Headwater (Basin 1) and contributes drainage to flow nodes A, B and D, as per Figure J-1 of the hydrology study. The 12-hour AES storm distribution was used for the Etobicoke Creek hydrology model to assess the 2 to 100-year peak flows under existing and future conditions. The last 12 hours of the Regional storm (Hurricane Hazel) was also simulated with AMC III conditions. Based on this assessment, target unit flow rates were determined for each catchment within Basin 1 of the Etobicoke subwatershed. These unit target rates reflect controlling post-development flows to 60% of existing flows, which was the criteria identified for the Etobicoke Creek headwater basins to ensure mitigation of downstream flow increases.

As there are several catchments within Basin 1, each with specific unit target flow rates, catchment 89 was selected as the basis for the quantity control criteria for the 2 to 100-year storms for the portion of the subject Alloa area within the Etobicoke Creek subwatershed, as this catchment has the most conservative unit flow rates. Similarly, the unit flow rate for catchment 85 was selected for the Regional storm, as it was the most conservative. **Table 2-4** below summarizes the unit target rates for the required quantity control for the portion of the subject site draining to Etobicoke Creek Basin 1.

Table 2-4: Selected Quantity Control Criteria, Unit Flow Rates (Etobicoke Creek, Basin 1)

Design Storm	Unit Flow Rates (m^3/s/ha)
2-Year Storm	0.00272
5-Year Storm	0.00483
10-Year Storm	0.00648
25-Year Storm	0.00877
50-Year Storm	0.01059
100-Year Storm	0.01255
Regional Storm	0.05155

In addition to the required storage to control the Tertiary Plan area within the Etobicoke Creek subwatershed to the unit flow rate for the Regional storm event, an additional unit storage of 214 m^3/ha is required for Regional controls to account for the first 36 hours of the Regional event preceding the peak during the last 12 hours.

A summary of the Basin 1 quantity control requirements and unit flow rates from the Etobicoke Creek Hydrology Update is provided in **Appendix F.**

It should be noted that the Etobicoke Creek hydrology model was calibrated as part of the Etobicoke Creek Hydrology Update.

<u>Fletcher's Creek</u>

As per the Subwatershed Study for the Huttonville and Fletcher's Creeks (June 2011), the subject area contributes drainage to flow nodes F2 and F3, as per Figure 3G of the subwatershed study. **Table 2-5** and **Table 2-6** below summarizes the unit target rates for the required quantity control for the portion of the subject site draining to Fletcher's Creek.

Table 2-5: Quantity Control Criteria, Unit Flow Rates (Fletcher's Creek)

Design Storm	Unit Flow Rates [1] (m^3/s/ha)	
	Flow Node F2	Flow Node F3
25-Year Storm	0.0083	0.0083
100-Year Storm	0.0250	0.0260
Regional Storm	N/A	

[1] While only the 25-year and 100-year targets were provided in the HFSWS, the other storms targets have historically been determined through interpolation and subsequently confirmed through model verification. No targets for the regional storm were provided in the HFSWS; only the model verification determined if the provided storage and flow control adequately mitigated the post-development flow increase.

Table 2-6: Quantity Control Criteria, Unit Volumes (Fletcher's Creek)

Design Storm	Unit Flow Rates [1] (m^3/impervious ha)	
	Flow Node F2	Flow Node F3
25-Year Storm	500	700
100-Year Storm	850	900
Regional Storm	446	Not required

[1] While only the 25-year and 100-year targets were provided in the HFSWS, the other storms targets have historically been determined through interpolation and subsequently confirmed through model verification.

A summary of the quantity control requirements from the Subwatershed Study for the Huttonville and Fletcher's Creeks is provided in **Appendix F.**

The proposed SWM plan for the subject Tertiary Plan area will be designed according to the quantity control criteria outlined for Etobicoke Creek and Fletcher's Creek (**Table 2-4, Table 2-5** and **Table**

2-6). The proposed SWM design, based on the subwatershed studies for Etobicoke Creek and Fletcher's Creek will then be verified against the recommended ranges for quantity control volumes in the SABE Scoped Subwatershed Study.

2.3.4. Thermal Mitigation Requirements

Thermal mitigation practices are recommended in the Subwatershed Study for Fletcher's Creek and in the SABE Scoped Subwatershed Study. Thermal mitigation can be achieved by implementing effective stormwater management facility measures (shading, orientation, outlet design, floating islands, etc.), including LIDs. The target SWM facility discharge temperature for thermal mitigation is 24ºC. Thermal mitigation options will be further refined through Draft Plans.

2.4. PROPOSED STORMWATER MANAGEMENT PLAN

The stormwater management plan proposed in support of the Phase 1 Tertiary Plan is designed to satisfy the required SWM criteria, as outlined in **Section 2.3**. Stormwater management, including quantity, quality and erosion control will be provided for the Tertiary Plan area by several SWM pond facilities, on-site controls and LID measures.

As per **Drawing 2.4A**, the preliminary storm servicing plan identifies seven (7) proposed SWM pond facilities to achieve the SWM requirements for the proposed neighbourhood/residential areas. Two (2) of the SWM pond facilities are located in the Fletcher's Creek subwatershed, which will be designed to meet the SWM criteria from the HFSWS. Five (5) of the SWM pond facilities are located in the Etobicoke Creek subwatershed, which will be designed to meet the SWM criteria as per the Etobicoke Creek Hydrology Update and Mayfield West EIS. The proposed SWM pond locations have been selected based on the following criteria:

- To make use of existing / natural low points in terrain to minimize earthworks/cut and fill operations and maintain existing drainage patterns as much as possible.
- To maintain a permanent pool and drain into the receiving watercourse.
- To maintain flow input locations along the receiving watercourse.
- To minimize storm sewer infrastructure size.
- To efficiently use land and maximize serviceable area.

Drawing 2.4A also shows mixed use and medium-high rise development planned along the southeast boundary (adjacent to Chinguacousy Road between Mayfield Road and Tim Manley Avenue) that will be controlled by private on-site SWM facilities, discharging to a new clean water pipe running on Chinguacousy Road from north of Street A to Mayfield Road. Additional clean water collected from residential roofs and foundations (located adjacent to Chinguacousy Road) will also be directed to the clean water pipe. The clean water pipe will connect to an existing storm sewer on Mayfield Road which runs east to an existing culvert. The approved drainage plans for both the Mayfield West Phase 2 and Mount Pleasant Block 51-2 lands included provision for drainage from this area of Phase 1 Alloa to the clean water pipe on Mayfield Road.

As shown on **Drawing 2.4A**, there are several areas which are to be controlled by private on-site SWM facilities. These areas include commercial / medium-high density blocks, as well as residential areas where these catchments could not be accommodated by the proposed SWM ponds due to grading constraints.

Several of the medium-high density blocks in the southeast corner of the subject lands discharge to a clean water pipe on Chinguacousy Road.

2.4.1. Minor System

As per Town design standards and IDF parameters, the minor system is designed to accommodate the 10-year storm event flows. Flows that are greater than the 10-year storm event will be conveyed overland to the stormwater management facilities. The invert elevations of storm sewers at the inlet to SWM ponds are established such that the storm sewer system is not surcharged during a 10-year storm event, taking into consideration the extended detention elevation in the SWM pond for the 10-year storm. This will be confirmed during detailed design through a hydraulic grade line analysis. The minor system network is illustrated on **Drawing 2.4B**. Storm sewer design sheets are provided in **Appendix B**.

2.4.2. Major System

The major storm system will use the internal road network, designed with sufficient capacity to allow excess flows up to the 100-year design storm to be conveyed via overland flow within the proposed ROW limits. This will be confirmed at detailed design via an overland flow analysis, when final grading and servicing plans are available. The major system flow pathways and directions are shown on **Drawing 2.4B**.

Ultimate storm outlets across boundary roads will be coordinated with coincident road widening projects by the Region of Peel and Town of Caledon (e.g., Mayfield Road and Chinguacousy Road improvement projects).

2.5. SWM POND DESIGN

2.5.1. Imperviousness

The Subwatershed Studies provide recommendations for SWM end-of-pipe facility sizing based on a required storage per impervious hectare and a release rate per hectare. As such, to establish the preliminary pond design, the imperviousness of the contributing drainage areas to each proposed SWM facility was required. The imperviousness is utilized to calculate the permanent pool and target storage volumes for each SWM facility.

The catchment imperviousness values for each drainage area were determined based on the land use composition of each catchment. The proposed unit types and land use distribution within each catchment were determined from the Land Use Plan, as per **Figure 1.4**. A total imperviousness was assumed for each land use type based on the ratio of impervious surface (roofs, pavement, etc.) to total catchment area. The land use imperviousness values are summarized in **Table 2-7**.

Table 2-7: Percent Imperviousness by Land Use

Land Use Type	Percent Imperviousness
Single Detached Homes	50
Townhomes	80
Medium-High Density Residential	80
Mixed-Use	95
Commercial	95
Elementary Schools	75
Neighbourhood Parks	10
Open Space	10
Natural Heritage System	0
SWM Ponds	100
Greenbelt Plan Area	0
Road ROW	90

The catchment areas to the proposed SWM ponds and overall weighted imperviousness values are summarized in **Table 2-8**. Also refer to **Drawing 2.4A** for all drainage areas and associated imperviousness values.

Table 2-8: Pond Catchment Areas and Imperviousness

Catchment	Total Area (ha)	Impervious Area (ha)	Imperviousness (%)
SWM Pond 1	57.24	41.79	73
SWM Pond 2	36.51	28.11	77
SWM Pond 3	15.20	11.40	75
SWM Pond 4	25.57	17.64	69
SWM Pond 5	40.31	28.22	70
SWM Pond 6	52.37	39.75	74
SWM Pond 7	26.5	18.02	68

2.5.2. SWM Pond Design

The proposed SWM ponds are designed as wet pond facilities incorporating a wet forebay and subsequent wet cell. Flow between the forebay and wet cell is routed via a submerged weir. The proposed SWM ponds are able to meet or exceed all the SWM pond criteria provided in the previous sections. SWM pond configuration and design has respected the guidelines as set out by the Ontario Ministry of the Environment's (MOE) Stormwater Management Planning and Design Manual (March 2003).

The preliminary designs of the SWM ponds include:

- The side slopes within the ponds are 4:1 from the bottom of the permanent pool to 0.5 m below the normal water level, and from 0.5 m above the normal water level to the top of pond. 7:1 slopes are provided from 0.5 m below the normal water level to 0.5 m above the normal water level.
- The side slopes on the outside of the pond are 4:1 and were graded to match the proposed grades at the pond block boundaries.
- Grades around pond blocks are set to match the proposed development grades.
- The access roads are currently located around the SWM facility at the free board elevation and extend to reach the headwalls, outlet structures and sediment drying areas.
- The width of the access road is 5.0 m. The purpose of the access road is to provide a suitable road for machinery at the time of maintenance to reach the outlet/inlet structures and the bottom of the sediment forebays in order to be properly cleaned.
- A 0.3 m freeboard is established above the active storage water level.
- Invert elevations of inlet pipes in the SWM facilities were assumed at the permanent pool elevation.
- The pond outlets discharge to the nearest watercourse. Ponds located adjacent to Mayfield Road are proposed to discharge to the culverts that are proposed to be constructed by the Region.
- Further detailed design will be completed in accordance with the Town of Caledon and the Ontario Ministry of Environment (MOE) Design Criteria. Refinements will be made to the inlet and outlet structures, access roads and emergency overflow spillways.
- Overall minimum facility length-to-width ratio of 3:1.
- Minimum forebay length-to-width ratio of 2:1.
- Maximum permanent pool depth of 3 m.
- Maximum active storage depth of 3.2 m.

All reasonable assumptions have been made based on standard current engineering practice. Outfall configurations have only preliminarily been sited and will require further site investigation and design considerations.

The preliminary designs of the SWM ponds have been completed to establish the required size of each of the SWM blocks to ensure sufficient lands are provided. The initial drafting process of the SWM ponds was iterative and attempted to optimize use of the SWM blocks and minimize impacts to the surrounding lands.

2.5.3. SWM Pond Stage-Storage-Discharge Characteristics

Section 2.3 provides the storage volume and flow targets for the 2 to 100-year and Regional storm events, based on the SWM criteria from the Subwatershed Studies. The proposed Tertiary Plan SWM facilities were designed based on the conventional storage volume (not accounting for LID measure storages) and flow targets as described in **Section 2.3.3**.

The permanent pools for the proposed SWM facilities were sized according to Table 3.2 in the MOE's Stormwater Planning and Design Manual (2003), as discussed in **Section 2.5.2**. The quality control sizing calculations for the proposed SWM facility are provided in **Appendix C**.

The preliminary stage-storage-discharge curves based on the proposed grading, as well as storage and release rate requirements, were developed for the proposed SWM facilities, as summarized in **Table 2-9** to **Table 2-15** below.

Table 2-9: SWM Pond 1 Stage-Storage-Discharge Relationship

Storm Event	Required Volume (m^3)	Provided Volume (m^3)	Stage (m)	Target Release Rate (m^3/s)
Permanent Pool	11470	38819	255.00	N/A
Extended Detention	10446	10446	255.42	0.023
25-Year	22398	22398	255.80	0.500
100-Year	38076	38076	256.36	1.506
Regional	58055	58055	257.07	N/A
Max. High Water Level	N/A	67150	257.40	N/A

Table 2-10: SWM Pond 2 Stage-Storage-Discharge Relationship

Storm Event	Required Volume (m^3)	Provided Volume (m^3)	Stage (m)	Target Release Rate (m^3/s)
Permanent Pool	7166	23053	256.15	N/A
Extended Detention	7028	7028	256.59	0.015
25-Year	14056	14056	256.88	0.303
100-Year	23896	23896	257.39	0.913
Regional	36434	36434	258.04	N/A
Max. High Water Level	N/A	54829	259.00	N/A

Table 2-11: SWM Pond 3 Stage-Storage-Discharge Relationship

Storm Event	Required Volume (m^3)	Provided Volume (m^3)	Stage (m)	Target Release Rate (m^3/s)
Permanent Pool	2916	11789	257.85	N/A
Extended Detention	3705	3705	258.29	0.005
2-Year	4800	4800	258.40	0.041
5-Year	6088	6088	258.52	0.073
10-Year	6947	9647	258.60	0.098
25-Year	8005	8005	258.69	0.133
50-Year	8790	8790	258.76	0.161
100-Year	9572	9572	258.84	0.191
Regional	24454	24454	260.19	0.784
Max. High Water Level	N/A	25112	260.25	N/A

Table 2-12: SWM Pond 4 Stage-Storage-Discharge Relationship

Storm Event	Required Volume (m^3)	Provided Volume (m^3)	Stage (m)	Target Release Rate (m^3/s)
Permanent Pool	4564	18907	258.50	N/A
Extended Detention	5734	5734	258.91	0.008
2-Year	7625	7625	259.04	0.070
5-Year	9723	9723	259.15	0.124
10-Year	11128	11128	259.22	0.166
25-Year	12873	12873	259.32	0.224
50-Year	14169	14169	259.39	0.271
100-Year	15454	15454	259.46	0.321
Regional	46685	46685	261.14	1.318
Max. High Water Level	N/A	47752	261.20	N/A

Table 2-13: SWM Pond 5 Stage-Storage-Discharge Relationship

Storm Event	Required Volume (m^3)	Provided Volume (m^3)	Stage (m)	Target Release Rate (m^3/s)
Permanent Pool	7284	36744	257.85	N/A
Extended Detention	9171	9171	258.20	0.012
2-Year	12281	12281	258.32	0.110
5-Year	15656	15656	258.45	0.195
10-Year	17918	17918	258.54	0.261
25-Year	20687	20687	258.64	0.354
50-Year	22762	22762	258.72	0.427
100-Year	24800	24800	258.80	0.506
Regional	67327	67327	260.43	2.078
Max. High Water Level	N/A	69222	260.50	N/A

Table 2-14: SWM Pond 6 Stage-Storage-Discharge Relationship

Storm Event	Required Volume (m^3)	Provided Volume (m^3)	Stage (m)	Target Release Rate (m^3/s)
Permanent Pool	9929	38812	259.00	N/A
Extended Detention	12595	12595	259.52	0.016
2-Year	16225	16225	259.57	0.152
5-Year	20577	20577	259.73	0.253
10-Year	23500	23500	259.83	0.339
25-Year	27085	27085	259.96	0.459
50-Year	29774	29774	260.05	0.555
100-Year	32412	32412	260.15	0.657
Regional	83250	83250	261.95	2.700
Max. High Water Level	N/A	90442	262.20	N/A

Table 2-15: SWM Pond 7 Stage-Storage-Discharge Relationship

Storm Event	Required Volume (m^3)	Provided Volume (m^3)	Stage (m)	Target Release Rate (m^3/s)
Permanent Pool	4671	12423	260.25	N/A
Extended Detention	5857	5857	260.80	0.008
2-Year	7884	7884	260.93	0.072
5-Year	10067	10067	261.08	0.128
10-Year	11525	11525	261.18	0.172
25-Year	13335	13335	261.30	0.232
50-Year	14679	14679	261.39	0.281
100-Year	16010	16010	261.48	0.333
Regional	41701	41701	263.21	1.366
Max. High Water Level	N/A	42322	263.25	N/A

The stage-storage-discharge data above is subject to change based on the detailed outlet structure design for the proposed SWM pond facilities. However, the target storage volumes and discharge rates will be maintained, unless the proposed drainage areas are revised at detailed design.

The grading details and cross sections of the proposed SWM facilities are illustrated on **Drawing 2.5A** to **Drawing 2.5G**.

2.5.4. Drawdown Time

Preliminary orifice sizing was completed for the drawdown of the extended detention volume in each of the proposed SWM ponds. The extended detention orifice controls were sized based on the erosion target release rates, as per **Section 2.3.2** and **Tables 2-9** to **2-15** above. A minimum orifice size of 75 mm was applied.

Table 2-16: Extended Detention Orifice Sizing

SWM Pond	Extended Detention Volume (m^3)	Extended Detention Release Rate (m^3/s)	Orifice Size (mm)
SWM Pond 1	10446	0.023	135
SWM Pond 2	7028	0.015	107
SWM Pond 3	3705	0.007	75
SWM Pond 4	5734	0.008	80
SWM Pond 5	9171	0.012	103

SWM Pond	Extended Detention Volume (m^3)	Extended Detention Release Rate (m^3/s)	Orifice Size (mm)
SWM Pond 6	12595	0.016	105
SWM Pond 7	5857	0.008	75

As per the drawdown time calculations provided in **Appendix C**, the drawdown time for the proposed ponds ranges from 8.4 days to 15.6 days. Although this duration extends beyond the minimum 48 hours, it should be noted that this is consistent with other SWM facilities in the Fletcher's Creek and Etobicoke Creek subwatersheds and is due to the low erosion control targets. Typically, approximately 50% of the extended detention volume drains within the first several days.

2.5.5. On-site Controls Stage-Storage-Discharge Characteristics

As shown on Drawing 2.4A, there are several areas which are to be controlled by private on-site SWM facilities. These areas include commercial / medium-high density blocks, as well as residential areas where these catchments could not be accommodated by the proposed SWM ponds due to grading constraints.

The catchment areas to the proposed SWM ponds and overall weighted imperviousness values are summarized in **Table 2-17**. Also refer to **Drawing 2.4A** for all drainage areas and associated imperviousness values.

Table 2-17: On-Site Catchment Areas and Imperviousness

Catchment	Total Area (ha)	Impervious Area (ha)	Imperviousness (%)
Chinguacousy Road Clean Water Pipe (Private Storages 1, 2 & 3)	15.10	13.23	88
Private Storage 4	9.72	9.23	95
Private Storage 5	2.93	2.67	91
Private Storage 6	3.98	3.14	79
Private Storage 7	2.06	1.46	71

The Town of Caledon Development Standards provides a comprehensive list of available stormwater management techniques. Specifically, for commercial blocks, available on-site controls include rooftop storage, parking lot storage, underground storage or a combination of the above. Quality control is to be provided by a combination of oil/grit separator (OGS) units, filtration and/or LID measures.

The CVC/TRCA LID Stormwater Management Planning and Design Guide will be referenced to provide further information on the design of these strategies at the detailed design stage.

The storage and release rate requirements for the private on-site SWM facilities were determined based on the SWM criteria for Etobicoke Creek and Fletcher's Creek subwatershed, as discussed in **Section 2.3**. are summarized in **Table 2-18** to **Table 2-24** below.

Table 2-18: Private Storage 1 Volume Requirements & Target Flows

Storm Event	Required Volume (m^3)	Target Release Rate (m^3/s)
25-Year	1960	0.029
100-Year	2520	0.091
Regional	N/A	

Table 2-19: Private Storage 2 Volume Requirements & Target Flows

Storm Event	Required Volume (m^3)	Target Release Rate (m^3/s)
25-Year	2632	0.039
100-Year	3384	0.122
Regional	N/A	

Table 2-20: Private Storage 3 Volume Requirements & Target Flows

Storm Event	Required Volume (m^3)	Target Release Rate (m^3/s)
25-Year	3086	0.039
100-Year	3967	0.121
Regional	N/A	

Table 2-21: Private Storage 4 Volume Requirements & Target Flows

Storm Event	Required Volume (m^3)	Target Release Rate (m^3/s)
25-Year	4617	0.081
100-Year	7849	0.243
Regional	11967	N/A

Table 2-22: Private Storage 5 Volume Requirements & Target Flows

Storm Event	Required Volume (m^3)	Target Release Rate (m^3/s)
25-Year	1333	0.024
100-Year	2266	0.073
Regional	3456	N/A

Table 2-23: Private Storage 6 Volume Requirements & Target Flows

Storm Event	Required Volume (m^3)	Target Release Rate (m^3/s)
2-Year	1230	0.011
5-Year	1593	0.019
10-Year	1818	0.026
25-Year	2098	0.035
50-Year	2307	0.042
100-Year	2513	0.050

Table 2-24: Private Storage 7 Volume Requirements & Target Flows

Storm Event	Required Volume (m^3)	Target Release Rate (m^3/s)
2-Year	604	0.006
5-Year	789	0.010
10-Year	909	0.013
25-Year	1052	0.018
50-Year	1157	0.022
100-Year	1264	0.026

2.5.6.SWM Pond Inlet and Outlet Design

Inlet and outlet size and locations for each pond are shown on **Drawing 2.5A** to **Drawing 2.5G**. The size of inlet pipes has been minimized where possible; however, box culverts are preferred as they can provide greater conveyance capacity with less pipe depth in locations where cover is limited.

The proposed pond inlet structures will be designed according to the Town standards and will discharge into the pond forebay. The forebay will be designed according to the settling and dispersion length equations provided in Section 4.6.2 of the MOE SWM Planning and Design Manual (2003).

The SWM pond facilities will have multiple outlet components, including extended detention, flood flows, emergency spillway and a maintenance drawdown pipe or sump (where applicable). The pond outlet details will be determined at the detailed design stage.

The extended detention pipe will consist of a reverse-slope bottom draw pipe extending from the bottom of the pond to an orifice plate on the control structure. The submerged end of the proposed bottom draw pipe will be fitted with a perforated pipe section of sufficient area of opening and will be protected by a gravel jacket. The orifice plate will be sized to meet the required extended detention flows and required drawdown time under approximately 0.85 m of head (i.e., extended detention level). The orifice plate will also be sized to meet the Region's extended detention criteria for a minimum 48-hour drawdown time. The orifice plate will be bolted onto the outlet structure with the invert set at the permanent pool water level. To prevent potential blockage of the extended detention control by debris, etc., a minimum orifice size of 75 mm is desirable.

A series of orifices or a compound weir knock-out will be designed at the detailed design stage for the pond outlet control structure in order to achieve the quantity control target flows.

The conveyance of emergency flows (i.e., uncontrolled Regional flows) through the SWM pond facilities will be accommodated by emergency outlet structures within the pond set above the Regional pond operating water level, in the event that all outlet structures within the SWM pond are blocked. The emergency conveyance details will be provided at the detailed design stage for the proposed SWM facilities.

If the grading and pond design permit, maintenance sumps or drawdown pipes will be provided to drain the facilities for the purpose of maintenance works. These operations and maintenance structures will also connect to the pond outfall structures.

The proposed outfall headwalls for the pond outlets will be designed to Town Standards.

As shown on **Drawing 2.5A** to **Drawing 2.5G**, plunge pools with rip rap stone are proposed at the downstream ends of the SWM pond outlets in order to provide energy and velocity dissipation of flows from the pond.

2.5.7. Pond Naturalization

The main purpose of stormwater management is to maintain watershed hydrology and protect the ecological health and integrity of downstream waterbodies by providing the flood, erosion and water quality controls necessary to protect downstream ecosystems. In addition to these functions, SWM facilities can complement and support adjacent natural heritage systems and their ecological functions. As this green infrastructure is typically constructed adjacent to valley and creek corridors which form part of natural heritage systems, they can enhance linkage and buffering functions and opportunities to improve the condition quality of adjacent natural features. Many of these functions can be achieved by naturalizing components of the SWM facilities by planting a diversity of locally native trees, shrubs and groundcovers.

The use of native species in naturalization is beneficial to maintaining and enhancing local biodiversity. Often times, adjacent natural heritage systems are in a degraded ecological state and have lost much of their native biodiversity, so providing a source of native seed nearby can help to restore these systems.

Consistent with the *Stormwater Management Facility Planting Guidelines* (CVC 2003) and *Thermal Impacts of Urbanization including Preventative and Mitigation Techniques* (CVC 2011), it is recommended that locally native tree, shrub and groundcover species be utilized for landscaping the proposed SWM facilities.

The purpose of inlet and outlet plantings is two-fold:

- To provide shading of incoming and outgoing water; and
- To help prevent substrate erosion.

Numerous native trees and shrubs can be utilized for these areas including, trembling aspen, large-toothed aspen, red maple, sugar maple, speckled alder, red-osier and grey dogwood, nannyberry, and numerous native species of willow.

Landscaping plans for the proposed SWM pond facility will be prepared at detailed design.

The timing of SWM pond landscaping is dependent on timing of development. Plant species that are dependent on the permanent pool elevation will not be installed until it is confirmed that the SWM facility functionally maintains the permanent pool elevations. Further, no planting of any proposed aquatic species in the sediment forebay and/or areas of the permanent pool will be undertaken until after initial cleaning and subsequent assumption.

2.5.8. Downstream Erosion Assessment

In addition to applying the erosion criteria to the proposed SWM facilities, an erosion assessment was undertaken by GeoMorphix in order to evaluate the downstream impacts of the subject development within Etobicoke Creek. The continuous model output from the calibrated Visual OTTHYMO model provided by TRCA was used to compare the exceedance of the erosion threshold under both pre- and post-development conditions. As per the Erosion Mitigation Assessment prepared by GeoMorphix (September 2024) provided in **Appendix F**, it was determined that the proposed SWM plan is effective in mitigating downstream erosion impacts within the receiving watercourse.

2.5.9. Thermal Mitigation Measures

Several thermal mitigation techniques were researched as part of the HFSWS in an effort to develop a prioritized list of measures for implementation within the Huttonville Creek and Fletcher's Creek subwatershed. As a result, a number of mitigation measures were proposed in the HFSWS, including mitigation measures that research suggests will have an impact on reduction of water temperature (where feasible). The recommendations in the HFSWs were used as a guide for thermal mitigation as part of the SWM strategy for the subject lands.

Of specific interest is the CVC study "*Thermal Impacts of Urbanization including Preventative and Mitigation Techniques*" (draft, December 2010), which indicated that an east-west pond orientation can reduce the hours of potential solar radiation, although a north-south orientation is preferable for narrow SWM facilities. Similarly, orienting the long side of the facility perpendicular to the prevailing wind direction (west) can assist in reducing thermal impacts.

The Draft CVC Thermal Impacts report identified five "zones" where thermal mitigation measures can be implemented. These include:

- Zone 1 – Up-gradient (i.e., pond catchment area)
- Zone 2 – SWM facility inlet
- Zone 3 – SWM facility
- Zone 4 – SWM facility outlet
- Zone 5 – Riparian corridor

The HFSWS Phase 3 Report recommended a list of potential thermal mitigation measures which have been reviewed and considered for use in each of the Alloa SWM pond facilities. This list of potential measures, as per the HFSWS, is summarized in **Table 2-25**.

Table 2-25: Thermal Mitigation Measures

SWM Facility Feature	Zone
Energy transfer between warm storm runoff and cool sub-surface storm sewers	Zone 1
LID measures	Zone 1
Roof colour	Zone 1
Downspout disconnection	Zone 1
Up-gradient plantings	Zone 1
Buried inlet pipe	Zone 2
Inlet cooling trench	Zone 2
Inlet plantings	Zone 2
Shading of open water areas by maximizing canopy	Zone 3
Artificial shade systems	Zone 3
Floating island	Zone 3

SWM Facility Feature	Zone
Reduce open water area	Zone 3
Increased L:W ratio	Zone 3
Pond orientation to reduce solar inputs	Zone 3
Pond orientation to increase exposure to prevailing wind	Zone 3
Landscaped jetties for shading	Zone 3
Sub-surface SWM ponds	Zone 3
Outlet sub-surface cooling trench and shading	Zone 4
Concrete outlet pipe	Zone 4
Introduce cool water at SWM pond outlets such as foundation drain collectors (FDC), where feasible and/or a Thermal Siphon	Zone 4
Reversed slope submerged pond outlet and extra permanent pool depth at outlet	Zone 4
Distributed outlets along the NHS to take advantage of the NHS shading	Zone 4

A summary table of the recommended thermal mitigation measures for each pond is provided in **Appendix C**.

2.6. SITE WATER BALANCE AND LOW IMPACT DEVELOPMENT

In addition to meeting the quantity, quality, and erosion control targets, the SWM strategy will address water balance requirements for the site and adjacent wetlands. The site water balance aims to mimic pre-development groundwater recharge rates in order to maintain groundwater as a source of flow. Feature-based water balance aims to mimic pre-development wetland hydroperiods to maintain their ecological function.

2.6.1. Site Water Balance

A site water balance has been conducted for the Tertiary Plan area in order to determine local pre-development annual infiltration volumes, impacts of proposed development to annual infiltration volumes, and potential mitigation measures to preserve annual groundwater recharge.

Development of an area affects the natural water balance. The most significant difference is the addition of impervious surfaces as a type of surface cover (i.e., roads, parking lots, driveways, and rooftops). Impervious surfaces prevent infiltration of water into the soils and the removal of the vegetation removes the evapotranspiration component of the natural water balance. The evaporation component from impervious surfaces is relatively minor compared to the evapotranspiration component that occurs with a healthy vegetation cover. The net effect of the development of a property is expected to be an increase in the water surplus resulting in a decrease in infiltration and an increase in runoff.

It is important to note that the proposed development will be serviced by municipal water supply and wastewater services. Therefore, there will be no impact on the water balance and local groundwater or surface water quantity and quality conditions related to any on-site groundwater taking or from septic effluent.

The site water balance assessment was completed using a continuous hydrologic model, as per Town requirements. For the portion of the site within the Etobicoke Creek subwatershed, the TRCA's approved and calibrated Visual OTTHYMO hydrologic model was used as a basis for the site water balance continuous model. The groundwater interaction for the subject lands is to be modelled and assessed as part of the EIR.

The results from the site water balance continuous model for the portion of the site within the Etobicoke Creek subwatershed are summarized in
Table 2-26. The continuous model was simulated for the period of 1986 to 2007. The average annual GWI (groundwater infiltration) for each land use type within the portion of the Tertiary Plan in the Etobicoke Creek subwatershed was compared to the pre-development average annual GWI to assess the impacts of the subject development on infiltration and groundwater recharge. The continuous site water balance model is provided in **Appendix D**.

Table 2-26: Summary of Continuous Modelling Results (Etobicoke Creek)

Land Use Type	Detached Residential	Townhouse / Medium-High Density Residential	Schools	Roads	Total
Pre-Development GWI (mm/year)	202				
Post-Development GWI (mm/year)	102	44	36	14	-
GWI Deficit (mm/year)	99	157	165	187	-
Target Retention (mm)	1.0	1.5	1.5	2.0	-
Developed Area (ha)	42.77	31.35	2.44	64.57	169.18
Target Retention (m^3)	428	471	37	1291	2226

As per **Table 2-26**, the target retention volume to mitigate the annual GWI deficit for the portion of the subject lands within Etobicoke Creek is 2,226 m^3.

For the portion of the site within the Fletcher's Creek subwatershed, the unitary infiltration targets from the HFSWS were applied to the subject area, which are based on the modelling that was done for the water balance analysis for Huttonville Creek and Fletcher's creek. These target infiltration volumes for the portion of the subject lands within Fletcher's Creek are summarized in **Table 2-27**.

Table 2-27: Summary of Infiltration Targets (Fletcher's Creek)

Land Use Type	LID Infiltration Target (m^3/ha)	Total Area (ha)	Total Volume (m^3)
Low Density Residential	10.4	33.88	352
Medium Density Residential	9.6	45.39	436
Commercial	17.3	23.22	401
School	6.4	6.47	41
NHS / Open Space / Park / SWM Pond	0	11.30	0
Total	-	120.26	1231

As per **Table 2-27**, the target retention volume to achieve the infiltration target for the portion of the subject lands within Fletcher's Creek is 1,231 m^3.

Therefore, the combined total infiltration volume requirement for the subject lands is 3,457 m^3. LID measures for stormwater management are recommended, where practical, in order to promote infiltration and mitigate the overall infiltration deficit resulting from post-development conditions, as discussed in **Sections 2.6.2** and **2.6.3**.

2.6.2.Low Impact Development Alternatives

While end of pipe facilities provide the minimum required SWM controls, the use of LID (Low Impact Design) stormwater management measures can be helpful to reduce the amount of runoff by increasing on site retention, infiltration, and evapotranspiration. The use of LIDs in a "treatment-train" approach has long been endorsed by the TRCA and CVC.

There are many LID measures available for use. Techniques to maximize the water availability in pervious areas such as designing grades to direct roof runoff towards open space areas throughout the development, where possible (e.g., yards, boulevards, landscaped areas, swales, green space in parking lots, etc.), can increase recharge in the developed area. Where possible, increasing topsoil depths in the pervious areas to retain more water in storage can also assist to reduce runoff volumes and increase the potential for infiltration. Other engineered LID measures such as infiltration and/or exfiltration trenches, HDFs, enhanced grass swales, and bioswales can be used to reduce runoff volumes and increase the potential for infiltration. Some examples of possible LIDs that are typical for this type of development include:

Downspout Disconnection:
Roof leader discharge to pervious surfaces such as lawns or to LID measures provides a source of clean water that can be infiltrated. This is a low / no maintenance, lot-level control that is typically implemented by default.

Infiltration Trench:
These are rectangular trenches lined with geotextile fabric, filled with clean granular stone or void-forming materials. They are suitable for sites with limited space for infiltration, such as narrow strips of land between buildings or properties, or along road rights-of-way. They primarily handle roof and walkway runoff.

Bioretention:
This infiltration practice utilizes the natural properties of soil and vegetation to treat runoff from paved areas and remove contaminants. Variations can include the inclusion or exclusion of an underdrain and impermeable liner. Bioretention can help achieve Stormwater Management (SWM) objectives related to water quality, water balance, and erosion control.

Rain Barrel:
Water collected in rain barrels can serve as a non-potable source for various purposes like toilet flushing, urinals, and irrigation. Rain barrels can contribute to meeting SWM objectives related to water quality, water balance, and erosion control.

Soil Cells:
A modular storage system designed to support the growth of large trees and provide effective stormwater management through processes like absorption, evapotranspiration, and interception.

Infiltration Chambers:
Infiltration chambers provide large volume of underground void space, all the while maintaining the necessary structural stability for sub-surface Best Management Practices (BMPs). They consist of a variety of proprietary modular structures that can be installed beneath paved parking lots or landscaped areas. Typically featuring open bottoms, perforated side walls, and optional stone-filled reservoirs below, these chambers are versatile in treating runoff from roofs, walkways, parking lots, and roads, given proper sedimentation pre-treatment measures. Due to their significant storage capacity, this technology is often utilized in areas where little to no space is available for other stormwater BMP solutions.

The following **Section 2.6.3** provides further evaluation of the SWM Best Management Practices (BMPs) mentioned above. The evaluation will consider technical feasibility, cost, maintenance requirements, and operational feasibility. While some LID approaches may be technically feasible, they may ultimately be cost-prohibitive or pose challenges in terms of maintenance and operation, particularly on a scale of this magnitude. Additional geotechnical / hydrogeological studies may be required prior to finalizing and confirming the selection of LID techniques.

2.6.3.Low Impact Development – Proposed Location and Size

Drawing 2.6.3 shows the interpreted depth of groundwater throughout the Tertiary Plan area as well as preliminary preferred locations for LID measures. LID placement is typically best in areas where groundwater is at least 2+ m below proposed grade. As shown on **Drawing 2.6.3**, there are areas in the Tertiary Plan where high groundwater restricts potential locations for LID measures.

The proposed LID plan includes soil cells within the road rights-of-way (ROWs) and infiltration chamber facilities within park blocks, where feasible. On-site retention is also proposed for commercial blocks, mixed use blocks and school blocks. A summary of the infiltration mitigation provided by the proposed LID plan is summarized in **Table 2-28** below. Water balance calculations are provided in **Appendix D**.

Table 2-28: Infiltration Mitigation – LID Summary

LID Type	Etobicoke Creek	Fletcher's Creek	Total Tertiary Plan Area
Infiltration Tanks (m^3)	294	113	407
On-Site Retention – Commercial/Mixed Use Blocks (m^3)	0	342	324
On-Site Retention – School Blocks (m^3)	36	42	78
Soil Cells (m^3)	1823	1220	3043
Total Retention Volume Provided (m^3)	2153	1716	3869
Target Retention Volume (m^3)	2226	1231	3457
% Target Retention Volume Achieved	-3%	39%	12%

The proposed high-level LID plan is based on the CLI-ECA recommendations to incorporate public LIDs. Subject to Town approval, if the proposed public LIDs are not feasible due to maintenance constraints, opportunities to incorporate LIDs on private lots (i.e., infiltration trenches) can be investigated.

2.6.4.Feature Based Water Balance

As shown in **Drawing 2.3**, there are four (4) existing wetlands throughout the Tertiary Plan area. A fifth wetland, adjacent to SWM Pond 1 (as shown in **Drawing 2.4A**), has been added in accordance with CVC requirements regarding compensation for previous features removed from the landscape.

To understand the existing hydroperiod and potential hydrological impacts due to the proposed development a feature-based water balance assessment has been completed for Wetlands #4 and.

Wetland #6 and Wetland #7 are recreated within re-aligned watercourses in the Tertiary Plan and are considered 'flow through' features. There is also a re-created wetland feature located adjacent to SWM Pond 1. As such, these wetlands are designed and assessed differently. Information regarding the design of Wetland #6 and Wetland #7 is available in the Fluvial Geomorphology Assessment and Conceptual Natural Corridor Designs Report prepared by GeoMorphix (September 2024), available as **Appendix F** of this report.

The feature-based analysis establishes the current hydrologic function of each relevant feature and determines if mitigation measures are required to preserve the water balance under post-development conditions. This assessment was done using the calibrated Visual OTTHYMO model provided by TRCA (modified as described in the preceding section), run in continuous mode. This model is identical to the single event model, with the following additional parameters required for continuous mode:

- Continuous climate data set (temperatures and precipitation) – the Buttonville Airport climate data was used, in accordance with TRCA recommendations for other areas in Caledon.
- Soil type – clay loam soil type and associated properties were assigned based on the predominant Jeddo / Chinguacousy Clay Loam across the study area.

The continuous model has already been simulated for the period of 1986 to 2007. For the purposes of feature-based water balance, years of extreme precipitation have been identified by examining the total precipitation during the growing season (March to October). These extreme years were found to be 1992 (max precipitation) and 2007 (least precipitation). An average year was also computed.

The continuous model generates monthly runoff volumes for the feature-based water balance analysis for each wetland. Where available, detailed survey and water level monitoring in the wetland areas are used to simulate the wetland area as a reservoir and identify the changes in water levels.

Detailed results for each wetland are documented in the following sections.

Wetland #4: Feature Based Water Balance Results

Under pre-development conditions, an existing catchment of 9.88 ha is conveyed to Wetland #4, as shown on **Figure 2.3**. The existing drainage catchment consists primarily of woodlot and agricultural land.

Under post-development conditions, a proposed catchment of 10.57 ha is conveyed to Wetland #4, as shown on **Figure 2.4A**. The proposed drainage catchment consists primarily of woodlot and 1.27 ha of rear-lot drainage from the adjacent residential lands.

A continuous model of the drainage to Wetland #4 under pre- and post-development conditions was used to assess the impacts to water levels and storage depths within the subject wetland. The hydrology of the wetland catchments was simulated using the TRCA's approved and calibrated Visual OTTHYMO model for Etobicoke Creek.

A PCSWMM model was used to simulate the hydraulics within Wetland #4. A LiDAR surface from TRCA was used to develop the stage-storage relationship of the wetland. The LiDAR surface data was also used to obtain the geometry of the spill from Wetland #4. The continuous flow results from the Visual OTTHYMO model were then simulated through the wetland feature in the PCSWMM model to observe the water level fluctuations in the wetland for both pre- and post-development conditions. The wetland model output is provided in **Appendix D**.

As previously noted, the years of extreme precipitation (1992 for maximum precipitation and 2007 for minimum precipitation) were used to compare pre- and post-development water levels in Wetland #4. As per the model output results provided in **Appendix D**, it was observed that there is minimal change to the water level in the wetland in comparing pre- and post-development conditions.

As per the Wetland Water Balance Risk Evaluation guidelines prepared by TRCA (November 2017), the magnitude of hydrological change was assessed for Wetland #4. There is a proposed increase in drainage area of 7.0% to Wetland #4 under post-development conditions. The impervious cover score for Wetland #4 was also determined to be 6.4%. Therefore, the change in drainage area and impervious cover were determined to be a low magnitude risk for Wetland #4.

Wetland #5: Feature Based Water Balance Results

Under pre-development conditions, an existing catchment of 5.34 ha is conveyed to Wetland #5, as shown on **Figure 2.3**. The existing drainage catchment consists primarily of wetland/woodlot and agricultural land.

Under post-development conditions, a proposed catchment of 5.49 ha is conveyed to Wetland #5, as shown on **Figure 2.4A**. The proposed drainage catchment consists primarily of wetland/woodlot and 0.97 ha of rear-lot drainage from the adjacent residential lands.

A continuous model of the drainage to Wetland #5 under pre- and post-development conditions was used to assess the impacts to water levels and storage depths within the subject wetland. The hydrology of the wetland catchments was simulated using the TRCA's approved and calibrated Visual OTTHYMO model for Etobicoke Creek.

A PCSWMM model was used to simulate the hydraulics within Wetland #5. A LiDAR surface from TRCA was used to develop the stage-storage relationship of the wetland. The LiDAR surface data was also used to obtain the geometry of the spill from Wetland #5. The continuous flow results from the Visual OTTHYMO model were then simulated through the wetland feature in the PCSWMM model to observe the water level fluctuations in the wetland for both pre- and post-development conditions. The wetland model output is provided in **Appendix D**.

As previously noted, the years of extreme precipitation (1992 for maximum precipitation and 2007 for minimum precipitation) were used to compare pre- and post-development water levels in Wetland #5. As per the model output results provided in **Appendix D**, it was observed that there is minimal change to the water level in the wetland in comparing pre- and post-development conditions.

As per the Wetland Water Balance Risk Evaluation guidelines prepared by TRCA (November 2017), the magnitude of hydrological change was assessed for Wetland #5. There is a proposed increase in drainage area of 2.8% to Wetland #5 under post-development conditions. The impervious cover score for Wetland #5 was also determined to be 9.3%. Therefore, the change in drainage area and impervious cover were determined to be a low magnitude risk for Wetland #5.

3 SITE GRADING

3.1. TERTIARY PLAN PROPOSED GRADING

The future site grades required to service the Phase 1 Tertiary Plan lands are influenced by:

- Existing and/or proposed grades along the boundary roads (Mayfield Road, Creditview Road and Chinguacousy Road).
- Assumed grading for future Hwy. 413, to be confirmed by MTO.
- NHS boundaries and buffer limits.
- Downstream stormwater outlet invert elevations which determine the elevation of future SWM facilities' normal water levels and, ultimately, storm sewer depth and serviceable drainage areas.

The site grading plan is shown in **Drawing 3.1A** to **Drawing 3.1F**. Development of site grading has taken into consideration the following requirements and constraints:

- Conform to the Town's grading criteria.
- Minimize cut and fill operations and work towards a balanced site.
- Match existing boundary grading condition, where feasible.
- Match existing grades at woodland and wetland features and their buffers, where possible. Transition grading has been proposed within buffers in some areas in order to avoid the use of retaining walls on private properties.
- Maintain subwatershed drainage boundaries, where possible.
- Provide suitable cover on proposed servicing.
- Provide overland flow conveyance for major storm conditions.

The majority of the Tertiary Plan lands slope from the north to the south in existing conditions, towards either the Alloa Municipal Drain or towards existing culverts across Mayfield Road. There are some areas south of the Alloa Municipal Drain, within the Etobicoke Creek watershed, which drain from south to north, towards the watercourse. The proposed development grading is generally consistent with the pre-development drainage pattern, and it is based on an overall SWM strategy that includes maximizing the lands that can drain by gravity to the proposed SWM facilities, while avoiding excessive sewer sizes and pipe conflicts.

Proposed local internal road grades vary between the Town's minimum of 0.75% and do not exceed 5%. It is recommended that the minimum 0.5% centreline road grades are implemented along major collector and arterial roads to reduce significant fill import for site earthworks balancing. Sawtooth grading may be introduced to maximize overland flow drainage to SWM Ponds, minimize 100-year flow capture in the storm sewer and/or manage site earthworks. The net slope in these areas will not be less than 0.25% and will accommodate major system flow conveyance. Proposed Grading Plans for the Subject Lands including road grades and overland flow routes are illustrated on **Drawing 3.1A** to **Drawing 3.1F.**

3.2. CUT / FILL ANALYSIS

A preliminary cut/fill analysis has been carried out for the Tertiary Plan area. Refer to **Drawing 3.2** which shows areas of cut and areas of fill, along with preliminary depths.

Ultimately, site earthworks volumes are driven by development constraints, specifically SWM pond outlet elevations which are tied directly to watercourse limits. The decision to re-align and lower the existing Alloa Drain was made, in part, to provide appropriate gravity outlets for SWM ponds and to manage cut/fill requirements. Even so, it is anticipated that the overall site will require a significant net imports (fill) of material for earthworks.

A Soil Management Plan will be established at Detailed Design to optimize the use of on-site soils for cut/fill operations. The goal of the Plan is to achieve a self-sustainable development with respect to excavated material to control the placement of organic soils such that there is negligible impact on the settlement performance of the compacted fill material.

3.3. BOUNDARY ROAD GRADES

Existing boundary roads are within the jurisdiction of either the Town of Caledon (i.e., Chinguacousy Road, Creditview Road) or the Region of Peel (Mayfield Road).

The Town and the Region have road widening projects either planned or on-going for all boundary roads associated with the Phase 1 Tertiary Plan. Ultimately, internal development grades will need to be compatible with the approved vertical alignment of the boundary road conditions after road urbanization projects are completed by the Region and the Town. For the purposes of this study, the following has been assumed:

- Mayfield Road – detailed design for Mayfield Road widening has been finalized by Peel Region. Region staff have provided detailed design drawings to the Tertiary Plan study team. The grading plan includes provision for the design of Mayfield Road, as provided by Peel.
- Chinguacousy Road – the Town of Caledon is in the process of finalizing the Municipal Class Environmental Assessment (MCEA) Study for Chinguacousy Road. The Town has provided the road design as contemplated through the EA. The grading plan reflects the most current EA design.
- A future widening project is planned for Creditview Road. The MCEA Study has not been completed to-date. For the purposes of this study, preliminary road grades have been identified for the Creditview road corridor to ensure they are compatible with development and can be serviced by proposed storm infrastructure. Further coordination with the Town will be required as work proceeds.

Also refer to Section 7 for additional information on the Tertiary Plan roads, as well as **Drawing 7.2A**, **Drawing 7.2B** and **Drawing 7.2C** for Creditview Road and Chinguacousy Road preliminary road profiles and servicing.

3.4. HIGHWAY 413

The Phase 1 Tertiary Plan is bounded on the north side by the future planned Highway 413 (see **Figure 1.2**). As development planning for Alloa proceeds, coordination of Alloa land use with MTO requirements (e.g., Stormwater Management Ponds, Transitway Stations, interchanges, etc.) is required.

As part of the initial site grading plan, Urbantech has assumed reasonable Highway 413 grading and drainage, which conform with the Alloa Development Plan. Since full design details are not available, the following initial assumptions have been made:

- A flyover is assumed across Chinguacousy Road, which sets the highway grades at the northeast corner of the development (approximately 8.0 m above existing road grades).
- An underpass is assumed below Highway 413 at the Creditview Road crossing, to ensure drainage can be accommodated by gravity in the existing or realigned watercourses within the Phase 1 Tertiary Plan. However, if this crossing is ultimately designed as an overpass, it does not appear that the Highway grades would be significantly impacted by this change.

Recognizing that MTO's design work remains on-going, the grading concept proposed is preliminary and will need to be reviewed and confirmed by MTO as development proceeds.

4 NATURAL CHANNEL DESIGN

The existing floodplain limits shown in **Drawing 4.1A** are built upon work completed as part of the 12300 Mississauga Road flood mapping as well as mapping recently completed for the FP Mayfield lands in Mayfield West Phase II, east of Chinguacousy Road. The existing flood hazard mapping for the Alloa Phase 1 Tertiary Plan area informs the extent of the existing NHS and dictates the extent of future management strategies related to the development of the Phase 1 lands.

Under proposed conditions (see **Drawing 4.2A**) floodplain limits and associated watercourses in the Tertiary Plan area are intended to be regularized, realigned and improved. The NHS traversing the Subject Lands under post-development conditions will include a corridor designed to contain erosion hazards, meander belt, flood hazard, crossings and other environmental features / considerations.

The sections that follow provide additional information on the development of both existing and proposed floodplain / channel conditions for the Phase 1 Tertiary Plan. It is noted that hazards and regulatory allowances associated with natural features will be further reviewed and clarified as work proceeds.

4.1. EXISTING CONDITIONS

4.1.1.Existing Conditions Floodplain Mapping

Etobicoke Creek has undergone various flood mapping studies, including the Etobicoke Creek Synthesis Study (AMEC, December 2014), which was used as the basis for the Mayfield West Stage 1 and Stage 2 Functional Servicing Report, and accompanying CEISMP and EIR studies completed by Crozier in support of development in the Mayfield West Phase 2 area.

The Visual OTHYMO (2022 model by TRCA) introduced revisions to flow data, cross-section locations, naming conventions, and geometry based on presumably improved topographic mapping. As described in Section 2, this model was updated by Urbantech based on minor revisions to drainage areas. The updated “future” scenario was used for the existing conditions HEC-RAS analysis. Urbantech has further updated the TRCA flood mapping as described in the following sections.

Mississauga Road to Chinguacousy Road

The floodplain in this location is based on the September 2022 TRCA model, surface (2015 LiDAR) and flows, with minor refinements to incorporate the recent ground surveys for the surrounding lands (RPE, April 2024 / JD Barnes, April 2024) and which includes the low-flow channel survey of the Alloa Drain. The peak flows from the updated Visual OTTHYMO model were incorporated into the model. The Urbantech Regional floodplain is generally consistent with the TRCA Regional floodplain, with any difference attributed to refinements to the surface topography.

Chinguacousy Road to Downstream

The Urbantech HEC-RAS model completed through the Mayfield West Phase II FSR process was updated to incorporate the revised flow data and geometry west of Chinguacousy Road and downstream of the FP Mayfield lands to the nearest confluence downstream of the proposed channel works in Etobicoke Creek. The future configuration of the channel/floodplain near the FP Mayfield lands was assumed to be in place east of Chinguacousy Road, as the permitting process is currently underway. The proposed works and accompanying hydraulic modelling were described in a memo dated March 13, 2024. Therefore, the ultimate conditions for the FP Mayfield lands have been integrated into the existing (updated) TRCA model.

The floodplain limits shown on **Drawing 4.1A** is therefore a consolidation of:

- Updated September 2022 TRCA model between Mississauga Road to Chinguacousy Road
- Ultimate March 13, 2024 FP Mayfield Model east of Chinguacousy Road
- Existing September 2022 TRCA east of FP Mayfield.

In general, the floodplain through the Tertiary Plan area is large and is governed by backwater conditions downstream of Chinguacousy Road. The channel slopes throughout the study area are relatively flat and the backwater impacts are significant. This was demonstrated in the 2D model for existing conditions.

The refined existing conditions floodplain mapping and modeling was submitted to TRCA and the Town of Caledon for review on April 24, 2024. TRCA comments were received (via email) on May 27, 2024. In the email response TRCA confirms that the proposed refinements and existing floodplain mapping (as shown in **Drawing 4.1A**) are acceptable.

4.1.2.Existing Riparian / Flood Storage

The riparian storage represents the relationship between the volume of water in the floodplain and the discharge (flow rate) of the watercourse. This relationship is typically assessed without any human-made structures, such as culverts, to understand the natural behavior of the watercourse and its capacity to convey and store water during various flow conditions. However, culverts can influence the extent and depth of flooding in the surrounding floodplain area and can affect the volume of water that the floodplain can store during flood events, impacting the flood hazard downstream.

Given the significant floodplain and backwater in the Alloa system that is further affected by the culverts, a comprehensive analysis both with and without these structures in place was undertaken.

To evaluate the existing riparian storage and flood storage (with culverts in place) between Mississauga Road and Chinguacousy Road, a 1D HEC-RAS model was employed for the hydraulic modeling as the system is more characteristic of conveyance systems rather than a storage area.

The results of the HEC-RAS model runs are presented in **Table 4-1** and **Table 4-2,** which show the differences in floodplain storage and discharge relationships for both scenarios (with and without culverts).

Table 4-1: Existing Riparian Storage (1D Model, No Culverts)

Location	Volume (m^3)						
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	Regional
Eto Hdwtr S - South 6 to 10 (Main Channel)	35.31	63.75	83.18	107.48	125.45	144.21	502.74
Eto Hdwtr S - South M1	1.57	4.14	5.18	6.85	7.88	8.86	25.44
Eto Hdwtr S - South N1	9.01	15.72	21.16	28.61	34.17	40.11	134.93
Eto Hdwtr S - South O1	7.14	11.53	14.61	18.71	21.74	24.99	82.11
Eto Hdwtr S - South P1	3.82	6.47	8.61	11.31	13.41	15.68	59.26
TOTAL	56.85	101.61	132.74	172.96	202.65	233.85	804.48

Table 4-2: Existing Flood Storage (1D Steady-State Model, With Culverts)

Location	Volume (m^3)						
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	Regional
Eto Hdwtr S - South 6 to 10 (Main Channel)	37.46	67.26	89.82	123.55	155.40	189.63	532.10
Eto Hdwtr S - South M1	1.57	4.14	5.18	6.85	7.88	8.86	25.45
Eto Hdwtr S - South N1	9.21	16.23	21.88	30.02	36.93	44.44	142.88
Eto Hdwtr S - South O1	7.16	11.54	14.62	18.73	21.76	25.03	82.09
Eto Hdwtr S - South P1	13.20	15.75	16.93	19.65	21.43	23.56	63.48
TOTAL	68.6	114.92	148.43	198.80	243.4	291.52	846.00

The storage volumes computed for each method are significant. Upon investigation of the conveyance of flows through the channel between Mississauga Road and Chinguacousy Road, it was found that there are areas of zero velocity in the floodplain, suggesting that a portion of the volume does not contribute to conveyance. In other words, the storage in this area may not affect peak flow routing significantly.

To evaluate the importance of maintaining the flood plain storage as it relates to flow routing / attenuation along the reach, a 2D HEC-RAS model was completed for the reaches between Mississauga Road and Chinguacousy Road. This simulation establishes the "actual" volume occupied during the regional storm and demonstrates the total "routed" peak flow at Chinguacousy Road. This analysis was conducted for the regional storm only. The 2D model represents that entire study area including the lands west of Mississauga Road (with scenarios assuming ultimate conditions and interim Phase 1 conditions). It provides additional confirmation and utilizes quasi-steady-state flows as preferred by TRCA. A 1-D dynamic model is to be completed at the draft plan stage to confirm the 2D model results discussed as part of this study.

Table 4-3: Existing Riparian Storage (2D Dynamic Model, With Culverts)

Location	Regional Storage	Regional Peak Flows at Confluence East of Chinguacousy Road (VO6 model with no channel routing elements; adjusted for quasi-steady-state flow)	Actual Routed Regional Peak Flow at Confluence East of Chinguacousy Road (2D model)
	(m^3)	(m^3/s)	(m^3/s)
Entire Study Area (Heritage Road to Confluence East of Chinguacousy Road	Existing	1,181,804	71.91 arrives at confluence TP = 19.92 hours 27.34 spills west over Heritage Road Total flow leaving site = 99.25

The 2D model indicates that there is a significant portion of flow leaving the study area west across Heritage Road, due to backwater / spill. This is not reflected in the Visual OTTHYMO model, which directs all of the flows generated towards Chinguacousy Road with no routing. The 2D flows are lower than the 1D steady state model. The significant difference in time to peak is due to the quasi-steady state approach to 2D modelling.

4.2. PROPOSED INTERIM CONDITIONS

4.2.1. Proposed Interim NHS and Channel Corridor

The proposed interim / Phase 1 conditions hydrologic and hydraulic modelling builds upon the framework and data used in the existing conditions analysis, as well as the preliminary NHS corridor design, provided by GeoMorphix in consultation with Urbantech and Crozier.

The post-development channel in Phase 1 defines the NHS limits for the watercourse corridors and fully contains the post-development floodplain, as shown in **Drawing 4.2A**. The design focusses on a pool and run channel typology mixed with wetland and wet meadow features. The proposed wetland features provide connection to the floodplain and help maintain moist habitats while functionally attenuating flows. The objective of these features is to provide retention and detention of flows over longer attenuated periods. The design also enhances aquatic and terrestrial habitat and increases corridor variability by creating a low flow channel with variable geometry. This variability provides benefits to the system by replicating conditions found in natural systems, adding diversity to the valley corridor and providing additional pockets of sediment sources.

Drawings 4.5A, Drawing 4.5B and **Drawings 4.5C** provide details on the proposed channel design and NHS limits from both a plan, profile and cross-section perspective at various locations throughout Phase 1 of the Secondary Plan.

4.2.2.Proposed Phase 1 Hydrologic Model

The hydrologic model was further updated by Urbantech to reflect post-development conditions based on the Tertiary Plan and proposed drainage area delineation (see **Drawing 2.4A**). Similar to the updates for existing conditions, model parameters for external catchments under proposed conditions remained consistent with the original version provided by TRCA, except where larger, lumped catchments were split into smaller catchments to refine drainage patterns in areas requiring more resolution. Developed areas were modelled using the STANDHYD command. All model parameters are included in **Appendix E**.

The following scenarios were simulated for post-development conditions:

- 25mm, 2-year to 100-year storms (12-hour AES, AMC II conditions), with SWM facilities in place.
- Regional storm – Hurricane Hazel (AMC III conditions), uncontrolled (no SWM facilities), for use in hydraulic modelling.
- Regional storm – Hurricane Hazel (AMC III conditions), with SWM facilities in place.
- Continuous model, with SWM facilities in place (for use in the feature-based water balance and erosion analysis).

The Regional storm scenario (AMC III conditions) assuming no SWM facilities in place was used for hydraulic modelling. **Table 4-4** compares the proposed model flows to the existing flows at various key nodes.

Table 4-4: Interim (Phase 1) and Ultimate vs. Existing Peak Flows at Key Nodes

Location	NHYD	Area (ha)	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	Regional (no SWM)
Node 2167 (Mississauga Road)	Existing UT	301.2	1.525	2.732	3.550	4.522	5.317	6.154	24.736
	Interim Phase 1	301.2	Post-development flows with SWM controls to relevant to flood mapping						24.736
	Proposed UT	298.58							29.998

Location	NHYD	Area (ha)	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	Regional (no SWM)
	Difference (ultimate vs existing	-2.62							5.262
	Difference (Phase 1 vs existing)	0							0
Node 1125 (Creditview Road)	Existing UT	856.50	3.387	6.186	8.315	11.138	13.369	15.758	66.885
	Interim Phase 1	832.36	Post-development flows with SWM controls to relevant to flood mapping						63.19
	Proposed UT	867.67							81.982
	Difference (ultimate vs existing	11.17							15.097
	Difference (Phase 1 vs existing)	-24.14							-3.695
Node 1105 (Chinguacousy Road)	Existing UT	1465.32	5.624	10.066	13.506	18.083	21.81	25.814	112.762
	Interim Phase 1	1461.34	Post-development flows with SWM controls to relevant to flood mapping						107.149
	Proposed UT	1454.2							126.577
	Difference (ultimate vs existing	-11.12							13.815
	Difference (Phase 1 vs existing)	--4							-5.616

Based on the uncontrolled Regional flow scenario, there is decrease in the peak flows approaching Chinguacousy Road. These flows results do not include Regional storm control, which will be provided. The target release rates in the Etobicoke Creek Hydrology Update Study are expected to reduce the Regional flows below the existing conditions values due to the requirement to control to 60% of existing conditions flows. Therefore, under Phase 1 conditions, there is a net reduction in the peak Regional flow.

4.2.3.Proposed Phase 1 Hydraulic Model

The primary objective of the post-development Phase 1 hydraulic modeling exercise is to compare the existing and proposed conditions to identify changes and potential impacts on the floodplain, storage, and flow conveyance. The following sections provide a detailed overview of the Phase 1 interim conditions modelling, highlighting significant changes and their implications. The proposed Phase 1 corridor has been sized to handle the post-development, uncontrolled flows resulting from the proposed interim drainage plan (see **Drawing 4.2A**) and land use.

Proposed Hydraulic Structure Inventory

The preliminary span of proposed culverts and crossings are sized based on hydraulic conveyance requirements but have also been confirmed to meet geomorphological function and small mammal passage (as required by the Terrestrial Ecologist). See **Drawing 4.4** for a typical road crossing detail along the NHS corridor. Some of these crossings are located outside of Phase 1 and are only required for the ultimate development of the Alloa lands.

The HEC-RAS model was used to evaluate the proposed culvert infrastructure within the study area. The proposed conditions incorporate new or modified structures that are anticipated due to development or infrastructure projects. Smaller farm road crossings were not considered in this evaluation.

Table 4-5: Post-Development Channel Crossings / Culvert Sizing

Crossing Location & HEC-RAS Section	Crossing Type	Size of Opening [span x rise] or [diameter] (m)	Upstream Invert (m)	Downstream Invert (m)	Road Centerline Elevation (m)	Approx. Level of Service Prior to Overtopping
Creditview Road Eto Hdwtr S South 8 XS 237	3x CSP Circ.	1.35 / 1.40 / 1.40	258.87	258.84	261.09	50-year
Chinguacousy Eto Hdwtr S South 6 XS 267	Conc. Box	6.05 x 1.67	256.56	256.56	258.58	100-year
Chinguacousy Eto Hdwtr S Trb H South H2 XS 180	Conc. Box	4.37 x 1.07	258.74	258.74	260.18	100-year
Chinguacousy Eto Hdwtr S Trb I South I1 XS 479	Conc. Box	3.00 x 0.86	261.27	261.27	262.22	100-year
Chinguacousy Eto Hdwtr S Trb F South F1 XS 824.71	Conc. Box	6.3 x 1.06	262.61	262.60	263.86	100-year
Creditview Road Eto Hdwtr S South 8 XS 237	3x CSP Circ.	1.35 / 1.40 / 1.40	258.87	258.84	261.09	50-year

Crossing Location & HEC-RAS Section	Crossing Type	Size of Opening [span x rise] or [diameter] (m)	Upstream Invert (m)	Downstream Invert (m)	Road Centerline Elevation (m)	Approx. Level of Service Prior to Overtopping
Chinguacousy Eto Hdwtr S South 6 XS 267	Conc. Box	6.05 x 1.67	256.56	256.56	258.58	100-year
Chinguacousy Eto Hdwtr S Trb H South H2 XS 180	Conc. Box	4.37 x 1.07	258.74	258.74	260.18	100-year
Chinguacousy Eto Hdwtr S Trb I South I1 XS 479	Conc. Box	3.00 x 0.86	261.27	261.27	262.22	100-year
Chinguacousy Eto Hdwtr S Trb F South F1 XS 824.71	Conc. Box	6.3 x 1.06	262.61	262.60	263.86	100-year
Creditview Road Eto Hdwtr S South 8 XS 237	3x CSP Circ.	1.35 / 1.40 / 1.40	258.87	258.84	261.09	50-year
Chinguacousy Eto Hdwtr S South 6 XS 267	Conc. Box	6.05 x 1.67	256.56	256.56	258.58	100-year

Phase 1 Riparian Storage

To ensure that the loss of riparian storage does not adversely impact downstream flows, further analysis using a 2D dynamic model was conducted. This model provides a more comprehensive view of the flow dynamics and storage interactions over time and across the floodplain.

To evaluate the importance of maintaining the flood plain storage as it relates to flow routing / attenuation along the reach, a 2D HEC-RAS model was completed for the reaches between Mississauga Road and Chinguacousy Road. This simulation establishes the "actual" volume occupied during the regional storm and demonstrates the total "routed" peak flow at Chinguacousy Road. This analysis was conducted for the regional storm only. The 2D model provides an additional confirmation and utilizes quasi-steady-state flows as preferred by TRCA.

Table 4-6: Existing Riparian Storage (2D Dynamic Model, With Culverts)

Location	Scenario	Regional Storage	Sum of Peak Flows at Chinguacousy Road (VO6 model with no channel routing elements; adjusted for quasi-steady-stage flow)	Actual Routed Regional Peak Flow at Chinguacousy Road
		(m^3)	(m^3/s)	(m^3/s)
Entire Study Area (Heritage Road to Chinguacousy Road)	Existing	1,181,804	**131.66** TP = 11.25 hours	*71.91*+ 27.34 spill = **99.25** (19.92 hours)
	Phase 1	1,062,269	**129.704** TP = 11.00 hours	*78.053*+26.78 spill= **104.833** (20.00 hours)
	Ultimate (based on Secondary Plan)	1,022,367	**139.84** TP = 11.00 hours	**110.50** (20.00 hours)
	Difference (ultimate vs. existing)	**-12,279**	**8.18** **(-0.25 hours)**	**11.25** **(0.08 hours)**
	Difference (Phase 1 vs. existing)	**-159,437**	**-1.956** **(-0.25 hours)**	**5.583** **(0.08 hours)**

The key findings from these models are as follows:

- Peak Flow Comparisons: The dynamic 2D model was used to compare peak flows downstream of the proposed Phase 1 channel modifications. The results indicated that despite the reduction in storage capacity, the peak flows at downstream locations such as Chinguacousy Road did not show significant increases even under uncontrolled Phase 1 or Ultimate conditions (notwithstanding the increase attributed to the Highway 413 construction, which diverts additional flow from Heritage Road to Chinguacousy Road under ultimate conditions). There is no significant difference in peak flow timing in the 2D model or total flow attributed to loss of storage.
- Floodplain Impacts: The analysis confirmed that the more efficient flow routing through the trapezoidal Phase 1 channel compensated for the loss of storage. The channel's enhanced conveyance capacity ensured that floodwaters were transported more effectively, reducing the risk of backwater effects and localized flooding.

The proposed changes to the channel design within Phase 1, while reducing riparian storage, do not adversely impact downstream flows. The more efficient trapezoidal channel design improves flow conveyance, and the lost storage primarily comprises dead storage that does not significantly contribute to flow dynamics. The validation using the 2D HEC-RAS models confirms that peak flows downstream remain within acceptable limits, ensuring that the proposed conditions maintain effective floodplain management and minimize flood risks.

4.3. NATURAL CHANNEL DESIGN - EXPECTATIONS and IMPLEMENTATION

4.3.1. Design Expectations

It is expected that the proposed channel design will promote and improve communication with the floodplain, retention and detention of flows and sediment, fish habitat features and provide a stable geomorphic form.

The current channel is low energy with intermittent flow that is controlled by the vegetation. It has good communication with its floodplain. There is evidence that modifications have been made to this channel previously given that it is part of the Municipal Drain system. There is compromised capacity for detention or retention due to the limited morphological variability.

The proposed channel design will have similar gradient and bankfull characteristics to the current channel. The main goal of the design is to provide access to the floodplain and greater variability to the channel and floodplain. The addition of greater complexity in sediments will provide added benefits.

4.3.2. Recommendations for Design and Construction of the Channel

The following are recommendations for implementation:

- Construction should be carried out within the existing channel during low-flow conditions and as regulated by the fisheries timing window, or as dictated by the Conservation Authority.
- The design elements are unique and as such, the designer or representative should be part of construction supervision to ensure proper installation and function of the design elements. Onsite supervision will ensure a rapid response to construction issues.
- The constructed watercourse should be deemed stable by the designer prior to flow introduction.
- All works within the perimeter of the constructed watercourse should be isolated from the existing watercourse in order to mitigate against impacts, such as sediment loading. The perimeter of the constructed watercourse should be stabilized using the prescribed combination of coir cloth, live staking and seed. It is to be stable prior to the introduction of flows from the existing watercourse.
- Dewatering discharge should be pumped at least 30 m from the channel through a filter bag prior to release on the floodplain. The water should be dispersed across the floodplain through straw bales or Filtrexx Silt Soxx.
- All materials and equipment used in the constructed watercourse should be maintained to prevent deleterious substances from entering the water. A staging area, with appropriate erosion controls, should be placed away from the work area. All re-fuelling and maintenance should be conducted in the staging area.

4.4. TRAILS

Trails and pathways are intended to provide pedestrian linkages that facilitate the continuity of the Town of Caledon and Region of Peel active transportation networks, enhance the continuity of the Town's open space and transit systems, and provide access to recreational opportunities within each neighbourhood. A preliminary trail system is proposed throughout the Tertiary Plan area to connect important community destinations and take advantage of the natural features.

The proposed trail network within the Alloa Phase 1 plan is shown comprehensively on **Drawing 4.3**. The trail system includes:

- Recreational trails within the NHS, designed as 3.0 m wide limestone pathways. These trails follow the perimeter of the re-aligned Alloa Drain channel corridor (north and south sides, sections of the woodlots, and the south perimeter of the re-aligned channel corridor in the northeast corner of the plan. These trails are anticipated to be located within the NHS buffer. Site grading for lots backing on to the NHS trail system has been designed to avoid private drainage across buffers to protect from trail wash-out. Refer to NHS cross-section drawings (**Drawing 4.5A**, **Drawing 4.5B** and **Drawing 4.5C**) for additional information regarding trail design and location.

- Urban Trails:
    - Sidewalks (throughout the plan).
    - Multi Use Trails (located along the major road corridors – Creditview Road, Chinguacousy Road and Mayfield Road).

Trails are designed to accommodate a wide range of users and abilities with trail gradients that meet Municipal and Provincial standards.

5 SANITARY SERVICING

5.1. EXISTING SANITARY SERVICING AND REGIONAL SYSTEM CAPACITY

The subject lands are serviced by Peel Region's lake-based wastewater system, which collects wastewater from the City of Mississauga, the City of Brampton and part of the Town of Caledon (including the Alloa Phase 1 Tertiary Plan area). The Peel lake-based system consists of two (2) wastewater treatment facilities (G.E. Booth Wastewater Treatment Plant (WWTP) and Clarkson WWTP) and a network of pumping stations, forcemains and gravity sewers (both trunk and local). The system is divided into three main north/south trunk sewer systems – McVean, East and West.

The Alloa Phase 1 area is currently tributary to the Peel Region West Trunk system. Wastewater generated from the Phase 1 area will drain to an existing sanitary connection (750 mm sewer) at Brisdale Drive, which has been designed to accommodate the Alloa Phase 1 wastewater flow. The Brisdale sewer is part of a sub-trunk network within the West Trunk system known as the Fletcher's Creek trunk.

Recent discussions with Peel Region Staff indicate that planned growth in this service area (generally north of Mayfield Road, including Alloa Phase 1) has triggered new downstream capacity improvements in the broader wastewater system. As a result, Peel Region 2024 DC Wastewater Mapping includes the following new wastewater projects:

- Project 34521 and Project 29450: new 1500 mm sanitary sewer along Bovaird Drive from west of McLaughlin Road to Kennedy Road and south on Kennedy Road from Bovaird Drive to south of Steeles Road East.

When complete, these projects will alleviate constraints in the Fletcher's Creek trunk by shifting a portion of flow from the West Trunk to the East Trunk network. Upgrades are scheduled for construction in the 2026 – 2028 timeframe. It is anticipated that:

- There is existing capacity in the downstream sewer system to allow initial development to proceed in Alloa Phase 1, generally from Mayfield Road north to the Alloa Drain (refer to **Drawing 9.1** for preliminary development staging).
- Regional improvements will proceed concurrently with development planning and initial housing starts. As existing capacity is used, new capacity will come online, such that there will be no impact to the overall Alloa Phase 1 development timing.

Planned Regional sanitary infrastructure projects that directly support the Phase 1 Tertiary Plan are summarized in **Table 5-1** and shown graphically in **Figure 5-1**.

Table 5-1: Alloa Phase 1 Wastewater Servicing (Planned Regional Projects[1])

Project No.	Project Description	Project Timing [2]	Supporting
56982	Brisdale Sewer Extension (Mayfield Road north to mid-block)	2031	Alloa Phase 1

[1] *Taken from Peel Region Wastewater Map 2024 (Map ID: 3871-WW-DC), 2024 Budget (October, 2023).*

[2] *If required to accommodate development timing, the Alloa Landowner's Group may enter into a front ending agreement with Peel for delivery of necessary regional infrastructure ahead of the capital program planning schedule*

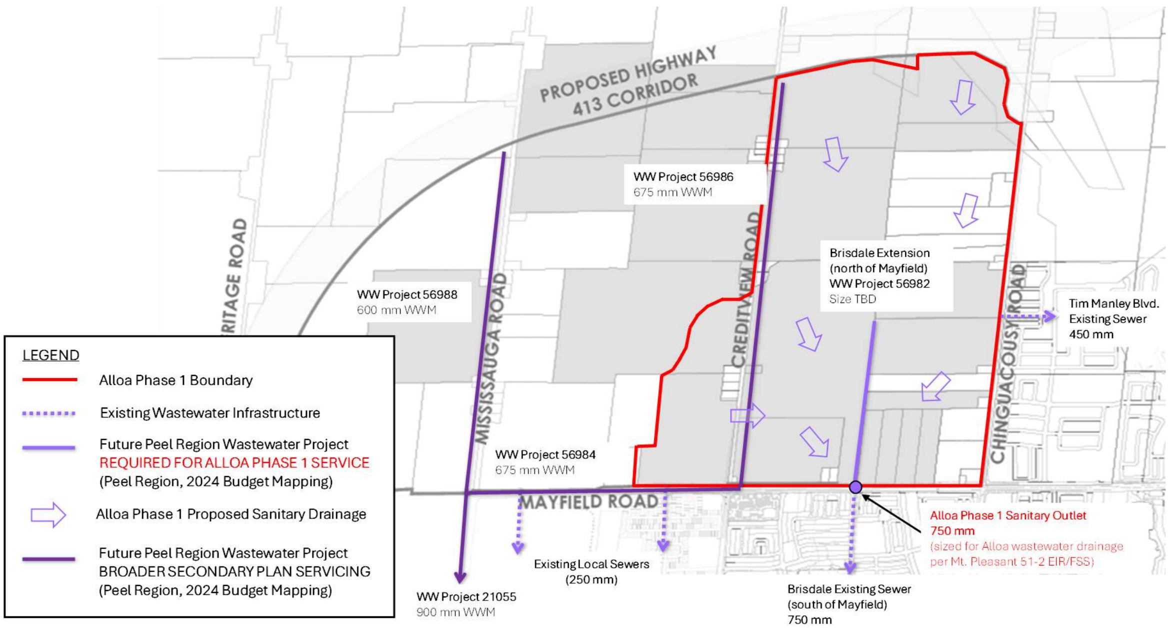

Figure 5-1: Alloa Phase 1 Wastewater Servicing (Existing/Future Regional Infrastructure Plan)

5.2. SANITARY DESIGN CRITERIA AND WASTEWATER GENERATION RATES

Peel Region wastewater design criteria and design standards are taken from the Public Works Linear Wastewater Standards (March, 2023). Pipe size, slope and depth, as shown in **Drawing 5.1** follow the requirements set out in the March 2023 Design Manual.

The calculated overall wastewater generation rates for the Phase 1 area are shown in **Table 5-3**. The full sanitary design sheet is available in **Appendix B**.

Sanitary flow rates are determined using:

- Land use areas as shown in **Figure 1.4** (Tertiary Plan Land Use Schedule).
- Population / Employment density targets, as outlined in **Section 1.4**, **Table 1-2.**

- Peel Region Sanitary Design Criteria shown in **Table 5-2**, taken from the March 2023 Design Manual and consistent with the 2020 Master Plan.

Table 5-2: Peel Region Wastewater Generation Design Criteria

Population Type	Average Dry Weather Flow (L/cap/day)	Peaking Factor	Inflow and Infiltration (L/s/ha)
Residential	290	Harmon Formula	0.260
Employment	270	Harmon Formula	0.260

Table 5-3: Alloa Phase 1 – Wastewater Generation (Cumulative at Brisdale Sewer Connection)

	Population + Jobs (Total)	Average Dry Weather Flow (L/s)	Peaking Factor (Harmon Formula)	Peak Wet Weather Flow (L/s)
Alloa – Phase 1	36,100	121.2	2.4	356.8

The values in **Table 5-3** are preliminary and subject to refinement in future studies as more information becomes available. Ultimately, pipes internal to the Alloa Phase 1 Tertiary Plan will be designed based on peak wet weather flow for their specific sewer catchment area, and in accordance with Peel Region's design standards (size, slope, depth, etc.).

5.3. PROPOSED TERTIARY PLAN SANITARY SERVICING

Drawing 5.1 shows the proposed Tertiary Plan sanitary servicing strategy, including all existing and future Peel Region service connections. The Tertiary Plan is intended to be serviced by a series of local sub-trunk sewers, generally draining from north to south and connecting into the existing 750 mm sewer at Brisdale Drive.

As noted in **Section 5.1**, discussions with Peel Region to-date have confirmed that the sanitary sewer on Brisdale Drive is sized with capacity to support growth in Alloa Phase 1. The Brisdale sewer was designed and approved as part of the Mount Pleasant Block 51-2 EIR/FSR and the associated Block 51-2 subdivision design. As per the approved design, the sewer includes provision for Alloa Phase 1 drainage equal to 502.9 ha and 25,460 people (329.2 L/s). Current population and flow estimates for the Tertiary Plan area (shown in **Table 5-3**) are marginally higher, but not anticipated to significantly impact downstream servicing.

While the Alloa Phase 1 servicing concept and sanitary design sheet (**Appendix B**) follows the approved Block 51-2 and Mayfield West supporting studies (i.e., all Phase 1 areas connected to the Brisdale trunk sewer), there are two areas on the plan where alternative servicing options are shown:

- A portion of the Phase 1 lands (eastern boundary) could be accommodated (either temporarily or permanently) into the existing 450 mm diameter sewer at Tim Manley Boulevard and Chinguacousy Road.
- The Commercial lands along Mayfield Road west of Creditview Road could be serviced (either on an interim or permanent basis) via an extension of the existing 250 mm sanitary sewer on Robert Parkinson Drive in Block 51-2.

Further discussion with Peel Region staff would be required to confirm servicing capacity in these sewers on an interim and/or long-term basis.

In addition to the above, it is noted that there is a future Peel Region DC sewer planned for Creditview Road which may provide additional flexibility for future servicing of the Phase 1 lands.

6 WATER SERVICING

6.1. EXISTING WATER SERVICING AND REGIONAL SYSTEM CAPACITY

The Subject Lands are serviced by the Region of Peel's lake-based water system, which distributes water from Lake Ontario to the City of Mississauga, the City of Brampton and part of the Town of Caledon (including the Alloa Secondary Plan). The Region's lake-based system consists of two (2) treatment facilities, transmission systems, and distribution systems. There are three transmission systems (west, central and east), each containing a series of booster pump stations, water reservoirs and elevated tanks. The Alloa Secondary Plan is part of the west transmission system.

There are a total of seven (7) water pressure zones in the Peel System, each separated by approximately 30 m intervals of elevation. The Phase 1 Tertiary Plan is proposed to develop on the Pressure Zone 7 West (7W) system. Zone 7W has a top water level of 327.7 m, a hydraulic grade line of 335.3 m and services elevations between 243.4 m and 289.6 m. The Alloa Booster Pump Station and Alloa Reservoir, both located within the Alloa Secondary Plan area (west of Creditview Road, north of Mayfield Road) provide storage and pumping capacity for the Alloa Secondary Plan area as well as other growth areas within Zone 7W.

The Zone 7W system is intended to be expanded in the near-term to include new transmission mains from the Alloa Booster Pump Station to the new West Caledon Elevated Tank. A Schedule C Municipal Class Environmental Assessment study is currently underway to select the ultimate location for the Elevated Tank and the alignment of the future transmission mains. This study is anticipated to be completed by early 2025. Currently, the Alloa Reservoir provides all of the Zone 7W floating storage. The future addition of the West Caledon Elevated Tank will improve the storage capacity for the zone as well as system redundancy and security of supply.

Peel Region staff have confirmed that Alloa Phase 1 development is not reliant on the future West Caledon Elevated Tank (or associated distribution / transmission mains). Phase 1 development can proceed with only the trunk watermains within Phase 1, as identified on **Drawing 6.1**. Broader area projects, like the West Caledon Elevated Tank will provide additional capacity and security for the remainder of the Secondary Plan area (Phase 2).

Planned Regional water infrastructure projects that directly support the Tertiary Plan are summarized in **Table 6-1** and shown graphically in **Figure 6-1**.

Table 6-1: Alloa Phase 1 Water Servicing (Planned Regional Projects[1])

Project No.	Project Description	Project Timing [2]	Supporting
53977	600 mm watermain on Chinguacousy Road from Tim Manley Blvd to Old School Road	2026	Phase 1
57094	400 mm watermain on new Alloa internal east-west road from Chinguacousy Road to Creditview Road	2026	Phase 1 / Phase 2

Project No.	Project Description	Project Timing [2]	Supporting
57096	400 mm watermain on Creditview Road from Mayfield Road north to new Alloa internal east-west road	2026	Phase 1 / Phase 2

[1] *Taken from Peel Region Wastewater Map 2024 (Map ID: 3870-W-DC), 2024 Budget (October, 2023).*

[2] *If required to accommodate development timing, the Alloa Landowner's Group may enter into a front ending agreement with Peel for delivery of necessary regional infrastructure ahead of the capital program planning schedule*

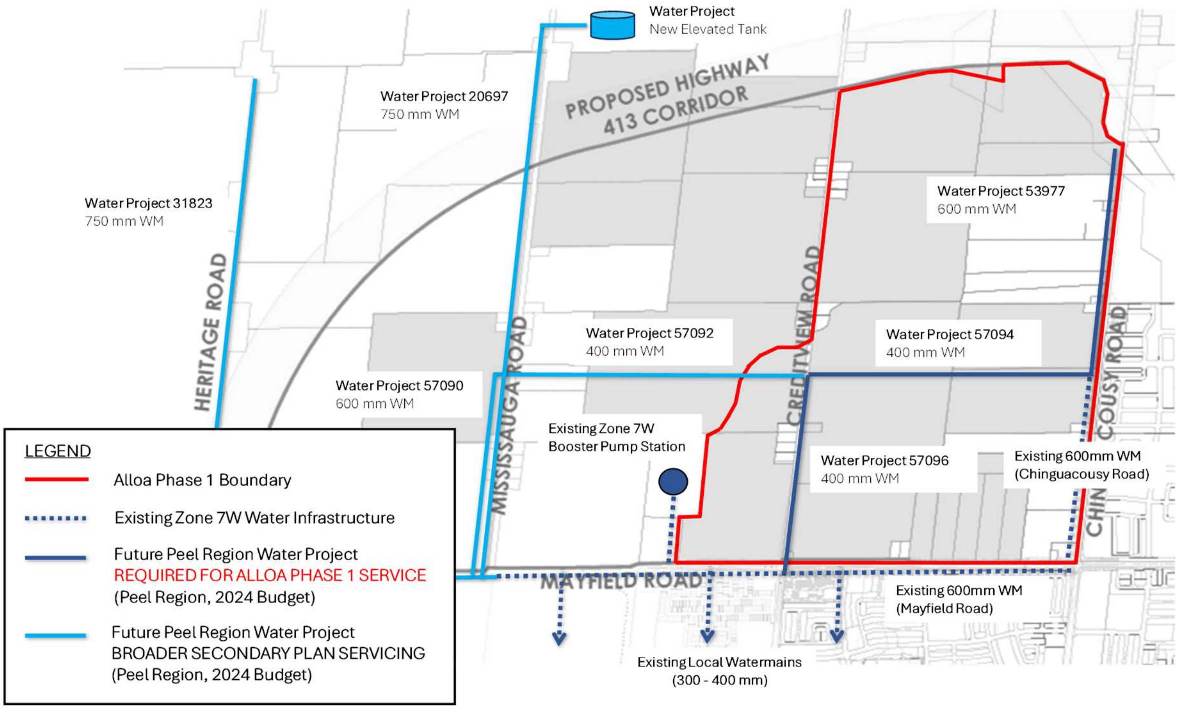

Figure 6-1: Alloa Phase 1 Water Servicing (Existing/Future Regional Infrastructure Plan)

6.2. WATER DESIGN CRITERIA AND SYSTEM DEMAND

Peel Region provides design criteria and water supply standards to ensure uniformity in their system. The Region of Peel Public Works Design, Specifications and Procedures Manual (June, 2010) provides comprehensive instruction for the design and construction of municipal services. Watermain size, slope and depth, as shown in **Drawing 6.1**, follows the June 2010 Design Manual.

Peel Region per capita water demand criteria were updated through the 2020 Water and Wastewater Master Plan. As such, the criteria in the June 2010 Design Manual are considered superseded by the 2020 Master Plan values. The Master Plan water demand criteria are shown in **Table 6-2.**

Similar to sanitary flow rate calculations, water demand rates are determined using:

- Land use areas as shown in **Figure 1.4** (Tertiary Plan Land Use Schedule).
- Population / Employment density targets, as outlined in **Section 1.4**, **Table 1-2.**
- Peel Region Water Demand Criteria shown in **Table 6-2**.

Table 6-2: Peel Region Water Demand Design Criteria

Population Type	Average Dry Water Demand (L/cap/day)	Max Day Peaking Factor	Peak Hour Peaking Factor
Residential	270	1.8	3.0
Employment	250	1.4	3.0

Preliminary water demand rates are tabulated in **Table 6-3**. The values are preliminary and subject to refinement in future studies as more information becomes available.

Table 6-3: Alloa Phase 1 – Water Demand (Domestic)

	Average Day Demand (L/s)	Max Day Demand (L/s)	Peak Hour Demand (L/s)
Alloa – Phase 1	113.0	201.9	337.7

In addition to the domestic demand outlined above, the water distribution system will provide water capacity for fire protection, in accordance with the requirements of the Underwriters Laboratories of Canada. Fire flow will be further defined as more information becomes available regarding built form. Water distribution systems are commonly designed to provide either Max Day + Fire Flow or Peak Hour Flow (whichever is higher).

The Region requires delivery pressures between 40 psi and 100 psi (not including during fire events).

The water distribution system analysis, including local watermain sizing and layout, for the subject site will be completed/confirmed as engineering proceeds and more information is available regarding built form and neighbourhood concept plans. Interim water servicing and looping is also to be determined, based on the future development phasing, as applicable. The Phase 1 Tertiary Plan watermains will be designed to supply demand under all operating scenarios, while maintaining adequate pressure to the system as required by Peel Region

6.3. PROPOSED TERTIARY PLAN WATER SERVICING

Drawing 6.1 shows the proposed Tertiary Plan water servicing strategy, including all existing and future Peel Region service connections. The Alloa Phase 1 area is intended to be serviced by a series of local watermains, connected and looped with existing or planned Regional DC infrastructure.

There is an existing 600 mm diameter Zone 7W watermain that runs along Mayfield Road from Mississauga Road to east of Chinguacousy Road. There is also an existing 600 mm diameter Zone 7W watermain that runs north on Chinguacousy Road, terminating at Tim Manley Blvd. This watermain will be extended further north by the Region in the 2026 timeframe. The Alloa Phase 1 lands will use these existing watermains for water distribution and looping. Additional Regional DC watermains on Creditview Road and mid-block within the Tertiary Plan area will be required for development of Phase 1.

7 ROADS

7.1. ROAD RIGHTS-OF-WAY

New road rights-of-way (ROW) are proposed throughout the Phase 1 Tertiary Plan. In addition to providing passage of traffic, the proposed road ROWs will be sized sufficiently to accommodate all proposed services and utilities, as well as to convey overland flow for major storm conditions, as required.

Proposed ROWs are consistent with the current Town of Caledon design standards. As work proceeds, the standard Town ROW cross sections may be modified to meet urban design objectives, in consultation with Town Staff. **Figure 7.1A** through **Figure 7.1F** provide cross-sections and servicing details for each ROW width. Standard ROWs proposed for the Tertiary Plan are as follow:

- 30.0 m
- 26.0 m
- 22.0 m
- 18.0 m
- 16.0 m
- 8.0 m (Laneway)

7.2. ROAD CROSSINGS OF THE NHS

As shown in **Drawing 4.3** there are five (5) NHS road crossings proposed for Phase 1 associated with the re-aligned Alloa drain channel and two (2) NHS road crossings associated with woodlots.

As noted in **Section 4.2.3**, the preliminary span of proposed culverts and crossings (associated with the channel) are sized based on hydraulic conveyance requirements but have also been confirmed to meet geomorphological function and small mammal passage (as required by the Terrestrial Ecologist). Refer to **Drawing 4.4** for a typical road crossing detail along the NHS corridor and **Table 4-5** for culvert sizing.

7.3. BOUNDARY ROADS

Existing boundary roads are within the jurisdiction of either the Town of Caledon (i.e., Chinguacousy Road, Creditview Road) or the Region of Peel (Mayfield Road).

The Town and the Region have road widening projects either planned or on-going for all boundary roads associated with the Phase 1 Tertiary Plan:

- Mayfield Road – detailed design for Mayfield Road widening has been finalized by Peel Region. Region staff have provided detailed design drawings to the Tertiary Plan study team.

- Chinguacousy Road – the Town of Caledon is in the process of finalizing the Municipal Class Environmental Assessment (MCEA) Study for Chinguacousy Road. The Town has provided the road design as contemplated through the EA.
- A future widening project is planned for Creditview Road. The MCEA Study has not been completed to-date. Further coordination with the Town will be required as work proceeds.

Ultimately, internal development grades will be coordinated with on-going Town and Region road projects. Refer to **Drawing 7.2A**, **Drawing 7.2B** and **Drawing 7.2C** for Creditview Road and Chinguacousy Road preliminary road profiles and servicing.

8 CLIMATE ADAPTATION

The Resilient Caledon Community Climate Change Action Plan identifies how the Town of Caledon intends to respond to potential climate-related challenges including changes in the frequency of extreme weather (droughts, floods, etc.). In order to design a community that is resilient to climate change, the following items have been (and will continue to be) considered as the studies for this area advance.

Flood hazards: Flood hazards in the adjacent creeks have been established using the regional event (Hurricane Hazel) which is based on an historic event. As such, the extent of existing or proposed flood hazards will not be affected by increased intensity, frequency and duration of storm events due to climate change.

Erosion: As there is the potential for increased frequency of flows in the creeks due to climate change, the impacts of these flows on erosion protection measures should be considered at detailed design. While this will not affect channel block sizes, it could impact the sizing of stone protection or other mitigation measures.

Stormwater Management: All proposed stormwater management facilities within the study area have been designed to control, and in the case of Etobicoke Creek facilities, over-control the regional event. Due to the use of this historical storm in the sizing, the pond blocks are not anticipated to increase as a result of climate change.

Storm Sewers: To ensure stormwater sewers/downstream culverts are able to withstand the impacts of climate change during more frequent and/or intense events, the proposed sizes will be reevaluated at the detailed stage of the design when considering the potential for increased frequency, duration and intensity of storm events. The storm sewers in the community are currently designed to convey the 10-year storm event in accordance with Caledon standards. This requirement is more conservative than other GTA municipalities which only require storm sewers to be designed to convey the 5-year event. The storm sewer design can be updated once the Town has published updated IDF parameters incorporating climate change.

Irrigation: In parks and site plan blocks, the potential for storing stormwater and utilizing it for irrigation should be explored in future studies to decrease reliance on municipal water during drought conditions. Increased irrigation demand due to potential drought should be considered in the final water distribution analysis. This can be mitigated through public education, signage, and the incorporation of efficient fixtures and irrigation methods.

Roadways: Proposed roadways within the development will be designed to avoid excessive flooding during large storms as well as ensuring adequate conveyance of flows. This can be accomplished by verifying the capacity in the roadways compared to the 100-year event, as well designing and implementing adequate catchbasins to capture the flows.

Site water balance: Where feasible based on soil / groundwater constraints, LIDs such as green roofs (in the site plan / high density blocks), infiltration measures, tree pits, etc., in will be utilized in the design to mitigate the effects of climate change (i.e., managing more frequent runoff events).

Environmental features / wetlands: Potential impacts of climate change on feature-based water balance for the wetlands will continue to be evaluated and have considered extreme conditions (wet / dry years). Mitigation could include utilizing stormwater to irrigate the wetlands and preparing monitoring plans for post-development to evaluate the health of the wetlands.

9 DEVELOPMENT STAGING and ESC PLANNING

The Alloa Phase 1 development is intended to build out following a logical construction sequence as shown in **Drawing 9.1**, although the ultimate stages of development will be confirmed following approval of draft plans.

- Initial Phase: Lands within Fletchers subcatchment.
- Later Phase: Lands within Etobicoke subcatchment.

The phasing plan shown in **Drawing 9.1** provides a logical extension of growth in this area of Caledon (south to north) and is consistent with Town and Regional infrastructure planning (water, sanitary, roads). Further, stormwater management for the areas within the Etobicoke Creek subcatchment will rely on realignment and lowering of existing watercourses and management of floodplain. Areas within the Fletcher's Creek subcatchment do not require the same level of channelization work to move forward.

Recent discussions with Peel Region staff have indicated that water treatment and transmission infrastructure is in place to service Phase 1, and water system capacity is available. There are trunk sewer upgrades required in the downstream sanitary network (i.e., Bovaird Drive and Kennedy Road) to provide sufficient sanitary capacity for future growth north of Mayfield Road. However, it is anticipated that current capacity in the Fletcher's Creek sewer can be utilized to advance the initial phase of development in the Tertiary Plan area. Peel Region sanitary system upgrades will advance in parallel with planning approvals the development of the later phase(s), such that wastewater capacity is available coincident with development timing.

It is also important to note that:

- If required to accommodate development timing and phasing, the Alloa Landowner's Group may enter into a front-ending agreement with Peel Region to deliver necessary regional infrastructure ahead of the capital program planning schedule. This will be further discussed as planning proceeds.

- Phasing internal to each Block will be determined as work proceeds and draft plans come forward. Considerations for interim phasing of stormwater management, water, sanitary, creek re-alignment and floodplain management will be reviewed, as required, with the Planning Authorities at an appropriate time in the process.

- Preliminary site alternation (rough grading and earthworks) will extend across both Fletcher's Creek and Etobicoke Creek subcatchment boundaries in the initial phase of development to effectively manage the overall site earthworks balance (also see **Drawing 3.2** for preliminary cut-fill).

9.1. Erosion and Sediment Control Plan During Construction

Rigorous erosion and sediment control measures will be designed, implemented and maintained throughout the construction period. At detailed design, an Erosion and Sediment Control Plan will be prepared and designed in conformance with the Town and Conservation Authority guidelines (e.g., Guidelines for Erosion and Sediment Control for Urban Construction Sites (2006)). Erosion and sediment control will be implemented for all construction activities including topsoil stripping, earthworks, foundation excavation and stockpiling of materials and will remain in place and functional until bare surfaces are stabilized.

The following erosion and sediment control measures are typical for this type of development:

- Natural features will be staked, and temporary fencing provided to keep machinery out of sensitive areas.
- Sediment control fence and snow fence will be placed prior to earthworks.
- Logistics/construction plan will be implemented to limit the size of disturbed areas, minimizing the non-essential clearing and grading areas.
- Temporary sediment ponds.
- Rock check-dams and cut-off swales will be provided, where required, in order to control, slow down and direct runoff to sediment basins.
- Sediment traps will be provided.
- Gravel mud mats will be installed at construction vehicle access points to minimize off-site tracking of sediments.
- All temporary erosion and sediment control measures will be routinely inspected / monitored and repaired during construction. Temporary controls will not be removed until the areas they serve are restored and stable.
- The “multiple barrier approach” will be applied to all construction stages to ensure erosion is prevented rather than reduced. Recommended measures are to be installed prior to the initiation of the earthworks and grading.

ESC Applications will be prepared to support any creek re-alignments and grading works within and outside of TRCA/CVC regulation limits. Temporary sediment control ponds will be constructed at locations of the ultimate SWM Ponds. Temporary diversion channels and crossings (as required) will be constructed to accommodate ultimate creek alignments. ESC measures will be implemented to protect diversion channels and watercourses at all times during construction.

10 CONCLUSION

This FSR has been prepared in support of the Phase 1 Tertiary Plan and in conformance with the Alloa Secondary Plan and Local Subwatershed Study. This study is meant to provide the framework for servicing work at the Draft Plan stage.

Key conclusions are as follows:

- The Alloa Phase 1 Tertiary Plan lands fall within the Fletcher's Creek and Etobicoke Creek watersheds. The north portion of the site drains to the Alloa Municipal Drain, which discharges to Etobicoke Creek east of Chinguacousy Road. The south portion of the site drains to existing roadside ditches and culverts across Mayfield Road. This storm sewer network outlets to the Fletcher's Creek watersheds.
- The stormwater management requirements for the Tertiary Plan Area are based on the criteria as specified in the Alloa Secondary Plan Local Subwatershed Study (Crozier, 2024).
- The storm servicing plan identifies seven (7) proposed SWM pond facilities to achieve the SWM requirements for the proposed neighbourhood/residential areas. Two (2) of the SWM pond facilities are located in the Fletcher's Creek subwatershed. Five (5) of the SWM pond facilities are located in the Etobicoke Creek subwatershed.
- Mid/high rise blocks in the southeast portion of the site will be controlled by private on-site controls to achieve the required SWM criteria.
- There are two catchment areas that could not be accommodated by the proposed SWM Ponds due to grading constraints. Stormwater management for these areas will be provided by on-site controls/storage.
- The minor and major drainage systems for the subject lands will be designed to convey storm runoff to the proposed SWM facilities, prior to the outlets at Fletcher's Creek and Etobicoke Creek. The minor storm system will be designed to convey flows up to the 10-year design storm (via storm sewers) without surcharge. The major storm system will allow excess flows up to the 100-year design storm to be conveyed via overland flow within the proposed ROW limits.
- The SWM strategy will address water balance requirements for the site and adjacent wetlands through the use of LID technology, where practical and appropriate.
- Under proposed conditions floodplain limits and associated watercourses across the Tertiary Plan area are intended to be regularized, realigned and improved. The NHS traversing the site under post-development conditions will include a corridor designed to contain erosion hazards, meander belt, flood hazard, crossings and other environmental features / considerations.
- The proposed changes to the channel design between Mississauga Road and Chinguacousy Road, while reducing riparian storage, do not adversely impact downstream flows. The more efficient trapezoidal channel design improves flow conveyance, and the loss of storage primarily comprises dead storage that does not significantly contribute to flow dynamics.

- Sanitary effluent from the Phase 1 area is intended to be conveyed via the existing 750 mm trunk sewer connection at Mayfield Road and Brisdale Drive, which is sized to provide service to the Alloa Phase 1 lands. Upgrades to the downstream Fletcher's Creek trunk system (at Bovaird and Kennedy) have been identified by Peel Region to support growth north of Mayfield Road. It is anticipated that current capacity in the Fletcher's Creek sewer can be utilized to advance the initial phase of development in the Tertiary Plan area. Peel Region sanitary system upgrades will advance in parallel with planning approvals the development of the later phase(s), such that wastewater capacity is available coincident with development timing.
- Pressure Zone 7W watermains are in place along Mayfield Road and Chinguacousy Road. Peel Region has confirmed that the existing Alloa Reservoir and Pump Station are sized to provide sufficient water capacity to support initial growth in Alloa Phase 1.
- Development phasing is anticipated to proceed in a logical progression from south to north, with areas south of the re-aligned channel advancing first.

Report prepared by:
Urbantech Consulting

D. Zec

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Partner

Andrew Fata, M. Sc., P. Eng.
Senior Associate, Water Resources

APPENDIX A
DRAWINGS AND FIGURES

Provided Separately

APPENDIX B
DESIGN SHEETS

Storm Sewer Design Sheet (10-yr Storm)
Storm Sewer Design Sheet (100-yr Constant Flow Calculation)
Sanitary Sewer Design Sheet

URBANTECH®

STORM SEWER DESIGN SHEET
10 Year Storm
Alloa Caledon
Town of Caledon

PROJECT DETAILS

Project No: 20-665
Date: 16-Sep-24
Designed by: T.L.
Checked by: J.O.

DESIGN CRITERIA

Min. Diameter =	300	mm	Rainfall Intensity =	$\frac{A}{(Tc+B)^c}$
Mannings 'n'=	0.013			
Starting Tc =	20	min	A =	2221
			B =	12
Factor of Safety =	10	%	c =	0.908

NOMINAL PIPE SIZE USED

STREET	FROM MH	TO MH	AREA (ha)	RUNOFF COEFFICIENT "R"	'AR'	ACCUM. 'AR'	RAINFALL INTENSITY (mm/hr)	FLOW (m^3/s)	CONSTANT FLOW (m^3/s)	ACCUM. CONSTANT FLOW (m^3/s)	TOTAL FLOW (m^3/s)	LENGTH (m)	SLOPE (%)	PIPE DIAMETER (mm)	FULL FLOW CAPACITY (m^3/s)	FULL FLOW VELOCITY (m/s)	INITIAL Tc (min)	TIME OF CONCENTRATION (min)	ACC. TIME OF CONCENTRATION (min)	PERCENT FULL (%)
SWM POND 1																				
STREET B	101	102	1.15	0.71	0.82	0.82	95.5	0.217	0.114	0.114	0.331	264.2	0.30	675	0.46	1.29	20.00	3.42	23.42	72%
STREET B	102	103				0.82	87.1	0.197		0.114	0.311	16.7	0.30	675	0.46	1.29	23.42	0.22	23.64	68%
STREET D	103	104	7.63	0.71	5.42	6.23	86.6	1.499		0.114	1.613	240.9	0.30	1200	2.14	1.89	23.64	2.13	25.77	76%
	105	104	1.13	0.71	0.80	0.80	95.5	0.213	0.304	0.304	0.517	231.9	0.30	750	0.61	1.38	20.00	2.80	22.80	85%
STREET D	104	106	6.43	0.71	4.57	11.60	82.1	2.647		0.418	3.065	23.4	0.30	1200x1800 (BOX)	4.61	2.13	25.77	0.18	25.95	67%
STREET D	106	107				11.60	81.8	2.635		0.418	3.053	148.9	0.30	1200x1800 (BOX)	4.61	2.13	25.95	1.16	27.11	66%
	108	109	3.83	0.71	2.72	2.72	95.5	0.721	0.426	0.426	1.147	67.9	0.30	1050	1.50	1.73	20.00	0.66	20.66	77%
	109	110				2.72	93.7	0.708		0.426	1.134	130.9	0.30	1050	1.50	1.73	20.66	1.26	21.92	76%
	110	107				2.72	90.6	0.684		0.426	1.110	27.2	0.30	1050	1.50	1.73	21.92	0.26	22.18	74%
STREET D	107	111	0.92	0.71	0.65	14.97	79.6	3.310		0.844	4.154	73.3	0.30	1200x1800 (BOX)	4.61	2.13	27.11	0.57	27.69	90%
STREET A	112	113	0.76	0.71	0.54	0.54	95.5	0.143	0.085	0.085	0.228	62.0	0.30	600	0.34	1.19	20.00	0.87	20.87	68%
STREET A	113	111				0.54	93.2	0.140		0.085	0.225	169.2	0.30	600	0.34	1.19	20.87	2.37	23.24	67%
STREET D	111	114	0.49	0.71	0.35	15.86	78.5	3.460		0.929	4.389	66.7	0.30	1200x2400 (BOX)	6.59	2.29	27.69	0.49	28.17	67%
STREET D	114	115				15.86	77.7	3.422		0.929	4.351	91.5	0.30	1200x2400 (BOX)	6.59	2.29	28.17	0.67	28.84	66%
STREET D	115	116				15.86	76.5	3.371		0.929	4.300	41.4	0.30	1200x2400 (BOX)	6.59	2.29	28.84	0.30	29.14	65%
STREET D	117	116	0.20	0.71	0.14	0.14	95.5	0.038			0.038	62.3	0.30	300	0.05	0.75	20.00	1.39	21.39	71%
POND 1	116	HW1-1				16.00	76.0	3.378		0.929	4.307	43.6	0.30	1200x2400 (BOX)	6.59	2.29	29.14	0.32	29.46	65%
STREET E	118	119	2.11	0.71	1.50	1.50	95.5	0.397			0.397	137.5	0.30	675	0.46	1.29	20.00	1.78	21.78	86%
STREET E	119	120				1.50	90.9	0.378			0.378	47.4	0.30	675	0.46	1.29	21.78	0.61	22.40	82%
STREET E	120	121	4.44	0.71	3.15	4.65	89.4	1.155			1.155	186.5	0.50	900	1.28	2.01	22.40	1.54	23.94	90%
STREET E	121	122				4.65	85.9	1.110			1.110	60.1	0.50	900	1.28	2.01	23.94	0.50	24.44	87%
STREET A	122	123	6.83	0.71	4.85	9.50	84.9	2.239			2.239	187.3	0.50	1200	2.76	2.44	24.44	1.28	25.72	81%
STREET A	124	123	3.43	0.71	2.44	2.44	95.5	0.646			0.646	233.9	0.50	750	0.79	1.78	20.00	2.19	22.19	82%
	123	125	0.86	0.71	0.61	12.55	82.2	2.866			2.866	154.2	0.50	900x1800 (BOX)	3.95	2.44	25.72	1.05	26.77	73%
	125	126	10.11	0.71	7.18	19.72	80.2	4.394			4.394	144.5	0.50	1200x1800 (BOX)	5.95	2.75	26.77	0.87	27.65	74%
POND 1	126	HW1-2	4.71	0.71	3.34	23.07	78.6	5.036			5.036	53.0	0.30	1200x2400 (BOX)	6.59	2.29	27.65	0.39	28.03	76%

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STORM SEWER DESIGN SHEET

10 Year Storm

Alloa Caledon

Town of Caledon

PROJECT DETAILS

Project No: 20-665
Date: 16-Sep-24
Designed by: T.L.
Checked by: J.O.

DESIGN CRITERIA

Min. Diameter =	300	mm	Rainfall Intensity =	A / (Tc+B)^c
Mannings 'n'=	0.013			
Starting Tc =	20	min	A =	2221
			B =	12
Factor of Safety =	10	%	c =	0.908

NOMINAL PIPE SIZE USED

STREET	FROM MH	TO MH	AREA (ha)	RUNOFF COEFFICIENT "R"	'AR'	ACCUM. 'AR'	RAINFALL INTENSITY (mm/hr)	FLOW (m^3/s)	CONSTANT FLOW (m^3/s)	ACCUM. CONSTANT FLOW (m^3/s)	TOTAL FLOW (m^3/s)	LENGTH (m)	SLOPE (%)	PIPE DIAMETER (mm)	FULL FLOW CAPACITY (m^3/s)	FULL FLOW VELOCITY (m/s)	INITIAL Tc (min)	TIME OF CONCENTRATION (min)	ACC. TIME OF CONCENTRATION (min)	PERCENT FULL (%)
SWM POND 2																				
STREET F	201	202	10.98	0.74	8.13	8.13	95.5	2.155			2.155	77.1	0.50	1200	2.76	2.44	20.00	0.53	20.53	78%
CREDITVIEW ROAD	203	204	0.87	0.74	0.64	0.64	95.5	0.171			0.171	140.4	0.50	450	0.20	1.27	20.00	1.85	21.85	85%
CREDITVIEW ROAD	205	206	0.94	0.74	0.70	0.70	95.5	0.184			0.184	50.3	0.50	525	0.30	1.40	20.00	0.60	20.60	61%
CREDITVIEW ROAD	206	204				0.70	93.9	0.181			0.181	188.1	0.50	525	0.30	1.40	20.60	2.23	22.83	60%
STREET A	204	207	6.18	0.74	4.57	5.91	88.4	1.452			1.452	82.0	0.30	1200	2.14	1.89	22.83	0.72	23.55	68%
STREET A	207	202				5.91	86.8	1.425			1.425	228.9	0.30	1200	2.14	1.89	23.55	2.02	25.57	67%
STREET F	202	208				14.04	82.5	3.218			3.218	215.9	0.30	1200x1800 (BOX)	4.61	2.13	25.57	1.69	27.26	70%
STREET F	208	209				14.04	79.3	3.092			3.092	88.3	0.30	1200x1800 (BOX)	4.61	2.13	27.26	0.69	27.95	67%
CREDITVIEW ROAD	210	211	0.95	0.74	0.70	0.70	95.5	0.186	0.482	0.482	0.668	104.2	0.35	825	0.849	1.59	20.00	1.09	21.09	79%
CREDITVIEW ROAD	211	212				0.70	92.6	0.181		0.482	0.663	75.5	0.35	825	0.849	1.59	21.09	0.79	21.89	78%
EASEMENT	212	213				0.70	90.6	0.177		0.482	0.659	55.4	0.35	825	0.849	1.59	21.89	0.58	22.47	78%
	213	214	8.73	0.74	6.46	7.16	89.2	1.776		0.482	2.258	173.1	0.35	900x1800 (BOX)	3.304	2.04	22.47	1.41	23.88	68%
	214	215				7.16	86.0	1.712		0.482	2.194	6.7	0.35	900x1800 (BOX)	3.304	2.04	23.88	0.05	23.94	66%
	215	216				7.16	85.9	1.710		0.482	2.192	60.3	0.35	900x1800 (BOX)	3.304	2.04	23.94	0.49	24.43	66%
	216	217				7.16	84.9	1.689		0.482	2.171	10.2	0.35	900x1800 (BOX)	3.304	2.04	24.43	0.08	24.51	66%
	217	218				7.16	84.7	1.685		0.482	2.167	67.2	0.35	900x1800 (BOX)	3.304	2.04	24.51	0.55	25.06	66%
	218	209				7.16	83.6	1.663	0.628	1.110	2.773	11.6	0.35	900x1800 (BOX)	3.304	2.04	25.06	0.09	25.16	84%
POND 2	209	HW2-1				21.20	78.0	4.596		1.110	5.706	28.8	0.35	1200x2400 (BOX)	7.115	2.47	27.95	0.19	28.14	80%
	219	220	0.81	0.74	0.60	0.60	95.5	0.159			0.159	211.3	0.50	450	0.202	1.27	20.00	2.78	22.78	79%
	220	221	4.03	0.74	2.98	3.58	88.5	0.881			0.881	28.8	0.50	900	1.280	2.01	22.78	0.24	23.02	69%
POND 2	221	HW2-2				3.58	88.0	0.875			0.875	38.6	0.50	900	1.280	2.01	23.02	0.32	23.34	68%

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STORM SEWER DESIGN SHEET	PROJECT DETAILS	DESIGN CRITERIA
10 Year Storm	Project No: 20-665	Min. Diameter = 300 mm
Alloa Caledon	Date: 16-Sep-24	Mannings 'n'= 0.013
Town of Caledon	Designed by: T.L.	Starting Tc = 20 min
	Checked by: J.O.	Factor of Safety = 10 %
		Rainfall Intensity = $\frac{A}{(Tc+B)^c}$
		A = 2221
		B = 12
		c = 0.908
		NOMINAL PIPE SIZE USED

STREET	FROM MH	TO MH	AREA (ha)	RUNOFF COEFFICIENT "R"	'AR'	ACCUM. 'AR'	RAINFALL INTENSITY (mm/hr)	FLOW (m^3/s)	CONSTANT FLOW (m^3/s)	ACCUM. CONSTANT FLOW (m^3/s)	TOTAL FLOW (m^3/s)	LENGTH (m)	SLOPE (%)	PIPE DIAMETER (mm)	FULL FLOW CAPACITY (m^3/s)	FULL FLOW VELOCITY (m/s)	INITIAL Tc (min)	TIME OF CONCENTRATION (min)	ACC. TIME OF CONCENTRATION (min)	PERCENT FULL (%)
SWM POND 3																				
STREET B	301	302	1.07	0.73	0.78	0.78	95.5	0.207			0.207	213.1	0.50	525	0.304	1.40	20.00	2.53	22.53	68%
STREET B	302	303				0.78	89.1	0.193			0.193	20.3	0.50	525	0.304	1.40	22.53	0.24	22.77	64%
STREET D	303	304	0.69	0.73	0.50	1.28	88.5	0.316			0.316	51.5	0.50	600	0.434	1.54	22.77	0.56	23.33	73%
	304	305	3.68	0.73	2.69	3.97	87.3	0.963			0.963	28.1	0.50	900	1.280	2.01	23.33	0.23	23.56	75%
	305	306				3.97	86.7	0.957			0.957	210.5	0.50	900	1.280	2.01	23.56	1.74	25.30	75%
	306	307	1.67	0.73	1.22	5.19	83.1	1.198			1.198	52.2	0.50	975	1.585	2.12	25.30	0.41	25.71	76%
	304	305	3.68	0.73	2.69	3.97	87.3	0.963			0.963	28.1	0.50	900	1.280	2.01	23.33	0.23	23.56	75%
	305	306				7.94	86.7	1.914			1.914	210.5	0.50	1200	2.757	2.44	23.56	1.44	25.00	69%
	306	307	1.66	0.73	1.21	13.13	83.1	3.028	0.083	0.083	3.111	52.2	0.50	900x1800 (BOX)	3.949	2.44	25.30	0.36	25.66	79%
	307	308				18.32	82.2	4.184		0.083	4.267	63.1	0.50	1200x1800 (BOX)	5.946	2.75	25.71	0.38	26.10	72%
	309	310	2.29	0.73	1.67	1.67	95.5	0.443			0.443	216.7	0.30	750	0.610	1.38	20.00	2.62	22.62	73%
	310	311	2.57	0.73	1.88	3.55	88.9	0.876			0.876	161.0	0.50	825	1.015	1.90	22.62	1.41	24.03	86%
	311	312	0.91	0.73	0.66	4.21	85.7	1.003			1.003	11.6	0.50	900	1.280	2.01	24.03	0.10	24.13	78%
	312	313				4.21	85.5	1.001			1.001	57.5	0.50	900	1.280	2.01	24.13	0.48	24.60	78%
	313	314				4.21	84.5	0.989			0.989	12.7	0.50	900	1.280	2.01	24.60	0.11	24.71	77%
	314	308				4.21	84.3	0.986			0.986	64.6	0.50	900	1.280	2.01	24.71	0.54	25.24	77%
	308	315	0.55	0.73	0.40	22.93	81.5	5.190		0.083	5.273	11.3	0.30	1200x2400 (BOX)	6.587	2.29	26.10	0.08	26.18	80%
POND 3	315	HW 3				22.93	81.3	5.180		0.083	5.263	37.1	0.30	1200x2400 (BOX)	6.587	2.29	26.18	0.27	26.45	80%
SWM POND 4																				
CREADITVIEW ROAD	400	401	0.55	0.68	0.37	0.37	95.5	0.099			0.099	72.1	0.50	375	0.124	1.12	20.00	1.07	21.07	80%
	401	402	2.08	0.68	1.41	1.79	92.7	0.460			0.460	311.4	0.30	750	0.610	1.38	21.07	3.76	24.83	75%
STREET F	402	403	3.12	0.68	2.12	5.70	84.0	1.330			1.330	147.0	0.50	975	1.585	2.12	24.83	1.15	25.99	84%
	404	403	0.70	0.68	0.48	0.48	95.5	0.126			0.126	100.4	0.50	450	0.202	1.27	20.00	1.32	21.32	63%
STREET F	403	405	0.50	0.68	0.34	10.90	81.7	2.474			2.474	38.9	0.50	1200	2.757	2.44	25.99	0.27	26.25	90%
STREET F	405	406				15.63	81.2	3.524			3.524	44.4	0.50	900x1800 (BOX)	3.949	2.44	26.25	0.30	26.55	89%
STREET B	407	406	0.98	0.68	0.67	0.67	95.5	0.177			0.177	174.8	0.50	450	0.202	1.27	20.00	2.30	22.30	88%
STREET F	408	409	1.55	0.69	1.07	1.07	95.5	0.284			0.284	167.0	0.30	600	0.336	1.19	20.00	2.34	22.34	84%
STREET F	409	406	1.64	0.69	1.13	2.20	89.5	0.547			0.547	77.0	0.30	750	0.610	1.38	22.34	0.93	23.27	90%
STREET B	406	410	0.70	0.69	0.48	18.98	80.6	4.249			4.249	147.9	0.30	1200x1800 (BOX)	4.605	2.13	26.55	1.16	27.71	92%
STREET B	410	411	0.53	0.69	0.37	19.34	78.5	4.217			4.217	118.2	0.30	1200x1800 (BOX)	4.605	2.13	27.71	0.92	28.63	92%
STREET B	412	411	2.83	0.68	1.92	1.92	95.5	0.510			0.510	57.3	0.30	750	0.610	1.38	20.00	0.69	20.69	84%
POND 4	411	HW4-1	4.36	0.68	2.96	24.23	76.9	5.173			5.173	26.2	0.30	1200x2400 (BOX)	6.587	2.29	28.63	0.19	28.83	79%
	413	414	1.75	0.68	1.19	1.19	95.5	0.316			0.316	73.6	0.30	675	0.460	1.29	20.00	0.95	20.95	69%
POND 4	414	HW4-2	1.82	0.68	1.24	2.43	93.0	0.627			0.627	29.7	0.30	825	0.786	1.47	20.95	0.34	21.29	80%

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STORM SEWER DESIGN SHEET	PROJECT DETAILS	DESIGN CRITERIA
10 Year Storm **Alloa Caledon** Town of Caledon	Project No: 20-665 Date: 16-Sep-24 Designed by: T.L. Checked by: J.O.	Min. Diameter = 300 mm Mannings 'n'= 0.013 Starting Tc = 20 min Factor of Safety = 10 % Rainfall Intensity = A / (Tc+B)^c A = 2221 B = 12 c = 0.908 NOMINAL PIPE SIZE USED

STREET	FROM MH	TO MH	AREA (ha)	RUNOFF COEFFICIENT "R"	'AR'	ACCUM. 'AR'	RAINFALL INTENSITY (mm/hr)	FLOW (m^3/s)	CONSTANT FLOW (m^3/s)	ACCUM. CONSTANT FLOW (m^3/s)	TOTAL FLOW (m^3/s)	LENGTH (m)	SLOPE (%)	PIPE DIAMETER (mm)	FULL FLOW CAPACITY (m^3/s)	FULL FLOW VELOCITY (m/s)	INITIAL Tc (min)	TIME OF CONCENTRATION (min)	ACC. TIME OF CONCENTRATION (min)	PERCENT FULL (%)
SWM POND 5																				
	501	502	1.74	0.69	1.20	1.20	95.5	0.318			0.318	15.2	0.40	600	0.388	1.37	20.00	0.18	20.18	82%
	502	503				1.20	95.0	0.317			0.317	10.5	0.40	600	0.388	1.37	20.18	0.13	20.31	82%
	503	504				1.20	94.6	0.316			0.316	53.8	0.40	600	0.388	1.37	20.31	0.65	20.96	81%
	504	505				1.20	92.9	0.310			0.310	16.0	0.40	600	0.388	1.37	20.96	0.19	21.16	80%
	505	506				1.20	92.4	0.308			0.308	65.3	0.40	600	0.388	1.37	21.16	0.79	21.95	79%
	506	507				1.20	90.5	0.302			0.302	39.9	0.40	600	0.388	1.37	21.95	0.48	22.44	78%
	507	508	1.75	0.69	1.21	2.41	89.3	0.597			0.597	41.7	0.40	750	0.704	1.59	22.44	0.44	22.87	85%
	508	509				2.41	88.3	0.591			0.591	37.8	0.40	750	0.704	1.59	22.87	0.40	23.27	84%
	509	510	2.13	0.69	1.47	3.88	87.4	0.942			0.942	56.8	0.40	900	1.145	1.80	23.27	0.53	23.79	82%
	510	511				3.88	86.2	0.929			0.929	12.2	0.40	900	1.145	1.80	23.79	0.11	23.91	81%
	511	512				3.88	86.0	0.926			0.926	31.4	0.40	900	1.145	1.80	23.91	0.29	24.20	81%
	512	513				3.88	85.4	0.920			0.920	37.8	0.40	900	1.145	1.80	24.20	0.35	24.55	80%
STREET C	513	514	2.12	0.69	1.46	5.34	84.6	1.255			1.255	130.7	0.40	975	1.417	1.90	24.55	1.15	25.69	89%
STREET C	514	515				5.34	82.3	1.221			1.221	57.3	0.40	975	1.417	1.90	25.69	0.50	26.20	86%
STREET C	515	516	4.54	0.69	3.13	8.47	81.3	1.913			1.913	52.4	0.40	1200	2.466	2.18	26.20	0.40	26.60	78%
STREET C	516	517				8.47	80.5	1.895			1.895	59.8	0.40	1200	2.466	2.18	26.60	0.46	27.05	77%
STREET C	517	518				8.47	79.7	1.875			1.875	96.2	0.40	1200	2.466	2.18	27.05	0.74	27.79	76%
STREET D	518	519	1.81	0.69	1.25	9.72	78.3	2.115			2.115	71.2	0.30	900x1800 (BOX)	3.059	1.89	27.79	0.63	28.42	69%
STREET D	519	520				9.72	77.2	2.086			2.086	131.3	0.30	900x1800 (BOX)	3.059	1.89	28.42	1.16	29.58	68%
STREET D	520	521				9.72	75.3	2.033			2.033	42.8	0.30	900x1800 (BOX)	3.059	1.89	29.58	0.38	29.96	66%
STREET D	521	522	7.81	0.69	5.39	15.11	74.7	3.134			3.134	161.0	0.30	1200x1800 (BOX)	4.605	2.13	29.96	1.26	31.21	68%
POND 5	522	HW5-1	2.74	0.69	1.89	17.00	72.7	3.432			3.432	33.0	0.30	1200x1800 (BOX)	4.605	2.13	31.21	0.26	31.47	75%
	523	524	5.95	0.69	4.11	4.11	95.5	1.089			1.089	73.0	0.50	900	1.280	2.01	20.00	0.60	20.60	85%
	524	525	0.64	0.69	0.44	4.55	93.9	1.186			1.186	57.7	0.50	975	1.585	2.12	20.60	0.45	21.06	75%
	525	526	3.11	0.69	2.15	6.69	92.7	1.723			1.723	89.7	0.50	1050	1.931	2.23	21.06	0.67	21.73	89%
	526	527				6.69	91.0	1.692			1.692	36.8	0.50	1050	1.931	2.23	21.73	0.28	22.00	88%
	527	528				6.69	90.4	1.680			1.680	16.2	0.50	1050	1.931	2.23	22.00	0.12	22.12	87%
	528	529				6.69	90.1	1.674			1.674	114.8	0.50	1050	1.931	2.23	22.12	0.86	22.98	87%
POND 5	529	HW5-2	1.87	0.69	1.29	7.98	88.1	1.953			1.953	51.1	0.50	900x1800 (BOX)	3.949	2.44	22.98	0.35	23.33	49%
SWM POND 6																				
STREET F	601	602	0.84	0.72	0.60	0.60	95.5	0.160			0.160	166.1	0.50	450	0.202	1.27	20.00	2.18	22.18	80%
STREET F	602	603				0.60	89.9	0.151			0.151	16.7	0.50	450	0.202	1.27	22.18	0.22	22.40	75%
STREET F	603	604	8.97	0.72	6.46	7.06	89.4	1.754			1.754	77.5	0.50	1200	2.757	2.44	22.40	0.53	22.93	64%
STREET F	604	605	6.30	0.72	4.54	11.60	88.2	2.841			2.841	35.6	0.50	900x1800 (BOX)	3.949	2.44	22.93	0.24	23.18	72%
STREET F	605	606				11.60	87.6	2.823			2.823	102.8	0.50	900x1800 (BOX)	3.949	2.44	23.18	0.70	23.88	71%
STREET F	606	607	8.41	0.72	6.06	17.65	86.0	4.220			4.220	128.6	0.50	1200x1800 (BOX)	5.946	2.75	23.88	0.78	24.66	71%
STREET F	607	608				17.65	84.4	4.138			4.138	28.8	0.50	1200x1800 (BOX)	5.946	2.75	24.66	0.17	24.83	70%
STREET F	608	609				17.65	84.0	4.121			4.121	54.6	0.50	1200x1800 (BOX)	5.946	2.75	24.83	0.33	25.16	69%
STREET F	609	610				17.65	83.3	4.087			4.087	19.9	0.50	1200x1800 (BOX)	5.946	2.75	25.16	0.12	25.28	69%
STREET F	610	611	3.47	0.72	2.50	20.15	83.1	4.652			4.652	73.3	0.50	1200x1800 (BOX)	5.946	2.75	25.28	0.44	25.73	78%
	612	613	6.48	0.72	4.67	4.67	95.5	1.237			1.237	194.7	0.50	975	1.585	2.12	20.00	1.53	21.53	78%
	613	611				4.67	91.5	1.186			1.186	173.3	0.50	975	1.585	2.12	21.53	1.36	22.89	75%
STREET F	611	614	1.34	0.72	0.96	25.78	82.2	5.888			5.888	37.5	0.30	1200x2400 (BOX)	6.587	2.29	25.73	0.27	26.00	89%
POND 6	614	HW6-1	1.92	0.72	1.38	27.17	81.7	6.163			6.163	35.1	0.30	1200x2400 (BOX)	6.587	2.29	26.00	0.26	26.26	94%
CREDITVIEW ROAD	615	616	5.82	0.72	4.19	4.19	95.5	1.111	0.589	0.589	1.700	362.9	0.35	1200	2.307	2.04	20.00	2.97	22.97	74%

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URBANTECH®

STORM SEWER DESIGN SHEET

10 Year Storm

Alloa Caledon

Town of Caledon

PROJECT DETAILS

Project No: 20-665
Date: 16-Sep-24
Designed by: T.L.
Checked by: J.O.

DESIGN CRITERIA

Min. Diameter =	300	mm	Rainfall Intensity =	$\frac{A}{(Tc+B)^c}$
Mannings 'n'=	0.013			
Starting Tc =	20	min	A =	2221
			B =	12
Factor of Safety =	10	%	c =	0.908

NOMINAL PIPE SIZE USED

STREET	FROM MH	TO MH	AREA (ha)	RUNOFF COEFFICIENT "R"	'AR'	ACCUM. 'AR'	RAINFALL INTENSITY (mm/hr)	FLOW (m^3/s)	CONSTANT FLOW (m^3/s)	ACCUM. CONSTANT FLOW (m^3/s)	TOTAL FLOW (m^3/s)	LENGTH (m)	SLOPE (%)	PIPE DIAMETER (mm)	FULL FLOW CAPACITY (m^3/s)	FULL FLOW VELOCITY (m/s)	INITIAL Tc (min)	TIME OF CONCENTRATION (min)	ACC. TIME OF CONCENTRATION (min)	PERCENT FULL (%)
CREDITVIEW ROAD	616	617	3.27	0.72	2.35	6.54	88.1	1.601		0.589	2.190	400.3	0.35	900x1800 (BOX)	3.304	2.04	22.97	3.27	26.24	66%
CREDITVIEW ROAD	617	618				6.54	81.2	1.477		0.589	2.066	45.2	0.35	900x1800 (BOX)	3.304	2.04	26.24	0.37	26.61	63%
CREDITVIEW ROAD	618	619				6.54	80.5	1.464		0.589	2.053	49.4	0.35	900x1800 (BOX)	3.304	2.04	26.61	0.40	27.01	62%
CREDITVIEW ROAD	620	621	0.81	0.72	0.58	0.58	95.5	0.155			0.155	148.2	0.35	525	0.254	1.18	20.00	2.10	22.10	61%
CREDITVIEW ROAD	621	619				0.58	90.1	0.146			0.146	32.7	0.35	525	0.254	1.18	22.10	0.46	22.57	57%
POND 6	619	HW6-2				7.13	79.8	1.579		0.589	2.168	17.3	0.35	900x1800 (BOX)	3.304	2.04	27.01	0.14	27.15	66%
SWM POND 7																				
STREET G	701	702	1.52	0.68	1.03	1.03	95.5	0.274			0.274	203.1	0.50	525	0.304	1.40	20.00	2.41	22.41	90%
STREET G	702	703	1.79	0.68	1.22	2.25	89.4	0.559			0.559	150.0	0.50	750	0.787	1.78	22.41	1.40	23.81	71%
	703	704	8.94	0.68	6.08	8.33	86.2	1.994			1.994	197.6	0.50	1200	2.757	2.44	23.81	1.35	25.16	72%
STREET A	705	706	4.34	0.68	2.95	2.95	95.5	0.783			0.783	72.4	0.50	825	1.015	1.90	20.00	0.64	20.64	77%
	706	707				2.95	93.8	0.769			0.769	21.2	0.50	825	1.015	1.90	20.64	0.19	20.82	76%
	707	708	2.27	0.68	1.54	4.49	93.3	1.165			1.165	140.4	0.50	975	1.585	2.12	20.82	1.10	21.92	74%
	708	704				4.49	90.5	1.130			1.130	14.2	0.50	975	1.585	2.12	21.92	0.11	22.04	71%
POND7	704	HW7				12.82	83.3	2.969			2.969	53.0	0.30	1200x1800 (BOX)	4.605	2.13	25.16	0.41	25.58	64%
COMMUNITY PARK	709	HW7-2	5.83	0.68	3.96	3.96	95.5	1.051			1.051	100.0	0.50	900	1.280	2.01	20.00	0.83	20.83	82%
TO CULVERT																				
CREDITVIEW ROAD	801	802	1.36	0.83	1.13	1.13	95.5	0.299			0.299	208.4	0.50	600	0.434	1.54	20.00	2.26	22.26	69%
CREDITVIEW ROAD	802	CULVERT				1.13	89.7	0.281			0.281	75.8	0.50	600	0.434	1.54	22.26	0.82	23.08	65%
CREDITVIEW ROAD	803	804	0.61	0.83	0.51	0.51	95.5	0.134			0.134	134.0	0.50	450	0.202	1.27	20.00	1.76	21.76	67%
CREDITVIEW ROAD	804	CULVERT				0.51	90.9	0.128			0.128	23.1	0.50	450	0.202	1.27	21.76	0.30	22.07	63%
TO NHS																				
TO NHS	805	HW8-O	3.75	0.75	2.81	2.81	95.5	0.746			0.746	10.0	0.30	900	0.992	1.56	20.00	0.11	20.11	75%
TO NHS	901	902	2.06	0.70	1.44	1.44	95.5	0.382			0.382	36.7	0.30	675	0.460	1.29	20.00	0.48	20.48	83%
STREET G ROW																				
	1C	EX.MH102	0.53	0.83	0.44	0.44	95.5	0.117			0.117	61.6	0.50	450	0.202	1.27	20.00	0.81	20.81	58%
STREET D ROW																				
	2C	3C	0.29	0.83	0.24	0.24	95.5	0.064			0.064	65.3	0.50	375	0.124	1.12	20.00	0.97	20.97	51%
	3C	HW1				0.24	92.9	0.062			0.062	21.9	0.50	375	0.124	1.12	20.97	0.33	21.29	50%

URBANTECH®

PROJECT DETAILS	
Title1:	STORM SEWER DESIGN SHEET
Title2:	Constant Flow Calculations
Project Name:	Alloa Caledon
Municipality:	Town of Caledon
Project No:	20-665
Date:	Aug-24
Designed by:	TL
Checked by:	JO

IDF Parameters			
		10-yr	100-yr
$I=A/(T+b)^c$	A	2221	4688
	B	12	17
	C	0.908	0.9624

ID	STREET	MH	A	R	AR	L	Tc	I10	I100	Q10	Q100	Q100-Q10 (Const.Flow)
			ha			*m*	*min*	*mm/hr*	*mm/hr*	*m3/s*	*m3/s*	*m3/s*
100YR-1	CREDITVIEW ROAD	615	5.76	0.72	4.15	780	18.67	99.2	150.3	1.143	1.732	0.589
100YR-2	CREDITVIEW ROAD	204	4.55	0.74	3.37	750	18.33	100.2	151.7	0.937	1.419	0.482
100YR-3	STREET F	204	5.83	0.74	4.31	680	17.56	102.6	155.0	1.230	1.857	0.628
100YR-4	STREET A	112	0.74	0.71	0.53	245	12.72	120.7	179.2	0.176	0.262	0.085
100YR-5		108	3.80	0.71	2.70	360	14.00	115.3	172.1	0.864	1.290	0.426
100YR-6		105	2.75	0.71	1.95	415	14.61	112.9	168.9	0.612	0.916	0.304
100YR-7	STREET B	101	0.97	0.73	0.71	278	13.09	119.1	177.1	0.234	0.348	0.114
100YR-8		306	0.70	0.73	0.51	233	12.59	121.3	180.0	0.172	0.255	0.083

SANITARY SEWER DESIGN SHEET

URBANTECH®

Alloa Caledon

Region of Peel

PROJECT DETAILS

Project No: 20-665
Date: 16-Sep-24
Designed by: T.L.
Checked by: J.O.

DESIGN CRITERIA

Min. Flow =	13	l/s			
Min Diameter =	200	mm	Daily Per Capital Flow (Residential) =	290.0	l/c/d
Mannings 'n'=	0.013		Daily Per Capital Flow (Non-Residential) =	270.0	l/c/d
Min. Velocity =	0.75	m/s	Extraneous Flows =	0.260	l/s/ha
Max. Velocity =	3.00	m/s	Max. Peaking Factor =	4.00	
			Min. Peaking Factor=	2.00	
Factor of Safety =	30	%			

NOMINAL PIPE SIZE USED

			RESIDENTIAL							NON-RESIDENTIAL					FLOW CALCULATIONS							PIPE DATA					
STREET	FROM MH	TO MH	AREA (ha)	ACC. AREA (ha)	UNITS (#)	DENSITY (P/ha)	DENSITY (P/unit)	POP	ACCUM. POP.	AREA (ha)	ACC. AREA (ha)	EQUIV. POP. (p/ha)	POP.	ACCUM. POP.	EXTRANEOUS FLOW (l/s)	TOTAL ACCUM. POP.	PEAKING FACTOR	RESIDENTIAL FLOW (l/s)	MIN. FLOW (l/s)	NON RESIDENTIAL FLOW (l/s)	DESIGN FLOW (l/s)	SLOPE (%)	PIPE DIA (mm)	FULL FLOW CAPACITY (l/s)	FULL FLOW VELOCITY (m/s)	ACTUAL VELOCITY (m/s)	PERCENT FULL (%)
STREET C		24A	4.06	4.06		475		1929	1929						1.1	1,929	3.60	23.3	23.3		24.4						
STREET C		24A	2.51	2.51		175		440	440						0.7	440	4.00	5.9	13.0		13.7						
STREET C	24A	25A	1.14	7.71		70		80	2449						2.0	2,449	3.52	28.9	28.9		30.9	1.00	250	59.5	1.21	1.20	52%
STREET C	25A	23A		7.71					2449						2.0	2,449	3.52	28.9	28.9		30.9	0.50	250	42.0	0.86	0.92	73%
STREET D		23A	0.84	0.84		175		147	147						0.2	147	4.00	2.0	13.0		13.2						
STREET D		23A	2.76	2.76											0.7						0.7						
STREET D		23A	2.55	2.55		175		447	447						0.7	447	4.00	6.0	13.0		13.7						
STREET D		23A	23.91	23.91		70		1674	1674						6.2	1,674	3.64	20.5	20.5		26.7						
STREET D		23A	1.05	1.05		175		184	184						0.3	184	4.00	2.5	13.0		13.3						
STREET D		23A	0.54	0.54		175		95	95						0.1	95	4.00	1.3	13.0		13.1						
STREET D		23A	2.22	2.22											0.6						0.6						
STREET D	23A	26A	2.43	44.01		186		452	5448						11.4	5,448	3.21	58.7	58.7		70.1	0.40	375	110.9	1.00	1.03	63%
STREET D	26A	32A		44.01					5448						11.4	5,448	3.21	58.7	58.7		70.1	0.40	375	110.9	1.00	1.03	63%
STREET D	32A	33A		44.01					5448						11.4	5,448	3.21	58.7	58.7		70.1	0.40	375	110.9	1.00	1.03	63%
STREET D	33A	34A		44.01					5448						11.4	5,448	3.21	58.7	58.7		70.1	0.40	375	110.9	1.00	1.03	63%
STREET D	34A	35A		44.01					5448						11.4	5,448	3.21	58.7	58.7		70.1	0.40	375	110.9	1.00	1.03	63%
STREET D	35A	36A		44.01					5448						11.4	5,448	3.21	58.7	58.7		70.1	0.40	375	110.9	1.00	1.03	63%
STREET D	36A	37A		44.01					5448						11.4	5,448	3.21	58.7	58.7		70.1	0.40	375	110.9	1.00	1.03	63%
STREET D		37A	10.06	10.06		70		705	705						2.6	705	3.89	9.2	13.0		15.6						
STREET D	37A	38A	2.57	56.64		175		450	6603						14.7	6,603	3.13	69.4	69.4		84.1	0.40	375	110.9	1.00	1.09	76%
STREET D	38A	45A		56.64					6603						14.7	6,603	3.13	69.4	69.4		84.1	0.40	375	110.9	1.00	1.09	76%
STREET B	45A	46A	3.70	60.34		175		648	7251						15.7	7,251	3.09	75.2	75.2		90.9	0.40	450	180.3	1.13	1.12	50%
STREET B	46A	47A		60.34					7251						15.7	7,251	3.09	75.2	75.2		90.9	0.40	450	180.3	1.13	1.12	50%
STREET F		48A	2.75	2.75		175		482	482						0.7	482	3.98	6.4	13.0		13.7						
STREET F	48A	49A	6.17	8.92		70		432	914						2.3	914	3.82	11.7	13.0		15.3	1.00	200	32.8	1.04	1.00	47%
STREET F	49A	50A		8.92					914						2.3	914	3.82	11.7	13.0		15.3	0.50	200	23.2	0.74	0.78	66%
STREET F	50A	51A		8.92					914						2.3	914	3.82	11.7	13.0		15.3	0.50	200	23.2	0.74	0.78	66%
STREET F		51A	7.75	7.75		175		1357	1357						2.0	1,357	3.71	16.9	16.9		18.9						
STREET F	51A	52A	8.18	24.85		70		573	2844						6.5	2,844	3.46	33.0	33.0		39.5	0.50	300	68.4	0.97	0.98	58%
STREET F	52A	53A		24.85					2844						6.5	2,844	3.46	33.0	33.0		39.5	0.50	300	68.4	0.97	0.98	58%
STREET F	53A	54A		24.85					2844						6.5	2,844	3.46	33.0	33.0		39.5	0.50	300	68.4	0.97	0.98	58%
STREET F	54A	55A		24.85					2844						6.5	2,844	3.46	33.0	33.0		39.5	0.50	300	68.4	0.97	0.98	58%
STREET F	55A	56A		24.85					2844						6.5	2,844	3.46	33.0	33.0		39.5	0.50	300	68.4	0.97	0.98	58%
STREET F	56A	57A		24.85					2844						6.5	2,844	3.46	33.0	33.0		39.5	0.50	300	68.4	0.97	0.98	58%
STREET F	57A	58A		24.85					2844						6.5	2,844	3.46	33.0	33.0		39.5	0.50	300	68.4	0.97	0.98	58%
STREET F		58A	1.31	1.31		175		230	230						0.3	230	4.00	3.1	13.0		13.3	0.50					
STREET F	58A	59A	10.77	36.93		70		754	3828						9.6	3,828	3.35	43.0	43.0		52.6	0.50	375	124.0	1.12	1.04	42%
STREET F	59A	60A		36.93					3828						9.6	3,828	3.35	43.0	43.0		52.6	0.50	375	124.0	1.12	1.04	42%
STREET F	60A	61A	6.65	43.58		70		466	4294						11.3	4,294	3.31	47.6	47.6		59.0	0.50	375	124.0	1.12	1.08	48%
STREET F	61A	62A		43.58					4294						11.3	4,294	3.31	47.6	47.6		59.0	0.50	375	124.0	1.12	1.08	48%
STREET B	62A	47A	6.00	49.58		175		1050	5344						12.9	5,344	3.22	57.7	57.7		70.6	0.50	375	124.0	1.12	1.13	57%
STREET E	47A	63A	1.42	111.34		175		249	12844						28.9	12,844	2.85	122.7	122.7		151.6	0.30	525	235.6	1.09	1.12	64%
STREET E	63A	64A		111.34					12844						28.9	12,844	2.85	122.7	122.7		151.6	0.30	525	235.6	1.09	1.12	64%

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URBANTECH®

SANITARY SEWER DESIGN SHEET

Alloa Caledon

Region of Peel

PROJECT DETAILS

Project No: 20-665
Date: 16-Sep-24
Designed by: T.L.
Checked by: J.O.

DESIGN CRITERIA

Min. Flow = 13 l/s
Min Diameter = 200 mm
Mannings 'n'= 0.013
Min. Velocity = 0.75 m/s
Max. Velocity = 3.00 m/s
Factor of Safety = 30 %

Daily Per Capital Flow (Residential) = 290.0 l/c/d
Daily Per Capital Flow (Non-Residential) = 270.0 l/c/d
Extraneous Flows = 0.260 l/s/ha
Max. Peaking Factor = 4.00
Min. Peaking Factor= 2.00

NOMINAL PIPE SIZE USED

			RESIDENTIAL							NON-RESIDENTIAL					FLOW CALCULATIONS							PIPE DATA					
STREET	FROM MH	TO MH	AREA (ha)	ACC. AREA (ha)	UNITS (#)	DENSITY (P/ha)	DENSITY (P/unit)	POP	ACCUM. POP.	AREA (ha)	ACC. AREA (ha)	EQUIV. POP. (p/ha)	POP.	ACCUM. POP.	EXTRANEOUS FLOW (l/s)	TOTAL ACCUM. POP.	PEAKING FACTOR	RESIDENTIAL FLOW (l/s)	MIN. FLOW (l/s)	NON RESIDENTIAL FLOW (l/s)	DESIGN FLOW (l/s)	SLOPE (%)	PIPE DIA (mm)	FULL FLOW CAPACITY (l/s)	FULL FLOW VELOCITY (m/s)	ACTUAL VELOCITY (m/s)	PERCENT FULL (%)
STREET E	64A	65A		111.34					12844						28.9	12,844	2.85	122.7	122.7		151.6	0.30	525	235.6	1.09	1.12	64%
		65A	1.12	1.12		175		196	196						0.3	196	4.00	2.6	13.0		13.3						
STREET E	65A	66A	8.76	121.22		70		614	13654						31.5	13,654	2.82	129.2	129.2		160.7	0.30	525	235.6	1.09	1.14	68%
STREET E	66A	67A		121.22					13654						31.5	13,654	2.82	129.2	129.2		160.7	0.30	525	235.6	1.09	1.14	68%
		68A								2.78	2.78	50	139	139	0.7	139	4.00			1.7	2.5						
		68A								9.72	9.72	50	486	486	2.5	486	3.98			6.0	8.6						
		68A	4.89	4.89		70		343	343						1.3	343	4.00	4.6	13.0		14.3						
		68A	7.41	7.41		175		1297	1297						1.9	1,297	3.72	16.2	16.2		18.1						
STREET A	68A	69A	2.11	14.41		475		1003	2643		12.50			625	7.0	3,268	3.41	30.3	30.3	6.7	43.9	1.00	250	59.5	1.21	1.30	74%
STREET A	69A	70A		14.41					2643		12.50			625	7.0	3,268	3.41	30.3	30.3	6.7	43.9	0.50	300	68.4	0.97	1.00	64%
		70A	5.53	5.53											1.4						1.4						
STREET A	70A	71A	4.57	24.51		175		800	3443		12.50			625	9.6	4,068	3.33	38.4	38.4	6.5	54.6	0.50	375	124.0	1.12	1.04	44%
STREET A	71A	72A		24.51					3443		12.50			625	9.6	4,068	3.33	38.4	38.4	6.5	54.6	0.50	375	124.0	1.12	1.04	44%
		72A	3.93	3.93		70		276	276						1.0	276	4.00	3.7	13.0		14.0						
STREET A	72A	73A	1.58	30.02		175		277	3996		12.50			625	11.1	4,621	3.28	43.9	43.9	6.4	61.4	0.50	375	124.0	1.12	1.11	50%
		73A	3.02	3.02		175		529	529						0.8	529	3.96	7.0	13.0		13.8						
		73A	2.11	2.11											0.5						0.5						
		73A	7.64	7.64		70		535	535						2.0	535	3.96	7.1	13.0		15.0						
		73A	3.25	3.25		139		452	452						0.8	452	4.00	6.1	13.0		13.8						
STREET A	73A	74A	1.34	47.38		175		235	5747		12.50			625	15.6	6,372	3.15	60.7	60.7	6.1	82.4	0.50	375	124.0	1.12	1.18	66%
STREET A	74A	75A		47.38					5747		12.50			625	15.6	6,372	3.15	60.7	60.7	6.1	82.4	0.50	375	124.0	1.12	1.18	66%
		75A	5.04	5.04		175		882	882						1.3	882	3.83	11.4	13.0		14.3						
STREET A	75A	67A	4.47	56.89		70		313	6942		12.50			625	18.0	7,567	3.07	71.6	71.6	6.0	95.7	0.50	450	201.6	1.27	1.22	47%
STREET A	76A	77A	1.06	1.06		175		186	186						0.3	186	4.00	2.5	13.0		13.3	1.00	200	32.8	1.04	0.97	40%
STREET A	77A	78A		1.06					186						0.3	186	4.00	2.5	13.0		13.3	0.50	200	23.2	0.74	0.75	57%
		78A	1.52	1.52		70		107	107						0.4	107	4.00	1.4	13.0		13.4						
		78A	3.50	3.50		475		1663	1663						0.9	1,663	3.65	20.4	20.4		21.3						
		78A	2.22	2.22											0.6						0.6						
		78A	9.45	9.45		175		1654	1654						2.5	1,654	3.65	20.3	20.3		22.7						
		78A	3.24	3.24		139		451	451						0.8	451	4.00	6.1	13.0		13.8						
		78A	0.51	0.51		70		36	36						0.1	36	4.00	0.5	13.0		13.1						
STREET A	78A	79A	1.47	22.97		70		103	4200						6.0	4,200	3.31	46.7	46.7		52.7	0.50	375	124.0	1.12	1.04	43%
STREET A	79A	67A		22.97					4200						6.0	4,200	3.31	46.7	46.7		52.7	0.50	375	124.0	1.12	1.04	43%
STREET E	67A	80A	0.95	202.03		175		167	24963		12.50			625	55.8	25,588	2.55	213.3	213.3	5.0	274.0	0.30	675	460.4	1.29	1.33	60%
		80A	2.80	2.80		475		1330	1330						0.7	1,330	3.72	16.6	16.6		17.3						
		80A	7.81	7.81		70		547	547						2.0	547	3.95	7.3	13.0		15.0						
		80A	11.22	11.22		175		1964	1964						2.9	1,964	3.59	23.7	23.7		26.6						
		80A	4.70	4.70		475		2233	2233						1.2	2,233	3.55	26.6	26.6		27.8						
STREET E	80A	92A	4.51	233.07		475		2143	33180		12.50			625	63.8	33,805	2.43	270.2	270.2	4.7	338.8	0.30	675	460.4	1.29	1.38	74%
		92A	2.50	2.50		70		175	175						0.7	175	4.00	2.3	13.0		13.7						
		92A	1.35	1.35		475		642	642						0.4	642	3.92	8.4	13.0		13.4						
		92A	1.41	1.41		475		670	670						0.4	670	3.91	8.8	13.0		13.4						
	92A	EX. PLUG 1	4.69	243.02		175		821	35488		12.50			625	66.4	36,113	2.40	285.7	285.7	4.7	356.8	0.30	750	609.8	1.38	1.39	59%

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SANITARY SEWER DESIGN SHEET

Alloa Caledon

Region of Peel

PROJECT DETAILS

Project No: 20-665
Date: 16-Sep-24
Designed by: T.L.
Checked by: J.O.

DESIGN CRITERIA

Min. Flow =	13	l/s			
Min Diameter =	200	mm	Daily Per Capital Flow (Residential) =	290.0	l/c/d
Mannings 'n'=	0.013		Daily Per Capital Flow (Non-Residential) =	270.0	l/c/d
Min. Velocity =	0.75	m/s	Extraneous Flows =	0.260	l/s/ha
Max. Velocity =	3.00	m/s	Max. Peaking Factor =	4.00	
			Min. Peaking Factor=	2.00	
Factor of Safety =	30	%			

NOMINAL PIPE SIZE USED

STREET	FROM MH	TO MH	RESIDENTIAL AREA (ha)	ACC. AREA (ha)	UNITS (#)	DENSITY (P/ha)	DENSITY (P/unit)	POP	ACCUM. POP.	NON-RESIDENTIAL AREA (ha)	ACC. AREA (ha)	EQUIV. POP. (p/ha)	POP.	ACCUM. POP.	FLOW CALCULATIONS EXTRANEOUS FLOW (l/s)	TOTAL ACCUM. POP.	PEAKING FACTOR	RESIDENTIAL FLOW (l/s)	MIN. FLOW (l/s)	NON RESIDENTIAL FLOW (l/s)	DESIGN FLOW (l/s)	PIPE DATA SLOPE (%)	PIPE DIA (mm)	FULL FLOW CAPACITY (l/s)	FULL FLOW VELOCITY (m/s)	ACTUAL VELOCITY (m/s)	PERCENT FULL (%)
COMMERCIAL BLOCK																											
		93A								9.72	9.72	50	486	486	2.5	486	3.98			6.0	8.6						
	93A	94A								2.78	12.50	50	139	625	3.3	625	3.92			7.7	10.9	1.00	200	32.8	1.04	0.91	33%
	94A	EX.MH1									12.50			625	3.3	625	3.92			7.7	10.9	0.50	200	23.2	0.74	0.71	47%
CREDITVIEW ROAD																											
	5B	6B	60.00	60.00		155		9300	9300						15.6	9,300	2.99	93.2	93.2		108.8	0.50	450	201.6	1.27	1.25	54%

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P:\Projects\20-665 - Alloa Caledon (Argo - Peel)\Reports\Phase 1 FSR_Drawings & Figures\5_SANITARY SERVICING\20-665 SAN.xlsx:SAN

APPENDIX C
SWM POND MODELING & CALCULATIONS

Model Files – Continuous Model and Pond Design Model (***Provided Separately***)
Pond Extended Detention Drawdown Calculations
Pond Permanent Pool Sizing Calculations
Pond Thermal Mitigation Measures

SWM POND 1 DESIGN CALCULATIONS
Drawdown Time

URBANTECH®

Project Name:	Alloa Phase 1 Tertiary Plan	**Prepared by:**	A.V.G.
Municipality:	Town of Caledon	**Checked by:**	K.R.
Project No.:	20-665	**Submission Number:**	1
Date:	09/16/2024		

Detention Time Calculations

$t = (0.66C_2h^{1.5}+2C_3h^{0.5})/2.75Ao$ *(MOECC Eq'n 4.11)*

t=	**726620**	*drawdown time in seconds*
t=	**201.8**	*drawdown time in hours*
d=	0.135	*diameter of the orifice (m)*
A_0=	0.0143	*cross-sectional area of the orifice (m^2)*
h=	0.352	*maximum water elevation above orifice (m)*
Q_{target}=	0.023	*target extended detention release rate (m3/s)*
$Q_{ext\ det}$=	0.023	*proposed extended detention release rate (m3/s)*
C_2=	4859.52	*slope coefficient from the area-depth linear regression*
C_3=	23522	*intercept from the area-depth linear regression*

Pond area-depth relationship:

	Elevation (m)	Area (m^2)	Depth (m)
PERM POOL	255.00	23522	0.00
EXT DET	255.42	25563	0.42

The drawdown time for is 201.8 hours (8.4 days)

SWM POND 2 DESIGN CALCULATIONS
Drawdown Time

URBANTECH®

Project Name: Alloa Phase 1 Tertiary Plan
Municipality: Town of Caledon
Project No.: 20-665
Date: 09/16/2024

Prepared by: A.V.G.
Checked by: K.R.
Submission Number: 1

Detention Time Calculations

$t = (0.66C_2h^{1.5}+2C_3h^{0.5})/2.75Ao$ *(MOECC Eq'n 4.11)*

t=	**778331**	*drawdown time in seconds*
t=	**216.2**	*drawdown time in hours*
d=	0.107	*diameter of the orifice (m)*
A_0=	0.0090	*cross-sectional area of the orifice (m^2)*
h=	0.386	*maximum water elevation above orifice (m)*
Q_{target}=	0.015	*target extended detention release rate (m3/s)*
$Q_{ext\ det}$=	0.015	*proposed extended detention release rate (m3/s)*
C_2=	3961.36	*slope coefficient from the area-depth linear regression*
C_3=	14974	*intercept from the area-depth linear regression*

Pond area-depth relationship:

	Elevation (m)	Area (m^2)	Depth (m)
PERM POOL	256.15	14974	0.00
EXT DET	256.59	16717	0.44

The drawdown time for is 216.2 hours (9 days)

SWM POND 3 DESIGN CALCULATIONS
Drawdown Time

URBANTECH®

Project Name: Alloa Phase 1 Tertiary Plan
Municipality: Town of Caledon
Project No.: 20-665
Date: 09/16/2024

Prepared by: A.V.G.
Checked by: K.R.
Submission Number: 1

Detention Time Calculations

$t = (0.66C_2h^{1.5}+2C_3h^{0.5})/2.75Ao$ *(MOECC Eq'n 4.11)*

t= 852268	*drawdown time in seconds*
t= 236.7	*drawdown time in hours*
d= 0.075	*diameter of the orifice (m)*
A_0= 0.0044	*cross-sectional area of the orifice (m^2)*
h= 0.402	*maximum water elevation above orifice (m)*
Q_{target}= 0.005	*target extended detention release rate (m3/s)*
$Q_{ext\ det}$= 0.007	*proposed extended detention release rate (m3/s)*
C_2= 2720.45	*slope coefficient from the area-depth linear regression*
C_3= 7799	*intercept from the area-depth linear regression*

Pond area-depth relationship:

	Elevation (m)	Area (m^2)	Depth (m)
PERM POOL	257.85	7799	0.00
EXT DET	258.29	8996	0.44

The drawdown time for is 236.7 hours (9.9 days)

SWM POND 4 DESIGN CALCULATIONS
Drawdown Time

URBANTECH®

Project Name: Alloa Phase 1 Tertiary Plan
Municipality: Town of Caledon
Project No.: 20-665
Date: 09/16/2024

Prepared by: A.V.G.
Checked by: K.R.
Submission Number: 1

Detention Time Calculations

$$t = (0.66C_2h^{1.5}+2C_3h^{0.5})/2.75Ao$$ *(MOECC Eq'n 4.11)*

t= 1173800 *drawdown time in seconds*
t= 326.1 *drawdown time in hours*

d= 0.08 *diameter of the orifice (m)*
A_0= 0.0050 *cross-sectional area of the orifice (m^2)*
h= 0.370 *maximum water elevation above orifice (m)*

Q_{target}= 0.008 *target extended detention release rate (m3/s)*
$Q_{ext\ det}$= 0.008 *proposed extended detention release rate (m3/s)*

C_2= 4743.90 *slope coefficient from the area-depth linear regression*
C_3= 12758 *intercept from the area-depth linear regression*

Pond area-depth relationship:

	Elevation (m)	Area (m^2)	Depth (m)
PERM POOL	258.50	12758	0.00
EXT DET	258.91	14703	0.41

The drawdown time for is 326.1 hours (13.6 days)

SWM POND 5 DESIGN CALCULATIONS
Drawdown Time

URBANTECH®

Project Name: Alloa Phase 1 Tertiary Plan
Municipality: Town of Caledon
Project No.: 20-665
Date: 09/16/2024

Prepared by: A.V.G.
Checked by: K.R.
Submission Number: 1

Detention Time Calculations

$$t = (0.66C_2h^{1.5}+2C_3h^{0.5})/2.75Ao$$ *(MOECC Eq'n 4.11)*

t=	**1054302**	*drawdown time in seconds*
t=	**292.9**	*drawdown time in hours*
d=	0.103	*diameter of the orifice (m)*
A_0=	0.0083	*cross-sectional area of the orifice (m^2)*
h=	0.298	*maximum water elevation above orifice (m)*
Q_{target}=	0.012	*target extended detention release rate (m3/s)*
$Q_{ext\ det}$=	0.012	*proposed extended detention release rate (m3/s)*
C_2=	5091.43	*slope coefficient from the area-depth linear regression*
C_3=	21607	*intercept from the area-depth linear regression*

Pond area-depth relationship:

	Elevation (m)	Area (m^2)	Depth (m)
PERM POOL	257.85	21607	0.00
EXT DET	258.20	23389	0.35

The drawdown time for is 292.9 hours (12.2 days)

SWM POND 6 DESIGN CALCULATIONS
Drawdown Time

URBANTECH®

Project Name:	Alloa Phase 1 Tertiary Plan	**Prepared by:**	A.V.G.
Municipality:	Town of Caledon	**Checked by:**	K.R.
Project No.:	20-665	**Submission Number:**	1
Date:	09/16/2024		

Detention Time Calculations

$t = (0.66C_2h^{1.5}+2C_3h^{0.5})/2.75Ao$ *(MOECC Eq'n 4.11)*

t=	**1346667**	*drawdown time in seconds*
t=	**374.1**	*drawdown time in hours*
d=	0.105	*diameter of the orifice (m)*
A_0=	0.0087	*cross-sectional area of the orifice (m^2)*
h=	0.467	*maximum water elevation above orifice (m)*
Q_{target}=	0.016	*target extended detention release rate (m3/s)*
$Q_{ext\ det}$=	0.016	*proposed extended detention release rate (m3/s)*
C_2=	4536.54	*slope coefficient from the area-depth linear regression*
C_3=	22750	*intercept from the area-depth linear regression*

Pond area-depth relationship:

	Elevation (m)	Area (m^2)	Depth (m)
PERM POOL	259.00	22750	0.00
EXT DET	259.52	25109	0.52

The drawdown time for is 374.1 hours (15.6 days)

SWM POND 7 DESIGN CALCULATIONS
Drawdown Time

URBANTECH®

Project Name: Alloa Phase 1 Tertiary Plan
Municipality: Town of Caledon
Project No.: 20-665
Date: 09/16/2024

Prepared by: A.V.G.
Checked by: K.R.
Submission Number: 1

Detention Time Calculations

$t = (0.66C_2h^{1.5}+2C_3h^{0.5})/2.75Ao$ *(MOECC Eq'n 4.11)*

t=	**1186947**	*drawdown time in seconds*
t=	**329.7**	*drawdown time in hours*
d=	0.075	*diameter of the orifice (m)*
A_0=	0.0044	*cross-sectional area of the orifice (m^2)*
h=	0.513	*maximum water elevation above orifice (m)*
Q_{target}=	0.008	*target extended detention release rate (m3/s)*
$Q_{ext\ det}$=	0.008	*proposed extended detention release rate (m3/s)*
C_2=	5047.27	*slope coefficient from the area-depth linear regression*
C_3=	9218	*intercept from the area-depth linear regression*

Pond area-depth relationship:

	Elevation (m)	Area (m^2)	Depth (m)
PERM POOL	260.25	9218	0.00
EXT DET	260.80	11994	0.55

The drawdown time for is 329.7 hours (13.7 days)

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WATER QUALITY SIZING (POND 1) - PERMANENT POOL CALCUALTIONS

Project Name:	Alloa Phase 1 Tertiary Plan	Prepared by:	A.V.G.
Municipality:	Town of Caledon	Checked by:	K.R.
Project No.:	20-665	Submission:	1
Date:	09/16/2024		

Wet Pond *(REFER: MOECC Stormwater Management Planning and Design Manual 2003, Table 3.2)*

Impervious Level (%)	Water Quality Storage Vol m^3/ha	Extended Detention m^3/ha	Permanent Pool m^3/ha
35%	140	40	100
55%	190	40	150
70%	225	40	185
85%	250	40	210

Interpolated Storage Requirement

74%	230	40	**190**

	Area [ha]	IMP%
Total Contributing Area	60.25	74%
Quantity Control Only	60.25	74%
Quality Control Only	60.25	74%

Total WQ Vol Required =	13880	m3
Total Ext Det Vol Required =	2410	m3
Total Perm Pool Vol Required =	11470	m3

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WATER QUALITY SIZING (POND 2) - PERMANENT POOL CALCUALTIONS

Project Name:	Alloa Phase 1 Tertiary Plan	Prepared by:	A.V.G.
Municipality:	Town of Caledon	Checked by:	K.R.
Project No.:	20-665	Submission:	1
Date:	09/16/2024		

Wet Pond *(REFER: MOECC Stormwater Management Planning and Design Manual 2003, Table 3.2)*

Impervious Level (%)	Water Quality Storage Vol m^3/ha	Extended Detention m^3/ha	Permanent Pool m^3/ha
35%	140	40	100
55%	190	40	150
70%	225	40	185
85%	250	40	210

Interpolated Storage Requirement

77%	236	40	**196**

	Area [ha]	IMP%
Total Contributing Area	36.51	77%
Quantity Control Only	36.51	77%
Quality Control Only	36.51	77%

Total WQ Vol Required =	8626	m3
Total Ext Det Vol Required =	1460	m3
Total Perm Pool Vol Required =	**7166**	m3

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WATER QUALITY SIZING (POND 3) - PERMANENT POOL CALCUALTIONS

Project Name:	Alloa Phase 1 Tertiary Plan	Prepared by:	A.V.G.
Municipality:	Town of Caledon	Checked by:	K.R.
Project No.:	20-665	Submission:	1
Date:	09/16/2024		

Wet Pond *(REFER: MOECC Stormwater Management Planning and Design Manual 2003, Table 3.2)*

Impervious Level (%)	Water Quality Storage Vol m^3/ha	Extended Detention m^3/ha	Permanent Pool m^3/ha
35%	140	40	100
55%	190	40	150
70%	225	40	185
85%	250	40	210

Interpolated Storage Requirement

75%	232	40	**192**

	Area [ha]	IMP%
Total Contributing Area	15.20	75%
Quantity Control Only	15.20	75%
Quality Control Only	15.20	75%

Total WQ Vol Required =	3524	m3
Total Ext Det Vol Required =	608	m3
Total Perm Pool Vol Required =	**2916**	m3

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WATER QUALITY SIZING (POND 4) - PERMANENT POOL CALCUALTIONS

Project Name:	Alloa Phase 1 Tertiary Plan	Prepared by:	A.V.G.
Municipality:	Town of Caledon	Checked by:	K.R.
Project No.:	20-665	Submission:	1
Date:	09/16/2024		

Wet Pond *(REFER: MOECC Stormwater Management Planning and Design Manual 2003, Table 3.2)*

Impervious Level (%)	Water Quality Storage Vol m^3/ha	Extended Detention m^3/ha	Permanent Pool m^3/ha
35%	140	40	100
55%	190	40	150
70%	225	40	185
85%	250	40	210

Interpolated Storage Requirement

69%	218	40	**178**

	Area [ha]	IMP%
Total Contributing Area	25.57	69%
Quantity Control Only	25.57	69%
Quality Control Only	25.57	69%

Total WQ Vol Required =	5587	m3
Total Ext Det Vol Required =	1023	m3
Total Perm Pool Vol Required =	**4564**	m3

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WATER QUALITY SIZING (POND 5) - PERMANENT POOL CALCUALTIONS

Project Name:	Alloa Phase 1 Tertiary Plan	Prepared by:	A.V.G.
Municipality:	Town of Caledon	Checked by:	K.R.
Project No.:	20-665	Submission:	1
Date:	09/16/2024		

Wet Pond *(REFER: MOECC Stormwater Management Planning and Design Manual 2003, Table 3.2)*

Impervious Level (%)	Water Quality Storage Vol m^3/ha	Extended Detention m^3/ha	Permanent Pool m^3/ha
35%	140	40	100
55%	190	40	150
70%	225	40	185
85%	250	40	210

Interpolated Storage Requirement

70%	221	40	**181**

	Area [ha]	IMP%
Total Contributing Area	40.31	70%
Quantity Control Only	40.31	70%
Quality Control Only	40.31	70%

Total WQ Vol Required =	8897	m3
Total Ext Det Vol Required =	1612	m3
Total Perm Pool Vol Required =	**7284**	m3

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urbantech.com

URBANTECH®

WATER QUALITY SIZING (POND 6) - PERMANENT POOL CALCUALTIONS

Project Name:	Alloa Phase 1 Tertiary Plan	Prepared by:	A.V.G.
Municipality:	Town of Caledon	Checked by:	K.R.
Project No.:	20-665	Submission:	1
Date:	09/16/2024		

Wet Pond *(REFER: MOECC Stormwater Management Planning and Design Manual 2003, Table 3.2)*

Impervious Level (%)	Water Quality Storage Vol m^3/ha	Extended Detention m^3/ha	Permanent Pool m^3/ha
35%	140	40	100
55%	190	40	150
70%	225	40	185
85%	250	40	210

Interpolated Storage Requirement

74%	230	40	**190**

	Area [ha]	IMP%
Total Contributing Area	52.37	74%
Quantity Control Only	52.37	74%
Quality Control Only	52.37	74%

Total WQ Vol Required =	12024	m3
Total Ext Det Vol Required =	2095	m3
Total Perm Pool Vol Required =	**9929**	m3

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URBANTECH®

WATER QUALITY SIZING (POND 7) - PERMANENT POOL CALCUALTIONS

Project Name:	Alloa Phase 1 Tertiary Plan	Prepared by:	A.V.G.
Municipality:	Town of Caledon	Checked by:	K.R.
Project No.:	20-665	Submission:	1
Date:	09/16/2024		

Wet Pond *(REFER: MOECC Stormwater Management Planning and Design Manual 2003, Table 3.2)*

Impervious Level (%)	Water Quality Storage Vol m^3/ha	Extended Detention m^3/ha	Permanent Pool m^3/ha
35%	140	40	100
55%	190	40	150
70%	225	40	185
85%	250	40	210

Interpolated Storage Requirement

68%	216	40	**176**

	Area [ha]	IMP%
Total Contributing Area	26.50	68%
Quantity Control Only	26.50	68%
Quality Control Only	26.50	68%

Total WQ Vol Required =	5731	m3
Total Ext Det Vol Required =	1060	m3
Total Perm Pool Vol Required =	**4671**	m3

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SWM Facility Pond 1	Zone	Recommended
Energy transfer between warm storm runoff and cool sub-surface storm sewers	Zone 1	✓
LID measures	Zone 1	✓
Roof colour	Zone 1	X
Downspout disconnection	Zone 1	✓
Up-gradient plantings	Zone 1	✓
Buried inlet pipe	Zone 2	✓
Inlet cooling trench	Zone 2	X[3]
Inlet plantings	Zone 2	✓
Shading of open water areas by maximizing canopy	Zone 3	✓
Artificial shade systems	Zone 3	X[3]
Floating island	Zone 3	X[1]
Reduce open water area	Zone 3	✓
Increased L:W ratio	Zone 3	X[3]
Pond orientation to reduce solar inputs	Zone 3	✓
Pond orientation to increase exposure to prevailing wind	Zone 3	X[2]
Landscaped jetties for shading	Zone 3	X[3]
Sub-surface SWM ponds	Zone 3	X[4]
Outlet sub-surface cooling trench and shading	Zone 4	X[3]
Concrete outlet pipe	Zone 4	✓
Introduce cool water at SWM pond outlets such as foundation drain collectors (FDC), where feasible and/or a Thermal Siphon	Zone 4	X[3]
Reversed slope submerged pond outlet and extra permanent pool depth at outlet	Zone 4	✓
Distributed outlets along the NHS to take advantage of the NHS shading	Zone 4	X[3]
Night time release	Zone 4	X[5]
Watercourse shading	Zone 5	✓

Notes:

1. The CVC did a study for a floating island in Pond 10 in Fletcher's Meadow The results from the monitoring program of this study concluded that while vegetated floating islands may provide some thermal mitigation through shading, coverage of at least 1/3 of the pond may be needed to provide tangible results. Therefore, it was determined that vegetated floating islands are not the most practical or feasible method of thermal mitigation in SWM ponds.
2. The orientation of this pond is required in an east to west configuration.
3. Not recommended due to grading, capacity, or maintenance constraints.
4. Sub-surface storage is typically not suitable for large drainage areas since costs become prohibitive. There may be application of sub-surface storage in commercial areas.
5. Night-time release requires complex control systems that would have to be maintained by the City. These measures are therefore not recommended at this time.

SWM Facility Pond 2	Zone	Recommended
Energy transfer between warm storm runoff and cool sub-surface storm sewers	Zone 1	✓
LID measures	Zone 1	✓
Roof colour	Zone 1	X
Downspout disconnection	Zone 1	✓
Up-gradient plantings	Zone 1	✓
Buried inlet pipe	Zone 2	✓
Inlet cooling trench	Zone 2	X[3]
Inlet plantings	Zone 2	✓
Shading of open water areas by maximizing canopy	Zone 3	✓
Artificial shade systems	Zone 3	X[3]
Floating island	Zone 3	X[1]
Reduce open water area	Zone 3	✓
Increased L:W ratio	Zone 3	X[3]
Pond orientation to reduce solar inputs	Zone 3	✓
Pond orientation to increase exposure to prevailing wind	Zone 3	X[2]
Landscaped jetties for shading	Zone 3	X[3]
Sub-surface SWM ponds	Zone 3	X[4]
Outlet sub-surface cooling trench and shading	Zone 4	X[3]
Concrete outlet pipe	Zone 4	✓
Introduce cool water at SWM pond outlets such as foundation drain collectors (FDC), where feasible and/or a Thermal Siphon	Zone 4	X[3]
Reversed slope submerged pond outlet and extra permanent pool depth at outlet	Zone 4	✓
Distributed outlets along the NHS to take advantage of the NHS shading	Zone 4	X[3]
Night time release	Zone 4	X[5]
Watercourse shading	Zone 5	✓

Notes:

1. The CVC did a study for a floating island in Pond 10 in Fletcher's Meadow The results from the monitoring program of this study concluded that while vegetated floating islands may provide some thermal mitigation through shading, coverage of at least 1/3 of the pond may be needed to provide tangible results. Therefore, it was determined that vegetated floating islands are not the most practical or feasible method of thermal mitigation in SWM ponds.
2. The orientation of this pond is required in an east to west configuration.
3. Not recommended due to grading, capacity, or maintenance constraints.
4. Sub-surface storage is typically not suitable for large drainage areas since costs become prohibitive. There may be application of sub-surface storage in commercial areas.
5. Night-time release requires complex control systems that would have to be maintained by the City. These measures are therefore not recommended at this time.

SWM Facility Pond 3	Zone	Recommended
Energy transfer between warm storm runoff and cool sub-surface storm sewers	Zone 1	✓
LID measures	Zone 1	✓
Roof colour	Zone 1	X
Downspout disconnection	Zone 1	✓
Up-gradient plantings	Zone 1	✓
Buried inlet pipe	Zone 2	✓
Inlet cooling trench	Zone 2	X[3]
Inlet plantings	Zone 2	✓
Shading of open water areas by maximizing canopy	Zone 3	✓
Artificial shade systems	Zone 3	X[3]
Floating island	Zone 3	X[1]
Reduce open water area	Zone 3	✓
Increased L:W ratio	Zone 3	X[3]
Pond orientation to reduce solar inputs	Zone 3	✓
Pond orientation to increase exposure to prevailing wind	Zone 3	✓
Landscaped jetties for shading	Zone 3	X[3]
Sub-surface SWM ponds	Zone 3	X[4]
Outlet sub-surface cooling trench and shading	Zone 4	X[3]
Concrete outlet pipe	Zone 4	✓
Introduce cool water at SWM pond outlets such as foundation drain collectors (FDC), where feasible and/or a Thermal Siphon	Zone 4	X[3]
Reversed slope submerged pond outlet and extra permanent pool depth at outlet	Zone 4	✓
Distributed outlets along the NHS to take advantage of the NHS shading	Zone 4	X[3]
Night time release	Zone 4	X[5]
Watercourse shading	Zone 5	✓

Notes:

1. The CVC did a study for a floating island in Pond 10 in Fletcher's Meadow The results from the monitoring program of this study concluded that while vegetated floating islands may provide some thermal mitigation through shading, coverage of at least 1/3 of the pond may be needed to provide tangible results. Therefore, it was determined that vegetated floating islands are not the most practical or feasible method of thermal mitigation in SWM ponds.
3. Not recommended due to grading, capacity, or maintenance constraints.
4. Sub-surface storage is typically not suitable for large drainage areas since costs become prohibitive. There may be application of sub-surface storage in commercial areas.
5. Night-time release requires complex control systems that would have to be maintained by the City. These measures are therefore not recommended at this time.

SWM Facility Pond 4	Zone	Recommended
Energy transfer between warm storm runoff and cool sub-surface storm sewers	Zone 1	✓
LID measures	Zone 1	✓
Roof colour	Zone 1	X
Downspout disconnection	Zone 1	✓
Up-gradient plantings	Zone 1	✓
Buried inlet pipe	Zone 2	✓
Inlet cooling trench	Zone 2	X[3]
Inlet plantings	Zone 2	✓
Shading of open water areas by maximizing canopy	Zone 3	✓
Artificial shade systems	Zone 3	X[3]
Floating island	Zone 3	X[1]
Reduce open water area	Zone 3	✓
Increased L:W ratio	Zone 3	X[3]
Pond orientation to reduce solar inputs	Zone 3	✓
Pond orientation to increase exposure to prevailing wind	Zone 3	X[2]
Landscaped jetties for shading	Zone 3	X[3]
Sub-surface SWM ponds	Zone 3	X[4]
Outlet sub-surface cooling trench and shading	Zone 4	X[3]
Concrete outlet pipe	Zone 4	✓
Introduce cool water at SWM pond outlets such as foundation drain collectors (FDC), where feasible and/or a Thermal Siphon	Zone 4	X[3]
Reversed slope submerged pond outlet and extra permanent pool depth at outlet	Zone 4	✓
Distributed outlets along the NHS to take advantage of the NHS shading	Zone 4	X[3]
Night time release	Zone 4	X[5]
Watercourse shading	Zone 5	✓

Notes:

1. The CVC did a study for a floating island in Pond 10 in Fletcher's Meadow The results from the monitoring program of this study concluded that while vegetated floating islands may provide some thermal mitigation through shading, coverage of at least 1/3 of the pond may be needed to provide tangible results. Therefore, it was determined that vegetated floating islands are not the most practical or feasible method of thermal mitigation in SWM ponds.
2. The orientation of this pond is required in an east to west configuration.
3. Not recommended due to grading, capacity, or maintenance constraints.
4. Sub-surface storage is typically not suitable for large drainage areas since costs become prohibitive. There may be application of sub-surface storage in commercial areas.
5. Night-time release requires complex control systems that would have to be maintained by the City. These measures are therefore not recommended at this time.

SWM Facility Pond 5	Zone	Recommended
Energy transfer between warm storm runoff and cool sub-surface storm sewers	Zone 1	✓
LID measures	Zone 1	✓
Roof colour	Zone 1	X
Downspout disconnection	Zone 1	✓
Up-gradient plantings	Zone 1	✓
Buried inlet pipe	Zone 2	✓
Inlet cooling trench	Zone 2	X[3]
Inlet plantings	Zone 2	✓
Shading of open water areas by maximizing canopy	Zone 3	✓
Artificial shade systems	Zone 3	X[3]
Floating island	Zone 3	X[1]
Reduce open water area	Zone 3	✓
Increased L:W ratio	Zone 3	X[3]
Pond orientation to reduce solar inputs	Zone 3	✓
Pond orientation to increase exposure to prevailing wind	Zone 3	✓
Landscaped jetties for shading	Zone 3	X[3]
Sub-surface SWM ponds	Zone 3	X[4]
Outlet sub-surface cooling trench and shading	Zone 4	X[3]
Concrete outlet pipe	Zone 4	✓
Introduce cool water at SWM pond outlets such as foundation drain collectors (FDC), where feasible and/or a Thermal Siphon	Zone 4	X[3]
Reversed slope submerged pond outlet and extra permanent pool depth at outlet	Zone 4	✓
Distributed outlets along the NHS to take advantage of the NHS shading	Zone 4	X[3]
Night time release	Zone 4	X[5]
Watercourse shading	Zone 5	✓

Notes:

1. The CVC did a study for a floating island in Pond 10 in Fletcher’s Meadow The results from the monitoring program of this study concluded that while vegetated floating islands may provide some thermal mitigation through shading, coverage of at least 1/3 of the pond may be needed to provide tangible results. Therefore, it was determined that vegetated floating islands are not the most practical or feasible method of thermal mitigation in SWM ponds.
3. Not recommended due to grading, capacity, or maintenance constraints.
4. Sub-surface storage is typically not suitable for large drainage areas since costs become prohibitive. There may be application of sub-surface storage in commercial areas.
5. Night-time release requires complex control systems that would have to be maintained by the City. These measures are therefore not recommended at this time.

SWM Facility Pond 6	Zone	Recommended
Energy transfer between warm storm runoff and cool sub-surface storm sewers	Zone 1	✓
LID measures	Zone 1	✓
Roof colour	Zone 1	X
Downspout disconnection	Zone 1	✓
Up-gradient plantings	Zone 1	✓
Buried inlet pipe	Zone 2	✓
Inlet cooling trench	Zone 2	X[3]
Inlet plantings	Zone 2	✓
Shading of open water areas by maximizing canopy	Zone 3	✓
Artificial shade systems	Zone 3	X[3]
Floating island	Zone 3	X[1]
Reduce open water area	Zone 3	✓
Increased L:W ratio	Zone 3	X[3]
Pond orientation to reduce solar inputs	Zone 3	✓
Pond orientation to increase exposure to prevailing wind	Zone 3	✓
Landscaped jetties for shading	Zone 3	X[3]
Sub-surface SWM ponds	Zone 3	X[4]
Outlet sub-surface cooling trench and shading	Zone 4	X[3]
Concrete outlet pipe	Zone 4	✓
Introduce cool water at SWM pond outlets such as foundation drain collectors (FDC), where feasible and/or a Thermal Siphon	Zone 4	X[3]
Reversed slope submerged pond outlet and extra permanent pool depth at outlet	Zone 4	✓
Distributed outlets along the NHS to take advantage of the NHS shading	Zone 4	X[3]
Night time release	Zone 4	X[5]
Watercourse shading	Zone 5	✓

Notes:

1. The CVC did a study for a floating island in Pond 10 in Fletcher's Meadow The results from the monitoring program of this study concluded that while vegetated floating islands may provide some thermal mitigation through shading, coverage of at least 1/3 of the pond may be needed to provide tangible results. Therefore, it was determined that vegetated floating islands are not the most practical or feasible method of thermal mitigation in SWM ponds.
3. Not recommended due to grading, capacity, or maintenance constraints.
4. Sub-surface storage is typically not suitable for large drainage areas since costs become prohibitive. There may be application of sub-surface storage in commercial areas.
5. Night-time release requires complex control systems that would have to be maintained by the City. These measures are therefore not recommended at this time.

SWM Facility Pond 7	Zone	Recommended
Energy transfer between warm storm runoff and cool sub-surface storm sewers	Zone 1	✓
LID measures	Zone 1	✓
Roof colour	Zone 1	X
Downspout disconnection	Zone 1	✓
Up-gradient plantings	Zone 1	✓
Buried inlet pipe	Zone 2	✓
Inlet cooling trench	Zone 2	X[3]
Inlet plantings	Zone 2	✓
Shading of open water areas by maximizing canopy	Zone 3	✓
Artificial shade systems	Zone 3	X[3]
Floating island	Zone 3	X[1]
Reduce open water area	Zone 3	✓
Increased L:W ratio	Zone 3	X[3]
Pond orientation to reduce solar inputs	Zone 3	✓
Pond orientation to increase exposure to prevailing wind	Zone 3	✓
Landscaped jetties for shading	Zone 3	X[3]
Sub-surface SWM ponds	Zone 3	X[4]
Outlet sub-surface cooling trench and shading	Zone 4	X[3]
Concrete outlet pipe	Zone 4	✓
Introduce cool water at SWM pond outlets such as foundation drain collectors (FDC), where feasible and/or a Thermal Siphon	Zone 4	X[3]
Reversed slope submerged pond outlet and extra permanent pool depth at outlet	Zone 4	✓
Distributed outlets along the NHS to take advantage of the NHS shading	Zone 4	X[3]
Night time release	Zone 4	X[5]
Watercourse shading	Zone 5	✓

Notes:

1. The CVC did a study for a floating island in Pond 10 in Fletcher's Meadow The results from the monitoring program of this study concluded that while vegetated floating islands may provide some thermal mitigation through shading, coverage of at least 1/3 of the pond may be needed to provide tangible results. Therefore, it was determined that vegetated floating islands are not the most practical or feasible method of thermal mitigation in SWM ponds.
3. Not recommended due to grading, capacity, or maintenance constraints.
4. Sub-surface storage is typically not suitable for large drainage areas since costs become prohibitive. There may be application of sub-surface storage in commercial areas.
5. Night-time release requires complex control systems that would have to be maintained by the City. These measures are therefore not recommended at this time.

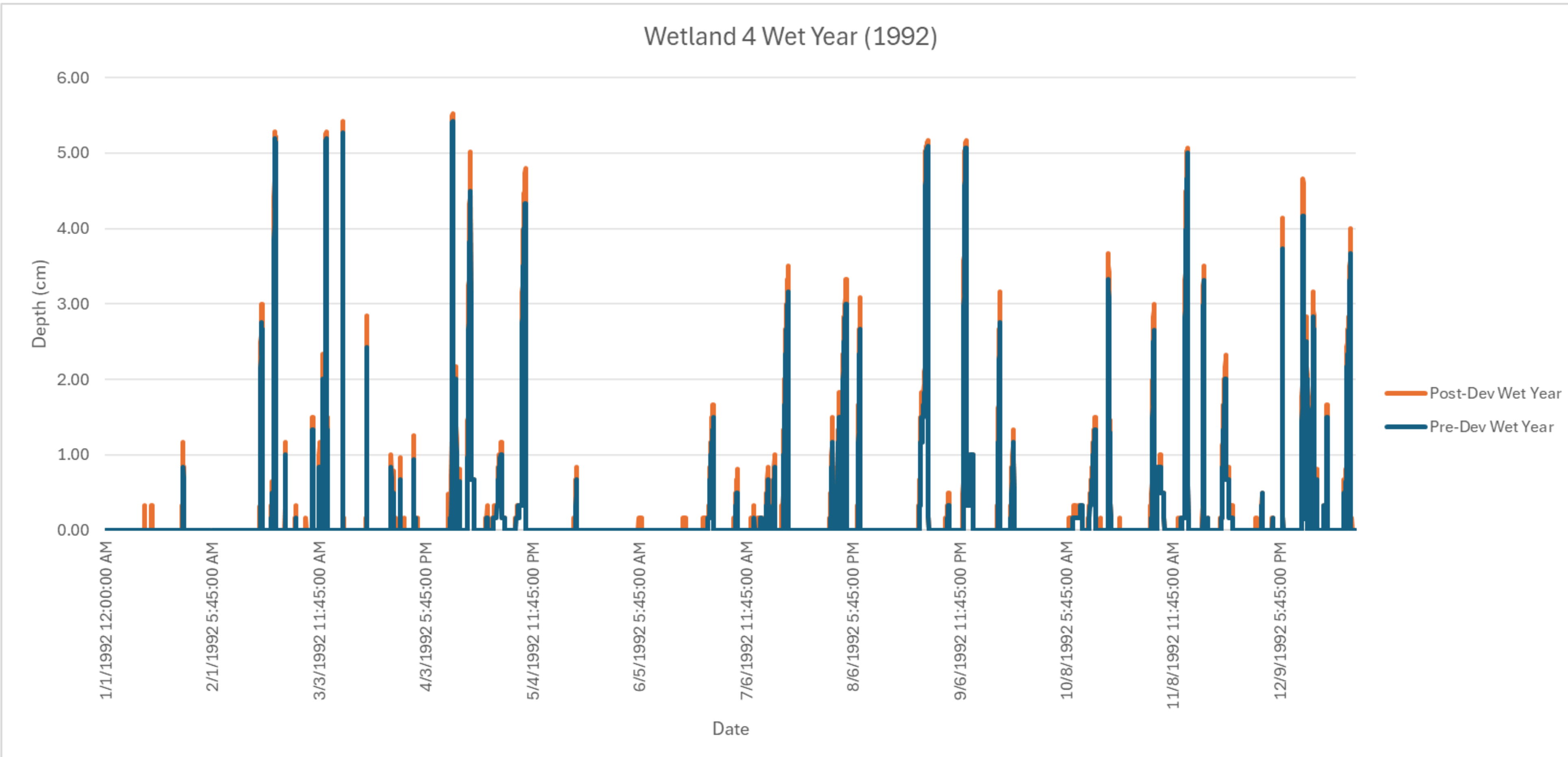
APPENDIX D
WATER BALANCE

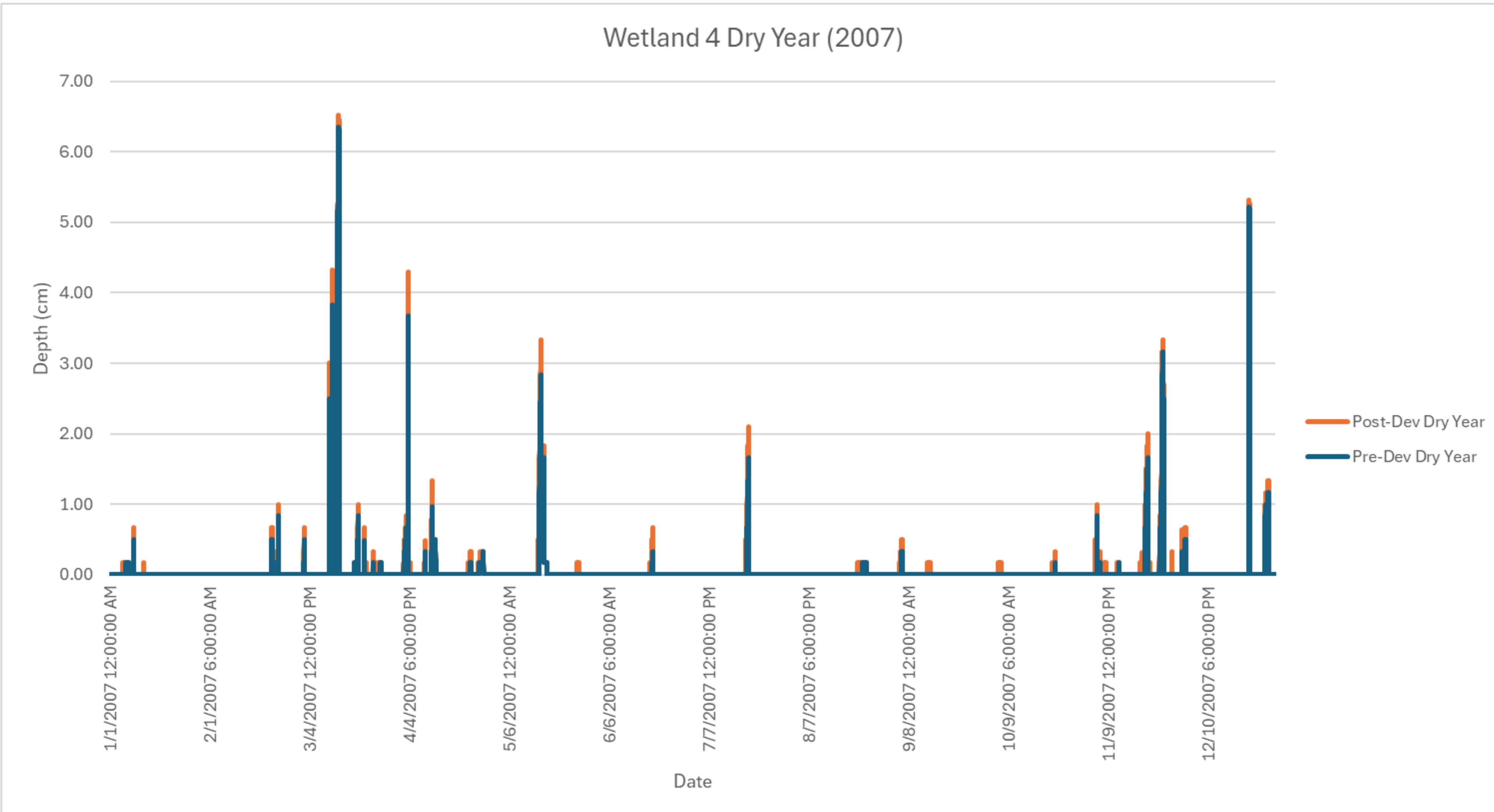
FEATURE BASED WATER BALANCE:

Model Files (***Provided Separately***)
Wetland 4 Model Results (Wet Year / Dry Year / Spill Calculations)
Wetland 5 Model Results (Wet Year / Dry Year / Spill Calculations)

SITE WATER BALANCE

Model Files (Provided Separately)
LID Mitigation – Etobicoke Creek
LID Mitigation – Fletcher's Creek
Water Balance Targets – Etobicoke Creek


Wetland 4 Wet Year (1992)
Depth (cm)
6.00
5.00
4.00
3.00
2.00
1.00
0.00
1/1/1992 12:00:00 AM
2/1/1992 5:45:00 AM
3/3/1992 11:45:00 AM
4/3/1992 5:45:00 PM
5/4/1992 11:45:00 PM
6/5/1992 5:45:00 AM
7/6/1992 11:45:00 AM
8/6/1992 5:45:00 PM
9/6/1992 11:45:00 PM
10/8/1992 5:45:00 AM
11/8/1992 11:45:00 AM
12/9/1992 5:45:00 PM
Date
Post-Dev Wet Year
Pre-Dev Wet Year


Wetland 4 Dry Year (2007)
Depth (cm)
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
1/1/2007 12:00:00 AM
2/1/2007 6:00:00 AM
3/4/2007 12:00:00 PM
4/4/2007 6:00:00 PM
5/6/2007 12:00:00 AM
6/6/2007 6:00:00 AM
7/7/2007 12:00:00 PM
8/7/2007 6:00:00 PM
9/8/2007 12:00:00 AM
10/9/2007 6:00:00 AM
11/9/2007 12:00:00 PM
12/10/2007 6:00:00 PM
Date
Post-Dev Dry Year
Pre-Dev Dry Year

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Sep 16 2024

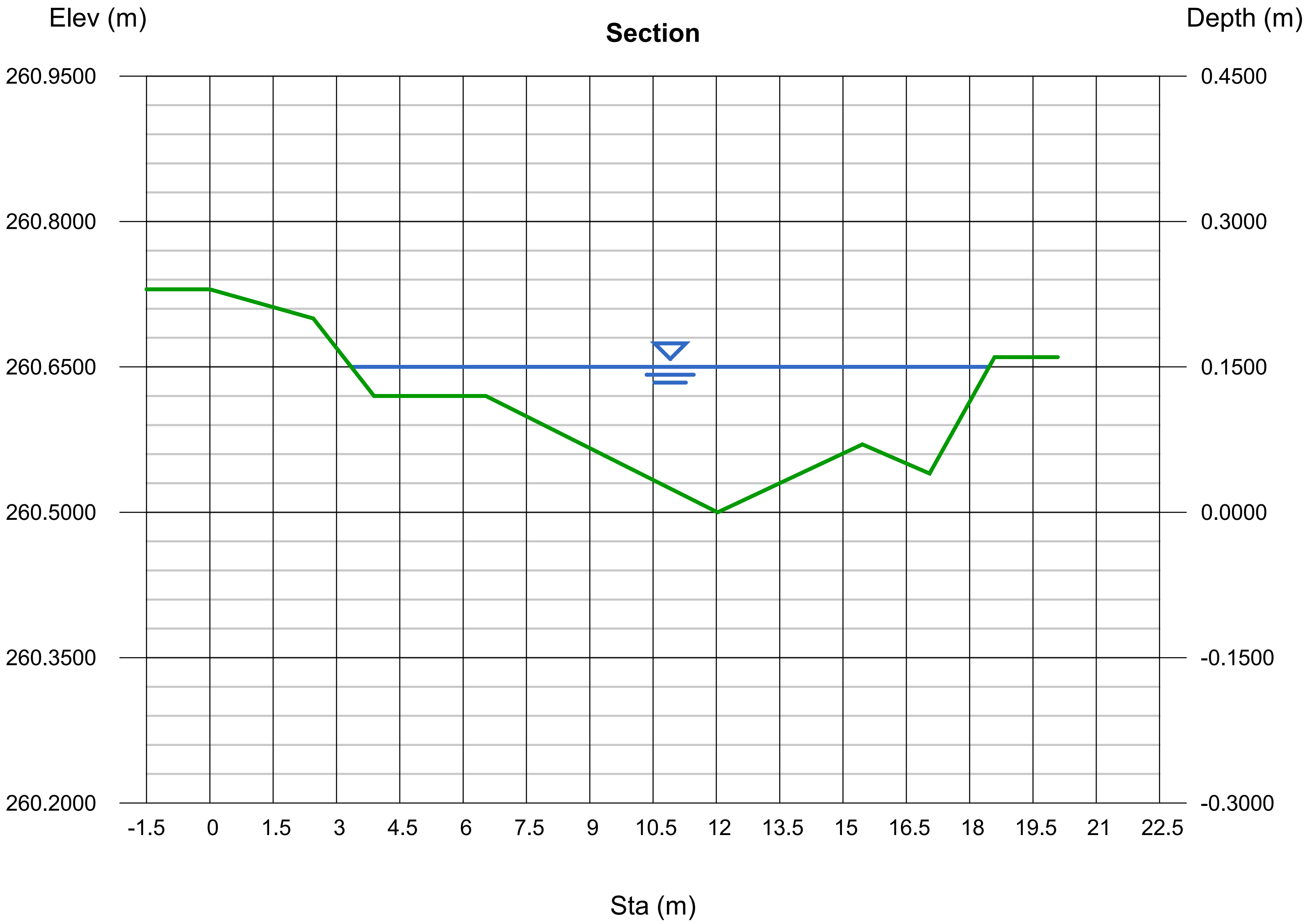
Wetland 4 Spill

User-defined
Invert Elev (m) = 260.5000
Slope (%) = 1.2000
N-Value = 0.035

Calculations
Compute by: Known Depth
Known Depth (m) = 0.1500

Highlighted
Depth (m) = 0.1500
Q (cms) = 0.6991
Area (sqm) = 1.2047
Velocity (m/s) = 0.5803
Wetted Perim (m) = 15.1187
Crit Depth, Yc (m) = 0.1311
Top Width (m) = 15.1113
EGL (m) = 0.1672

(Sta, El, n)-(Sta, El, n)...
(0.0000, 260.7300)-(2.4500, 260.7000, 0.035)-(3.8900, 260.6200, 0.035)-(6.5400, 260.6200, 0.035)-(12.0300, 260.5000, 0.035)-(15.4600, 260.5700, 0.035)-(17.050
-(18.5900, 260.6600, 0.035)

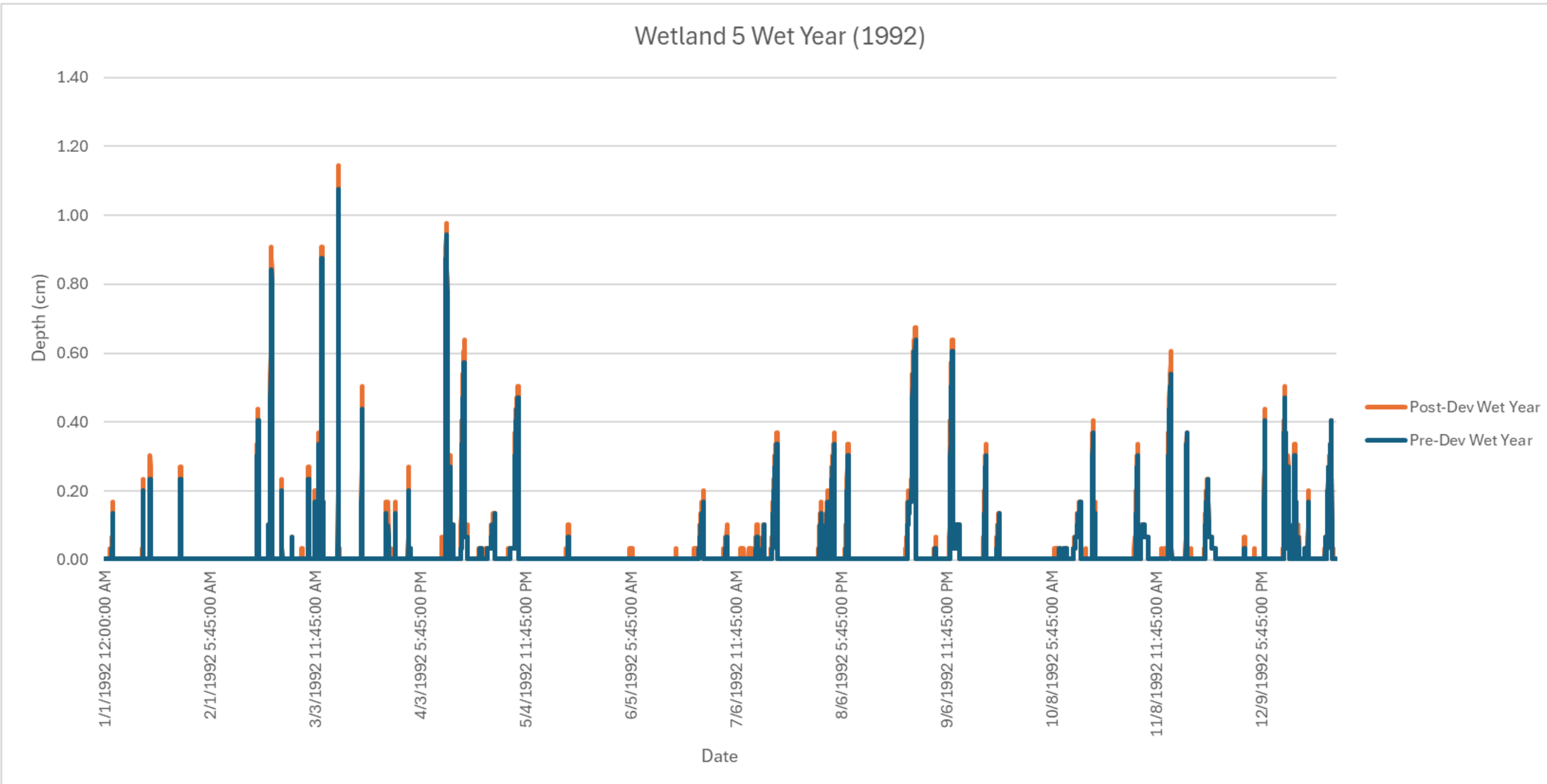


Depth	Q	Area	Veloc
(m)	(cms)	(sqm)	(m/s)
0.0100	0.000	0.005	0.0916
0.0200	0.003	0.019	0.1453
0.0300	0.008	0.043	0.1905
0.0400	0.017	0.076	0.2308
0.0500	0.030	0.122	0.2501
0.0600	0.051	0.184	0.2766
0.0700	0.080	0.262	0.3052
0.0800	0.125	0.351	0.3550
0.0900	0.178	0.446	0.3996
0.1000	0.241	0.546	0.4404
0.1100	0.312	0.653	0.4781
0.1200	0.393	0.765	0.5134
0.1300	0.449	0.909	0.4944
0.1400	0.568	1.055	0.5386
0.1500	0.699	1.205	0.5803
0.1600	0.842	1.357	0.6200
0.1700	1.000	1.513	0.6613
0.1800	1.170	1.669	0.7008
0.1900	1.351	1.828	0.7390
0.2000	1.543	1.989	0.7758
0.2100	1.706	2.154	0.7918
0.2200	1.881	2.328	0.8081

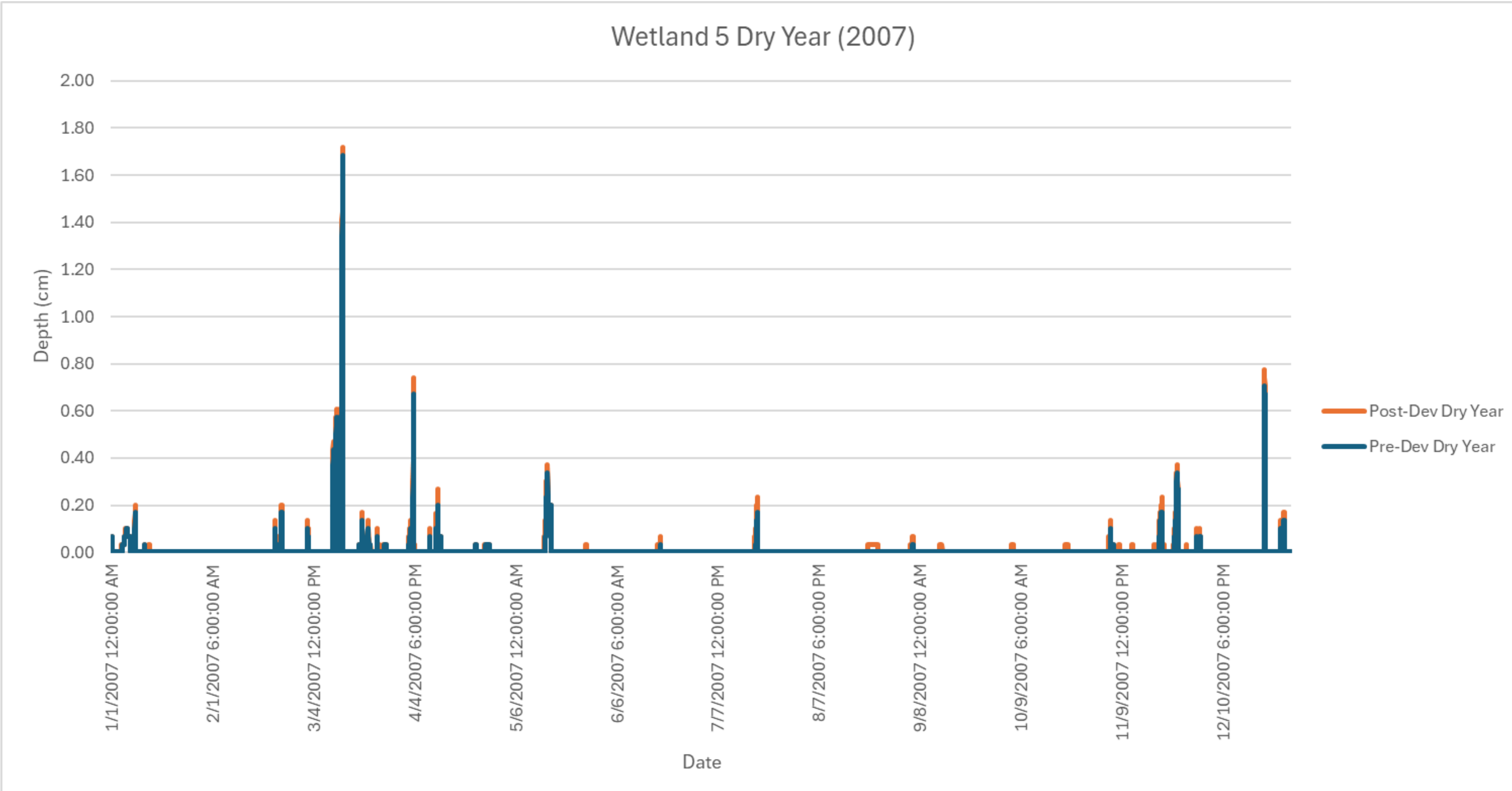
Depth	Q	Area	Veloc
(m)	(cms)	(sqm)	(m/s)
0.2300	2.069	2.510	0.8246

Wp	Yc	TopWidth	Energy
(m)	(m)	(m)	(m)
0.9483	0.0091	0.9481	0.0104
1.8949	0.0152	1.8945	0.0211
2.8432	0.0244	2.8426	0.0319
3.7898	0.0335	3.7889	0.0427
5.3961	0.0396	5.3946	0.0532
7.0008	0.0488	6.9985	0.0639
8.6083	0.0579	8.6054	0.0748
9.1970	0.0671	9.1936	0.0864
9.7828	0.0762	9.7788	0.0982
10.3696	0.0853	10.3651	0.1099
10.9553	0.0945	10.9504	0.1217
11.5421	0.1006	11.5367	0.1335
14.5008	0.1067	14.4947	0.1425
14.8100	0.1189	14.8033	0.1548
15.1187	0.1311	15.1113	0.1672
15.4279	0.1402	15.4198	0.1796
15.6083	0.1494	15.6000	0.1923
15.7884	0.1554	15.7798	0.2051
15.9688	0.1646	15.9599	0.2179
16.1489	0.1737	16.1397	0.2307
16.9654	0.1829	16.9562	0.2420
17.7816	0.1890	17.7723	0.2533

Wp	Yc	TopWidth	Energy
(m)	(m)	(m)	(m)
18.5994	0.1981	18.5900	0.2647



Wetland 5 Wet Year (1992)
Depth (cm)
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
1/1/1992 12:00:00 AM
2/1/1992 5:45:00 AM
3/3/1992 11:45:00 AM
4/3/1992 5:45:00 PM
5/4/1992 11:45:00 PM
6/5/1992 5:45:00 AM
7/6/1992 11:45:00 AM
8/6/1992 5:45:00 PM
9/6/1992 11:45:00 PM
10/8/1992 5:45:00 AM
11/8/1992 11:45:00 AM
12/9/1992 5:45:00 PM
Date
Post-Dev Wet Year
Pre-Dev Wet Year


Wetland 5 Dry Year (2007)
Depth (cm)
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
1/1/2007 12:00:00 AM
2/1/2007 6:00:00 AM
3/4/2007 12:00:00 PM
4/4/2007 6:00:00 PM
5/6/2007 12:00:00 AM
6/6/2007 6:00:00 AM
7/7/2007 12:00:00 PM
8/7/2007 6:00:00 PM
9/8/2007 12:00:00 AM
10/9/2007 6:00:00 AM
11/9/2007 12:00:00 PM
12/10/2007 6:00:00 PM
Date
Post-Dev Dry Year
Pre-Dev Dry Year

Channel Report

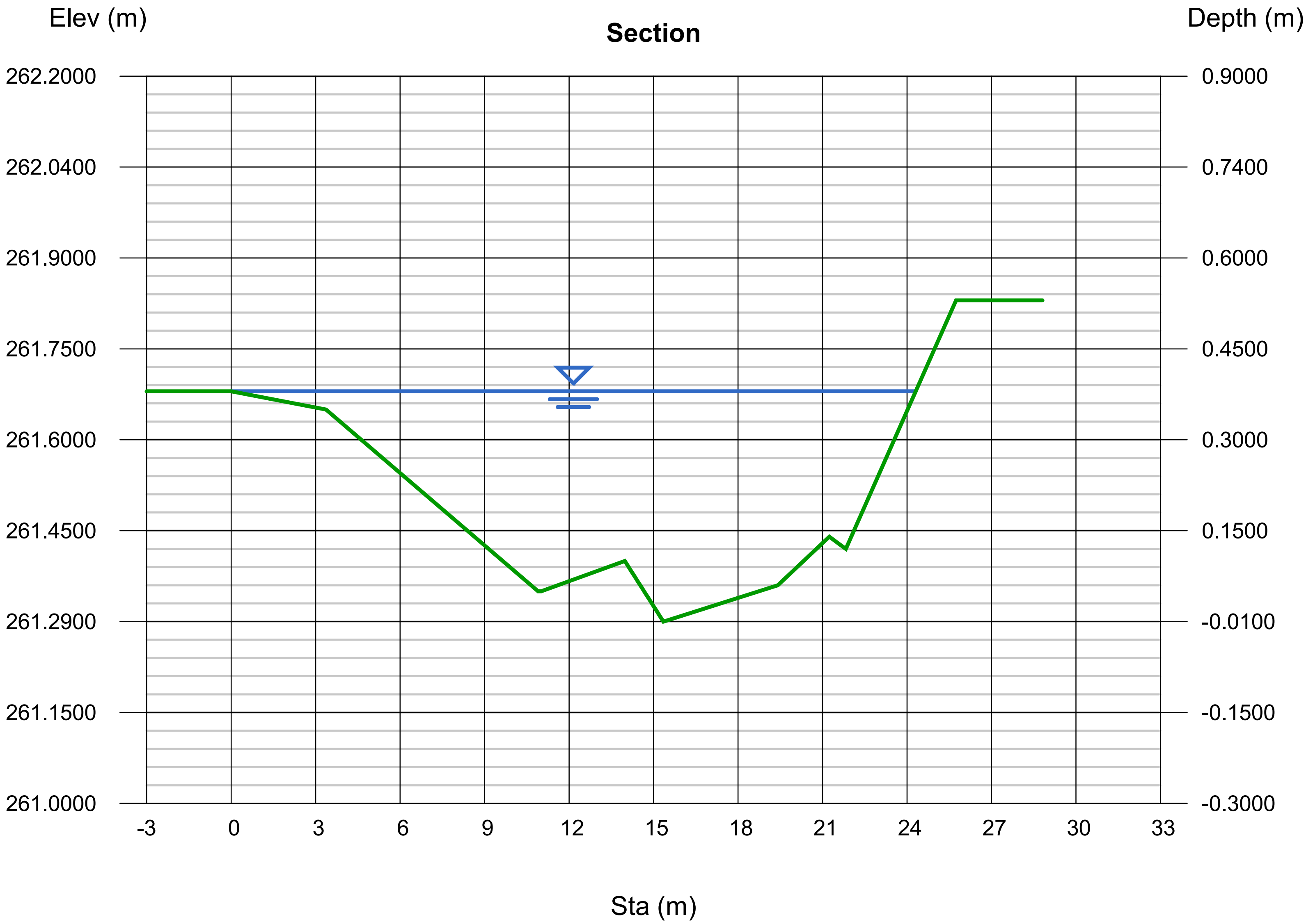
Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Sep 16 2024

Wetland 5 Spill

User-defined			**Highlighted**	
Invert Elev (m)	= 261.3000		Depth (m)	= 0.3800
Slope (%)	= 2.9000		Q (cms)	= 9.0667
N-Value	= 0.035		Area (sqm)	= 5.2030
			Velocity (m/s)	= 1.7426
Calculations			Wetted Perim (m)	= 24.3335
Compute by:	Known Depth		Crit Depth, Yc (m)	= 0.4115
Known Depth (m)	= 0.3800		Top Width (m)	= 24.3072
			EGL (m)	= 0.5349

(Sta, El, n)-(Sta, El, n)...

(0.0000, 261.6800)-(3.3700, 261.6500, 0.035)-(10.9000, 261.3500, 0.035)-(11.0100, 261.3500, 0.035)-(13.9800, 261.4000, 0.035)-(15.3500, 261.3000, 0.035)-(19.4
-(21.2400, 261.4400, 0.035)-(21.8300, 261.4200, 0.035)-(25.7400, 261.8300, 0.035)-(25.8100, 261.8300, 0.035)



Depth	Q	Area	Veloc
(m)	(cms)	(sqm)	(m/s)
0.0204	0.004	0.017	0.2288
0.0408	0.025	0.068	0.3633
0.0612	0.069	0.159	0.4331
0.0815	0.163	0.305	0.5326
0.1019	0.317	0.503	0.6311
0.1223	0.558	0.732	0.7616
0.1427	0.848	0.991	0.8551
0.1631	1.243	1.273	0.9765
0.1835	1.706	1.570	1.0869
0.2039	2.235	1.880	1.1887
0.2242	2.830	2.205	1.2834
0.2446	3.493	2.545	1.3726
0.2650	4.223	2.898	1.4570
0.2854	5.022	3.267	1.5374
0.3058	5.891	3.649	1.6142
0.3262	6.829	4.046	1.6879
0.3465	7.841	4.458	1.7589
0.3669	8.571	4.896	1.7506
0.3873	9.572	5.381	1.7787
0.4077	11.04	5.880	1.8770
0.4281	12.59	6.383	1.9722
0.4485	14.22	6.890	2.0645

Depth	Q	Area	Veloc
(m)	(cms)	(sqm)	(m/s)
0.4689	15.94	7.401	2.1542
0.4892	17.74	7.915	2.2413
0.5096	19.62	8.434	2.3263
0.5300	21.58	8.957	2.4093

Wp	Yc	TopWidth	Energy
(m)	(m)	(m)	(m)
1.6595	0.0183	1.6586	0.0231
3.3191	0.0396	3.3173	0.0475
5.9769	0.0579	5.9738	0.0707
8.4475	0.0792	8.4427	0.0960
10.7779	0.1006	10.7715	0.1222
11.8464	0.1219	11.8389	0.1519
13.4817	0.1433	13.4721	0.1800
14.1895	0.1676	14.1784	0.2117
14.8972	0.1890	14.8846	0.2437
15.6049	0.2134	15.5909	0.2759
16.3120	0.2377	16.2965	0.3083
17.0198	0.2591	17.0028	0.3407
17.7275	0.2835	17.7090	0.3733
18.4352	0.3078	18.4153	0.4059
19.1429	0.3322	19.1215	0.4387
19.8500	0.3597	19.8272	0.4715
20.5578	0.3871	20.5334	0.5044
22.7415	0.4023	22.7160	0.5232
24.4059	0.4206	24.3792	0.5487
24.6012	0.4450	24.5735	0.5874
24.7967	0.4694	24.7679	0.6265
24.9922	0.4968	24.9624	0.6659

Wp	Yc	TopWidth	Energy
(m)	(m)	(m)	(m)
25.1878	0.5212	25.1568	0.7056
25.3831	0.5300	25.3511	0.7455
25.5786	0.5300	25.5456	0.7857
25.7741	0.5300	25.7400	0.8261

URBANTECH®

LID MITIGATION - ETOBICOKE CREEK

Project Name: Alloa Phase 1 Tertiary Plan	Prepared by: A.V.G.
Municipality: Town of Caledon	Checked by: K.R.
Project No.: 20-665	Submission: 1
Date: 09/16/2024	

ID	Area (ha)	ROW Length (m)	# Soil Cells*	Cell Type	Unit Volume (m^3 / cell)	Volume (m^3)
ROW14	0.78	110	80	2x	0.714	57
		189	137	3x	0.995	136
ROW15	0.79	123	89	2x	0.714	64
		239	174	3x	0.995	173
ROW16-1	0.27	31	22	2x	0.714	16
		93	67	3x	0.995	67
ROW17-1	0.12	50	36	2x	0.714	26
ROW2	0.29	205	149	3x	0.995	148
ROW21	0.15	35	25	2x	0.714	18
		35	25	3x	0.995	25
ROW24	0.35	173	126	3x	0.995	125
ROW25	0.35	172	125	3x	0.995	124
ROW26	0.50	223	162	3x	0.995	161
ROW27	0.49	226	164	3x	0.995	163
ROW28	0.16	75	54	3x	0.995	54
ROW3	0.35	192	139	3x	0.995	138
ROW4	0.35	44	32	2x	0.714	23
		148	107	3x	0.995	106
ROW6	0.45	188	137	3x	0.995	136
					Total	**1823**

*based on unit length of 48" and 6" spacing

ID	Area (ha)	Retention Depth (mm)	Volume (m^3)
IT2	2.36	5	118
IT3	0.54	5	27
IT4	0.75	5	38
IT5	2.22	5	111
SCHOOL 1	2.43	1.5	36
		Total	**330**

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urbantech.com

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LID MITIGATION - FLETCHER'S CREEK

Project Name: Alloa Phase 1 Tertiary Plan
Municipality: Town of Caledon
Project No.: 20-665
Date: 09/16/2024

Prepared by: A.V.G.
Checked by: K.R.
Submission: 1

ID	Area (ha)	ROW Length (m)	# Soil Cells*	Cell Type	Unit Volume (m^3 / cell)	Volume (m^3)
ROW5	0.43	131	95	3x	0.995	95
ROW8	0.05	25	18	3x	0.995	18
ROW9	0.24	134	97	3x	0.995	97
ROW10	0.13	70	51	3x	0.995	51
ROW11	0.17	75	54	2x	0.714	39
		68	49	3x	0.995	49
ROW12	0.12	87	63	3x	0.995	63
ROW13	0.25	109	79	2x	0.714	56
		97	70	3x	0.995	70
ROW16-2	0.21	97	70	3x	0.995	70
ROW17-2	0.44	31	22	2x	0.714	16
		155	113	3x	0.995	112
ROW18	0.19	43	31	2x	0.714	22
		43	31	3x	0.995	31
ROW19	0.29	123	89	3x	0.995	89
ROW20	0.33	45	32	2x	0.714	23
		106	77	3x	0.995	77
ROW22	0.41	41	29	2x	0.714	21
		147	107	3x	0.995	106
ROW23	0.11	49	35	2x	0.714	25
ROW29	0.1	42	30	2x	0.714	21
ROW30	0.06	25	18	2x	0.714	13
ROW31	0.15	63	45	2x	0.714	32
					Total	**1220**

*based on unit length of 48" and 6" spacing

ID	Area (ha)	Retention Depth (mm)	Volume (m^3)
IT1	2.26	5	113
OS1	3.5	0.96	34
OS2	4.7	0.96	45
OS3	4.64	0.96	45
OS4	9.72	1.73	168
OS5	2.93	1.73	51
SCHOOL 3	3.24	0.64	21
SCHOOL 3	3.25	0.64	21
		Total	**497**

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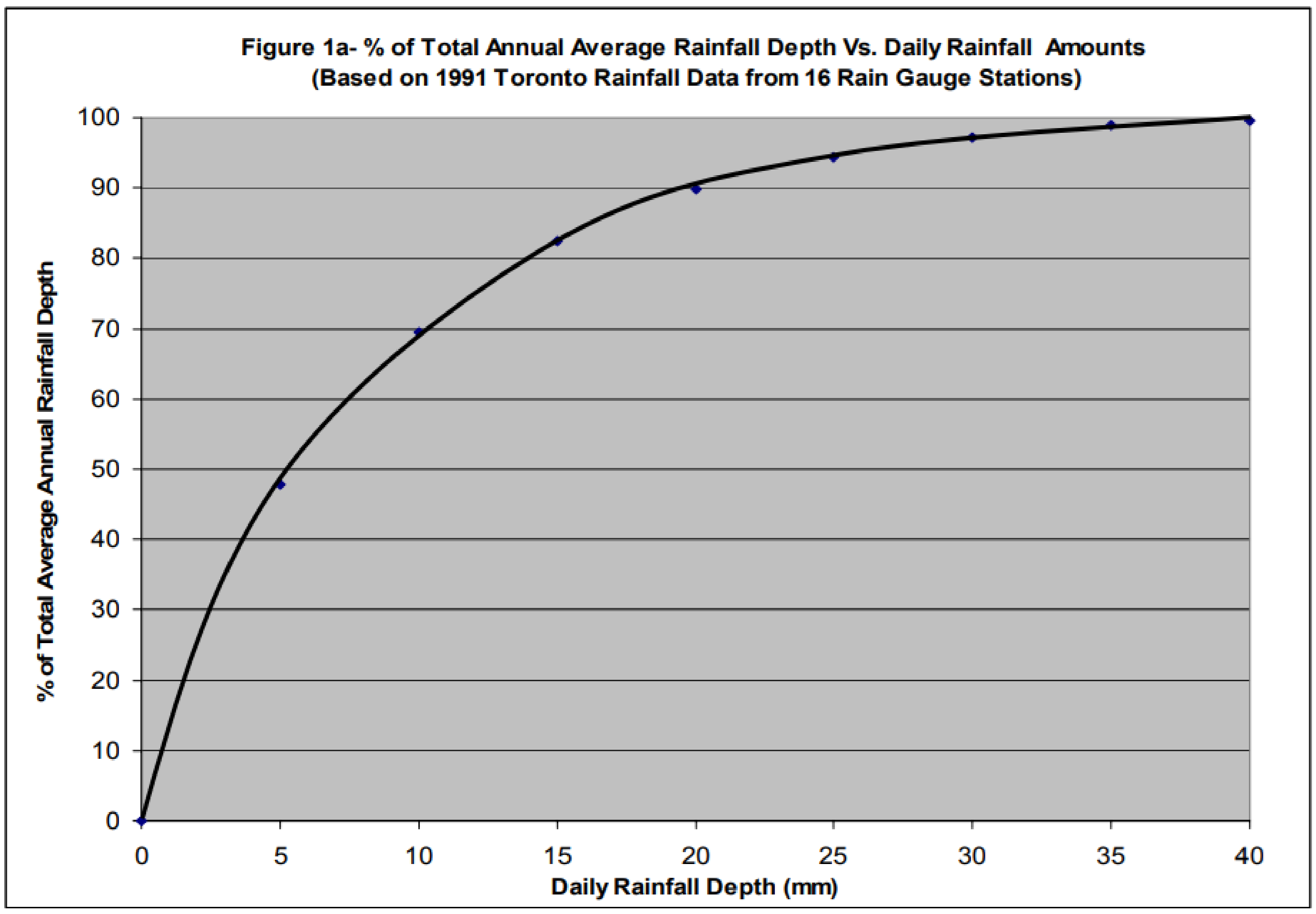
WATER BALANCE TARGETS - ETOBICOKE CREEK

Project Name: Alloa Phase 1 Tertiary Plan
Municipality: Town of Caledon
Project No.: 20-665
Date: 09/16/2024

Prepared by: A.V.G.
Checked by: K.R.
Submission: 1

Land Use	TIMP (%)	XIMP (%)	GWI - Post-Dev (mm)	GWI - Pre-Dev (mm)	GWI - Deficit (mm)	Annual Precipitation (mm)	% Annual Precip	Target Retention (mm)
Detached	50	25	102	202	99	826	12%	1.0
Townhouse / Med-High Density	80	67	44	202	157	826	19%	1.5
School	75	75	36	202	165	826	20%	1.5
Roads	90	90	14	202	187	826	23%	2.0



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LAND USE BREAKDOWN - ETOBICOKE CREEK
Site Water Balance

URBANTECH®

Project Name: Alloa Phase 1 Tertiary Plan
Municipality: Town of Caledon
Project No.: 20-665
Date: 09/16/2024

Prepared by: A.V.G.
Checked by: K.R.
Submission Number: 1

		Land Use Composition									
		Detached		Townhouse		Medium - High Density		Elementary School		Roads	
		Infiltration Target = 1.0 mm/ha		Infiltration Target = 1.5 mm/ha		Infiltration Target = 1.5 mm/ha		Infiltration Target = 1.5 mm/ha		Infiltration Target = 2.0 mm/ha	
Drainage ID	Drainage Plan Area (ha)	% of Drainage Area	Infiltration Target (m^3)	% of Drainage Area	Infiltration Target (m^3)	% of Drainage Area	Infiltration Target (m^3)	% of Drainage Area	Infiltration Target (m^3)	% of Drainage Area	Infiltration Target (m^3)
107107	15.20	35%	53	15%	35	0%	0	0%	0	40%	121
125132	25.57	20%	51	24%	92	0%	0	0%	0	34%	174
1107	40.31	28%	114	9%	55	7%	44	6%	37	31%	248
125	52.32	30%	158	14%	113	0%	0	0%	0	44%	462
132	26.70	8%	22	17%	69	8%	32	0%	0	39%	207
11073	2.06	38%	8	18%	5	0%	0	0%	0	42%	17
10710	0.62	100%	6	0%	0	0%	0	0%	0	0%	0
12541	0.44	86%	4	0%	0	0%	0	0%	0	0%	0
13241	0.42	100%	4	0%	0	0%	0	0%	0	0%	0
1324	3.98	18%	7	43%	26	0%	0	0%	0	39%	31
1321	1.56	0%	0	0%	0	0%	0	0%	0	100%	31
TOTAL	**169.18**	**25%**	**428**	**16%**	**395**	**3%**	**76**	**1%**	**37**	**38%**	**1291**

Total Volume Target = 2226 m^3

APPENDIX E
HYDRAULIC MODELLING & RESULTS

Model Files – 1D Model, 2D Model, Hydrology Model (***Provided Separately***)

APPENDIX F
BACKGROUND REPORTS & STUDIES

Fluvial Geomorphology Assessment and Conceptual Natural Corridor Designs, Alloa Secondary Plan – Phase 1 Lands (GeoMorphix)

Erosion Mitigation Assessment, Alloa Secondary Plan – Phase 1 Lands (GeoMorphix)

Provided Under Separate Cover