TOWN OF CALEDON
PLANNING
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FUNCTIONAL SERVICING REPORT

CALEDON STATION SECONDARY PLAN

TOWN OF CALEDON

REGION OF PEEL

PREPARED FOR
CALEDON COMMUNITY PARTNERS

Urbantech File No.: 15-458

1ST SUBMISSION – FEBRUARY 2021
2nd SUBMISSION – MAY 2023

DISCLAIMER

The content in this document as it relates to areas outside of the Caledon Station Secondary Plan (CSSP) area, is provided for contextual purposes and shall not predetermine the design or form of development within the other expansion areas. The consideration of land uses outside of the CSSP is beyond the scope of this report and is subject to the completion of additional studies and review.

No commitment or guarantee in the timing for parties to undertake or participate in processes outside of the CSSP is implied by this report.

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1.0 INTRODUCTION

1.1 Study Purpose

Urbantech Consulting was retained by the Community Partners to prepare a Comprehensive Environmental Impact Study and Management Plan (CEISMP) in support of a Secondary Plan for Caledon Station in Bolton, Ontario.

The Caledon Station Secondary Plan (CSSP) lands (herein referred to as the “Subject Lands”) include approximately 182 hectares (450 acres) of land generally located north of King Street, east of The Gore Road and west of the CP Railway tracks (**Figure 1**). The Subject Lands are predominantly agricultural with natural heritage features limited to headwater drainage features and non-provincially significant wetlands that are concentrated in the southwestern portion of the Subject Lands.

The Subject Lands are entirely within the Region of Peel’s Urban Area (ROP, Nov 2022) with the eastern portion of the Subject Lands being within the Region’s Major Transit Station Area (MTSA). As well, the Subject Lands are currently part of the Caledon Station Secondary Plan process (POPA-2021-0002). The effect of the Secondary Plan will be to apply land use designations to the Subject Lands, including Low Density Residential, Medium Density Residential, Mixed Use, Institutional, Open Space Policy Area. The subject Draft Plan of Subdivision and Zoning By-Law Amendment for the Subject Lands will ensure the creation of a compact, pedestrian and transit-oriented development through implementation of the Secondary Plan policies.

It is also important to note that on March 5, 2021, the Province of Ontario issued a Ministerial Zoning Order (‘MZO’) under Ontario Regulation 171 / 21 (‘O. Reg. 171 / 21’) for the eastern portion of the Subject Lands. This MZO established zoning for the eastern portion of the Subject Lands as a ‘Mixed Use Residential Zone’. This Zone permits a range of detached, semi-detached and townhouse dwellings as well as a range of mid-rise residential and commercial uses.

This FSR is intended to synchronize the environmental objectives described in the Comprehensive Environmental Impact Study and Management Plan (CEISMP) with the grading/servicing approach for the CSSP lands in support of the **Preliminary Framework Plan** as illustrated on **Drawing 102**.

This FSR is a community-wide, high level document intended to identify the development constraints, SWM targets and site serviceability, while providing guidance to the future Draft Plans and supporting studies. As such, this FSR will not be further revised to address potential minor revisions to the local road networks that may arise from the review of the individual Draft Plans. It will be the responsibility of the individual landowners to comply with the overall *intent* of the grading and servicing presented herein. Should individual Draft Plans deviate considerably from the road network presented herein, documentation will be provided to demonstrate how they will adhere to and respect the overall development constraints and servicing targets.

It was agreed with the Town of Caledon, Region of Peel, and TRCA staff that a comprehensive Functional Servicing Report coordinated with the CEISMP would be acceptable to support the

Draft Plan applications within the CSSP lands. This FSR is intended to demonstrate how the Draft Plans in CSSP will be developed to meet the requirements of the Secondary Plan and supporting studies. It has been also acknowledged by the Region, Town and Agencies that external infrastructure (outside of CSSP limit) will be required to support the entire CSSP development, as well as future growth within neighbouring development areas. The external infrastructure includes SWM Pond 2B, watermains and sanitary sewers.

The CSSP lands are approximately 182 hectares (450 acres). They include approximately 10.81 hectares (26.71 acres) of environmental policy areas (EPAs) and 1.37 hectares (3.39 acres) of proposed road widenings (not including internal roads). The net developable area is approximately 170 hectares.

This FSR includes the following information:

- Discussion on the existing drainage conditions.

- Demonstration of how the CSSP lands will integrate the Caledon Station community, with development limits and CEISMP Environmental Policy Areas (EPAs), into the surrounding environment.

- Documentation of the required infrastructure as it relates to grading, storm sewer, stormwater management (SWM),sanitary sewer, and water supply for CSSP, with consideration for future development outside of the community.

The CEISMP document has been coordinated with this FSR and it describes the environmental components/constraint mapping, impact assessments, mitigation strategies, and adaptive management / monitoring plan. While both documents are required in support of Draft Plan approval, they have been written such that they can be reviewed independently. The FSR and CEISMP documents have been informed, and iteratively re-designed by the preceding background studies that specified land-use patterns, a transportation network and an EPA. The goal of these studies has been to achieve superior, efficient, orderly and ecologically responsible urban development. The overall design follows applicable policies, guidelines and design criteria. Further, it set out the planning controls to be used in implementing these policies. This FSR is prepared in conformance with the requirements of the Municipal Class Environmental Assessment.

1.2 Study Area

The CSSP study area boundaries and land ownership are shown on **Drawing 101**.

The CSSP lands are located within two watersheds as set out on **Drawing 201**.

- West Humber River - The majority of the CSSP lands west of Humber Station Road are within this watershed.
- Main Humber River – The majority of the CSSP lands east of Humber Station Road are within this watershed. A portion located west of Humber Station Road toward the north end of CSSP is also located within the Main Humber River.

1.3 Preliminary Framework Plan

The CEISMP and FSR documents are based on CSSP development concept plan prepared by Gerrard Design. Refer to **Drawing 102, Preliminary Framework Plan.** The plan is supported by these studies and it is recognized that through the agency review of the CEISMP and FSR, additional revisions to future individual Draft Plans may be required.

As illustrated on **Drawing 102**, a number of major structural elements define the CSSP community, including:

- Development of the Caledon GO station on the east flank of the community will be the centerpiece of the community's transit infrastructure, as well as a focus for active transportation modes. The station will support:
    - GO bus services such as the existing Bolton service, from the on-site bus terminal;
    - Future GO Rail service determined to be feasible by Metrolink in their report, "Bolton Commuter Rail Service Feasibility Study";
    - Anticipated additional bus connections established by Brampton Transit, as the community develops; and
    - Opportunity for the Town of Caledon to establish local bus service.

- A logical hierarchy of collector and local roads the provide:
    - Internal movement in a manner that is supportive of non automobile modes of transportation;
    - Appropriate connectivity to the existing higher order road network;
    - Convenient access to the significant transit facilities centred on the future GO station.

- Key features of the above transportation hierarchy include:
    - A Multi-Modal Mobility Ring Road providing direct access to the GO station transit hub and carrying automobiles, internal transit vehicles and including a dedicated 2-way cycle track and double sidewalks;
    - An east-west Central Promenade connected to the GO station transit hub taking the form of a green corridor including a central active transportation spine with support for road cycling in shared lanes; and
    - An east-west collector connection proposed to connect the community to Emil Kolb Parkway.

- An Environmental Policy Area (EPA) that identifies, protects, restores and enhances the diversity and connectivity of natural areas and features;

- A variety of housing types and densities, including commercial and institutional developments in strategic locations;

- Commercial - Mixed-use node located near proposed GO station, adding support for compact urban forms of housing, retail, commercial, office, as well as live-work units; and,

- Community uses and features including three elementary schools, and a community park.

1.4 Background Studies

The CEISMP and FSR are intended to provide a further level of detail to implement findings and recommendations of several background studies listed below. In this instance, this FSR addresses findings and recommendations from the following studies and guidelines:

- **Ministry of the Environment, Conservation and Parks** (MECP, formerly Ministry of the Environment, MOE), Stormwater Management Practices, Planning and Design Manual, March 2003.
- **Region of Peel** and **GM BluePlan Engineering**, 2020 Water & Wastewater Master Plan for the Lake-Based System, Volumes 1 to 5.
- **Region of Peel, Public Works**, Design, Specifications and Procedures Manual – Watermain Design Criteria, June 2010.
- **Region of Peel, Public Works**, Linear Wastewater Standard, March 2023.
- **R.J. Burnside & Associates Limited**, Technical Memorandum, Bolton Option 3 Lands Preliminary Water Modelling, May 2023.
- **DS Consultants**, Preliminary Geotechnical Investigation,, The Gore Road & King Street, November 2022
- **DS Consultants Ltd.**, Report On: Preliminary Hydrogeological Investigation, Prepared For: Bolton Option 3 Landowners Group, May 2023.
- **Toronto and Region Conservation Authority (TRCA)** and **Civica Infrastructure Inc.**, Final Report, Humber River Hydrology Update, April 2018.
- **Toronto and Region Conservation Authority (TRCA)**, Humber River Watershed Plan, Pathways to a Healthy Humber, June 2008.
- **Toronto and Region Conservation Authority (TRCA)**, Stormwater Management Criteria, August 2012.
- **Town of Caledon**, Development Standards Manual, Version 5.0, 2019.

1.5 Study Team

Members of the study team involved in the preparation of the CEISMP/FSR documents and their respective disciplines are listed below:

Beacon Environmental Limited	Ecology Fluvial Geomorphology	CEISMP
DS Consultants Ltd.	Geotechnical Hydrogeology	FSR
Gerrard Design	Land Use Design	FSR
R.J Burnside & Associates Ltd.	Water Distribution	FSR
Glenn Schnarr & Associates Inc.	Planning	CEISMP/FSR
NAK Design Strategies	Land Use Design	FSR
Urbantech Consulting	Municipal Design Water Resources Group Engineering	FSR

2.0 EXISTING CONDITIONS

2.1 Comprehensive Environmental Impact Study and Management Plan

A detailed characterization of the existing conditions has been addressed in the Comprehensive Environmental Impact Study and Management Plan (CEISMP). The purpose of the CEISMP is to provide a detailed description and background review of the physical and ecological characteristics of the environmental policy area features from the subject lands including their functions, significance, and sensitivity. The CEISMP addresses potential impacts to these features and outlines how impacts can be minimized or mitigated.

The CEISMP includes discussion on the following with respect to existing conditions:

- Landform / topography
- Soils / Geology
- Existing erosion sites
- Hydrogeology
- Characterization of surface drainage features and associated geomorphology
- Vegetation assessment
- Wildlife / Terrestrial and Aquatic resources
- Species at Risk and Species of Concern
- Areas of Natural and Scientific Interest / Environmentally Significant Areas
- Provincially Significant Wetlands
- Biophysical environment analysis including evaluation of significant and sensitive features and functions and feature-based water budgets.

The CEISMP document has been submitted under separate cover.

2.2 Existing Drainage

The CSSP lands are situated at the approximate drainage divide between the West Humber River and Main Humber River watersheds. **Drawing 201** illustrates existing drainage patterns and subcatchments within the CSSP and immediate surrounding area. It is noted that the pre-development conditions provided by TRCA, including the subcatchment drainage boundaries within the West Humber and Main Humber watersheds intersected by CSSP, have been refined on **Drawing 201** from recent topographic surveys carried out locally to clarify flow paths, drainage boundaries and outlets.

The majority of the CSSP lands consisting of the west, central and southeast portions is within the West Humber River watershed. These portions consist mainly of some minor headwater features that convey runoff from various West Humber subcatchments that intersect the study area toward culverts along King Street and Humber Station Road. A group of wetlands is located just northeast of the intersection of King Street West and The Gore Road. The wetlands have been evaluated and were determined to be not provincially significant.

The northeast portion of the CSSP lands is located within the Main Humber River watershed. This portion consists mainly of some minor headwater features that convey runoff from the intersected Main Humber headwater subcatchments toward the Canadian Pacific Railway (CPR) line.

CEISMP **Figures 3.2.5.2a/b** illustrate the drainage features and CEISMP **Figure 4.8.1** illustrates the constraints and opportunities, within the study area.

The land use with the CSSP limits is predominantly agricultural, which has led to modification of the headwater features by farming activities. In general, the headwater features are poorly defined with ephemeral or intermittent flow.

Table 2-1 identifies the existing drainage outlets for the CSSP study area represented on **Drawing 201** and the respective contributing drainage areas.

Table 2-1 Existing CSSP Drainage Outlets

Outlet	Existing Drainage Area [ha]
West Humber River Outlet / Flow Node	
Node E4, 3.50 m Wide Concrete Box Culvert at The Gore Road	571.36
Total West Humber River Drainage Area at The Gore Road Crossing	**571.36**
Main Humber River Outlets	
Node 6, 800 mm Concrete Box Culvert Across CPR	18.80
Node 7, 500mm CSP Culvert Across CPR	2.78
Node 8, 2 x 700 mm Concrete Box / CSP Culverts Across CPR	19.00
Total Main Humber Drainage Area Within CSSP	**40.58**

Under proposed conditions, southeasterly drainage within CSSP, west of Humber Station Road, will be consolidated to a single outlet at the existing Humber Station Road crossing at Node 5. The consolidation to Node 5 includes drainage that contributes to Node 4 under existing conditions, from private property within the CSSP lands. Consolidation is not proposed for three (3) King Street crossings at the southwest of CSSP (i.e. Nodes 1, 2 and 3), in order to maintain drainage conditions for the wetland features.

There are three (3) minor headwater reaches within the Main Humber River consisting of three (3) culverts across the Canadian Pacific Railway (CPR) line. The existing and proposed conditions to each culvert have been evaluated in **Section 6**.

Refer to **Section 5** for the discussion regarding existing versus proposed drainage outlets.

External Drainage

In terms of external drainage, a ~79 ha area within the West Humber River watershed north of the CSSP lands that drains from northwest to southeast via an ephemeral swale into the CSSP lands as shown on **Drawing 201**. This external area is represented by Catchments 37.12A, 37.12B, 37.12C and 37.12D draining to Node 9. This includes drainage beginning from west of The Gore Road.

2.3 Headwater Drainage Feature Assessment

The CSSP lands are situated in the headwaters of the West Humber River and the Main Humber River and supports a number of surface drainage features, as shown in CEISMP **Figure 3.2.5.2a**, prepared by Beacon Environmental. Beacon has identified and assessed headwater drainage features (HDFs) in accordance with TRCA policies. The identification and assessment methods are further described in the CEISMP.

Figure 3.2.5.2b prepared by Beacon Environmental illustrates HDF assessment reaches and associated management recommendations. The following sections summarize the CEISMP HDF reaches by management classification.

No Management Required

The majority of the HDF reaches assessed within the Subject Lands were characterized as actively farmed, poorly defined features. These reaches provide limited hydrologic functions and do not provide aquatic or terrestrial habitat. In accordance with the TRCA (2014) Guidelines, these reaches have been identified as ‘No Management Required’.

Mitigation

All of the HDF reaches assessed east of Humber Station Road (draining to the main Humber River) were classified as mitigation. These features were characterized as providing surface drainage to downstream fish habitat, with meadow vegetation within riparian communities.

HDF assessment results for Reach WHT6-D determined that, given the enclosed (historical tile drainage) nature of this feature, it currently functions to provide surface drainage (valued hydrology) to downstream reaches. Similarly, WHT6-G and WHT6-H were presumed to have been subject to historical tile drainage. In accordance with the TRCA (2014) Guidelines, these reaches have been identified as ‘Mitigation”.

Conservation

Reaches WHT1-A through WHT1-F, WHT2-A, WHT2-B and WHT2-F, WHT3-A and WHT3-B, WHT6-B and WHT6-C all had valued or contributing hydrology with wetland riparian vegetation. Breeding amphibians were recorded in the WHT2-A meadow marsh. A management classification of “Conservation” is recommended for these reaches (marshes with amphibian breeding habitat).

Protection

Reach WHT6-A was identified as “Protection” based on the presence of flow during the June 8, 2020 sample event (important hydrology), presence of breeding amphibian habitat and wetland riparian vegetation.

Geomorphologic Considerations

The CEISMP has confirmed that all the hydrologic features within the CSSP lands are HDFs and most would not be considered watercourses due to the absence of a defined channel. The few HDFs that do exhibit a channel form lack the regular flows that could result in lateral channel migration. Consequently, it is our opinion that a fluvial geomorphic assessment of stream bank erosion, aggradation and channel migration is not warranted and that the HDF assessment has effectively characterized the relationship between hydrology, geomorphology and aquatic resources for the purposes of this study.

Meander Belt Considerations

In general, watercourses with drainage areas less than one square kilometer (100 hectares) do not generate sufficient hydraulic energy to initiate migration and the associated risk of potential erosion for property and infrastructure (TRCA 2015). Typically, these watercourses are vegetation controlled. Due to the poorly defined, vegetated nature of the HDFs within the CSSP lands, and overall lack of evidence of active geomorphic processes (i.e., erosion, aggradation or migration), it is our opinion that the regulatory floodline represents a more appropriate tool for delineating the watercourse hazard limit for applicable hydrologic features within the Study Area.

2.4 Existing Floodplain

The Humber River Hydrology Update (TRCA 2018) developed a hydraulic model for the Main and West Humber Rivers. The HEC-RAS hydraulic model was obtained from the TRCA in August 2020 to assess the existing conditions and Regulatory Floodplain within the CSSP lands.

For the CSSP FSR, Urbantech Consulting extended the 2018 existing model northwest towards Gore Road to represent headwater features that drain 75.6 hectares of external catchments north of the CSSP lands. Topographic LiDAR data with a resolution of 0.5m was obtained to generate a high-resolution terrain model for the model updates. The following updates to the 2018 TRCA model were completed:

- Extension of the West Humber (WH-37) approximately 1200 m northwest, beyond the CSSP lands boundary.
- Creation of approximately forty (40) new cross-sections at 50 m intervals along the extended West Humber reach. The LiDAR terrain model generated detailed channel and floodplain geometry for the new cross-sections.
- Addition of four (4) significant existing road crossings to the model, including Humber Station Road and King Street West. Invert data was applied from topographic survey data collected by JD Barnes in 2020. The characteristics and dimensions of the existing culverts in the vicinity of the CSSP are included in **Table 2-2**.

Table 2-2: Road Crossings Added to Existing Model

ID#	Right-of-Way | Node ID	Type	Opening Dimension	Length (m)	U/S Invert (m)	D/S Invert (m)
HS5	Humber Station Road | Node 5	CSP	1350 mm Dia.	18.9	262.83	262.65
K8	King Street West | Node E5	CSP	1800 mm Dia.	23.0	262.28	262.30
HS7	Humber Station Road | Node E6	Twin PVC	2 x 750 mm Dia.	14.8	256.68, 256.67	256.67, 256.63
G3	The Gore Road | Node E4	Conc. Box	3.5 m Wide	38.9	245.82	245.89

The existing model updates also involved flow updates based on the hydrology modelling outlined in **Section 6.0** and **Appendix 4** of this report. **Table 2-3** summarizes the flows and contributing areas to each cross-section for the existing model.

Table 2-3: Existing Model Flows

HECRAS XS ID	VO6 ID | Node ID	Drainage Area [ha]	Flow (m^3/s)						
			2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	Reg.
5139	**NYHD 96 | Node E1**	44.04	0.07	0.13	0.88	1.12	1.30	1.48	3.39
4397.62	**NHYD 3 | Node 9**	78.77	0.08	0.16	1.11	1.41	1.64	1.87	4.95
3459.49	**NHYD 79 | Node 5-2**	135.77	0.12	0.23	1.65	2.10	2.45	2.79	7.76
3129.04	**NYHYD 106 | Node 5-1**	145.27	0.13	0.26	1.75	2.24	2.62	3.00	8.44
3022.08	**NHYD 18 | Node 5**	163.59	0.16	0.30	2.03	2.60	3.04	3.49	9.71
2721.34	**NHYD 35 | Node E5**	170.05	0.16	0.31	2.08	2.67	3.13	3.60	10.12
2027	**NHYD 56 | Node E6**	194.43	0.18	0.34	2.31	2.96	3.46	3.97	11.29
1610.08	**NHYD 86 | Node 13**	209.86	0.18	0.35	2.35	3.31	3.54	4.08	12.00
1257.87	**NHYD 55 | Node 12**	324.85	0.34	0.66	4.03	5.24	6.19	7.11	20.64

Drawing 202 presents the existing conditions Regional Storm floodplain based on the updated model. This Regional Storm has been used to delineate the Regulatory Floodplain within the CSSP lands. The detailed HEC-RAS output is included in **Appendix 2**.

3.0 PROPOSED GRADING & ROADS

3.1 Grading Constraints and Objectives

The following grading constraints were taken into consideration in the development of the grading plans for the CSSP lands.

- The existing grades of King Street, a portion of Humber Station Road, The Gore Road and the CPR line establish the boundaries of the overall development grading.
- Accommodation of existing drainage patterns for lands north of CSSP.
- Compatibility of future road extensions into lands north and east of the CSSP.
- Maintenance of existing ground elevations in the vicinity of natural features that are to be preserved to provide appropriate buffering.

The site grading has been designed in consideration of the following objectives:

- Match existing boundary grading conditions/constraints.
- Conform to Town standards (where feasible).
- Maintain drainage patterns in / out of the natural areas.
- Maintain the overall West Humber River and Main Humber River watershed drainage boundaries, where possible.
- Provide overland flow conveyance for major storm conditions.
- Optimize cut and fill operations and work towards minimizing import/export.
- Maintain appropriate cover over buried utilities.
- Accommodate the proposed lot grading based on preliminary land use concepts in accordance with the Town standards.

3.2 Preliminary Grading Design

The preliminary grading design for the CSSP lands is depicted on **Drawings 301 to 304**. The grading plans present proposed road centerline elevation and slopes, existing surface contours, and the direction of overland flow paths. Lot specific grading is not presented at this point. The following sections describe critical elements of the grading design.

3.2.1 Compatibility with EPAs

The site is constrained by various natural wetland features as depicted on **DWG 303.** The wetlands are to be maintained and are subject to a 10.0 m buffer. Grading adjacent to the wetlands will be designed to match existing elevations at the buffer limits. In some circumstances, grading within the buffer may be required to blend lot/street grades with natural elevations to avoid retaining walls adjacent to buffers. Where grading in the buffers is proposed, appropriate measures will be undertaken to restore any disturbed buffers to a natural state.

Lot grading adjacent to buffers will be designed to promote the discharge of clean roof and rear yard runoff to the wetland features to aid in satisfying feature-based water balance objectives.

In addition to grading adjacent to buffers, there are circumstances where infrastructure is proposed to cross or encroach on buffers/EPA lands. In areas where infrastructure impacts buffers, restorative measures will be undertaken to the satisfaction of the agencies.

3.2.2 Road Centerline Gradients

The preliminary grading design general conforms to the Town design standard of maintaining a minimum of 0.75% centerline road gradient with a few noteworthy exceptions.

To mitigate cuts and fills and impacts on neighboring properties some saw-toothed grading is proposed and some road gradients have been set at 0.5%. The locations of these grading constraints are indicated on the Grading drawings.

3.2.3 Park Grading

The park that is situated in the southwest quadrant of the plan will be graded in such a way to maintain surface flows to adjacent wetlands to replicate in part predevelopment flows to the wetlands. See Section 7.0 for additional discussion regarding feature-based water balance.

Channel Corridor

The CSSP includes an open space channel situated in the southeastern portion of the plan as shown on **Drawing 304**. The channel has the following characteristics.

- Max 3:1 side slope.
- Includes a 5.0 m wide flat shelf at the east side for a 3.0m wide trail.
- Provides Regional flood conveyance.
- Provides an outlet for CWC pipe that drains land north of the CSSP area.
- Sized to provide wetland compensation of 1.27 ha.

3.2.4 *Ponds*

The proposed SWM facilities impose boundary conditions on the grading design. The permanent pool elevations for the SWM facilities were fixed based on the receiving outlet elevations as follows:

- SWM Pond 1 – (PP=263.00) based on the proposed elevation (262.70) of the new channel corridor immediately upstream of Humber Station Road.
- SWM Pond 2A (PP261.00) – based on the existing inlet elevation (260.70) of an 800 mm culvert situated on the north side of King Street 280m east of the Gore Road.
- SWM Pond 2B (PP 257.50) – based on the elevation (257.00) of the existing watercourse adjacent to the southwest corner of the pond.

Starting storm sewer inverts have been set at permanent pool elevations. Refer to pond **Drawings 601** and **602**A/B for conceptual pond grading.

3.2.5 Overland and Emergency Flow Routes

The roads have been graded (where practical) to ensure continuous drainage of major system flows towards the SWM facilities. In general, the major system drainage is directed overland to the SWM ponds. The major system will operate in the event of a minor system blockage or when the minor system capacity is exceeded in extreme rainfall events.

Additionally, each pond has been designed with an emergency spillway that will operate in the event of an outlet blockage. The emergency outlets for the ponds exit to the following watercourses:

- Pond 1: New Open Space channel
- Pond 2A: Wetland 4 upstream of King Road
- Pond 2B: A tributary of the West Humber River

3.2.6 Uncontrolled Flows

Portions of site will flow uncontrolled due to grading constraints and feature based water balance objectives. These areas are as follows:

- Piped flows to wetlands from select rear yards.
- The park situated in the southwest quadrant of the site.
- Surface flows to wetlands (rear yards adjacent to Natural Areas or the New Open space channel).

The storm drainage design accounts for the release of uncontrolled flows from the above areas by overcontrolling pond outflows.

3.3 Earthmoving

Development of the CSSP lands will necessitate the movement of significant amounts of earthen material. The primary objectives of the earthmoving designs are:

1. To minimize cuts.
2. To minimize haul distances.
3. To minimize import/export.

As draft plans are advanced, the conceptual grading design shown on Drawings 301 to 304 will be further refined to achieve the above objectives. It is likely that no single parcel of land will balance, as such, collaboration between landowners will be required to share cuts and fills.

Through the subsequent preparation of the development staging / phasing plans, the cut-fill areas will be further discretized to coordinate the earthworks program between individual owners.

3.4 Roads

The internal road design and proposed Right-of-Way (ROW) widths are shown on **Drawing 102**. Refer to the Road Hierarchy Plan and road cross sections prepared by NAK. Select details of special road cross sections with LID measures and civil infrastructure are provided on **Drawing 305.**

The community will be structured by a well-ordered and fine grain street hierarchy that will appropriately integrate transit connections, various densities and building types, support an expansive walking and cycling network throughout the community and achieve efficient block development.

The character of the streets will vary depending on the function and adjacent land uses proposed in Caledon Station. Minimum street ROW widths are reinforced, and alternative road standards are considered to ensure the best response to balancing pedestrian, cycling, stormwater objectives, transit and vehicular use and promoting easy circulation within the community. Design influences from shared streets or 'woonerfs' will be encouraged, where appropriate, to reinforce pedestrian comfort, provide unique streetscape opportunities, and achieve a reduction in ROW widths.

4.0 Environmental Policy Areas

The Preliminary Framework Plan**, Drawing 102,** has provided Environmental Policy Areas (EPAs) to protect the environmental features identified in the CEISMP. The CEISMP document describes the proposed EPA restoration and ecological / fluvial geomorphologic design considerations.

4.1 Southern Natural Heritage System

The southern natural heritage system is anchored by three tributary systems of the West Humber River (WHT1, WHT2 and WHT3). Associated with these tributaries are a complex of wetland communities W1 to W6). These wetlands are comprised mainly of mineral soil-based reed canary grass and cattail marshes, shallow aquatic wetlands associated with a dug pond, and a couple organic soil-based marsh and swamp communities. Most of these wetland communities are sustained by surface water, however there is evidence to suggest that some are seasonally sustained by groundwater discharge. These groundwater inputs contribute to baseflows along Tributary WHT1 and contribute to more perennial flows and cooler stream temperatures. For this reason, this tributary and its associated wetlands have been identified as fish habitat as well as potential contributing habitat for endangered Redside Dace that are known to occur downstream of the study area.

Protection of EPA features and their ecological functions can be achieved by:

- Prohibiting development and site alteration within the EPA features except where alteration may benefit the ecological function of the features;
- Maintaining the existing water balances of the EPA features to the extent feasible, by implementing the recommendations in the SWM Management Plan and LID Management Plan;
- Applying an appropriate buffer to the limits of the staked wetland features; and
- Designating the features and associated buffers as EPAs.

Maintenance and enhancement of the ecological integrity of the EPA features and their ecological functions is further described in the CEISMP. The feature-based water balance assessment for the EPAs is provided in Section 7.

4.2 Tributary WHT6 Enhanced Corridor / Greenway

A conceptual plan was developed for the WHT6 tributary corridor/greenway to confirm that the corridor has been sized appropriately on the Land Use Plan and Preliminary Framework Plan and can meet the following design objectives:

- Conveyance of the Regional Storm.
- Sinuous low flow channel.
- Run, riffle, and pool habitats.
- Low gradient profile to promote wetland establishment.
- Wetland habitat area equivalent to that of wetlands removed.
- 2.5H:1V – 3H:1V (horizontal to vertical) side slopes.

- 2-3 m wide trail system between the top-of-slope and the corridor boundary, on one side.

As the proposed Tributary WHT6 corridor/greenway will be newly created, the protection requirements applied to it are different from that applied to existing natural heritage features and systems. For example, buffers are typically applied to existing natural heritage features to mitigate the effects of intruding new land uses or new stressors to adjacent lands, however in this case, the corridor is being constructed at the same time as the rest of the development and therefore does not necessitate a buffer as no new land uses or stressors are being introduced. Therefore, the focus of protection efforts has focused on measures that can be applied to retaining the biodiversity of the existing wetland features that will be relocated within the new corridor.

The methodology of the Tributary WHT6 corridor design for achieving protection, maintenance and enhancement of habitats, biodiversity and ecological functions is further described in the CEISMP.

Typical channel cross sections for the Tributary WHT6 Enhanced Corridor / Greenway are provided on **Drawing 401**.

4.3 Infrastructure Crossings of EPAs

Two crossings of the EPAs are proposed with the CSSP as follows.

- Where Street EE crosses the improved WHT6 corridor. The crossing will consist of an earthen embankment with roadwork and utilities. A 1500 mm diameter circular pipe is proposed through the embankment to convey the Regional flow under minor surcharge.

- Where a proposed storm sewer crosses between wetlands 3 and 4. The crossing will consist of a 1.2 m x 2.4 m concrete box culvert. The proposed crossing is strategically placed in the location of redundant farm infrastructure and a former railway corridor. This location will result in the removal of unnatural features and restoration to a more natural state.

Refer to **Drawings 602A and 402** for details of the EPA crossings.

5.0 STORM DRAINAGE

The existing storm drainage patterns for the CSSP lands is described in **Section 2.1**. This section describes the storm drainage / related infrastructure design and proposed Low Impact Development (LID) measures.

5.1 Proposed Stormwater Drainage System

The major and minor drainage systems for the CSSP lands have been designed to convey storm runoff to the proposed SWM facilities prior to discharge to the outlets at the receiving drainage features.

5.1.1 Minor System Drainage

Storm sewer pipe sizing has been based on the following criteria:

- West Humber Watershed- 10-year design storm + oversizing to manage HGL and 100-year capture,
- Main Humber Watershed- 10-year design storm for Roads and public lands + controlled 100-year flows from lots.

Drawing 501 illustrates the overall drainage areas to both SWM facilities and existing flow nodes and **Table 5-1** summarizes the proposed catchment areas and their respective nodes.

Table 5-1 Proposed Catchment Areas and Receiving Flow Nodes

Proposed Catchment ID	Watershed	Receiving Flow Node
101	Main Humber	8
102	Main Humber	7
103	Main Humber	6
104	West Humber	5
105	West Humber	1/2/3
106	West Humber	10
107	West Humber	E5

Drawings 502 illustrates the minor system drainage plan. The provided level of detail includes:

- The discretization of drainage areas to trunk storm sewer shed within the overall catchments areas that were delineated on **Drawing 501**.
- Identification of select storm maintenance holes (STM MHs) with proposed grades for top and invert elevations.
- Identification of trunk storm sewer pipes with proposed length, diameter, and slope gradients.
- Identification of storm water infrastructure (3rd pipe or diversions) to achieve feature-based water balance objectives.

5.1.2 Major System Drainage

Drawing 503 illustrates the major system flow paths within the overall catchments areas that were delineated on **Drawing 501** and includes the following elements:

- Proposed overland flow route direction arrows; and
- Proposed primary flow collection routes through ROWs

In the event of total catchbasin blockage at low points, the flows will drain overland via emergency overland flow routes along subdivision roads. Emergency flows will enter SWM ponds (where feasible) or will exit the site to boundary roads. In locations where overland flow is directed to the outlet between lots, the designated overland flow blocks will be required to accommodate the major system flow path. In addition to the major system conveyance capacity requirements, the blocks will be sized according to the Town's recommended widths based on pipe size and depth where applicable.

The storm sewer system inverts were established based on the permanent pool elevation of the end-of-pipe SWM facilities, minimum cover requirements, and the minimum storm sewer slopes permitted by the Town standards. Trunk design details and major system capacity calculations are included in **Appendix 3**.

5.1.3 100 Year Capture

100-year capture is contemplated in a few areas within the CSSP. The areas are depicted on **Drawings 502**. 100-year capture is proposed where grading constraints (EPA and boundary roads) preclude a surface overland flow outlet to the pond. Areas of 100-year capture will be refined as the draft plans develop.

5.1.4 Hydraulic Grade Line and Sump Pumps

Storm sewer sizes will be verified through the completion of a hydraulic grade line analysis as part of detailed design. Sump pumps will be required in locations where the storm sewer obvert is < 1.0 below foundation elevations. HGL is anticipated to be above foundation elevations. Town of Caledon permits the use of sump pumps.

5.2 Drainage Area Exchange

The delineation of the proposed catchment areas has endeavoured to follow, as closely as possible, the existing drainage divide between the West Humber and Main Humber watersheds through the CSSP lands. As shown on **Drawing 501**, the separation between the existing drainage divide and proposed catchment boundaries has minimized the small areas of drainage exchanged between the two watersheds. It is expected that the refined drainage divide will have little to no impact on either watershed.

5.3 Clean Water Pipe

The existing external area north of CSSP will be directed to the proposed realigned channel west of Humber Station Road via a clean water pipe (CWP) as shown by the horizontal alignment on **Drawing 502** and vertical profile on **Drawing 504**. The extent of the external drainage area capture to the clean water pipe is illustrated on **Drawing 501.** As per grading details shown on **Drawings 301** and **302**, the temporary grade transition and stabilized interceptor swales are proposed along the north limit of the CSSP boundary to direct the external pre-development drainage to the clean water pipe via a headwall structure. The clean water pipe is sized to convey the Regional flows from the external area. The internal CWP alignment has been chosen as the shortest route through the future development to convey external drainage to the proposed channel, and the CWP will be accommodated within different ROW cross sections.

It should be noted that, due to the grading constraints associated with the existing upstream WHT6 drainage feature and existing Humber Station Road 1350 mm diameter culvert invert at the downstream end of the proposed channel, the clean water pipe is proposed at 0.35% in order to address the grading constraints. This slope is slightly lower than the Town's minimum slope of 0.4%; however, the flow in this large 1350 mm diameter concrete pipe will be sufficient to maintain self-cleaning velocities.

5.4 Feature Based Water Balance Measures

To satisfy feature-based water balance requirements for wetlands situated in the southwest quadrant of the CSSP the following measures are proposed:

- A diversion pipe is proposed in drainage area 105 to supply Wetland W3.
- Collection of rear yard drainage from catchments 105 and 106 to supply Wetland W5.
- Local drainage from catchment 105 where Street E intersects The Gore Road to supply Wetland W1.
- Local drainage from rear yards and front yards(roofs) in catchment 106 to Wetland W6.

Refer to Section 7 for details of the feature-based water balance and **Drawings 701** and **702** for the existing and post-development drainage contribution to the wetlands.

6.0 STORMWATER MANAGEMENT PLAN

6.1 Overall SWM Strategy

The SWM strategy maintains the approximate pre-development watershed divide between the West Humber River and Main Humber River, as well as the individual subcatchments/outlets within each watershed as described in **Section 5.1**. This approach ensures that, with appropriate SWM controls, the proposed development minimizes change to the overall drainage patterns and sources of drainage to each outlet aside from that associated with increased imperviousness.

The proposed SWM strategy aims to satisfy the TRCA SWM Criteria (2012) and the more recent Town of Caledon's Consolidated Linear Infrastructure Environmental Compliance Approval (CLI-ECA) SWM Criteria, summarized as follows:

1. **Water Quantity & Flood Control** – Control post-development peak flows to pre-development levels for all storms up to and including the 100-year storm for the Humber River, except for the main branches where no quantity control is required.

2. **Water Quality Control** – Control the 90th percentile storm event and if conventional methods are necessary, then the 80% total suspended solids (TSS) removal to achieve an Enhanced level of protection.

3. **Erosion Control** – Detain at a minimum, the runoff volume generated from a 25mm storm event over 24 to 48 hours.

4. **Water Balance** – Control the recharge to meet pre-development conditions on property or control the runoff from the 90th percentile storm event.

For the West Humber River watershed, three (3) end-of-pipe stormwater management facilities (wet ponds) are proposed to provide water quantity, quality, and erosion controls for the post-development drainage areas illustrated in **Drawing 501**. Additional low impact developments and SWM measures are proposed where possible to provide a "treatment train" approach.

For the Main Humber River watershed, quantity controls are not required; however, water quality controls will be provided via a variety of low impact developments and end-of-pipe manufactured treatment devices (e.g., oil-grit-separators).

Water balance is addressed for the overall site through proposed low impact developments and other infiltration measures discussed in **Section 8.0**.

6.2 Hydrologic Modelling

Hydrologic modelling of pre-development conditions is based on refinements to the Visual OTTHYMO (VO) hydrologic model in the 2018 Humber River Hydrology Update prepared by TRCA. The subcatchments within the West Humber and Main Humber watersheds intersected by CSSP have been refined from topographic surveys carried out locally to clarify drainage boundaries and outlets.

The TRCA SWM Criteria (2012) provided the unit flow relationships for the 2-year to 100-year storm events within the West Humber. Runoff characteristics for the 25 mm and Regional Storm events have been determined by passing these storm events through the hydrologic model.

Table 6-1 provides the results for calibration of existing flow rates of TRCA-defined subcatchments within the West Humber River watershed in the vicinity of the CSSP.

Table 6-1 Calibration of Existing Flow Rates for TRCA-Defined West Humber River Subcatchments

Calibration of Existing Flow Rates for TRCA-Defined West Humber River Subcatchments										
	37.12		37.11		37.10		37.02		J45	
	TRCA	UT	TRCA	UT	TRCA	UT	TRCA	UT	TRCA	UT
AES 6hr										
2	0.10	0.11	0.19	0.20	0.14	0.15	0.05	0.06	0.41	0.47
5	0.19	0.21	0.36	0.37	0.27	0.29	0.10	0.12	0.79	0.91
10	2.18	2.31	3.98	4.31	2.87	3.18	0.88	1.12	8.38	8.96
25	2.79	2.96	5.06	5.47	3.68	4.15	1.15	1.48	10.70	11.59
50	3.24	3.46	5.87	6.35	4.29	4.84	1.37	1.75	12.46	13.57
100	3.70	3.97	6.68	7.22	4.89	5.54	1.58	2.03	14.23	15.55
AES 12hr										
2	0.14	0.16	0.26	0.26	0.19	0.20	0.07	0.08	0.57	0.64
5	0.24	0.26	0.44	0.46	0.33	0.35	0.12	0.14	1.01	1.12
10	2.39	2.53	4.06	4.33	2.89	3.16	0.83	1.07	8.72	9.14
25	2.98	3.16	5.05	5.39	3.62	4.02	1.07	1.37	10.85	11.54
50	3.43	3.64	5.78	6.17	4.16	4.62	1.25	1.60	12.47	13.33
100	3.87	4.13	6.52	6.96	4.71	5.24	1.43	1.83	14.13	15.17
Regional Storm										
Regional	10.61	11.13	14.84	15.86	10.58	11.44	2.95	3.76	36.31	40.16

As indicated in **Table 6-1** above, for the majority of the subcatchments the AES 6-hour storm resulted in higher peak flows than the AES 12-hour event for the larger storm events (25 to 100-year). Based on these results AES 6-hour storm was used to determine the required stormwater management as it would result in higher water levels and storage requirements for the development.

6.3 West Humber River SWM

The post-development drainage areas discharging to the West Humber River are Catchment 104, 105, and 106. Three (3) SWM facilities are proposed to control and treat stormwater runoff from these catchments.

Pond 1 is situated northwest of the intersection of King Street & Humber Station Road adjacent to the new open space channel. Pond 2A is situated between wetlands W2 and W4 in the southwest quadrant of the CSSP lands. Pond 2B is located south of King Street in future development lands also owned by one of the CSSP proponents. Preliminary sizing of these facilities is provided herein.

Other SWM facility types (dry ponds, wetlands, etc.) were not considered for this development. Wet ponds were determined to be more appropriate in terms of meeting the quality and quantity control requirements for the subject lands.

The SWM facilities have been situated in the proposed locations for the following reasons:

- 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 channels / existing / planned storm sewer outlets;
- to locate SWM facilities adjacent to the EPA and maintain flow input locations along the receiving channels where possible;
- to minimize storm sewer infrastructure size and avoid potential servicing crossing conflicts; the contributing areas to the SWM facilities are generally limited to 65 ha;
- to optimize land use by maximizing tableland and serviceable area.

As shown on **Drawings 501-503**, the SWM facilities are located at the proposed drainage outlets along King Street and just south of the CSSP lands. These locations represent the low areas within the West Humber subcatchments intersected by CSSP.

6.3.1 SWM Facility Targets

The SWM facility targets / sizing criteria for the CSSP lands were established based on the TRCA SWM Criteria (2012) and the TRCA pre-development hydrologic model presented in the Humber River Hydrology Update (2018). These studies involved hydrologic modelling for pre- and post-development conditions, resulting in SWM design criteria to meet the unit flow rates as identified by TRCA (Civica 2018) for the West Humber River watershed, in addition to meeting the following requirements:

- Ensure that existing flow rates downstream of the subject lands do not vary for the larger storm events during post-development conditions, thereby providing flood protection for properties downstream of the CSSP area;
- Provide adequate drawdown time / erosion control to protect the form and function of watercourses downstream of the SWM facilities.
- Ensure that the MECP-recommended stormwater quality treatment of runoff is provided;
- Maintain recharge volumes through the use of low impact development and other practices as required based on hydrogeological assessments;
- Maintain water balance to wetland features (refer to **Section 8.0** for further details)

The following specific SWM Facility criteria were established:

Permanent Pool Volume - each stormwater management facility within CSSP must meet the Enhanced (Level 1) criteria as per the MOE SWM Planning and Design Manual (March 2003).

Extended Detention / Erosion Control – The extended detention volume for erosion control is based on detention of the 25 mm storm event for a minimum 48 hours for controlled release from the SWM ponds. An average release rate of 0.72 L/s/ha was utilized in accordance with the Town of Caledon Bolton Residential Expansion Study.

Quantity Control – Table E.1: Summary of Unit Flow Relationships, Humber River Watershed in the TRCA SWM Criteria (2012) provided the equations to determine the quantity control unit flow rates for the 2-year to 100-year storm events within the West Humber River watershed. The unit flow rates determined from these relationships are given below for the development areas in **Table 6-2**.

Table 6-2 SWM Facility Target Release Rates

Return Period	Area 104 Drainage Area = 69.48 ha		Area 105 Drainage Area = 31.75 ha		Area 106 Drainage Area = 35.63 ha	
	Unit Flow Rate ($m^3/s/ha$)	Target Release Rate (m^3/s)	Unit Flow Rate ($m^3/s/ha$)	Target Release Rate (m^3/s)	Unit Flow Rate ($m^3/s/ha$)	Target Release Rate (m^3/s)
100-Year	0.0201	1.396	0.0219	0.695	0.0216	0.771
50-Year	0.0177	1.232	0.0194	0.615	0.0191	0.681
25-Year	0.0153	1.060	0.0166	0.528	0.0164	0.585
10-Year	0.0121	0.843	0.0132	0.419	0.0131	0.465
5-Year	0.0098	0.683	0.0107	0.340	0.0106	0.377
2-Year	0.0065	0.449	0.0070	0.223	0.0069	0.247

A Visual OTTHYMO 6.2 (VO6) model was prepared to calculate the storage requirements for the SWM facilities to achieve the target release rates. The evaluation analyzed the 6-hour hour AES storm distributions.

Regional Control – control post-development flow rates to pre-development levels, as evaluated at a common downstream location. Regional storm control is required as per email correspondence with TRCA dated April 17, 2020.

SWM Facility Design Criteria - Through a consultation process with the Town of Caledon and review of the Town and MECP design criteria, the following SWM pond design criteria have been established and summarized in **Table 6-3**. Facilities will be designed accordingly to meet the criteria in Section 4.2.1 of the TRCA's Approaches to Manage Regulatory Event Flow Increases resulting from Urban Development (TRCA, 2016), where applicable.

Table 6-3 SWM Pond Design Criteria and Standards

SWM Pond Design Criteria	SWM Design Standards
Maintenance Access Road	A paved / concrete maintenance access road with a width of 5.0 m and cross slope of 2% into the pond shall be provided on at least two sides of the pond to access the inlet and outlet structures, forebay, and wet cell. The maintenance access road shall be configured such that two points of entry are provided (where possible). The access road shall be situated in a manner that allows trucks to drive around the pond without having to turn around, or incorporate a turning circle (minimum radius 12.0 m) where two access points cannot be provided. Access shall be provided to the bottom of the pond forebay and main cell with 12:1 (horizontal: vertical) slopes. Trails will be combined with the maintenance access roads in locations where the trail alignment passes through the SWM pond block.
Side Slopes	A 7:1 slope centered on the normal water level for 3.5 m on either side is proposed. Internal side slopes of 4:1 (H:V) will be provided in all other locations including transition grading above the high water level. The use of armor stone retaining wall is to be considered above the high-water level if required. All other Town criteria for maximum side slopes (3:1) shall be used on the outer side of the pond blocks where necessary.

6.3.2 SWM Facility Design

As noted in the preceding section, the SWM facility targets established in the subwatershed study are based on the drainage area and imperviousness being developed. The proposed drainage areas to each facility are noted in **Table 6-4** and correspond to **Drawing 501 and 600 series (SWM Pond) drawings**.

Table 6-4 SWM Facility Drainage Areas

SWM Facility	Total Area to Pond (including Pond Block) (ha)	Imperviousness (%)
Pond 1	69.48	75
Pond 2A	31.13	77
Pond 2B	33.91	77

The catchment imperviousness values were approximated based on the Town of Caledon's standard runoff coefficient values as listed in **Table 6-5** for various land uses, converted to imperviousness using the formula:

$$\%IMP = 100 \times (c - 0.2) / 0.7$$

Table 6-5 Runoff Coefficients & Imperviousness for Various Land Uses

Land Use	Runoff Coefficient	Impervious Values (%)
Medium Density Residential	0.83	90%
Mixed-Use Residential	0.87	95%
Go Transit Lands	0.90	100%
School	0.76	80%
Park	0.27	10%
Proposed Environmental Protection Area	0.27	10%
Environmental Protection Area	0.27	10%
SWM Pond	0.55	50%
Rear Lane Townhouses	0.80	85%
Dual Frontage Townhouse	0.80	85%
Back-to-back Townhouse	0.87	95%
Standard Townhouses	0.76	80%
Shallow Single Detached	0.69	70%
Standard Single Detached	0.66	65%
External	0.85	93%
Roads	0.76	80%

6.3.3 SWM Facility – Quantity Control

In addition to the development areas being directed to the ponds a portion of the site from drainage areas 105 and 106 will be directed to the adjacent wetlands to maintain the existing rainfall volumes. Refer to **Section 8.2** for details on feature-based water balance for the wetlands. The ponds have been overcontrolled to account for the uncontrolled flows to the wetlands.

Based on the contributing drainage areas and imperviousness values and TRCA unit rates / targets shown in **Section 6.3.1**, stage-storage-discharge relationships have been established for each SWM facility. These results are included in **Appendix 4**. The provided volumes are based on the preliminary pond grading designs presented in **Drawing 601** and **Drawing 602**. The tables below outline the SWM pond release rates as well as the required storage.

Table 6-6 SWM Pond 1 Release Rate Summary

Storm Event	Target Release Rate (m^3/s)	Pond 1 Release Rate (m^3/s)	Required Active Storage (m^3)
2	0.45	0.45	16,475
5	0.68	0.68	21,510
10	0.84	0.84	28,332
25	1.06	1.06	33,588
50	1.23	1.23	37,431
100	1.40	1.40	41,200
Regional*	-	5.51	78,017

*Release rate is based on not exceeding existing condition flows at Node E5.

Table 6-7 SWM Pond 2A Release Rate Summary

Storm Event	Target Release Rate (m^3/s)	Uncontrolled Flows (m^3/s)	Pond 2A Release Rate (m^3/s)	Required Active Storage (m^3)
2	0.22	0.13	0.09	7,300
5	0.34	0.15	0.19	9,742
10	0.42	0.17	0.25	12,739
25	0.53	0.19	0.34	15,146
50	0.61	0.20	0.41	16,889
100	0.70	0.21	0.48	18,607
Regional*	-	0.18	1.57	41,261

*Release rate is based on not exceeding existing condition flows at Node 2.

Table 6-8: SWM Pond 2B Release Rate Summary

Storm Event	Target Release Rate (m^3/s)	Uncontrolled Flows (m^3/s)	Pond 2B Release Rate (m^3/s)	Required Active Storage (m^3)
2	0.25	0.12	0.026	8,674
5	0.38	0.16	0.13	11,459
10	0.47	0.23	0.21	15,001
25	0.58	0.27	0.24	17,783
50	0.68	0.31	0.31	19,823
100	0.77	0.34	0.38	21,806
Regional*	-	0.25	2.559	42,618

*Release rate is based on not exceeding existing condition flows at Node 10.

The Flow Nodes were also evaluated to ensure that the post-development peak flow rates do not greatly vary from the pre-development conditions at each Flow Node location to provide flood protection for the downstream properties. As with the pre-development conditions, post-development peak flow rates were also modelled using VO6 with the summary parameters and output results included in **Appendix 4**. The drainage areas and pre- and post-development flow rates at each Flow Node are summarized in **Table 6-9** below.

Table 6-9 Existing and Post-Development Flow Rates along West Humber River Tributary 6 from North Limit of CSSP to The Gore Road

	Node 1		Node 2		Node 3		Node 5		Node E5		Node E6		Node 10		Node E4		Node 9	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
NHYD	10	10	11	11	12	12	18	5	35	35	56	56	90	90	49	49	3	3
Drainage Areas (ha)	6.42	4.16	28.76	38.67	26.24	8.37	163.59	148.01	170.05	156.58	194.43	181.19	127.74	145.94	571.36	568.56	78.77	75.57
25 mm	0.01	0.01	0.02	0.10	0.02	0.21	0.06	0.07	0.06	0.95	0.07	0.37	0.09	0.17	0.28	0.41	0.03	0.02
2	0.02	0.02	0.05	0.17	0.06	0.16	0.16	0.46	0.16	0.75	0.18	0.51	0.24	0.40	0.75	1.07	0.08	0.05
5	0.04	0.03	0.09	0.28	0.11	0.22	0.30	0.71	0.31	1.01	0.34	0.77	0.47	0.70	1.45	1.89	0.16	0.09
10	0.24	0.15	0.67	0.61	0.76	0.59	2.03	1.84	2.08	1.86	2.31	2.08	3.03	2.36	8.98	8.54	1.11	1.07
25	0.30	0.20	0.86	0.78	0.98	0.75	2.60	2.27	2.67	2.30	2.96	2.58	3.89	3.10	11.60	10.97	1.41	1.36
50	0.36	0.23	0.99	0.92	1.14	0.87	3.04	2.63	3.13	2.66	3.46	3.00	4.55	3.63	13.59	12.81	1.64	1.58
100	0.41	0.26	1.14	1.05	1.30	0.99	3.49	3.00	3.60	3.04	3.97	3.42	5.23	4.16	15.59	14.68	1.87	1.79
Regional	0.68	0.44	2.46	2.46	2.52	1.11	9.71	9.70	10.12	10.12	11.29	11.07	11.38	11.38	41.19	41.56	4.95	4.73

6.3.4 SWM Facility – Quality Control

Enhanced (Level 1) water quality protection through the removal of 80% of TSS will be provided in all of the stormwater ponds based on MOE Stormwater Management Planning and Design Manual Table 3.2. **Table 6-10** below outlines the required permanent pool based on the total area and impervious being proposed to each pond.

Table 6-10: Permanent Pool Requirements

Pond	Area (ha)	Imperviousness (%)	Permanent Pool Unit Rate (m^3/ha)	Required Permanent Pool (m^3)	Provided Permanent Pool (m^3)
Pond 1	69.48	75%	193	13,433	44,293
Pond 2A	31.13	77%	196	6,112	28,948
Pond 2B	33.91	77%	196	6,662	18,229

6.3.5 Pond Inlets & Forebays

The size of the inlet pipes will be 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 inlets will generally convey minor system flows, while an overland spillway into the facility will convey flows above the 10-year return period into the facility. The inlet pipe size was determined via storm sewer design calculations (i.e., conveyance capacity based on Manning's equation and Rational Method peak storm flows; refer to **Appendix 3** for the storm trunk design sheets).

All forebays have been designed according to the settling and dispersion length equations provided in Section 4.6.2 of the MOE SWM Planning and Design Manual (2003). Forebay calculations are included in **Appendix 4**.

6.3.6 Pond Outlets

The SWM facilities will have multiple outlet controls including an extended detention outlet, quantity control, emergency spillway and a maintenance sump. The extended detention pipe will consist of a reverse-slope pipe extending from 0.5 m from bottom of the permanent pool to an orifice plate on the control structure at the normal water level. The submerged end-of-pipe will be fitted with a perforated pipe section of sufficient open area and will be protected with riprap and filter fabric. The orifice plate will be sized to meet the required extended detention flows and required drawdown time (i.e., minimum 48 hours) under approximately 0.5 m to 1 m of head (i.e., extended detention level). The orifice plate will be bolted onto the outlet structure with the invert set at the permanent pool level. To prevent potential blockage by debris, etc., a minimum orifice size of at least 75 mm is recommended in accordance with Town of Caledon guidelines.

Preliminary orifice dimensions and the corresponding target and recommended release rates and drawdown times for the SWM facilities have been calculated and are indicated in **Table 6-11**.

By providing a minimum 48-hour drawdown time for the 25 mm event, the erosive effects of increased runoff volume should be adequately mitigated.

Table 6-11 Preliminary Extended Detention Orifice Dimensions

SWM Pond	Target Extended Detention Flow (m^3/s)	Minimum Orifice Diameter required to match target (mm)	Required Drawdown Time (hr)
1	0.05	75	48 - 72
2A	0.02	75	48 - 72
2B	0.026	75	48 - 72

A series of orifices or a compound weir knock-out will be designed for the outlet control structure to achieve the 2-year to 100 year / Regional target flows where applicable. The preliminary stage-storage-discharge relationships for the ponds are indicated in **Appendix 4** are subject to change based on the outlet structure design for each facility. However, the target discharge will be maintained. The detailed outlet structure will be determined at the detailed design stage. A tailwater assessment will confirm the performance of the outlet works relative to the downstream receiving channel.

The SWM facilities will have an emergency spillway located above the high year water level to manage overflows in the event that all outlet structures are blocked. The spillway will be suitably protected and landscaped to prevent erosion and could be integrated into a restoration design. If it is determined at a future design stage that additional emergency flow conveyance is required, the top of the outlet control structure could be fitted with an emergency overflow grate, to augment the total emergency conveyance capacity or to reduce the emergency spillway dimensions. The emergency flow capacity is the greater of the Regional Storm or 100-year flow in the event of a blockage of the primary outlets.

6.3.7 Pond Liners

The results of groundwater monitoring has indicated that the groundwater levels are located above the permanent pool of all of the proposed ponds. To overcome buoyancy effects of groundwater, pond liners and underdrain systems may be required. DS Consultants will undertaking pumping tests at each pond location this 2023 summer to confirm liner requirements.

6.3.8 Pond Outfalls

The proposed pond outfall locations are illustrated on **Drawings 601** and **602** and have been coordinated with and evaluated by the ecological study team members. The TRCA SWM criteria documents provide guidelines on outfall design and placement. In general, the facility outfalls have been placed:

- outside of the 25-year floodline, where possible;
- outside of the 100-year erosion limit, where possible; and
- outside of the meander belt, where possible.
- outlets into the watercourse to be angled at 45 degrees to reduce erosion impacts where possible.

The extent of the proposed outfall works is governed by the permanent pool elevations, which in turn are constrained by the low points along the development limits. Therefore, outfall channel works within EPA may be required since raising the permanent pool would prevent the low portions of the site from draining into the SWM facilities. The preliminary outfall works are illustrated on **Drawings 601** and **602** and will be further developed at future design stages.

Table 6-12 indicates the proposed SWM facilities outfall locations and associated works involved to ensure flows are conveyed safely to the receiving watercourse.

Table 6-12 SWM Facility Outfall Works

SWM Facility	Outfall Location	Required works
Pond 1	Proposed EPA created by realigned channel upstream of Humber Station Road via 1500 mm concrete storm pipe	Completion of proposed realigned channel and installation of outfall pipe and associated erosion protection including a stone core wetland at the outfall

SWM Facility	Outfall Location	Required works
Pond 2A	North side of King Street at west side of Wetland W4 in southwest of CSSP via 1200 mm concrete storm pipe	Installation of outfall pipe and associated erosion protection
Pond 2B	South side of King Street in a future development block which will outlet to the existing West Humber tributary.	Installation of outfall pipe and associated erosion protection

At detail design stage, all SWM facility outfalls will be provided with the erosion protection details to prevent scour.

6.3.9 Treatment Train – Silva Cells

The main quality control measure that will treat all stormwater runoff from the West Humber River catchments will be the proposed SWM facilities discussed above. The wet ponds (Pond 1, 2A and 2B) will provide conventional end-of-pipe quality control to satisfy the 80% TSS removal requirement. However, a treatment train approach is also incorporated into the West Humber SWM strategy, with best efforts focused on retention (infiltration) and low impact development filtration prior to the conventional wet ponds.

The high groundwater level throughout the site limits the implementation of infiltration measures. Best efforts were made to incorporate low impact developments to provide retention and filtration. Silva Cell systems are proposed within the wider road right-of-way sections (Street SS, R, and D) along the proposed Linear Park.

Silva Cell is a modular green infrastructure facility that can provide filtration and/or infiltration as well as stormwater storage. Infiltration Silva Cells will be implemented where groundwater levels allow (1m separation), and the remaining system will provide filtration (with impermeable lined cells). The proposed Silva Cell system will treat stormwater from approximately 10.3 hectares in Catchment 104 as illustrated in **Drawing 703**.

6.4 Main Humber River SWM

The developed drainage areas to the Main Humber River are Catchments 101, 102, and 103. In accordance with TRCA SWM Criteria (2012), quantity control is not required within the Main Humber River watershed; hence, SWM facilities are not proposed for these catchments. However, on-site storage is proposed on private property to mitigate impacts on the CPR culverts (Nodes 6, 7, and 8). Furthermore, a treatment train approach is proposed to satisfy the 80% TSS removal target prior to discharge.

6.4.1 Quantity Control

A post development 100-year flow rate of 125 L/s/ha has been applied to the areas draining to the Main Humber. This flow rate will be refined based on the exact culvert capacity available as the design advances.

Table 6-13 provides a comparison of existing and proposed flow rates to the three culverts (Nodes 6, 7 and 8) crossing the CPR at the east side of the CSSP within the Main Humber River watershed, as well as the required storage.

Table 6-13: Main Humber River Drainage to Nodes at CPR Culverts

Storm	Pre (m^3/s)	Post (m^3/s)	Storage (m^3)	Unit Storage (m^3/ha)	Unit Flow for Storage Tanks (L/s/ha)
Node 6 – Catchment 103					
Drainage Areas (ha)	18.80	13.32	-	Residential and GO Area: 7.58	
5	0.97	0.94	1731	228	43
100	2.32	1.67	2979	393	79
Node 7 – Catchment 102					
Drainage Areas (ha)	2.78	9	-	Residential and GO Area: 6.77	
5	0.16	0.64	1294	191	63
100	0.37	1.12	2210	327	112
Node 8 – Catchment 101					
Drainage Areas (ha)	19	14.61	-	Residential Area: 7.47 ha	
5	1.32	1.01	1785	239	39
100	2.98	1.83	3070	411	64

A Hydraflow Express model was run for each of the culverts to verify the existing conveyance capacity and that the proposed 100-year flows can be conveyed with sufficient freeboard. The analysis determined that post-development flows to Nodes 6 and 8 can be conveyed by the existing 800 mm and 2 x 700 mm diameter culverts, respectively. The 500 mm culvert at Node 7 will be upgraded to 900 mm to convey post-development flows. Refer to **Appendix 4** for the Hydraflow results.

6.4.2 Quality Controls

The proposed treatment train will consist of the following:

- Onsite quality controls imposed on residential and GO transit blocks to achieve a minimum of 80% TSS removal (e.g., Isolator row or Jellyfish Filter upstream or downstream of the storage tanks).
- CB Shields to provide 50% TSS removal for the road right-of-way.
- Downstream Oil-Grit Separator to provide 50% to 60% TSS removal prior to discharge.

Area-weighted water quality calculations were completed for Catchments 101, 102, and 103 to confirm that the 80% TSS removal will be achieved. The calculations are presented in **Table 6-14** to **Table 6-16**. The following equation was used to calculate the total TSS removal rate for BMPs in series in the treatment approach:

R = A + B – [(A X B) / 100]
Where:
R = Total TSS Removal Rate
A = TSS Removal Rate of the Upstream BMP (e.g., Catch basin Shield)
B = TSS Removal Rate of the Downstream BMP (e.g., OGS Unit)

Table 6-14: Total TSS Removal at Node 8 – Catchment 101

Area	Method	Effective TSS Removal	Area (ha)	% Area of Site	Overall TSS Removal
Parks & External	Inherent	100%	1.78	12%	12%
Residential & Go Transit	Isolator row or Jellyfish Filter	80%	7.47	51%	41%
School & ROW	CB Shields & OGS	75%	5.36	37%	28%
Total			14.61	100%	81%

Table 6-15: Total TSS Removal at Node 7 – Catchment 102

Area	Method	Effective TSS Removal	Area (ha)	% Area of Site	Overall TSS Removal
Parks & External	Inherent	100%	0.29	3%	3%
Residential & Go Transit	Isolator row or Jellyfish Filter	80%	6.77	75%	60%
School & ROW	CB Shields & OGS	75%	1.95	22%	16%
Total			9.01	100%	80%

Table 6-16: Total TSS Removal at Node 6 – Catchment 103

Area	Method	Effective TSS Removal	Area (ha)	% Area of Site	Overall TSS Removal
Parks & External	Inherent	100%	2.09	16%	16%
Residential & Go Transit	Isolator row or Jellyfish Filter	80%	7.58	57%	46%
School & ROW	CB Shields & OGS	75%	3.65	27%	21%
Total			13.32	100%	82%

7.0 Hydraulic Modelling

Hydraulic modelling was completed for the purposes of floodplain mapping and riparian storage analysis in support of the proposed development. The modelling exercises were completed using GeoHECRAS software.

7.1 Proposed Floodplain

A proposed model was prepared to reflect the hydraulic changes and delineate the floodplain resulting from the development of the CSSP lands. The following model updates were implemented in the proposed model:

- Removal of the West Humber reach segment proposed to be piped through the Clean Water Pipe, starting from Station 4397.62 at the northern boundary of the CSSP lands to Station 3459.49 at the upstream boundary of the proposed Greenway.
- Re-alignment of the West Humber reach and re-grading of the floodplain within the proposed Greenway from Station 3459.49 to Station 3022.08 (Humber Station Road). The floodplain and channel geometry were updated using an imported DEM consistent with the preliminary grading plan.
- Addition of the proposed Street EE crossing (Station 3140) and upgrade of the Humber Station Road crossing (Station 2998.53). The proposed culverts were sized to convey the Regional Storm and satisfy MTO freeboard criteria. The characteristics and dimensions of the proposed culverts are included in **Table 7-1**.

Table 7-1: Upgraded Crossings in Proposed Model

ID#	Right-of-Way	Type	Opening Dimension	Length (m)	U/S Invert (m)	D/S Invert (m)
EE	Street EE	CP	1500 mm Dia.	42.0	263.75	263.08
HS5	Humber Station Road	Box	3.0m W x 1.5m H	76.5	262.70	262.23

The proposed model also included flow updates based on the hydrology modelling outlined in Section 6 and **Appendix 4** of this report. The flow updates reflect the increased runoff and pond release rates proposed as part of the CSSP development. **Table 7-2** summarizes the flows and contributing areas to each cross-section for the proposed model.

Table 7-2: Proposed Model Flows

HECRAS XS ID	VO6 ID | Node ID	Drainage Area (ha)	Flow (m^3/s)						
			2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	Reg.
5139	**NYHD 96/66 | Node E1**	40.84	0.03	0.06	0.74	0.94	1.10	1.25	3.06
4397.62	**NHYD 3 | Node 9**	75.57	0.05	0.09	1.07	1.36	1.58	1.79	4.73
3459.49	**NHYD 79/80 | Node 5-2**	75.57	0.05	0.09	1.05	1.34	1.56	1.78	4.71
3129.04	**NYHYD 106/- | Node 5-1**	75.57	0.05	0.09	1.05	1.34	1.56	1.78	4.71
3022.08	**NHYD 18/122 | Node 5**	148.01	0.46	0.71	1.84	2.27	2.63	3.00	8.79
2721.34	**NHYD 35 | Node E5**	156.58	0.75	1.01	1.86	2.30	2.66	3.04	9.55
2027	**NHYD 56 | Node E6**	181.19	0.51	0.77	2.08	2.58	3.00	3.42	10.60
1610.08	**NHYD 86 | Node 13**	196.62	0.51	0.82	2.13	2.67	3.12	3.54	11.67
1257.87	**NHYD 55 | Node 12**	303.85	0.59	0.98	3.95	5.01	5.88	6.77	20.10

Drawing 604A and 604B present the proposed conditions Regional Storm floodplain based on the proposed model. This Regional Storm has been used to delineate the Proposed Regulatory Floodplain within the CSSP area. The detailed HEC-RAS output is included in **Appendix 2**.

Table 7-3 presents the changes in Regulatory flood elevations for the realigned West Humber reach at select locations. The complete comparison (all river stations) is included in **Appendix 2.** At the majority of the river stations, the Regulatory flood elevation is decreased due to Regional Control in the proposed SWM facilities. Minor increases in Regulatory flood elevation are within an acceptable tolerance and will not have any impact on the overall system or adjacent properties. The proposed Greenway (floodplain) contains the Regional Storm with sufficient freeboard to private property (minimum 0.30 m).

Table 7-3 Existing Vs. Proposed Regulatory Flood Elevations

River Station	Reg. Flow (m^3/s)	Existing Reg. W.S. Elev. (m)	Prop. Reg. W.S. Elev. (m)	∆ Reg. W.S. Elev. (m)
4460.53	3.06	270.91	270.9	-0.01
4397.62	4.73	270.54	270.54	0.00
3459.49	4.71	266.04	265.79	-0.25
3260	4.71	265.95	265.79	-0.16
3160	4.71	NA	265.47	NA
3140	Street EE Crossing			
3122	4.71	NA	264.79	NA
3022.08	8.79	265.02	264.58	-0.44
2998.53	Humber Station Road Crossing			
2934.09	8.79	263.87	264.1	+0.23*
2912.72	8.79	263.64	263.59	-0.05
2678.01	9.55	263.31	263.14	-0.17
2664.39	King Street Crossing			
2644.21	9.55	261.08	261.16	+0.08
2564.81	9.55	260.63	260.61	-0.02

*Hydraulic jump due to model inconsistency. Impacts dissipate at immediate downstream section.

7.2 Riparian Storage

The proposed Greenway (floodplain) grading was designed to provide sufficient storage volume to convey flows from the 2-year to 100-year and Regional Storm. A riparian storage analysis was conducted using the updated hydraulic HEC-RAS models to confirm the proposed floodplain will maintain the existing riparian storage for all storm events.

The riparian storage analysis was conducted by running the existing and proposed HEC-RAS models with all culverts (man-made structures) removed to represent the worse-case scenario. Ineffective areas, however, were maintained for both existing and proposed models as the road embankments are unlikely to fail / wash-out. Existing condition flows were applied to the existing and proposed models. The cumulative volume of water contained within the floodplain was compared to assess the change in riparian storage after development. Changes in riparian storage are generally impacted by the proposed watercourse piping and re-grading of the floodplain within the Greenway.

Table 7-4 summarizes the existing riparian storage and the post-development / proposed riparian storage volume for the West Humber Tributary. The comparison is presented for the “Site Only” (reach limits within the CSSP lands) and the “System” (entire reach starting north of the site and extending to the Gore Road crossing). The post-development riparian model demonstrates that the existing riparian storage volumes are generally maintained or increased across the range of storm events. The detailed riparian storage results are included in **Appendix 2**.

Note that this analysis does not consider flood plain storage in the proposed features such as the Clean Water Pipe, pools, wetland pockets, and off-line stormwater management ponds. The analysis results will be updated as the detailed design advances with the ultimate channel design.

Table 7-4 Existing and Proposed Riparian Storage

West Humber River Tributary	Existing			Proposed			
	Storm Profile	Channel Range	Riparian Storage (x1000m³)	Storm Profile	Channel Range	Riparian Storage (x1000m³)	Difference (x1000m³)
System	2-year	5139 (North of CSSP) to 0 (downstream of The Gore Rd crossing)	3.15	2-year	5139 to 4397.62 (North of CSSP) & 3459.49 (Node 5-2, Upstream Channel Extents) to 0 (downstream of The Gore Road crossing)	3.99	0.84
	5-year		5.15	5-year		6.44	1.29
	10-year		24.77	10-year		31.20	6.43
	25-year		30.66	25-year		38.58	7.92
	50-year		35.07	50-year		43.93	8.86
	100-year		39.72	100-year		49.41	9.69
	Regional		102.29	Regional		113.00	10.71
Site Only (CSSP)	2-year	4397.62 (Node 9) to 3011.93 (Node 5, upstream of Humber Station Rd crossing)	0.61	2-year	3459.49 (Node 5-2, Upstream Channel Extents) to 3011.93 (Node 5, upstream of Humber Station Rd crossing)	1.21	0.60
	5-year		1.03	5-year		1.89	0.86
	10-year		4.65	10-year		8.92	4.27
	25-year		5.65	25-year		10.98	5.33
	50-year		6.44	50-year		12.45	6.01
	100-year		7.27	100-year		13.90	6.63
	Regional		18.76	Regional		30.91	12.15

8.0 WATER BALANCE AND LOW IMPACT DEVELOPMENT

8.1 Overall Site Water Balance

In addition to meeting the quality, erosion control, and quantity control targets, one of the SWM strategy objectives is to address the overall water balance requirements for the site by maintaining the pre-development infiltration (recharge) and evapotranspiration volumes.

While end-of-pipe facilities provide the minimum required SWM controls, the use of LID stormwater management measures that reduce the amount of runoff by increasing on site retention, infiltration, and evapotranspiration, improve the overall SWM performance.

The water balance / recharge targets were established in the Preliminary Hydrogeological Investigation by DS Consultants (May 2023), by examining the average annual infiltration volumes that occur under existing conditions. The overall site water balance for the CSSP lands is presented in **Table 8-1**. Refer to **Appendix 5** for the complete report.

Table 8-1 Pre-Development vs. Post Development Infiltration

Site	Drainage Area (ha)	Existing Infiltration Volume (m^3)	Post-Dev. Infiltration Volume, Prior to Mitigation (m^3)	Post-Dev. Infiltration Deficit (m^3)	Post-Dev. Infiltration Volume, With Mitigation (m^3)	Post-Dev. Infiltration Deficit With Mitigation (m^3)
CSSP	181.7	138,717	44,502	94,215	117,803	21,851

The post-development infiltration mitigation volume has been determined based on two measures: connected impervious and pervious surfaces and low impact development infiltration/filtration.

The proposed water balance plan includes connecting about 9.8 ha of impervious surfaces with 20.5 ha of pervious area to maximize infiltration. The areas considered include impervious roofs and paved areas to allocated rear yards, parks, and ponds. The rear yard and roof infiltration volume has been determined based on the approximate rear yard area in the CSSP lands consisting of 50% rear roof area and 50% pervious rear yard. Parks and ponds infiltration volumes were determined based on an imperviousness value of 10% and 50%, respectively. The water balance calculations are based on an annual precipitation of 786 mm and allow for 15% evaporation from impervious cover.

Best efforts were made to incorporate low impact developments throughout the site to reduce the post-development infiltration deficit. Silva Cells are proposed within the wider road right-of-way sections (Street SS, R, and D) along the Linear Park. These modular cells provide infiltration and/or filtration through soil media and can be installed within the constrained road right-of-way as well as green spaces and parks. The water balance plan includes about 10.3 ha of impervious and pervious areas as shown in **Drawing 703**. The Silva Cell system was sized to capture and infiltrate the 25 mm rainfall volume, which equates to the 90th percentile of the total annual precipitation. Silva Cell sizing calculations are included in **Appendix 4**.

Table 8-2: Water Balance Mitigation

Mitigation Effort	Infiltration Mitigation Volume (m^3)
Connected Impervious / Pervious Areas (Roofs / Paved to Rear yards / Parks / Ponds)	18,041
Silva Cells	54,323
Total:	72,364

The total estimated infiltration deficit with mitigation is 21,851 m^3, which is only a 15% reduction from the original infiltration volume. Other opportunities will be investigated to further reduce the deficit as the design advances.

8.2 Wetland, Feature-Based Water Balance

Drawings 701 and **702** illustrate the existing and proposed surface drainage areas, respectively, contributing to the various wetland features within the CSSP lands. The existing drainage areas and drainage patterns to each wetland were identified from topographic mapping and site reconnaissance. The wetlands were characterized in the CEISMP document in terms of ecology, surface drainage and groundwater contributions and overall form and function.

A portion of the existing wetland drainage areas fall within the **Preliminary Framework Plan** development limit. To aid in determining the level of risk and evaluation requirements for the study, an assessment was completed using the Wetland Water Balance Risk Evaluation guidelines provided by the Toronto and Region Conservation Authority (TRCA, Nov 2017), as part of the Preliminary Hydrogeological Investigation. The guideline provides criteria used to evaluate the magnitude of potential hydrological impact on a wetland. The criteria for evaluating the changes in catchment area imperviousness and the size of the catchment include:

- The proportion of impervious cover in the catchment of the wetland that would result from the proposed development;
- The degree of change in the size of the wetland catchment;
- Water taking from, or discharge to, surface water bodies or aquifers directly connected to the wetland, and;
- The impact on locally significant recharge areas.

The effects of the above potential changes include:

- reductions in infiltration and baseflow and/or interflow contributions to the wetland; and
- increased runoff with associated risk of flooding and increased stormwater sediment and contaminant loading.

As a result of the proposed grading and drainage design, the existing drainage area to some of the existing wetlands will be modified and will require a water balance analysis to determine the potential impact to the form and function of the feature and the associated mitigation requirements.

An analysis of the hydrological change has been prepared by DS Consultants and the results provided in **Appendix 5**. The analysis completed demonstrates that there is a low magnitude of hydrological change as a result of impervious cover score and a high magnitude of hydrological change as a result of change to catchment size for each wetland units as illustrated & tabulated (existing vs. proposed wetland drainage areas) on **Drawing 702**.

The proposed drainage plan was designed to promote drainage of clean sources of water (vegetated areas and roof drainage) towards the wetlands to mitigate the impacts of change to catchment size. All lots backing onto the wetland features have been designed to drain clean flows from half of the rooftop and half of the yards towards the adjacent wetland area as illustrated on **Drawing 702**.

Additionally, uncontrolled flows from the development are being directed to Wetlands W1, W3, W5, and W6 to replicate the existing runoff. For Wetlands W1, W5 and W6 the existing conditions runoff to the wetlands will be matched on an annual basis. In order to meet quantity control targets for the development, flows to Wetland W3 will be restricted to the 5 mm event. The equivalent of the 5 mm event flows will be diverted using a dedicated pipe, which represents approximately 50% of the annual rainfall. **Table 8-3** below outlines the required post development areas to maintain the required runoff volumes to the wetlands. In areas where street drainage is being directed to the wetlands upstream water quality treatment will be implemented through the use of LIDs and an ETV certified OGS to achieve 80% TSS removal.

Table 8-3: Feature Based Water Balance

Wetland ID	Existing		Post Development						
			Wetland		Park		Development		Total Volume (m^3)
	Area (ha)	Volume (m^3)	Area (ha)	Volume (m^3)	Area (ha)	Volume (m^3)	Area (ha)	Volume (m^3)	
W1	1.34	2,633	0.48	943	0	0	0.25	1,690	2,633
W3	22.56	282	2.88	36	0	0	5.79	246	282
W5	7.42	14,580	1.93	3,792	2.76	5,423	0.80	5,364	14,580
W6	5.17	10,159	0.96	1,886	0.92	1,809	1.00	6,465	10,159

In coordination with Beacon and DS Consultants, the feature-based water balance will be further evaluated subject to a detailed hydrogeological study during the draft plan design.

8.3 Low Impact Development

In accordance with the Town of Caledon's CLI ECA, LIDs are proposed to promote the infiltration of runoff and filtration where the LID features are constrained by groundwater levels. The incorporation of LIDs will benefit the overall site water balance and water quality. LID methods will be applied throughout the plan and integrated into the public realm. The details of maintenance and ownership will be determined at the draft plan design stage.

The hydrogeological / water balance work in the CEISMP addresses the recharge requirements and mitigation measures in detail.

To achieve the water balance targets noted in the preceding section, the SWM strategy must incorporate measures to direct the excess runoff from impervious surface into pervious areas or Low Impact Development (LID) measures to promote attenuation / infiltration.

TRCA have endorsed the use of LID measures, particularly in a “treatment-train” approach involving consecutive stormwater management / LID measures in series to enhance the overall performance, reliability, and effluent water quality. The LID measures most feasible for application in the CSSP lands 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.

Additional Topsoil Depth: Coupled with downspout disconnection, an additional depth of topsoil beyond the minimum requirements provides additional storage volume at the lot-level which reduces runoff volume and promotes filtration / infiltration. This is a low / no maintenance practice.

Swales: Swales will be required in the CSSP lands to convey surface flows and have the added benefit of encouraging infiltration as well as peak flow / velocity reduction and improvements to water quality. Suggested swale locations include:

- Swales in Greenland corridors
- Swales in Parks and Schools (public ownership);
- Swales downstream of stormwater management outfalls
- Swales adjacent to rear lots located within buffers.
- Overland flow easements

Infiltration/Filtration Facilities: Dedicated infiltration facilities involve construction below grade and their performance is subject to the groundwater table elevations and infiltration rates of the native material. Infiltration facilities should be designed with an emergency overflow spillway to the storm sewer system to prevent infiltration trenches from being fully saturated. If groundwater levels preclude infiltration, the LIDs will be built with an impervious liner and underdrain to provide filtration benefits. Silva Cells are proposed infiltration/filtration facilities along the Linear Park.

Rainwater Harvesting: Rainwater harvesting typically consists of the use of rain barrels or stormwater cisterns within private property to attenuate stormwater for later use for irrigation. This measure is not guaranteed to remain in place over the long-term, as their longevity is subject to the homeowner. However, it is recommended that rainwater harvesting be considered on a larger scale to supplement the municipal supply to irrigate park / open space areas.

Additional geotechnical / hydrogeological studies may be required prior to finalizing and confirming the selection of LID techniques. The selected LID techniques will be based on the land use concept shown in the **Preliminary Framework Plan** and on the preliminary site grading. All proposed engineered LID structures that require maintenance will be located in public ownership and operated and maintained by the municipality as required by the CLI-ECA.

Refer to **Drawing 703** for the proposed LID locations.

9.0 SANITARY SERVICING

The proposed CSSP development is tributary to the South Peel Wastewater System and is ultimately treated in the G.E. Booth Wastewater Treatment Plant.

The September 24, 2020 Bolton Residential Expansion Area Servicing Study, prepared by the Region of Peel, identified the proposed sanitary outlet for the CSSP lands as a twinning and extension of an existing sewer located on Coleraine Drive. The excerpt from the Peel Region study is included in **Appendix 6**.

Since 2020, ongoing studies or design work by the Region and stakeholders in the CSSP have identified alternative servicing schemes for the CSSP lands. These schemes will be described in greater detail in the following sections.

9.1 Existing or Planned Sanitary Infrastructure

Referring to **Drawing 801** the following sewers are presently or will be available to provide service to the CSSP lands.

1. An existing 525 mm located on Coleraine Drive, and
2. The extension of new 1200 mm sewer along Humber Station Road from Mayfield Road to Healey Road.

It should be noted that each of the above sewers will need to be extended to the vicinity of King Road and Humber Station Road.

It is understood that Region is contemplating extending the existing 525 mm Coleraine sewer to service the ROPA 30 lands on an interim basis until the extension of the pipe north of Healey can be planned, designed and constructed.

9.2 Sanitary Sewer Design Criteria

The proposed sanitary sewer infrastructure within the CSSP lands was designed according to the Region of Peel's Linear Wastewater Standards (March 2023). The Region's criteria for population density for the land uses are summarized in **Table 9-1**.

Table 9-1 Population Density

Density	Persons/unit
Single family	4.2
Semi detached	4.2
Townhouses	3.4
Large Apartment (greater than 1 bedroom)	3.1
Large Apartment (1 bedroom)	1.7
Light industrial	70 people/ha
Commercial	50 people/ha

Density	Persons/unit
Schools	600 (Junior Public School) 900 (Senior Public School) 1,500 (Secondary School)

Please note that the populations calculated from the above table are based on Peel Region design criteria for infrastructure design and may differ from those reported in planning documents due to differing methodologies used for population accounting.

Based on the calculated populations contributing to each sewer, the peak sanitary flows and pipe sizes in **Appendix 6** were determined using the Region's design standards for flow generation rates (290 L/c/d for residential and 270 L/emp/d), sanitary flow peaking factors (based on Harmon Formula) and infiltration/inflow rate (0.26 L/s/ha) as per the Region's Standard Drawing 2-5-2.

The Region's sanitary sewer design criteria specifies:

1. Sewers shall be sloped to achieve a minimum self cleansing velocity of 0.75 m/s.
2. The starting leg for local sewers is to be laid at a minimum grade of 1.00%.
3. The maximum permissible capacity utilization is 70%.

9.3 Proposed Sanitary Sewer Design

9.3.1 Internal to CSSP Lands

The proposed sanitary sewer network for the CSSP lands is depicted on **Drawing 802.** Sewer Design sheets are provided in **Appendix 6.** Anticipated sewer sizes range from 200 mm to 525 mm. **Table 8-2** summarizes information about the two primary trunk sewers that will serve the subdivision as well as the total anticipated flow from the CSSP lands.

Table 9-2 Proposed CSSP Sanitary Outlets and Flows

Location	Size	Area, Population & Flow
Internal Streets and King Road	300 mm - 525 mm	117.4 ha 16,681 pp 182.7 L/s
Humber Station Road	375 mm - 450 mm	38.0 ha 10,379 pp 111.8 L/s
All CSSP Lands	600 mm	155.4 ha 27,060 pp 268.3 L/s

The flows presented in the above table do not take into account for lands outside of the CSSP lands. Refer to section 8.3.5 for more discussion regarding the White Belt Lands. The populations presented in the above table are based on Peel Region design criteria for infrastructure design and may differ form those reported in planning documents due to differing methodologies used for population accounting.

9.3.2 External – Via Coleraine Drive

It is understood that Peel Region is contemplating the extension of an existing 525 mm sewer from EX. MH118 located on Coleraine Drive up to the intersection of King Road and Humber Station Road. Refer to **Drawing 805** for a profile of this sewer. This sewer can be delivered at an elevation of ~ 258 which is sufficient to serve the CSSP lands. The capacity of the sewer (70% full per region standards) is 160.2 l/s which will serve an approximate population of 14,440 or approximately 4,000 units. Refer to the design sheet in Appendix 6.

This sewer is ~ 2,475 m long and ranges in depth from 5-9 m.

9.3.3 External – Via Humber Station Road

Through discussions with Peel Region it is believed that the ultimate servicing of the CSSP and White Belt Lands is intended to follow Humber Station Road. As noted above, Peel Region is currently designing a 1200 mm sewer to be extended to the intersection of Healey Road and Humber Station Road at an invert of 219.37. Peel Region has indicated that the extension of the sewer along Humber Station Road beyond Healey Road is dependent on of the findings of an updated Master plan anticipated in 2025.

The anticipated pipe size between Healey and King Road is 750 mm. This size makes accommodation for Option 1, Option 3 (CSSP), Option 4, Option 5 and the Rounding Out lands. Refer to Design Sheets in **Appendix 6** entitled Ultimate. Refer to **Drawings 803 and 804** which provides a profile of this sewer.

It is recommended that the Humber Station Road sewer be installed from day one in lieu of sewer extension of the Coleraine Drive sewer. This outlet option can accommodate all of Options 1 and 3-5 including the Rounding Out lands.

9.3.4 Accommodation of Option 1/Rounding Out

Resulting from discussions with Stakeholders and Peel Region, accommodation has been made in the Ultimate Scenario for servicing of the Rounding out lands and Option 1 lands.

Accommodation of these lands will require:

1. Reversing the flow direction of the Coleraine Pipe;
2. Providing a gravity outlet for the Rounding Out lands.
3. Clarification of the terminal manhole for pumped outlet for the Option 1 lands.
4. Lowering the invert in the Humber Station Road to accommodate Item 2 above.

9.3.5 Accommodation of White Belt Lands

The flows presented in the previous sections do not take into account lands outside of the CSSP lands. A shown on **Drawing 802** trunk sewers have been extended to the north limits of the CSSP lands and with available inverts. There is opportunity to provide greater depth and capacity for the future lands by flattening sewers within the CSSP lands. Additionally, there may be limitations to the amount of area that can be served within the white belt depending on the depth of the sewer delivered to the intersection of King Road and Humber Station Road. Refer to **Drawing 801** for possible service limit in the White Belt lands.

Inclusion of the White Belt Lands situated above the CSSP Lands adds an estimated population of 7,218 persons (60 pphs) and a flow at Humber Station Road and King of 106.2 l/s. This will increase the pipe size at King Road and Humber Station to 825 mm.

Additional work is required in collaboration with Peel Region as it relates to the routing, depth and sizing of trunk sewers to accommodate White Belt Lands. This likely to be resolved with the next Master Plan update.

9.3.6 DC Eligibility

The sanitary sewers greater than or equal to 375 mm will be considered as Development Charge (DC) infrastructure and will be confirmed by Region of Peel prior to approval of the CSSP FSR.

The external trunk sewers described above qualify for DC financing. There are ongoing discussions between Peel Region and CSSP stakeholders regarding the financing of the external works as the some of the described works are not recognized in the Peel Master Plan as of yet.

9.4 EA Requirements

Under new EA guidelines it is understood that the external sewers are exempt from EA requirements as they follow existing public rights of way. Further discussions are required with approving agencies to firm up final approval requirements.

10.0 WATER SERVICING

As determined in the Bolton Residential Expansion Study (Region of Peel, September 24, 2020) the CSSP lands are generally outside of the range of elevations associated with Pressure Zone 6 of the existing water distribution infrastructure in Bolton. As such, ultimate development of the CSSP lands will require the addition of Pressure Zone 7. Previous studies completed in support of BRES identified a new Zone 7 booster pumping station at King Street and Coleraine Drive. Ultimately, floating storage is proposed in the form of an elevated tank (ET) to provide storage for flow equalization, fire demands and emergencies. The ET is to be situated in the vicinity of the northwest corner of the CSSP lands. The excerpt from the Peel Region study is included in **Appendix 9**.

A technical memorandum (May 11, 2023) has been prepared by R.J. Burnside & Associates Limited on behalf of the CSSP landowners to provide water distribution servicing recommendations in support of interim and ultimate development of the CSSP lands. This section provides a summary of the memorandum including recommendations based on the results of the hydraulic modeling included therein. The complete memorandum is provided in **Appendix 9**.

Preliminary modelling was performed by Burnside to determine interim alternative water servicing arrangements that could leverage the existing Zone 6 water supply to allow some portion of the CSSP lands to be developed prior to the design and construction of the ultimate Zone 7 servicing solution. Water supply to the zone in the interim scenario would be principally through a new Zone 7 booster pumping station. The investigation included options to provide water supply to meet fire demands on an interim basis by pumping, as opposed to floating storage.

Bolton receives water supply from the Tullamore Pumping Station and Reservoir, through a transmission main along Mayfield Road and Coleraine Drive. Bolton's water distribution system is serviced in two pressure zones, Zone 5 and Zone 6. Zone 5 is serviced through Zone 6 by pressure reducing valves at the Bolton Zone 5 Standpipes. The Standpipes have a high-water level (HWL) of 274.1 m. Storage for Zone 6 is supplied by the Bolton ET and the North Bolton ET. The HWL of both ET's is 297.2 m. The Region of Peel is to confirm the operating levels of the Zone 6 ETs.

The existing ground elevations within the CSSP lands range from approximately 262 m to 280 m. These elevations fall outside of the range of elevations capable of being serviced by Zone 6 while maintaining adequate operating pressures within the system. The Region of Peel has reported operating pressure issues within an existing residential subdivision fronting on King Street in close proximity to the CSSP lands.

A new pressure Zone 7 with an elevated tower having a HWL of 327.7 m would adequately service all of the CSSP lands, as well as address existing operating pressure issues for some existing residents.

As per the Region of Peel 2013 Water and Wastewater Master Plan for the Lake-Based Systems, Volume III - Water Master Plan, prepared by GM BluePlan and AECOM, dated March 31, 2014, a minimum operating pressure of 40 psi and a maximum operating pressure of 100 psi shall be maintained within the water distribution system under maximum day demand and a minimum operating pressure of 40 psi shall be maintained under peak hour demand. The allowable operating pressure during fire flow conditions is a minimum of 20 psi.

Based on Region of Peel design criteria outlined in Section 8.2 above, the targets for residential and employment are 25,092 persons and 1968 jobs, respectively. The per capita demands for residential and employment are 270 L/cap/d and 250 L/cap/d, respectively.

The following water demands were determined in the Burnside Technical Memorandum:

- Average Day Demand (ADD) = 84.1L/s
- Maximum Day Demand (MDD) = 149.1L/s
- Peak Hour Demand (PHD) = 252.3 L/s

Demands for the CSSP Lands were distributed evenly throughout the proposed development. As the detailed design progresses, it is anticipated that future CSSP land-use plans will establish refined density targets to update the watermain modelling.

The required fire flow for the CSSP lands is 220 L/s while maintaining a minimum system operating pressure of 20 psi, as per Bolton Residential Expansion Study Infrastructure Report, prepared by GM BluePlan dated June 16, 2014.

Water servicing can be provided for the entire CSSP lands with the following provisions:

- a new Booster Pumping Station is constructed in the vicinity of Coleraine Drive and King Street and the diameter of the proposed trunk watermain from the Booster Pumping Station to a point approximately 1200 m southwest is increased to 600 mm, from the currently proposed 400 mm diameter required for the ultimate build out condition;
- the Booster Pumping Station will require appropriately sized booster pumps to provide the ADD, MDD and PHD within the 40 psi to 100 psi pressure range; and
- the Booster Pumping Station will also require a fire pump to provide the CSSP lands with 220 L/s of fire flow.

It is noted that further consultation with Peel Region and Town of Caledon will be required regarding the external watermain alignment and necessary EA requirements for the external infrastructure. The specific arrangement of the Booster Pumping Station would be determined during detailed design.

The existing and planned water distribution infrastructure is illustrated on **Drawing 901.** Based on the preliminary water modeling by Burnside, the external trunk watermain size is increased from 400 mm diameter (recommended by Bolton Residential Expansion Area Study) to 600 mm diameter to address the future potential population density increase.

11.0 IMPLEMENTATION

Delivery of various components of the CSSP EPA (Environmental Policy Area) and development areas requires an implementation plan that considers the following items:

- maintaining the environmental integrity of the existing EPA throughout development
- sequencing of site works to deliver the EPA and the development / infrastructure in a logical and timely manner.
- erosion and sediment prevention and control including stabilization of open spaces;
- co-operation amongst the developers, consultants and approval agencies; and,
- creativity and flexibility in solving implementation challenges.

This section provides and overview of various implementation aspects of the design, approvals, construction and conveyance of the EPA and surrounding developments.

Design and Approvals

Several approvals are required for the construction of components of the EPA and surrounding developments. Depending upon the specific works, permits / approvals may be required from the Town, TRCA, Region and MECP. The CEISMP and FSR will serve as key guiding documents for the detailed design of the EPA and elements of subdivision design.

Phasing and Construction Considerations

In conjunction with the preparation of detailed designs, construction staging and sequencing plans will be developed to demonstrate when/where/how works will be implemented. The construction sequence will identify interim works that may be required.

The proposed channel realignment is partially off-line from the existing channel, therefore the need for diversion is limited to the overlapping area immediately upstream of the existing Humber Station Road crossing. Where diversion is required, the diversion channels will convey flows until the low-flow channel of the ultimate channel is stabilized. At that point in time, flows will be redirected from the diversion channels into the ultimate channel and the diversion channels will be removed. The location of diversion channels required should consider objectives to:

- minimize disruption of existing drainage patterns;
- minimize the area of disturbance (cut/fill stripping of topsoil);
- locate diversion channels an adequate distance away from the ultimate channel to allow for its construction and close enough for the reconnection of flows;
- minimize the number of temporary construction crossings.

The construction of municipal services and road crossings of the EPA will be completed in the dry, prior to redirecting flows from the diversion channels to the ultimate channel. This would avoid the need to enter the natural channel system to install these services after its construction and restoration have been completed.

Detailed soil investigations along the channel alignments, deep trunk sewers, and in areas adjacent to the wetlands will be required to assess the potential for encountering layers of high hydraulic conductivity sediments. An assessment of the dewatering requirements for construction will be made based on the detailed construction plans. Management and mitigation plans will be developed to address groundwater control as well as the potential for long-term water table lowering. A temporary Permit to Take Water (PTTW) may be required from the MECP depending on the anticipated quantity of dewatering required 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. 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 should be considered for use during construction:

- 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; and,
- 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.

Reference will be made to the *Guidelines for Erosion and Sediment Control for Urban Construction Sites* prepared by the Greater Toronto Conservation Authorities (2020) when preparing Erosion and Sediment Control Plans.

Practical measures for the maintenance of water levels in wetlands and watercourses during construction, as well as monitoring requirements, must be identified and implemented, where feasible.

The construction and conveyance of the projects to public ownership will be implemented through agreements between the landowners and the Town. These agreements will address extent of works, construction phasing, securities requirements, conveyance mechanisms, etc.

The agencies have suggested the use of a single third-party erosion and sediment control monitoring consultant to facilitate monitoring during joint earthworks operations. However, this is only feasible to the extent that the various landowners will coordinate earthworks together, as they have the right to proceed independently and utilize the monitoring consultant of their choice.

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Urbantech Consulting

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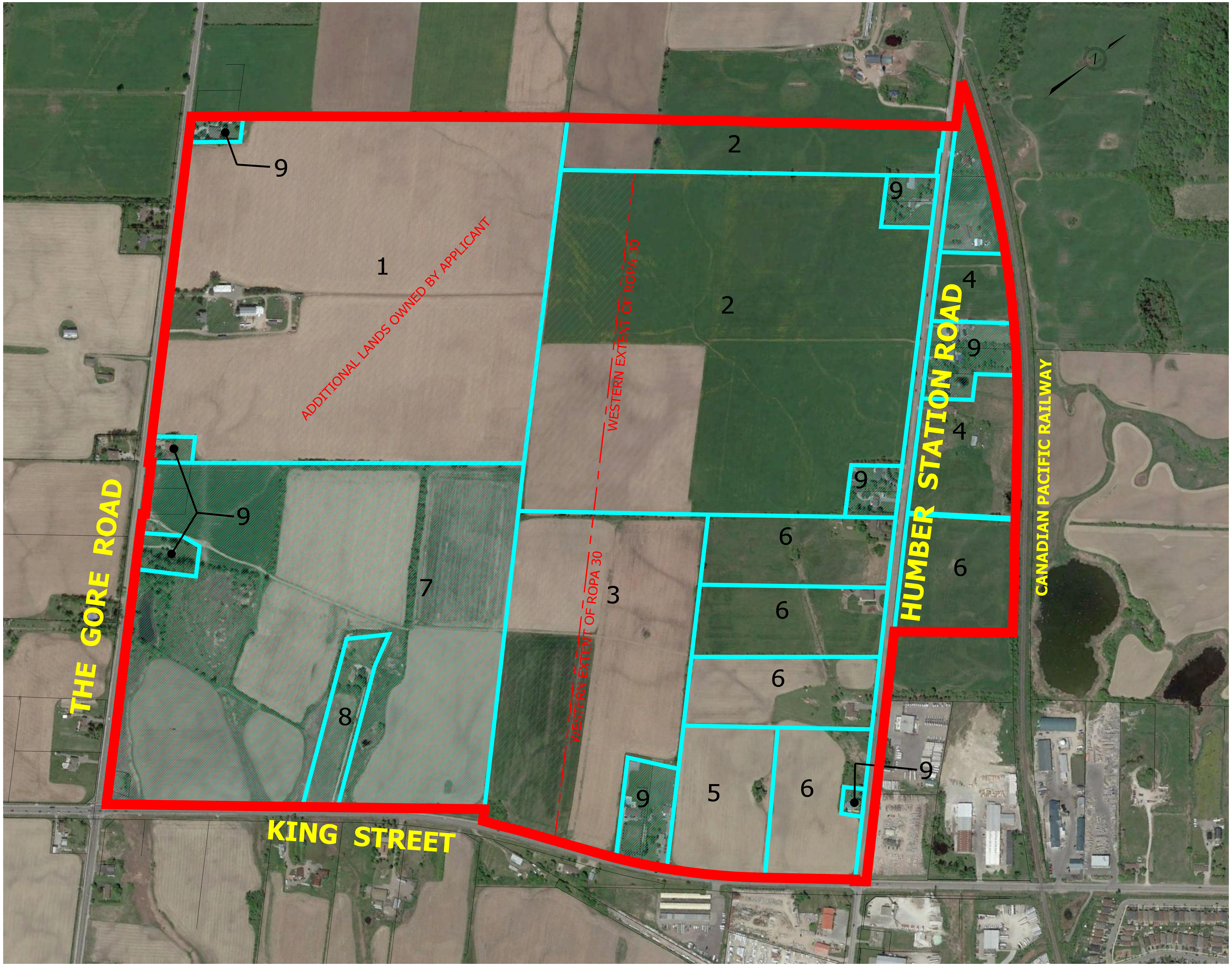
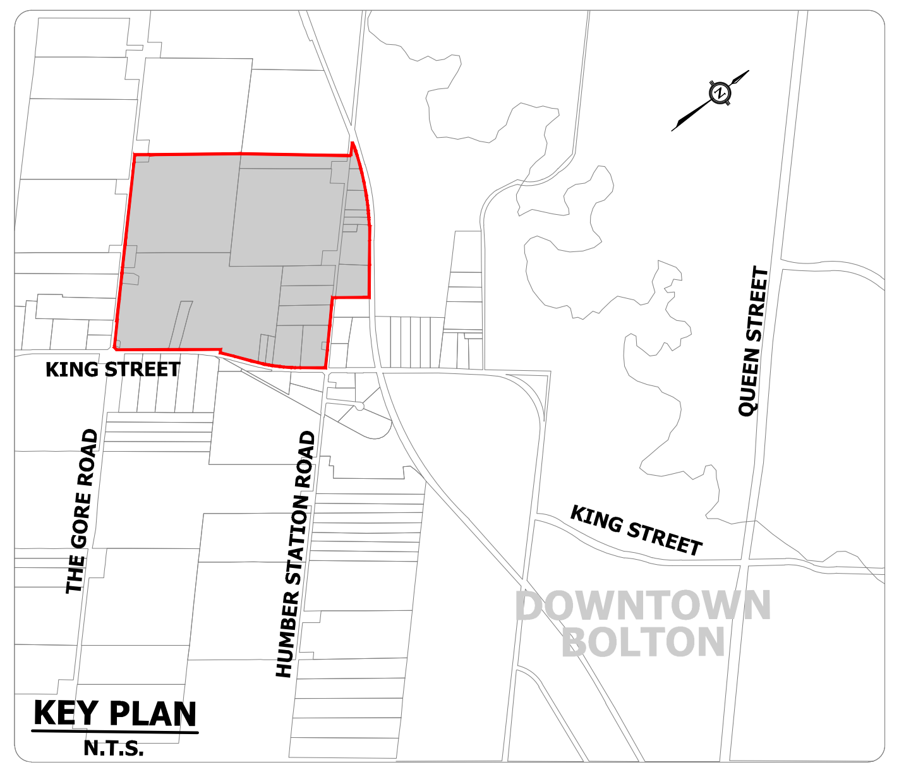
APPENDIX 1

Drawings and Figures





LEGEND:

🟥	CSSP LIMIT
6	PROPERTY BOUNDARY AND OWNER ID
▨	NON-PARTICIPATING PROPERTY

Participating Owners

1 - Argo Macville I Corporation
2 - Argo Macville II Corporation
3 - Argo Macville III Corporation
4 - Argo Humberking
5 - Humberking Developments Ltd
6 - Argo Humber Station
7 - Speirs Family
8 - Basile
9 - Others

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TOWN OF CALEDON
REGIONAL MUNICIPALITY OF PEEL
CALEDON STATION SECONDARY PLAN

LAND OWNERSHIP MAP

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DRAWN BY:	A.G./X.S.	CHECKED BY:	S.H.	DRAWING NO.		SHEET NO.
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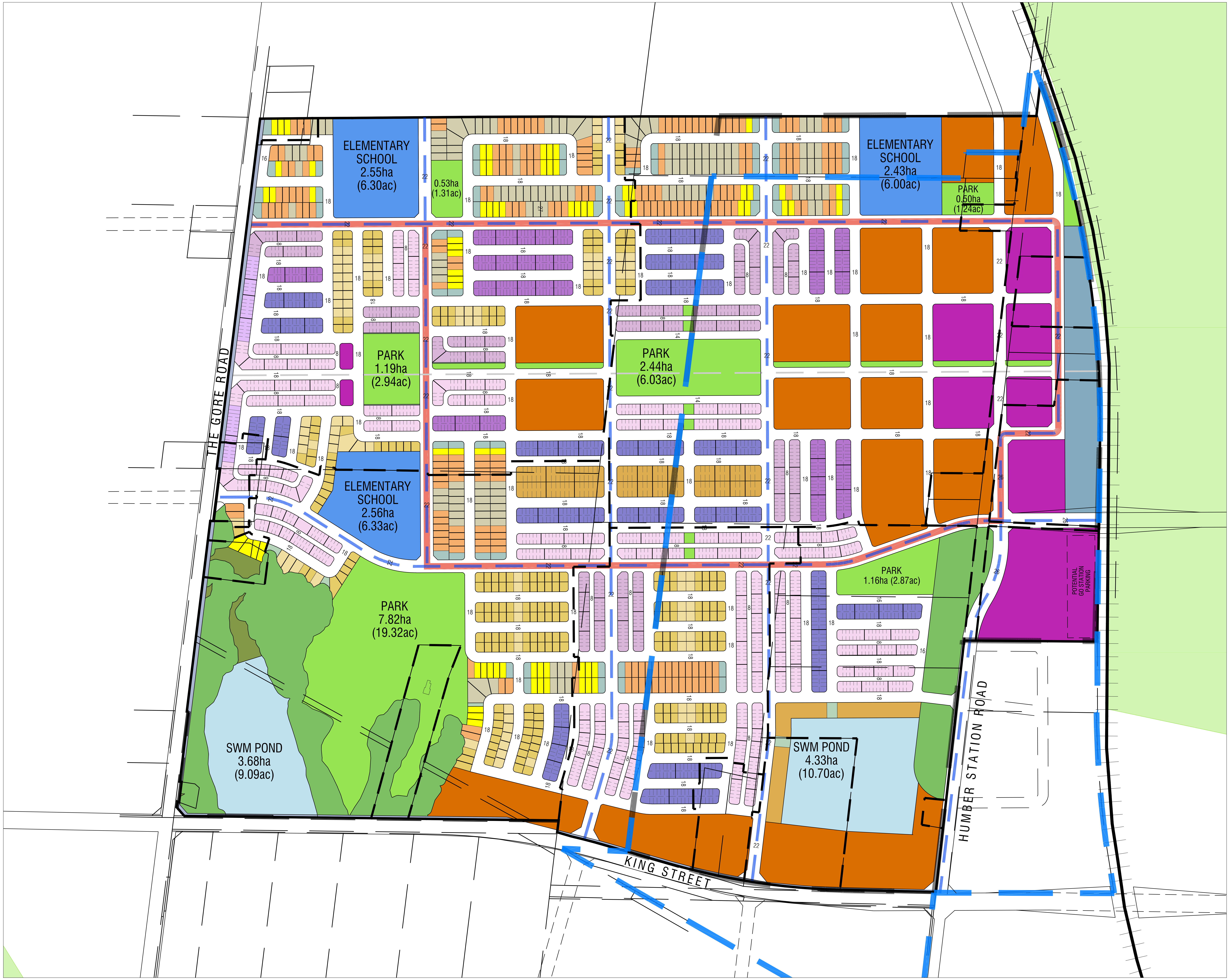

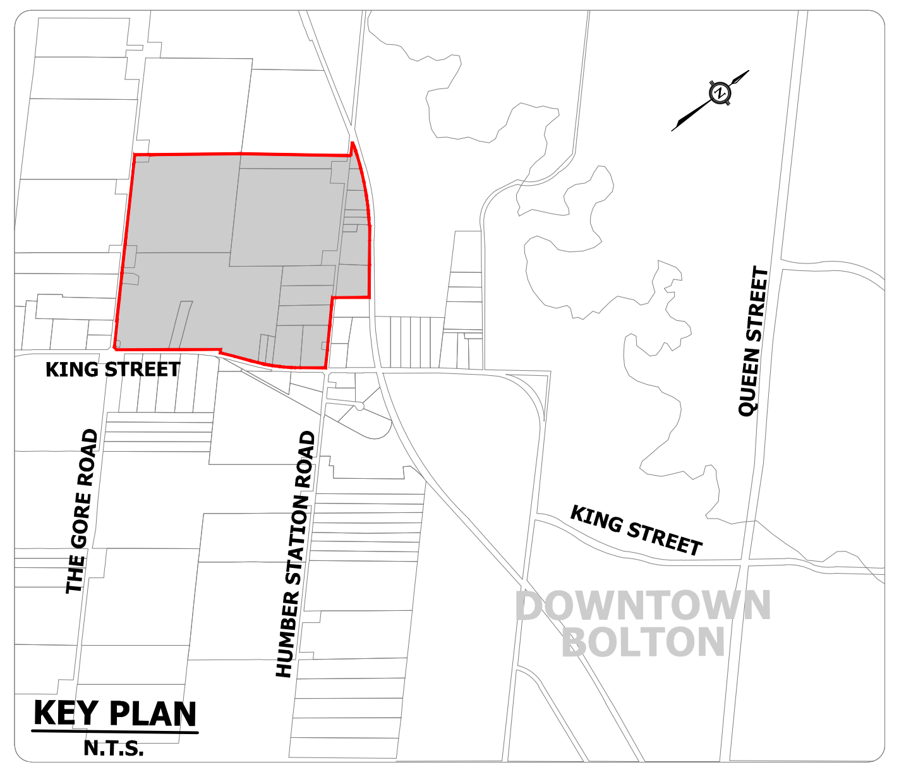

LEGEND:

- 🟧 MEDIUM DENSITY RESIDENTIAL
- 🟪 MIXED-USE RESIDENTIAL (AT GRADE COMMERCIAL)
- ▨ GO TRANSIT LANDS
- 🟦 SCHOOL
- 🟩 PARK
- 🟩 PROPOSED ENVIRONMENTAL PROTECTION AREA
- 🟩 ENVIRONMENTAL ENHANCEMENT AREA
- ▨ SWM POND

UNIT SPECIFIC USES

- ▨ REAR LANE TOWNHOUSE
- ▨ DUAL FRONTAGE TOWNHOUSES
- ▨ BACK-TO BACK TOWNHOUSES
- ▨ STANDARD TOWNHOUSES
- ▨ SHALLOW SINGLE DETACHED
- ▨ STANDARD SINGLE DETACHED

ROAD CLASSIFICATIONS

- ▬ MULTI MODAL LOOP ROAD
- ▭ COLLECTOR ROADS
- ▬ POST LAND EXCHANGE PROPERTY LINE
- 18 RIGHT OF WAY WIDTH (m)

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TOWN OF CALEDON
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FRAMEWORK PLAN

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SCALE:	1:3000	DATE:	MAY 2023		

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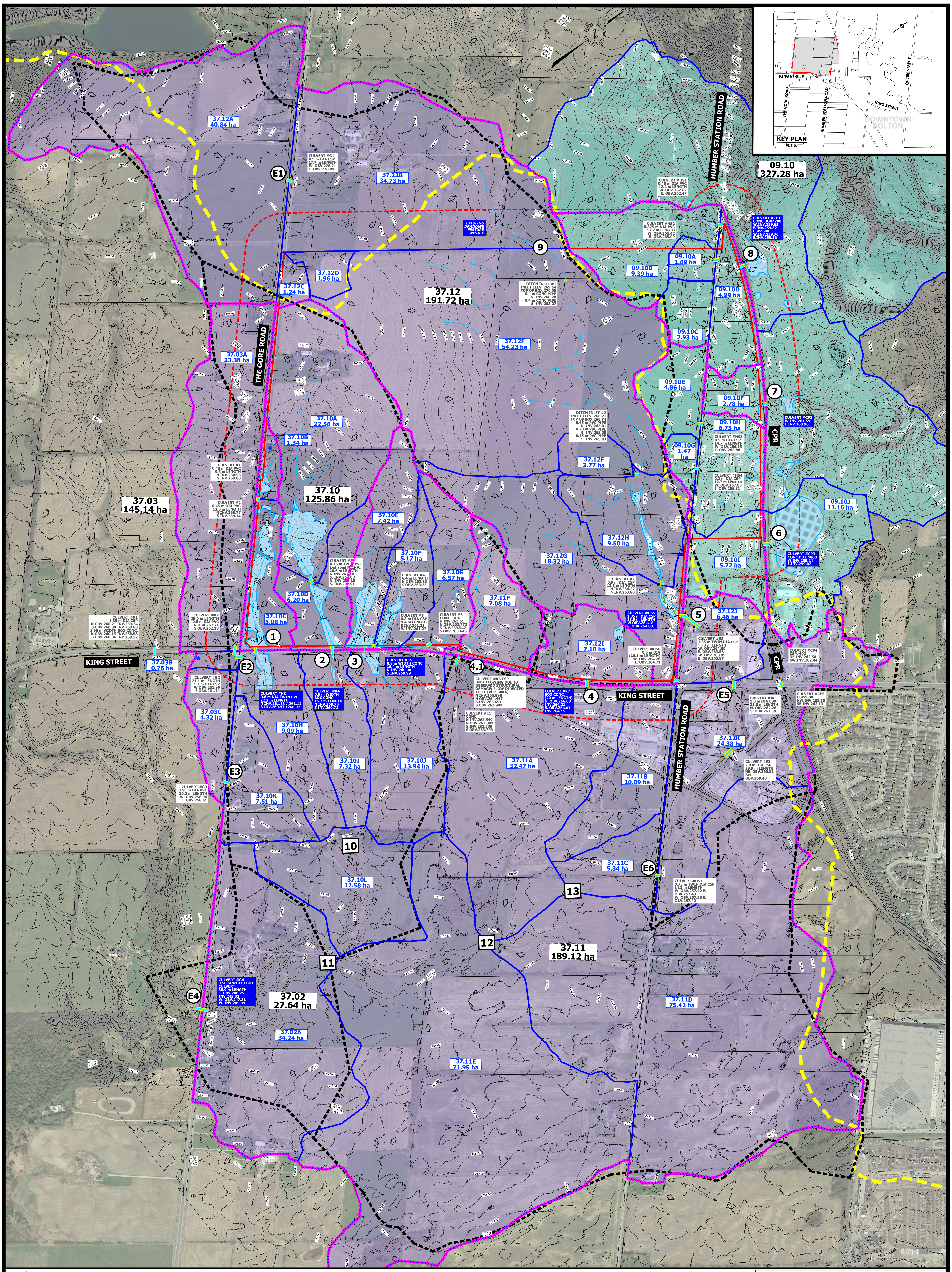

LEGEND:

- ━ CALEDON STATION SECONDARY PLAN LIMIT
- ╍ CEISMP STUDY LIMITS (SUBJECT LANDS + 120M BUFFER)
- 253.00 EXISTING CONTOUR
- ▬ EX. CULVERT LOCATION
- ─ · ─ CEISMP HEADWATER DRAINAGE FEATURES (BEACON)
- ─ · ─ UNEVALUATED CEISMP HEADWATER DRAINAGE FEATURES (BEACON)
- ⇦ EXISTING OVERLAND FLOW DRAINAGE PATH
- ▭ UNEVALUATED WETLANDS
- ▨ PROVINCIALLY SIGNIFICANT WETLAND
- ╍ WATERSHED BOUNDARY BETWEEN THE MAIN HUMBER AND THE WEST HUMBER RIVER BY TRCA
- ╍ TRCA SUBCATCHMENT BOUNDARY
- 37.02 27.64 ha TRCA DRAINAGE AREA ID
- ┅ DRAINAGE SUB-AREA BOUNDARY TO FLOW NODES (URBANTECH)
- ━ SUBCATCHMENT BOUNDARY BASED ON UPDATED TOPOGRAPHY (URBANTECH); REFER TO TABLE CONTRIBUTING DRAINAGE AREAS
- 09.10J 11.16 ha DRAINAGE SUB-AREA ID
- ② FLOW NODE ID WITHIN STUDY AREA LIMIT
- (E3) FLOW NODE ID OUTSIDE OF STUDY AREA LIMIT (CULVERT)
- 12 FLOW NODE ID OUTSIDE OF STUDY AREA LIMIT
- CULVERT #K3 0.9 m WIDTH BOX CONC. 16.2 m LENGTH N INV.260.70 S INV.260.71 — FLOW NODE CULVERT DESCRIPTION
- CULVERT #G4 21.1 m LENGTH 1.2 m DIA CSP W OBV.261.99 E OBV.261.74 — EXISTING CULVERT DESCRIPTION
- 🟪 WEST HUMBER DRAINAGE AREA BY URBANTECH
- 🟦 MAIN HUMBER DRAINAGE AREA BY URBANTECH

Flow Node ID	Drainage Area to Flow Node (ha)
1	6.42
2	28.76
3	26.24
4	7.10
4.1	7.08
5	163.59
9	78.77
10	127.74
11	537.12
12	324.85
13	209.86
E1	44.04
E2	24.14
E3	4.32
E4	571.36
E5	170.05
E6	194.43
6	18.80
7	2.78
8	19.00

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TOWN OF CALEDON
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PRE-DEVELOPMENT DRAINAGE AREAS TO FLOW NODES

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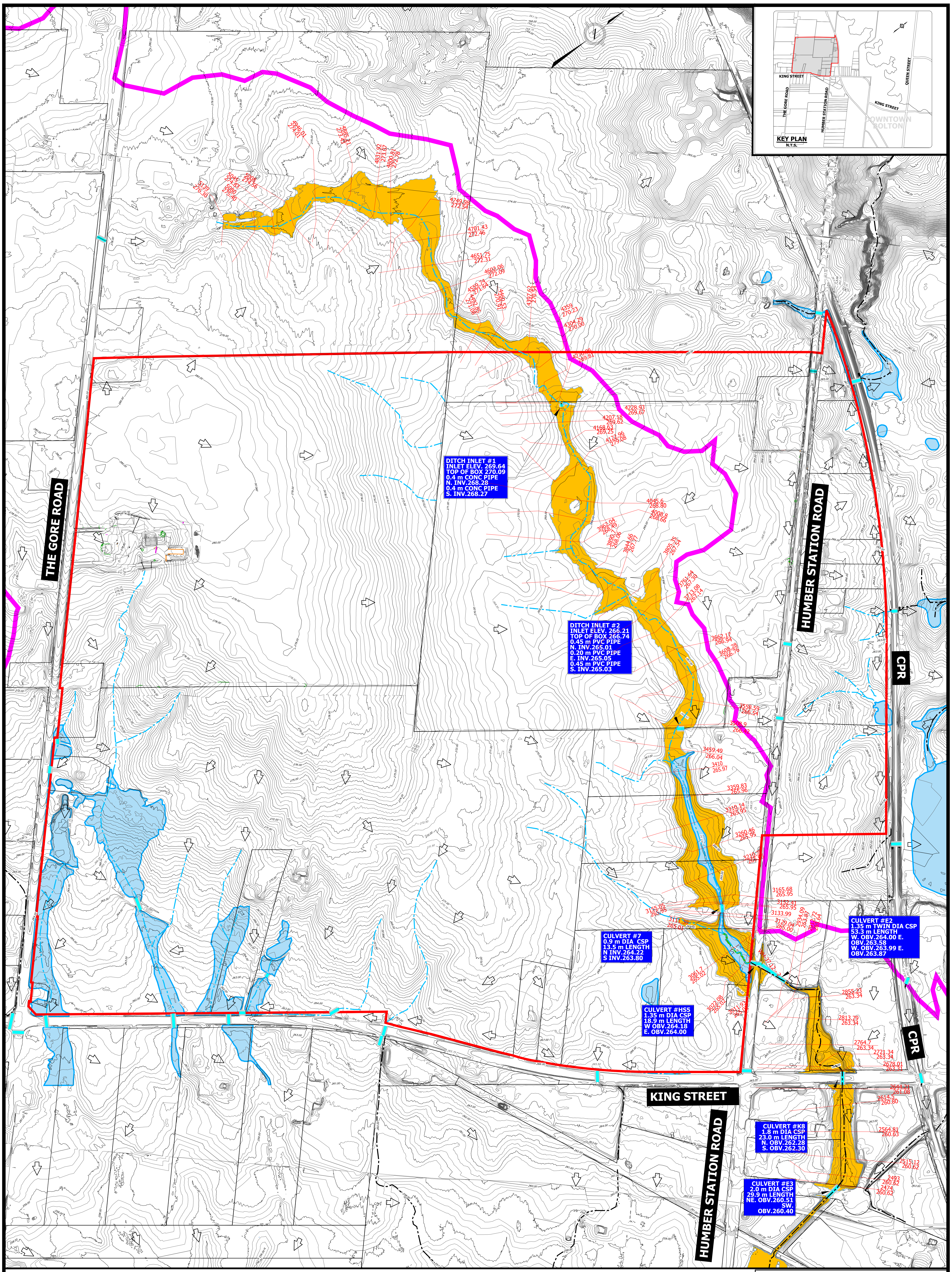

LEGEND:

🟥	CALEDON STATION SECONDARY PLAN LIMIT
253.00	EXISTING CONTOURS
▬	EXISTING CULVERT LOCATION
CULVERT #K3 0.9 m WIDTH BOX CONC. 16.2 m LENGTH N INV.260.70 S INV.260.71	EXISTING CULVERT DESCRIPTION
⇨	EXISTING OVERLAND FLOW DRAINAGE PATH
▨	UNEVALUATED WETLANDS
▬	WEST HUMBER WATERSHED BOUNDARY BASED ON UPDATED TOPOGRAPHY (URBANTECH)
— · — ·	CEISMP HEADWATER DRAINAGE FEATURES (BEACON)
— · — ·	UNEVALUATED CEISMP HEADWATER DRAINAGE FEATURES (BEACON)
5139 278.68	HEC-RAS STATION EXISTING FLOODLINE ELEVATION
🟧	EXISTING WEST HUMBER (WHT6) FLOODPLAIN

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TOWN OF CALEDON
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EXISTING FLOODPLAIN MAPPING

WEST HUMBER RIVER TRIBUTARY 6 (WHT6)

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DESIGNED BY:	S.K./E.L.	CHECKED BY:	S.K./A.F.	202-A			
SCALE:	1:3000	DATE:	MAY 2023				

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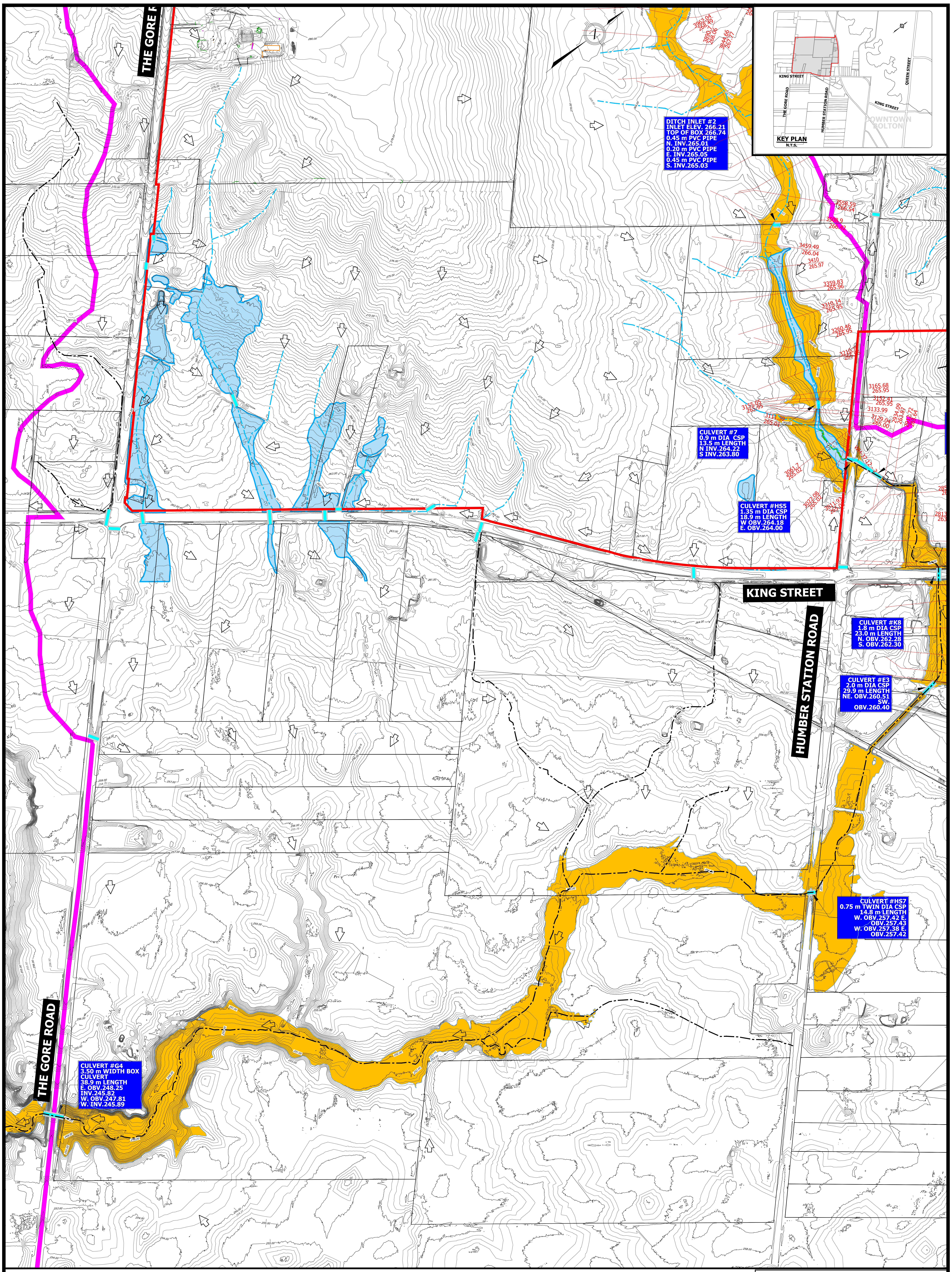

LEGEND:

▬	CALEDON STATION SECONDARY PLAN LIMIT
253.00	EXISTING CONTOURS
▬	EXISTING CULVERT LOCATION
CULVERT #K3 0.9 m WIDTH BOX CONC. 16.2 m LENGTH N INV.260.70 S INV.260.71	EXISTING CULVERT DESCRIPTION
⇨	EXISTING OVERLAND FLOW DRAINAGE PATH
▭	UNEVALUATED WETLANDS
▬	WEST HUMBER WATERSHED BOUNDARY BASED ON UPDATED TOPOGRAPHY (URBANTECH);
— · — ·	CEISMP HEADWATER DRAINAGE FEATURES (BEACON)
— · — ·	UNEVALUATED CEISMP HEADWATER DRAINAGE FEATURES (BEACON)
5139 278.68	HEC-RAS STATION EXISTING FLOODLINE ELEVATION
▬	EXISTING WEST HUMBER (WHT6) FLOODPLAIN

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TOWN OF CALEDON
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EXISTING FLOODPLAIN MAPPING

WEST HUMBER RIVER TRIBUTARY 6 (WHT6)

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DESIGNED BY:	S.K./E.L.	CHECKED BY:	S.K./A.F.	202-B	
SCALE:	1:3000	DATE:	MAY 2023		

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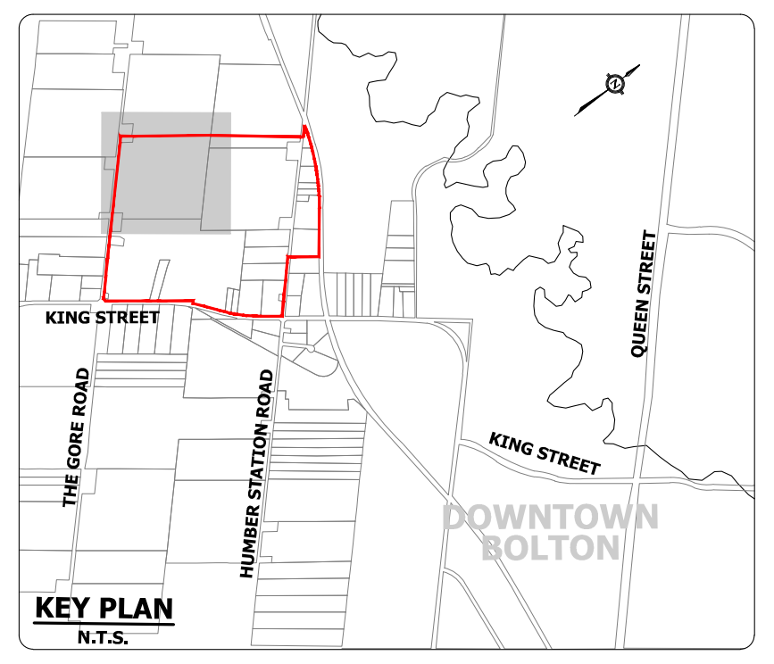

KEY PLAN
N.T.S.

LEGEND:

☐	PROPERTY BOUNDARY
🟩	GREENBELT
▨	EXISTING WETLAND BOUNDARY
W9	EXISTING WETLAND ID
▨	ENVIRONMENTAL POLICY AREA (EPA) INCLUDING BUFFER TO PROPOSED LIMIT OF DEVELOPMENT
— - —	EXISTING DRAINAGE FEATURE
× 261.15	EXISTING ELEVATION
263.50	EXISTING CONTOUR AND ELEVATION
⇨	PRE-DEVELOPMENT OVERLAND FLOW DIRECTION
☐	CSSP STUDY AREA LIMIT
× 261.15	PROPOSED ELEVATION
➡	POST-DEVELOPMENT OVERLAND FLOW DIRECTION
🟦	PROPOSED SWM POND
🟩	PROPOSED OPEN SPACE BLOCK
▨	PROPOSED EPA (ENVIRONMENTAL POLICY AREA) / CHANNEL
🟩	PROPOSED GREEN TRAIL
- · - · -	PROPOSED FLOODLINE

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TOWN OF CALEDON
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CALEDON STATION SECONDARY PLAN

GRADING PLAN
(1 OF 4)

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DRAWN BY:	A.G./X.S.	CHECKED BY:	S.H.	DRAWING NO.	SHEET NO.
DESIGNED BY:	S.K./E.L.	CHECKED BY:	S.K./A.F.	301	
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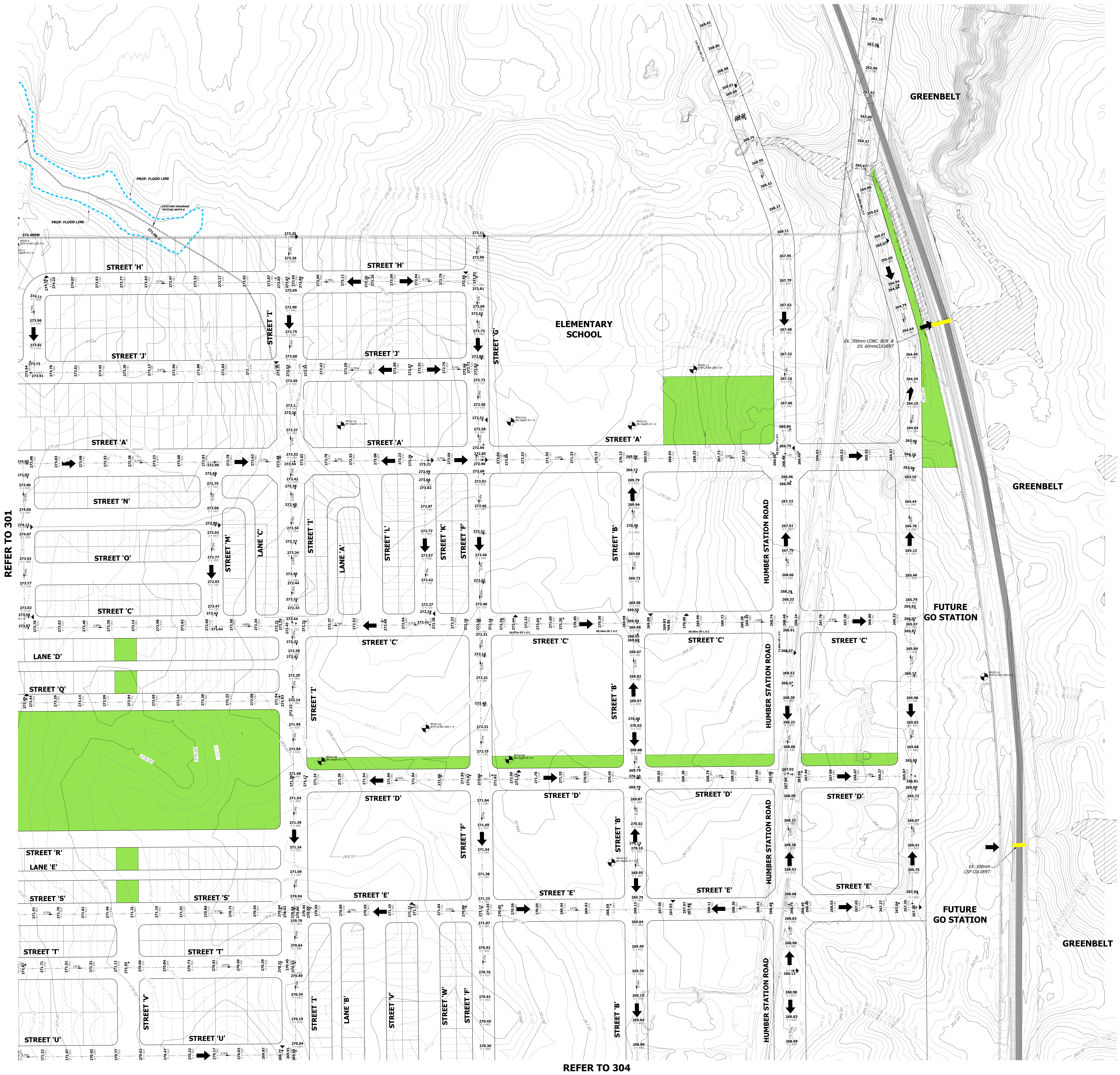

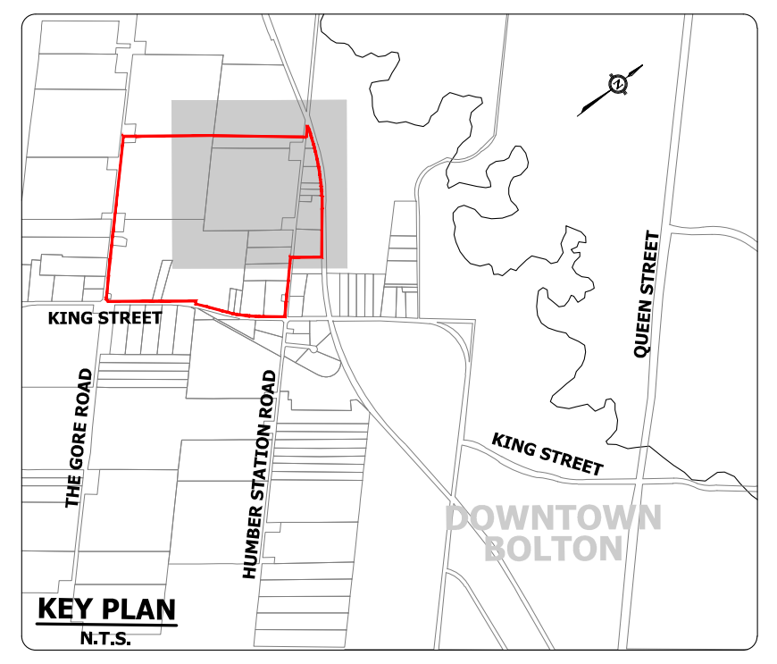

LEGEND:

- ▭ PROPERTY BOUNDARY
- 🟩 GREENBELT
- ▨ EXISTING WETLAND BOUNDARY
- W9 EXISTING WETLAND ID
- ▨ ENVIRONMENTAL POLICY AREA (EPA) INCLUDING BUFFER TO PROPOSED LIMIT OF DEVELOPMENT
- – – EXISTING DRAINAGE FEATURE
- × 261.15 EXISTING ELEVATION
- 263.50 EXISTING CONTOUR AND ELEVATION
- ⇨ PRE-DEVELOPMENT OVERLAND FLOW DIRECTION
- ▭ CSSP STUDY AREA LIMIT
- × 261.15 PROPOSED ELEVATION
- ➡ POST-DEVELOPMENT OVERLAND FLOW DIRECTION
- 🟦 PROPOSED SWM POND
- 🟩 PROPOSED OPEN SPACE BLOCK
- ▨ PROPOSED EPA (ENVIRONMENTAL POLICY AREA) / CHANNEL
- 🟩 PROPOSED GREEN TRAIL
- - - PROPOSED FLOODLINE

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TOWN OF CALEDON
REGIONAL MUNICIPALITY OF PEEL
CALEDON STATION SECONDARY PLAN

GRADING PLAN

(2 OF 4)

SURVEYED BY:	J.D.B.	DATE:	2020	JOB NO.	15-458
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DESIGNED BY:	S.K./E.L.	CHECKED BY:	S.K./A.F.	302	
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