Terra-Dynamics inc.
432 Niagara Street, Unit 2 St. Catharines, ON L2M 4W3

February 17, 2026

Primont (Thorold/Welland) Inc.
c/o Armando Lopes, Director of Development
9130 Leslie Street, Suite 301
Richmond Hill, Ontario L4B 0B9

Re: Official Plan Amendment & Hydrogeology, Part of Lot 228, City of Thorold, ON

Dear Mr. Lopes,

1.0 Introduction, Background Information and Purpose

It is our understanding that an Official Plan Amendment (OPA) is required to permit residential development within the City of Thorold in the southern portion of Lot 228, City of Thorold (the Site). The Site is 4.16 hectares (Appendix A) and was previously investigated by Terra-Dynamics Consulting Inc. (now Terra-Dynamics Inc.) as part of a Hydrogeologic Study and Wetland Water Balance of the 60.8 hectares of 436 Quaker Road Welland, and Lot 228/Part Lot 174, Thorold (Terra-Dynamics Consulting Inc., 2024).

The Site was historically within the Port Robinson West Subwatershed (NPCA, 1999), while later Niagara Peninsula Conservation Authority (NPCA) regional surface water catchment modelling (NPCA and AquaResource Inc., 2010) divided the Site between the Tow Path Drain (to the south in Welland) and the Singer's Drain drainage catchment to the north (part of the Port Robinson West Subwatershed, primarily in Thorold) (TDCI, 2024). The local catchment divide was further locally refined in our 2024 report with most of the Site within the Tow Path Drain southerly catchment (TDCI, 2024). WalterFedy have further completed stormwater management mapping placing 75% of OPA Site as within the Tow Path Drain surface water catchment with runoff to the south (WalterFedy, 2026 – Appendix A).

The Ministry of Natural Resources (MNR) have mapped a provincially significant wetland (PSW) consisting of swamp and marsh north and south of the Site as part of the Niagara Street Cataract Road Woodlot Wetland Complex (MNR, 2026). Previous monitoring and modelling support precipitation as the primary water supply for the wetlands (TDCI, 2024).

This letter summarizes our previous investigations with respect to the OPA Site to frame discussions with the City of Thorold as it is our understanding that they may wish to require an update to the Subwatershed Study. However, we believe sufficient investigations have been both recently, and historically, completed for sufficient characterization of the Site.

2.0 Methodology

Previous study tasks completed as part of the Hydrogeology Study and Wetland Water Balance included:

A. The physical setting was evaluated using published information from: (i) the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA), (ii) the Ministry of Natural Resources (MNR), (iii) the

Ministry of the Environment, Conservation and Parks (MECP), (iv) the Niagara Peninsula Conservation Authority (NPCA), and (v) the Ontario Geological Survey (OGS);

B. Field investigations have included:

(i) Geotechnical borehole investigations including laboratory soil grain-size analyses;
(ii) Construction of groundwater monitoring wells;
(iii) Adjacent wetland staff gauges deployed with water level dataloggers monitoring from July 2022 to November 2023, as well as wetland soil hand-augering; and
(iv) Seasonal manual and water level datalogger groundwater level measurements from May 2022 to November 2023.

C. Modelling of pre-development monthly water balance conditions through consideration of surface water catchments, land cover, soils, climate normals and wetland hydroperiods in order to inform future site design.

3.0 Physical Setting Summary

According to historical aerial photos, the Site was cleared for farming in 1934 and the Site is level to nearly level flat-lying, with a 1% slope (TDCI, 2024). The Site is regionally located on the Haldimand Clay Plain (Chapman and Putnam, 1984) described in the NPCA Port Robinson Subwatershed Study as a physical feature that "…*prevents significant infiltration to depth*…" (NPCA, 1999).

3.1 Soils

The Site soils are mapped as silty clay, consisting of either (i) Toledo – Loamy Phase, or (ii) Beverly – Loamy Phase, shown below in section (Figure 1) and details include (Kingston and Presant, 1989):

i. Toledo Loamy Phase: silty clay texture, poorly drained, slowly permeable, water levels stay near the surface much of the year, relatively high water-holding capacity and moderate to high surface runoff. The Singer's Drain PSW is perched on these low permeability soils.

ii. Beverly Loamy Phase: silty clay texture, imperfectly drained, moderately to slowly permeable, water occupies the surface horizons for a period of time each year and is prolonged where subsoil has been over compacted by heavy machinery, water-holding capacity ranges from medium to high, and surface runoff is moderate to high. Most of the OPA Site is mapped to be underlain by Beverly Soils.

3.2 Surficial Geology

The Site is covered by a layer of low permeability clayey silt to silty clay soil (Feenstra, 1984) as mapped by the OGS. This general characterization was confirmed by two geotechnical investigations of the Site (DS Consultants, 2022 and Soil-Mat Engineers and Consultants, 2023). The boreholes at the Site generally indicated clayey silt underlain by silty clay underlain by silt.

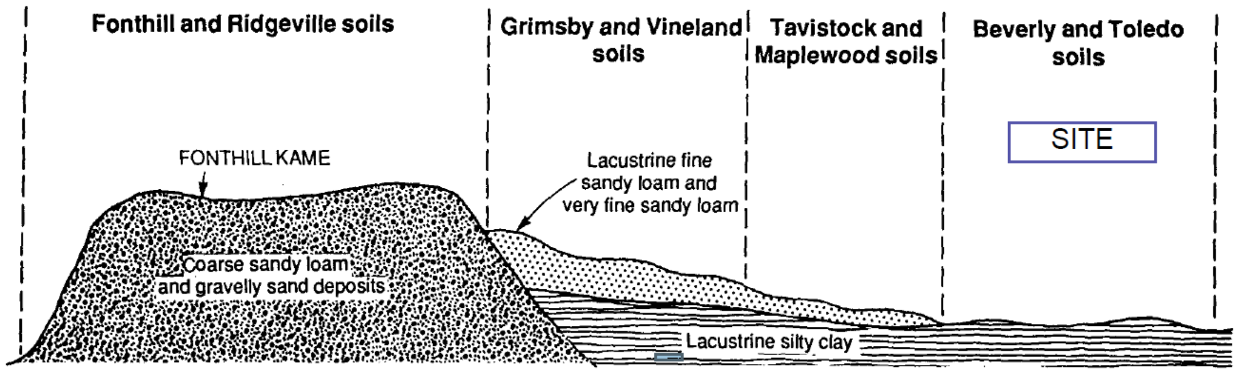

Figure 1 – Schematic landscape cross-section showing the relationship between soils on the Fonthill Kame-Delta Complex and its southern slopes (Kingston and Presant, 1989)

3.3 Hydrogeologic Setting

The Site is located on the Haldimand Clay Plain which is a regional aquitard (Gartner Lee Limited, 1987). An aquitard is "*a low-permeability geologic unit that can store groundwater, but that transmits groundwater slowly*" (Niagara Peninsula Source Protection Authority, 2013).

The Port Robinson Subwatershed Study (NPCA, 1999) previously described the hydrostratigraphy as follows (the numbered bullets below correspond with the numbers on the Figure 2 schematic below as modified from NPCA, 1999), and the hydrogeological setting has remained the same:

1. *The upper end of the subwatershed consists of permeable (sandy) deposits which often extend to bedrock;*
2. *The eastern part of the subwatershed is relatively flat, and is predominantly underlain by aquitard (clay) materials, with sandy pockets;*
3. *A thin, sand aquifer unit may separate the aquitard (Unit 2) from bedrock. This unit may be hydraulically connected to the sand deposits to the west;*
4. *The subwatershed is underlain by dolostone bedrock;*
5. *Precipitation falling within the western half of the subwatershed, could (a) runoff, (b) recharge radially from the topographic height to the deeper aquifer units, such as bedrock, or the lower sand, or (c) discharge to surface in the vicinity of the clay contact, providing baseflow to area tributaries; and*
6. *The majority of precipitation falling within the eastern half of the subwatershed will become runoff, rather than infiltration, however the limited precipitation that does infiltrate is expected to discharge to local tributaries.*

3.3.1 Overburden Aquitard

The hydraulic conductivity of the regional Haldimand Clay Plain overburden aquitard is reported as $7x10^{-7}$ m/s, or less (GLL, 1987). Hydraulic conductivity testing at the Site confirmed similar or lower hydraulic conductivities (TDCI, 2024).

Infiltration rates of the Site soils were calculated as less than 15 mm/hour based upon a relationship between soil hydraulic conductivity and infiltration rate as provided by Credit Valley Conservation (2012) via the laboratory grain-size analyses and a horizontal to vertical hydraulic conductivity of 10:1. Consequently, the native soils are considered unsuitable for infiltration trenches, soakaway pits and pervious pipes (MECP, 2003).

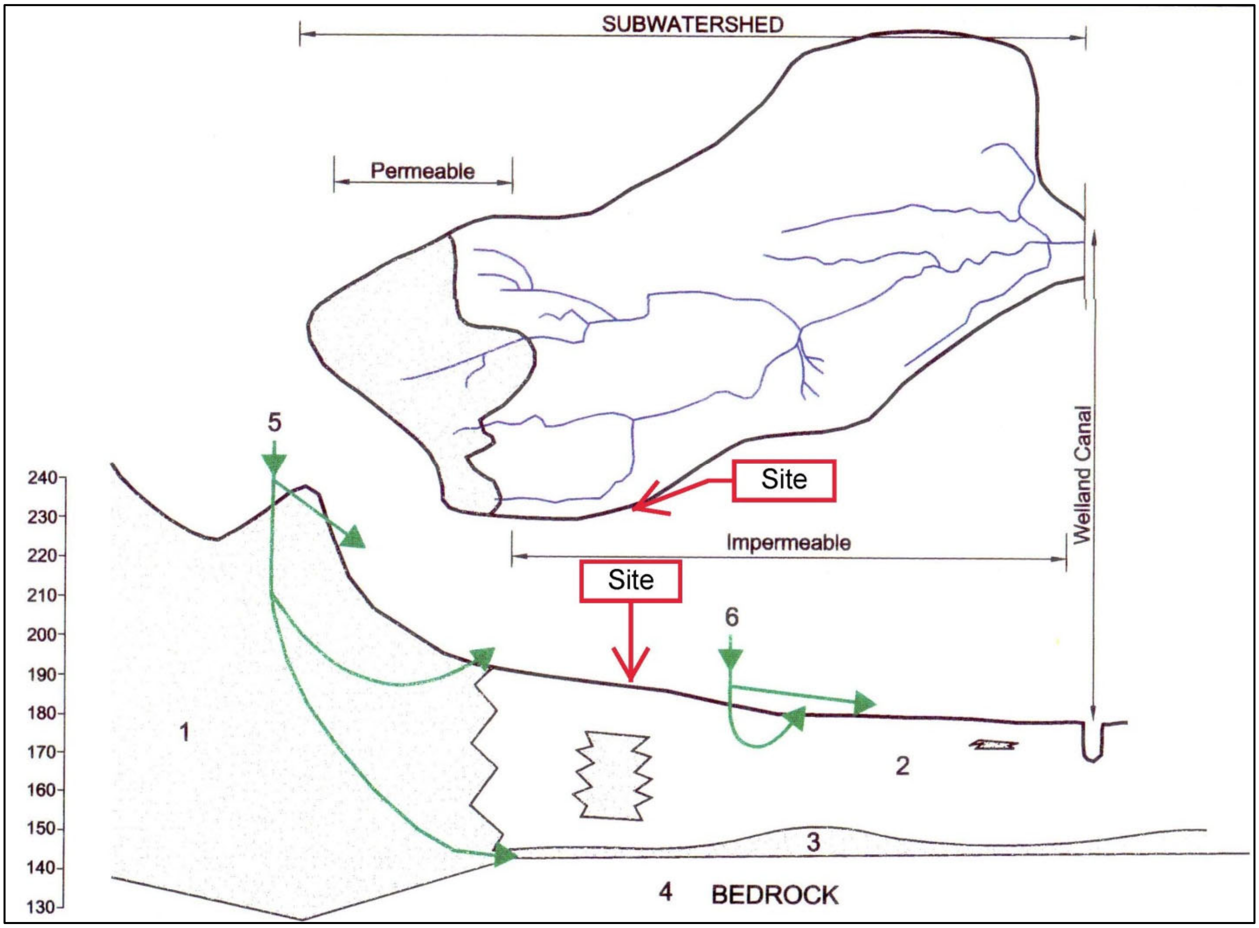

Figure 2 - Conceptual Hydrostratigraphy (modified after NPCA, 1999)

3.3.2 Overburden Groundwater Flow and Levels

Groundwater flow in the water table is generally west to east.

Spring-high groundwater levels at the OPA Site have been very close to surface, for example in April 2023 they were between 0.2 and 0.4 metres below ground surface. However, during the Summer 2022 drought conditions, the depth to groundwater was from 1.2 to 4.3 m BGS during a period of '*Abnormally dry to moderate*' drought as reported by Agriculture Canada (2023).

Groundwater levels were measured at the OPA Site at two groundwater monitoring wells (MW21-6 and MW22-01), as well as two nearby locations to the north (MW21-3) and south (MW21-8). The monitoring wells are screened in the underlying silty clay to silt between 3.1 to 6.1 m BGS. Manual groundwater levels were collected in spring, summer and fall for 1 ½ to 2 years between November 2021 and November 2023.

Upgradient western groundwater levels at MW21-6 showed a seasonal variation between the spring high and previous summer low of 0.8 m. Downgradient eastern groundwater levels at MW21-3 and MW21-8 showed similar greater seasonal variations between their spring season highs and fall season lows of 0.9 to 1.0 m.

3.4 Wetlands

The MNR has described the Provincially Significant Niagara Street Cataract Road Woodlot Wetland Complex as follows: "*dominant wetland type …* (is) *swamp, situated through a slough forest ecosystem. A slough forest ecosystem is characteristic of the Haldimand and Niagara Clay plain physiographic regions and consists of shallow to deep depressions…*" (MNR, 2009). It is noted an area of marsh was also mapped by the MNR north of the OPA Site.

General information regarding the Provincially Significant Wetlands mapped by the MNR at the Site are summarized below in Table 1. For example, the wetlands have been mapped as Palustrine wetlands, based upon having intermittent or no inflow, and either permanent or intermittent outflow and may rely on rainfall and some overland flow (MNRF, 2014).

Table 1 – Provincially Significant Wetland Information (MNRF, 2009)

Area	Type	Dominant Vegetation	Wetland Hydrology	Soils
North Swamp Singer's Drain	Swamp	Red maple	Palustrine	Clay/Loam
North Marsh Singer's Drain	Marsh	Broadleaf cattail	Palustrine	Clay/Loam
South Tow Path Drain	Swamp	Rice cut grass	Palustrine	Clay/Loam

3.4.1 Wetland Water Level/Hydroperiod Monitoring

A hydroperiod is defined as "*the seasonal pattern of the water level of a wetland…It characterizes each type of wetland, and the constancy of its pattern from year to year ensures a reasonable stability for that wetland. It defines the rise and fall of a wetland's surface and subsurface water by integrating all of the inflows and outflows"* (Mitsch and Gosselink, 2007).

Eighteen wetland water level staff gauges were previously installed by Terra-Dynamics between May 10 and 24, 2022 to monitor wetland hydroperiods (TDCI, 2024). Five of these locations were immediately north of the OPA Site, and five south of the OPA Site. During the installation of the staff gauges, silty clay soils were confirmed to be between 0.4 and 0.5 m BGS by hand-augering at each location.

Manual water level measurements began in the spring season of May 2022. Water level data loggers were deployed at staff gauges beginning in July 2022 to measure water levels at 15-minute intervals. The wetland water level staff gauges were constructed with well-points that allowed measurement of both surface water levels and shallow water levels to 0.1 m below ground surface.

The wetlands are reasonably characterized as follows: "*hydroperiods of many bottomland hardwood forests and swamps have distinct periods of surface flooding in the winter and early spring due to snow and ice conditions followed by spring floods but otherwise have a water table that can be a meter or more below the surface*" (Figure 3, Mitsch and Gosselink, 2007).

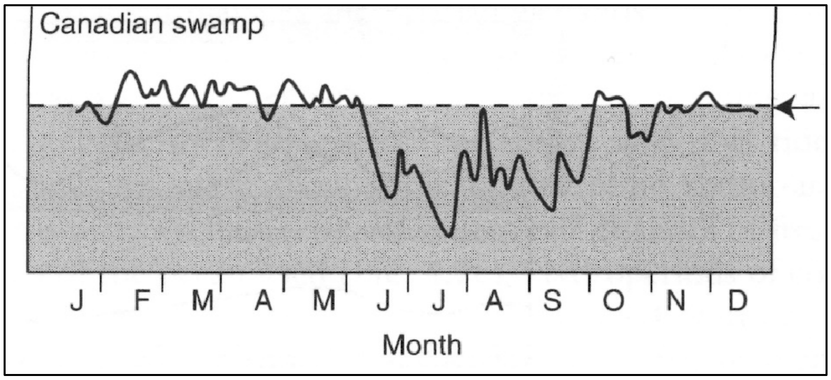

Figure 3 – Canadian Swamp Hydroperiod (Mitsch and Gosselink, 2007)
Note: arrow indicates wetland ground surface

3.4.2 Wetland Characterization

The wetlands were classified as *surface water depression wetlands* (Figure 4) (Mitsch and Gosselink, 2007). A surface water depression wetland is summarized as a: "*wetland…dominated by surface runoff and precipitation, with little groundwater outflow due to a layer of low-permeability soils*…". Low permeability silty clay soils have been noted beneath the wetlands as per this description.

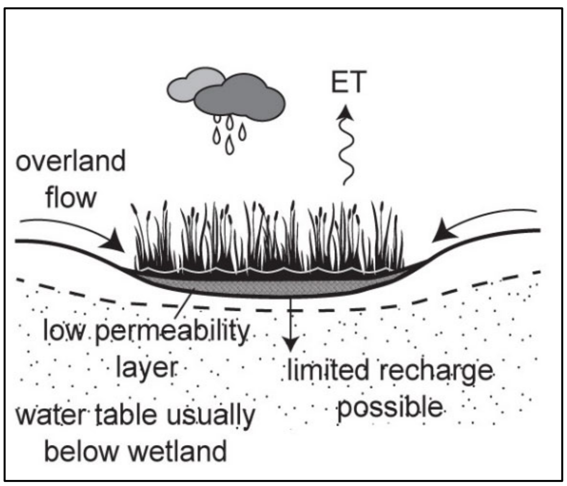

Figure 4 - Surface water depression wetland (Mitsch and Gosselink, 2007)

3.4.3 Wetland Water Balance Assessment

Wetland hydrographs from July 2022 to November 2023 supported precipitation as the primary wetland water supply when compared to monthly wetland water balance modelling (TDCI, 2024). Consequently, development was not predicted to negatively affect the wetland hydroperiods.

3.4.4 Wetland Risk Evaluation

Toronto Regional Conservation Authority (TRCA) recommended study, modelling and mitigation requirements (TRCA, 2017) that were previously completed:

(i) Pre-development monitoring as outlined in the Wetland Water Balance Monitoring Protocol (TRCA, 2016).
- Pre-development monitoring has occurred and informed the conceptual model and impact assessment for the Site.

(ii) Continuous hydrological modelling at daily aggregated to weekly resolution.
- Existing modelling (completed at 1-hour time steps) completed by NPCA was utilized as part of a monthly analysis. Re-visiting this modelling to extract weekly results would not provide discernable benefit.

(iii) Design of a mitigation plan to maintain the wetland water balance, in some cases an interim mitigation plan may also be required.
- Mitigation was not indicated to be required as precipitation is the primary water supply for the wetlands.

4.0 Key Hydrologic Areas and Features

The Niagara Region Official Plan (2022) lists under Policy 3.1.10.1 that:

> *Development or site alteration shall not be permitted unless it can demonstrated that it will not have negative impacts on:*
>
> *a. the quantity and quality of water in key hydrologic areas, key hydrologic features, sensitive surface water features, and sensitive ground water features;*
> *b. the hydrologic functions of key hydrologic areas, key hydrologic features, sensitive surface water features, and sensitive groundwater features;*
> *c. the interaction and linkage between key hydrologic areas, key hydrologic features, sensitive surface water features, and sensitive groundwater features and other components of the natural environment system;*
> *d. the natural hydrologic characteristics of watercourses such as base flow, form and function, and headwater drainage areas;*
> *e. natural drainage systems and shorelines areas; and*
> *f. flooding or erosion.*

Key Hydrologic Areas have been defined as "*Significant groundwater recharge areas, highly vulnerable aquifers, and significant surface water contribution areas that are necessary for the ecological and hydrologic integrity of a watershed*" (Niagara Region, 2022).

Key Hydrologic Features have been defined as "*Permanent streams, intermittent streams, inland lakes and their littoral zones, seepage areas and springs and wetlands*" (Niagara Region, 2022).

4.1 Highly Vulnerable Aquifers (HVAs)

There are no Highly Vulnerable Aquifers (HVAs) mapped at the Site. It is noted that potential HVAs are mapped adjacent to the Site, however, these are related to potential historical water wells requiring decommissioning at those lands (NPCA, 2011). The off-site HVA mapping has no bearing on development at the Site. However, it should be noted that as monitoring wells at the Site are no longer required, they must be decommissioned by a licensed water well contractor (MECP, 2023).

4.2 Significant Groundwater Recharge Areas (SGRAs)

Significant Groundwater Recharge Areas (SGRAs) have been mapped at the Site which were mapped based upon prescribed Technical Rules for source water protection studies (MECP, 2009). However, site-level investigations have confirmed the Site is underlain by a low permeability aquitard unsuitable for on-site infiltration activities (i.e. <15 mm/hour infiltration and often high water table conditions). No negative impacts to the ecological and hydrologic integrity of the watershed are predicted and additional groundwater recharge mitigation measures are not required.

The NPCA SGRA mapping was intended as a screening layer to be informed by site-level investigations. NPCA had recommended two levels of SGRA significance (NPCA, 2009) however that is not currently reflected in SGRA mapping. Two levels of significance were recommended as the Source Protection Committee chose an MECP SGRA threshold that is very low and includes clayey silt where infiltration may not be suitable. During development of the Niagara Peninsula Source Protection Plan, no policies were included for SGRAs (NPSPC, 2014).

4.3 Key Hydrologic Features

No negative impacts to the wetlands are predicted as they are primarily sustained by precipitation.

5.0 Discussion

5.1 Subwatershed

The Niagara Peninsula Conservation Authority Port Robinson West Subwatershed Study (SWS) Executive Summary (1999) framed the impetus for the SWS as:

> "*There is a current proposal to enlarge Singer's Drain over a central reach to remove sediment deposits and reduce flood potential… Singer's Drain has been impacted upon by past land use activities… Flooding problems have been experienced along portions of Singer's Drain where buildings are located near the watercourse and at some road crossings. The proposed work on the municipal drain portion are directed at reducing flood potential.*"

The SWS indicated that its purpose was to:

> "*develop a management strategy to direct future land use and other activities that will affect environmental and resource conditions in the Port Robinson West Subwatershed and Singer's Drain*."

The OPA Site is 75% within the Tow Path Drain not the Port Robinson West SWS. We believe this supports not requiring the OPA to update the Port Robinson West Subwatershed Study for this Site.

5.2 Port Robinson West Management Strategy

The management strategy of the Port Robinson West SWS (1999) included three components:

1. *Stormwater management measures for drainage of existing and future land use activities*
2. *Land use controls to protect (and enhance) terrestrial features*
3. *Site specific works to mitigate existing problems and provide for remediation*

We would propose that the relevant/appropriate SWS management strategy elements can be appropriately addressed at the Subdivision Stage:

1. *Stormwater Management: provide for flood, erosion and water quality (Level 2) control for new development – Use of "at source" controls as a first priority*
2. *Land Use Management: Re-evaluate wetland features*
3. *Site Specific Measures*: none applicable to the OPA Site

The Port Robinson West SWS (1999) included reviews of: (a) Physiography, (b) Hydrogeology, (c) Groundwater Use, (d) Hydrology, (e) Terrestrial Conditions and (f) Aquatic Habitat. An Environmental Impact Study will be completed to update the Terrestrial Conditions for the OPA Site however, the other categories do not require updating, which further supports not requiring the OPA to update the Port Robinson West SWS.

6.0 Conclusions

The following conclusions are provided:

1. The Site is located on the Haldimand Clay Plain, a regional thick aquitard of silty clay/clayey silt soils and is downgradient of the Fonthill Kame-Delta Complex which is considered a regional groundwater recharge area.

2. Native Site soils are low permeability and not suitable for infiltration trenches, soakaway pits or pervious pipes.

3. Surface water runoff drainage is primarily to the south and Tow Path Drain in Welland (75%) with a portion of drainage to the north and Singer’s Drain in Thorold.

4. Shallow groundwater flow is generally from west to east. The high water table in the spring season of 2023 was generally less than 0.5 m below the natural ground surface.

5. The wetlands are on low permeability silty clay, consisting of surface water depression wetlands.

6. Wetland water levels resembled a published hydroperiod for a Canadian swamp and reasonably matched modelled monthly water balance results for being sustained primarily by precipitation.

7. Pre-development monthly water balance modelling reasonably matched wetland water level monitoring, supporting the conceptual model of palustrine wetlands (e.g. intermittent or no inflow) supported primarily by precipitation.

8. Residential development of the Site should not negatively impact the hydrology of the wetlands because the wetlands are primarily supplied by precipitation and therefore implementation of buffers as prescribed in the Environmental Impact Study should be sufficient.

9. No negative impacts to the ecological and hydrological integrity of the watershed were predicted and additional groundwater recharge mitigation measures are not required.

10. A Subwatershed Study update (i.e. an updated regional analysis) is not required for the proposed OPA Site to adequately characterize conditions to inform development constraints.

We trust this information is sufficient for your present needs. Please do not hesitate to contact us if you have any questions.

Yours truly,

TERRA-DYNAMICS INC.

Jayme D. Campbell

Jayme D. Campbell, P. Eng.
Senior Water Resources Engineer

cc. Rachelle Larocque, The Biglieri Group Ltd.
Tristan Knight, Terrastory Environmental Consulting Inc.
Eric Salembier, WalterFedy

Attachments
Appendix A – Pre-Development Storm Drainage Area Plan

7.0 References

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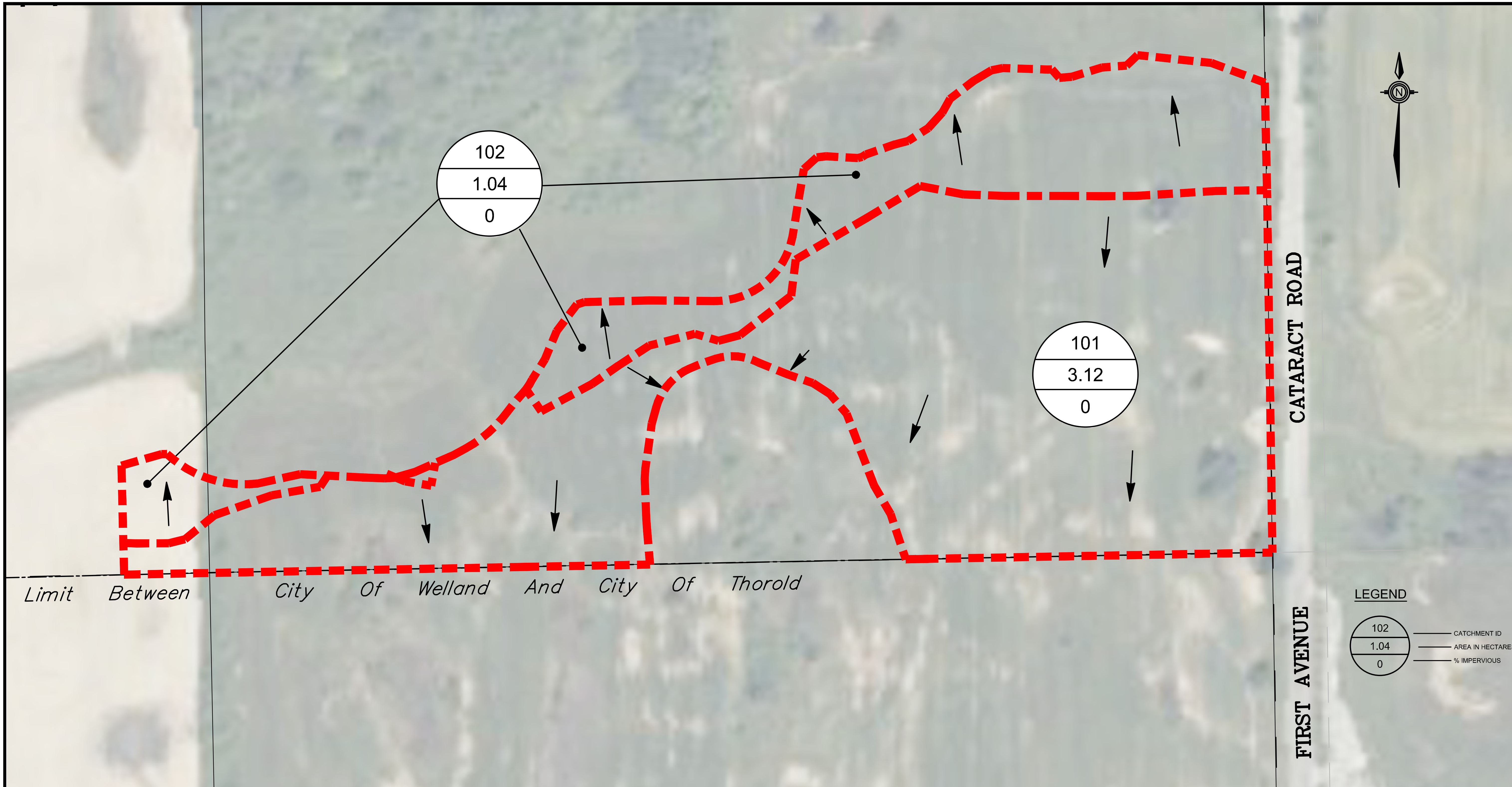
Toronto and Region Conservation Authority, 2016. Wetland Water Balance Monitoring Protocol.

WalterFedy, 2026. Pre-Development Storm Drainage Plan, Thorold (DAP1), Cataract Road, Thorold.

Appendix A

Pre-Development Storm Drainage Area Plan



PROJECT:

CATARACT ROAD
THOROLD

TITLE:

PRE-DEVELOPMENT STORM DRAINAGE AREA PLAN
THOROLD

WALTERFEDY

HAMILTON OFFICE
20 Hughson Street South, Suite 1000, Hamilton, Ontario, L8N 2A1
T: 289.799.3547 Toll Free: 800.685.1378 walterfedy.com

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