Simpson Road Landowners Group
Inc.C/O: Helen Mihailidi
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Vaughan, ON
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May 17, 2024
Reference: 20-717

Attention: Simpson Road Landowners Group

Reference: Simpson Road Extension and Rainbow Creek Culvert Feasibility Study

Dear Simpson Road Landowners Group,

Greck and Associates Limited (Greck) is pleased to provide this technical letter report in support of the proposed endeavor to continue development within The Town of Caledon's Phase 3 Simpson Industrial Secondary Plan Area. Specifically, our work examines the technical feasibility of draining the Simpson Road Industrial Area through a new extended underground culvert system that is to be located under the Simpson Road Extension. This solution would effectively replace the current Secondary Plan proposal to construct an open channel system along the future Simpson Road right-of-way. We offer information to assess the feasibility of a new culvert conveyance system as it pertains specifically to drainage and flood hazard.

It is our understanding that the Phase 3 area includes several landowners and parcels of land that are being contemplated for industrial development to utilize new/future access from Simpson Road in lieu of Coleraine Drive. As part of the Phase 3 Simpson Industrial Secondary Plan Area, Simpson Road is to be extended southerly to Mayfield Road. This new extension and intersection are required to provide necessary access to industrial properties to improve traffic conditions on Coleraine Drive to the west.

Included as part of the Phase 3 Simpson Industrial Secondary Plan Submission were detailed design drawings prepared by Wood, dated September 14, 2021. These drawings illustrate the proposed Simpson Road extension along with a proposed open channel re-alignment for the headwater reach of Rainbow Creek.

The result of this study has determined that a single 1.8m high by x 2.4m wide box culvert extending from the Equity Prestige Business Park SWM Pond through the Simpson Road right-of-way can convey upstream regulatory runoff and service the lands draining to Mayfield Road / Rainbow Creek. The installation of this culvert system would remove the need for an open channel system to convey flows to Mayfield Road through the subject properties.

Preliminary hydrologic and hydraulic analysis was undertaken using the Toronto and Region Conservation Authority's (TRCA) Visual Otthymo (VO) model. Greck prepared a

new PCSWMM, HECRAS and updated the VO model to design the new culvert system and quantify potential drainage and flood hazard impacts downstream. It was found that replacing 526m of routed channel will result in a 4.1% to 0.1% flow increase up to 7km downstream (Huntington Road and Rutherford Road). This flow change translates to a maximum flood elevation increase of 9cm for the regulatory flood event.

Background

The subject properties that form the Simpson Industrial Secondary Plan Area are within the headwaters of the Rainbow Creek tributary. We understand that earlier phases located north of the subject properties are now entirely developed industrial lands that drain into the constructed Stormwater Management Facility (SWMF) located immediately north of 0 Coleraine Drive. The facility referred to as the Equity Prestige Business Park SWM Pond, outlets directly into Rainbow Creek. The SWM pond outfall is the origin of the drainage feature. Outflows from the SWMF are conveyed in a south easterly direction through the subject properties (Phase 3 Lands) towards Mayfield Road where flows are then conveyed by an existing 1300mm diameter culvert under Mayfield Road.

The property east of the subject properties has been developed and is serviced by a SWM pond located at the northeast corner of Mayfield Road and the Rainbow Creek drainage feature. This SWM pond discharges to an existing 1300 diameter Mayfield Road culvert which drains Rainbow Creek southbound across Mayfield Road, see **Figure 1**.

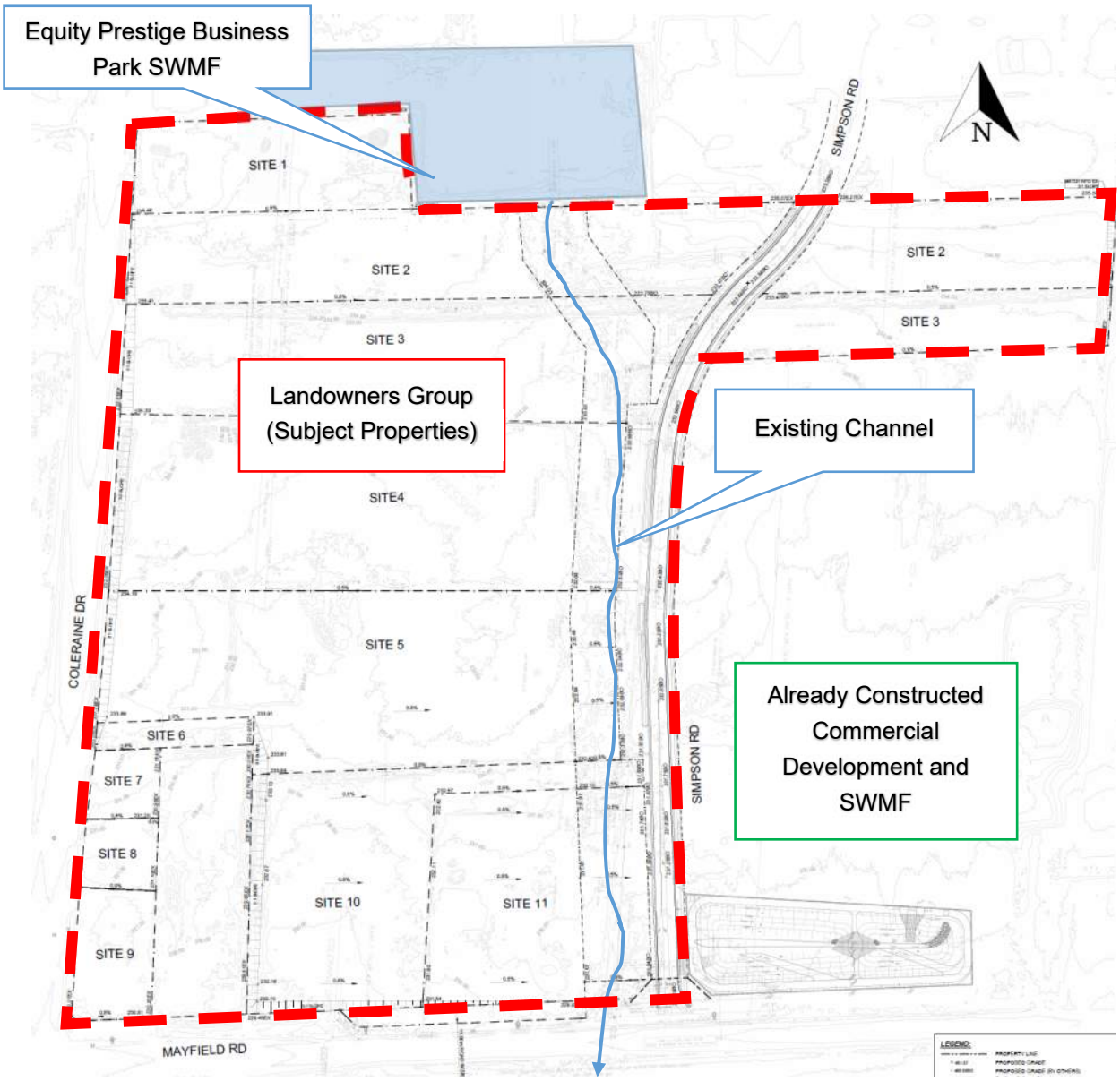


FIGURE 1: SIMPSON ROAD EXTENSION AND SIMPSON SECONDARY PLAN AREA – GEI PARCEL MAP

The existing channel is noted to have limited ecological value and functions more as an ephemeral channel (ditch), conveying wet weather flow only. The ecological significance of the feature is being further characterised by environmental consultants; see ecology study submitted under separate cover. Historical photography shows that the entire drainage area to Rainbow Creek upstream of Mayfield Road was once agricultural lands with no defined watercourse present, see **Figure 2**.

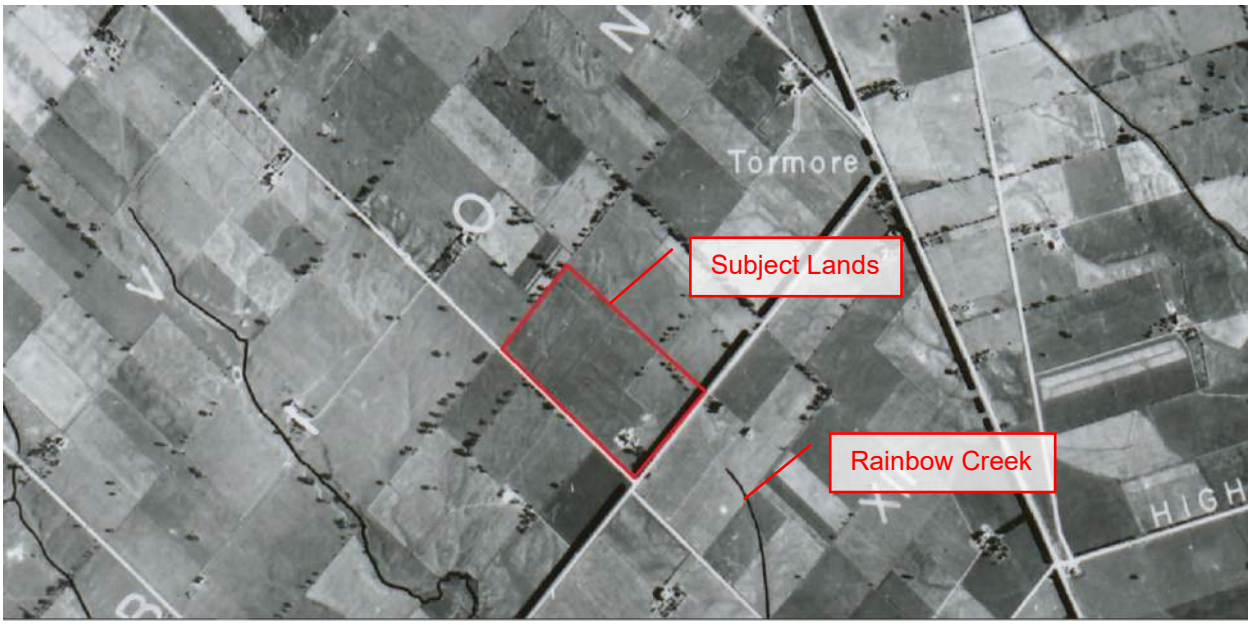


FIGURE 2 - 1954 AIR PHOTO OF SOUTHERN ONTARIO
HTTPS://MAPS.LIBRARY.UTORONTO.CA/DATAPUB/ONTARIO/APS_1954/ZIPPED/437.793.ZIP

As part of the Phase 3 Simpson Industrial Secondary Plan, detailed design drawings were prepared by Wood, dated September 14, 2021. These drawings illustrate the proposed Simpson Road extension along with a proposed channel re-alignment for the headwater drainage feature known as Rainbow Creek. The design proposes channel modifications that include a 45m wide by 1m deep corridor with a 2m wide bank full/low flow channel, see **Figure 3**.

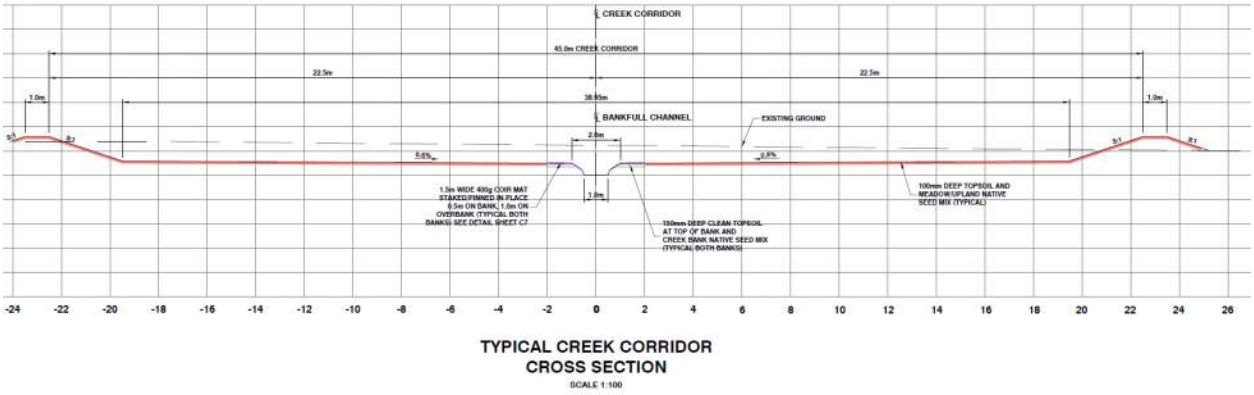


FIGURE 3 – TYPICAL CREEK CORRIDOR CROSS SECTION (WOOD, DRAWING C4, 2021)

It is our understanding that there was no hydraulic or hydrologic reporting in support of the proposed channel design however, a fluvial geomorphological report was prepared by Aqua Logic Revised March 5, 2015 & February 11, 2019. As per this report it can be concluded that the valley width is attributed to both meander amplitude and flood storage requirements. No technical analysis was provided to quantify hydrology and hydraulics impacts. We note the hydraulic modelling and channel design work provided as part of the past secondary plan did not include driveways and crossing structures.

The proposed channel was to be 560m long, 1m deep, and 45m wide, requiring 2.52ha of land along the southeast side of Simpson Road. The channel would originate from the Equity Prestige Business Park SWMF flowing downstream to Mayfield Road, see **Figure 4**.

FIGURE 4 – PROPOSED 45M WIDE CHANNEL (WOOD, DRAWING C1, 2021)

Illustrated in **Figure 4**, by Greck, are four areas (red) that show the proposed driveway locations identified by Wood. These areas are roughly 39m-50m wide along the channel. On average, the 39m width shown in red includes a total 30m wide driveway for two 15m wide industrial driveways per OPSD standards, 6m for two 3:1 side slopes into a 1m deep valley and 3m for property setbacks. Based on a 560m open channel system, roughly 30% or 167m of channel would need to be filled to accommodate the industrial crossings shown. Each crossing would require a minimum 1.8m by 2.4m wide box culvert to convey flows without overtopping onto Simpson Road.

It should be noted that to our knowledge the ecological, hydrological, and hydraulic impacts related to the overall channel design, crossings, and intended segregation were not quantified and reported on to obtain approval for the secondary plan channel design and road extension.

Proposed Culvert System Design

The Landowners Group has requested the proposed bypass culvert system to support the secondary plan. The purpose of the secondary plan is to maintain the current utilization of land for industrial use with improved accessibility. The current proposed open channel design conflicts with these primary objectives by sterilizing a significant portion of land to low probability floodplain and culvert crossings.

To accommodate and support the existing and proposed needs of the Secondary Plan Area, a culvert system is proposed instead of an open channel design. The conceptual culvert system design has considered the following:

- Provides sufficient drainage of regulatory runoff (100-year uncontrolled and Regional).
- Accommodates the Simpson Road Extension with minor deviation to already approved road profile and servicing modifications.

The proposed culvert system includes three (3) parts starting from upstream working downstream, See the Conceptual Culvert Conveyance System drawing appended to this report and **Figure 5** below:

- Part 1 – is a proposed 5.9m long open channel reach immediately downstream of the Equity Prestige Business Park SWM Pond, located on public land. This short channel system will receive outflow from the SWM Pond and is located along the current channel and natural low point. At the end of this open channel reach will be the beginning of the concrete culvert system. The culvert inlet will feature a high-capacity inlet to reduce inlet losses and promote pressure head. The inlet will feature a high-capacity grate capable of passing 100% design flow even if 50% blocked/clogged.

    - Note that the proposed culvert inlet will be constructed on City property and the Equity Park SWM Pond outlet will need to be modified (approved in concept by The City), which consists of a 750mm diameter outlet pipe. The 750mm diameter outlet pipe will be cut back to the edge of the 37.0m wide emergency spillway berm, and a new headwall for the 750mm diameter outlet pipe will be installed with concrete or armor stone up to the emergency spillway elevation.

    - The proposed culvert system high-capacity inlet will be installed at the property line.

    - A retaining wall or vegetated channel with a top elevation of 234.0 m will be installed from the west and east edge of the emergency spillway to the proposed high-capacity inlet to direct the pond overflow into the culvert system. A concept design of the modified pond outlet and culvert system inlet are provided in the Conceptual Culvert Conveyance System Drawing (Drawing C101) appended to this report .

- Part 2 – includes a 526m long 1.8m x 2.4m (rise x span) concrete box culvert at a 0.5% slope. The box culvert will extend from the SWM pond outfall channel towards Simpson Road to the east before bending southwards along the Simpson Road Extension and towards Mayfield Road. The culvert will daylight and outlet into an open channel reach approximately 50m upstream of Mayfield Road.

- Part 3 – is a proposed 35m long open channel reach to be located immediately upstream of the Mayfield Road culvert crossing into Rainbow Creek. This portion of the system will receive outflow from the proposed culvert before outletting to

the future culvert under Mayfield Road. This reach is located in the existing channel system which is the natural low point for the area. This reach also exists to receive overland flow from Simpson Road. Erosion control measures such as concrete headwall blocks (dragon teeth) and/or appropriately sized stone and rip-rap will be installed to immediately dissipate energy and long-term erosional forces upon daylighting from the culvert outfall.

It should be noted that the entire culvert system and all open channel areas as described above will be owned and maintained by the municipality. Easements will be required on private property as required to maintain this infrastructure.

Hydraulic Modelling - Proposed Culvert System

The proposed culvert system design was modelled using PCSWMM software. The model included the three (3) parts as stated above. An open channel (inlet), box culvert and open channel (outlet). The PCSWMM model included the following input parameters:

TABLE 1 – PCSWMM MODELLING INPUT PARAMETERS

Section	Input Parameter	Value	Justification
Open Channel	Baseline Flow	10.2 m^3/s	From VO modelling catchment 24.11, 100-year event
Box Culvert	Baseline Flow	1.5 m^3/s	Target flow rate of 1.05m^3/s provided by GEI for subject properties
Box Culvert	Conduit Length	526m	Length of box culvert based on preliminary layout of pipe.
Box Culvert	Roughness	0.013	Typical value for concrete pipe (PCSWMM Support)
Box Culvert	Entry Loss Coefficient	0.2	Typical value for box culvert with wingwalls (PCSWMM Support)
Box Culvert	Exit Loss Coefficient	1.0	Typical value (HEC-RAS Hydraulic Reference Manual)
Box Culvert	Average Loss Coefficient	0.7	From Table 23.6 of Minor Loss Coefficients for Storm Drain Modelling with SWMM by William H Frost (2006)
Open Channel	Roughness	0.035	Typical value for natural channels (PCSWMM Support)

Figure 5 illustrates the model profile under regulatory peak flow conditions (100 year, 6hr AES). Note, no flooding occurs.

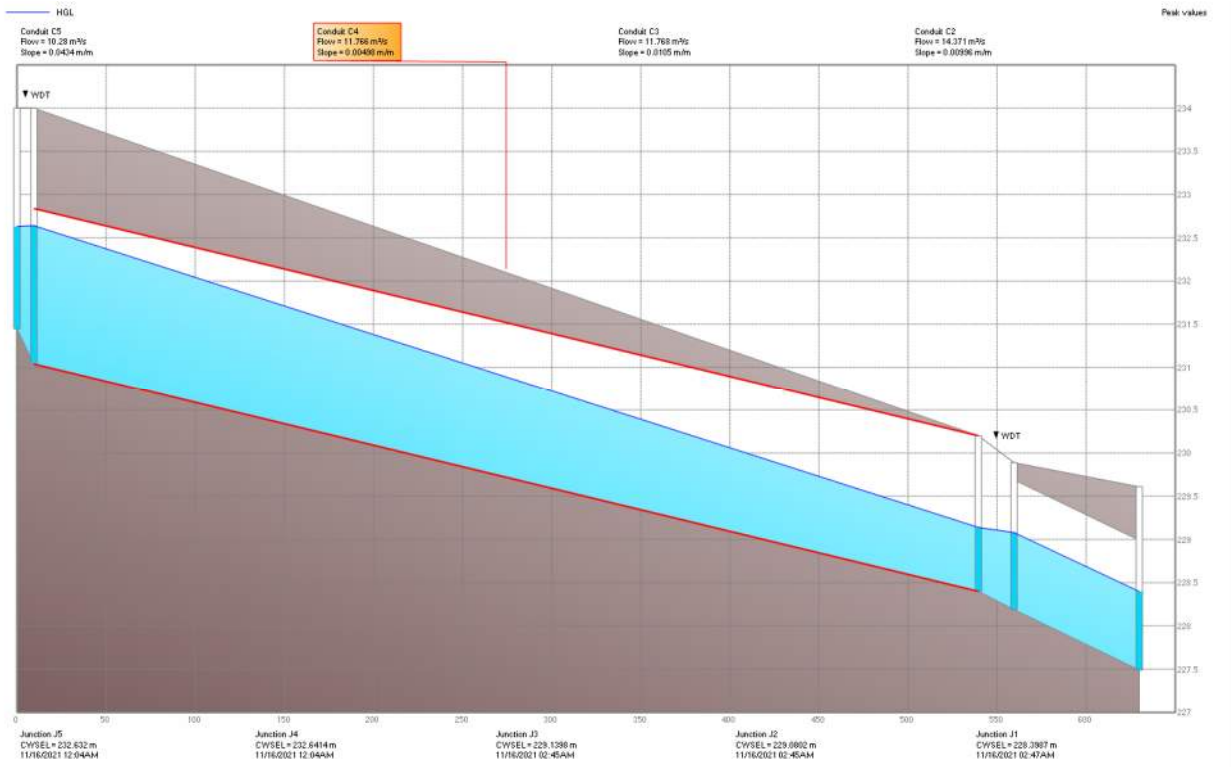


FIGURE 5 – PROPOSED CULVERT PROFILE UNDER REGULATORY PEAK FLOW CONDITIONS

The downstream boundary condition in the PCSWMM model is based on the hydraulic modelling results of the downstream open channel which was modeled in HEC-RAS. The HEC-RAS model includes an open channel sufficient in size and slope to convey the regulatory event from the culvert system outlet to the future culvert crossing proposed on Mayfield Road. It should be noted that based on Wood's drawings and Mayfield Road expansion work drawings, a 6m x 1.8m concrete box culvert is proposed under future widened Mayfield Road. Currently, there is a 1.3m diameter CSP.

Based on PCSWMM and hydraulic modelling results the upstream (Part 1) and downstream (Part 2) open channel reaches must be trapezoidal in shape with a minimum 1.3m wide base and 35m wide top width featuring 3:1 vegetated slopes and a minimum 0.5% channel gradient. This results in a channel depth of 1.64m which includes a minimum freeboard depth of 0.3m above the calculated regulatory flood elevation. These basic sizing parameters are illustrated in the Conceptual Culvert Conveyance System Drawing (Drawing C101) appended. See **Figure 6** for a typical cross section of the open channel.

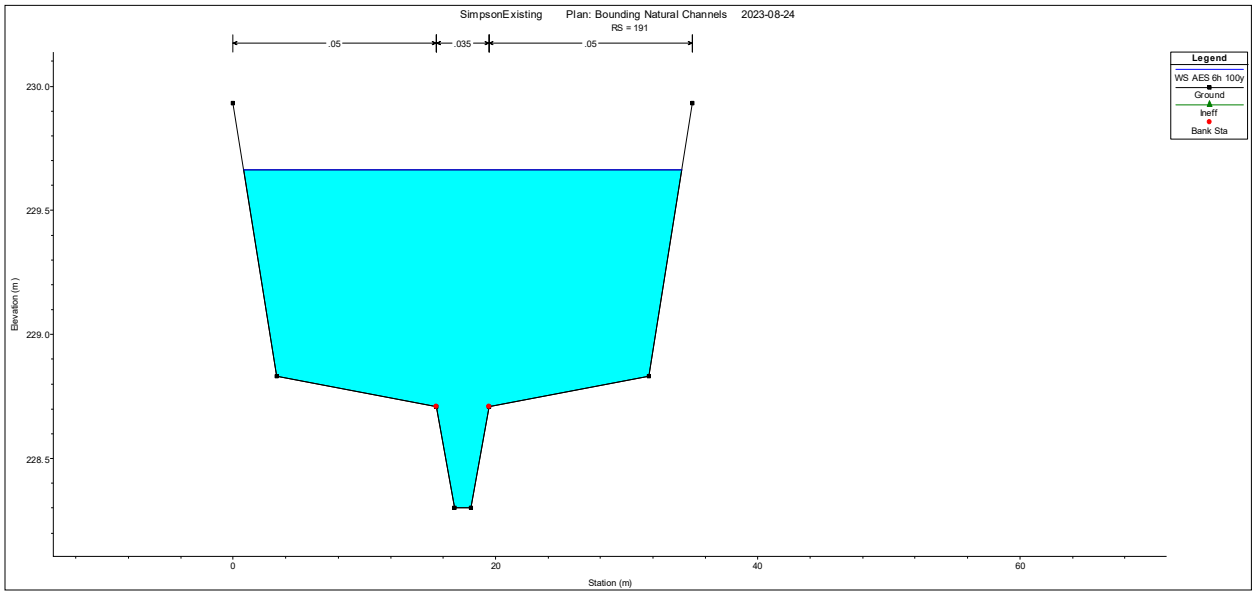


FIGURE 6 – TYPICAL CROSS SECTION OF THE OPEN CHANNEL

Emergency Flood Conditions

An emergency spill path was contemplated in the unlikely event that all SWM is incapacitated, and the proposed culvert conveyance system is incapacitated under uncontrolled flow conditions. A new hydraulic scenario in HEC-RAS was created to assess this overland flow condition.

This emergency spill considered future concept grading conditions for the subject properties provided by GEI, the current proposed Simpson Road design drawings by Wood, and as-built grades for easterly neighbouring lands (100 Pillsworth Road). During this unlikely scenario not only are all stormwater management facilities unfunctional, but the culvert system itself and the proposed high-capacity inlet grate is 100% blocked. Under this scenario, flood water must be conveyed by sheet flow to spill from the Equity Prestige Business Park SWM Pond eastward towards Simpson Road. Runoff will concentrate on Simpson Road and then drain southwards towards Mayfield Road before spilling back into the proposed open channel immediately upstream of Mayfield Road, see the Conceptual Culvert Conveyance System Drawing (Drawing C101).

We note that in this scenario not all flows are contained within the Simpson Road right-of-way (ROW). Some flows are expected to spill outside of the ROW onto the Subject Lands and the neighbouring lands to the east. Hydraulic results suggest maximum flood depths from the crown of Simpson Road will reach 0.18m to 0.32m and a peak velocity of 1.4m/s.

In accordance with MNRF Technical Guidelines, **Figure 7** illustrates risk thresholds for typical flood risk assessment.

Table 4 Flood Risk Criteria

Risk Level	Low	Medium	High *
Depth	≤ 0.3 m	> 0.3 m and ≤ 0.8 m	> 0.8 m
Velocity	≤ 1.7 m/s	≤ 1.7 m/s	> 1.7 m/s
Depth-Velocity Product	≤ 0.37 m^2/s	≤ 0.37 m^2/s	> 0.37 m^2/s

* Exceedance of any one of the criteria results in high risk.

FIGURE 7: TABLE 4 FROM FLOODPLAIN SPILL ASSESSMENT PREPARED BY MATRIX

For areas classified as low risk, ingress and egress are feasible for pedestrian and vehicular traffic. For medium risk areas, ingress and egress are feasible for pedestrian traffic and emergency vehicles but not private vehicles. For high-risk areas, ingress and egress are not feasible for pedestrian nor vehicular traffic.

Currently, preliminary grading of the subject properties and the Simpson Road alignment result in a medium risk scenario. Best effort should be made to accommodate conveyance during detail design to improve flood risk during this unlikely emergency scenario. This may include dedicating and grading lot frontage (driveways, parking and grassed areas) on private property to better accommodate and convey emergency spill to relieve flooding on Simpson Road and other external properties.

Hydrologic Modelling

The hydrology model was updated with the proposed culvert system to assess impacts to peak flows.

TRCA's most recent hydrologic modelling was provided to Greck. The modelling was prepared by Civica, dated 2018. To assess acceptable impacts of the proposed culvert system, including channel routing and attenuation, Greck ran 4 (four) modelling scenarios with the Regional and 100-year Uncontrolled Flows (6hr AES) under the future land use scenario:

- Scenario 1: Future Conditions – Untouched Civica Model (route channel)
- Scenario 2: Future Conditions – Removed 500m of channel (modified route channel)
- Scenario 3: Future Proposed Open Channel by Wood (500m of modified route channel)
- Scenario 4: Future Proposed 1.8m x 2.4m box culvert (500m route pipe)

The following results were obtained at ADDHYD #7413 in the VO modelling (the flow location that receives all routed flows and drainage catchments), see **Table 2** and **Figure 8**.

TABLE 2 - DOWNSTREAM FLOW COMPARISON FOR ALTERNATIVE FLOW ROUTING

Scenario	Regional Flow (m^3/s)	100 Year Uncontrolled Flow (m^3/s)
1 - Future Conditions	25.316	29.632
2 - No Channel Routing (removed 560m of channel)	26.151	31.251
3 - Proposed 393m of 45m wide Open Channel by Wood	25.651	29.695
4 - Proposed 494m of 1.8m x 2.4m box culvert	26.059	30.906

The result of this exercise demonstrates that the proposed culvert system will result in a maximum downstream peak flow increase for the 100 year and regulatory event by 4.30% and 2.93% respectively. This is primarily because the open channel offers more cross-sectional area / floodplain to attenuate flow during major return events i.e. flood storage.

To further assess the impacts of attenuation between the proposed open channel and culvert system, flow results were compared to the rest of the reach and greater watershed system downstream, see **Table 3** and **Figure 8**.

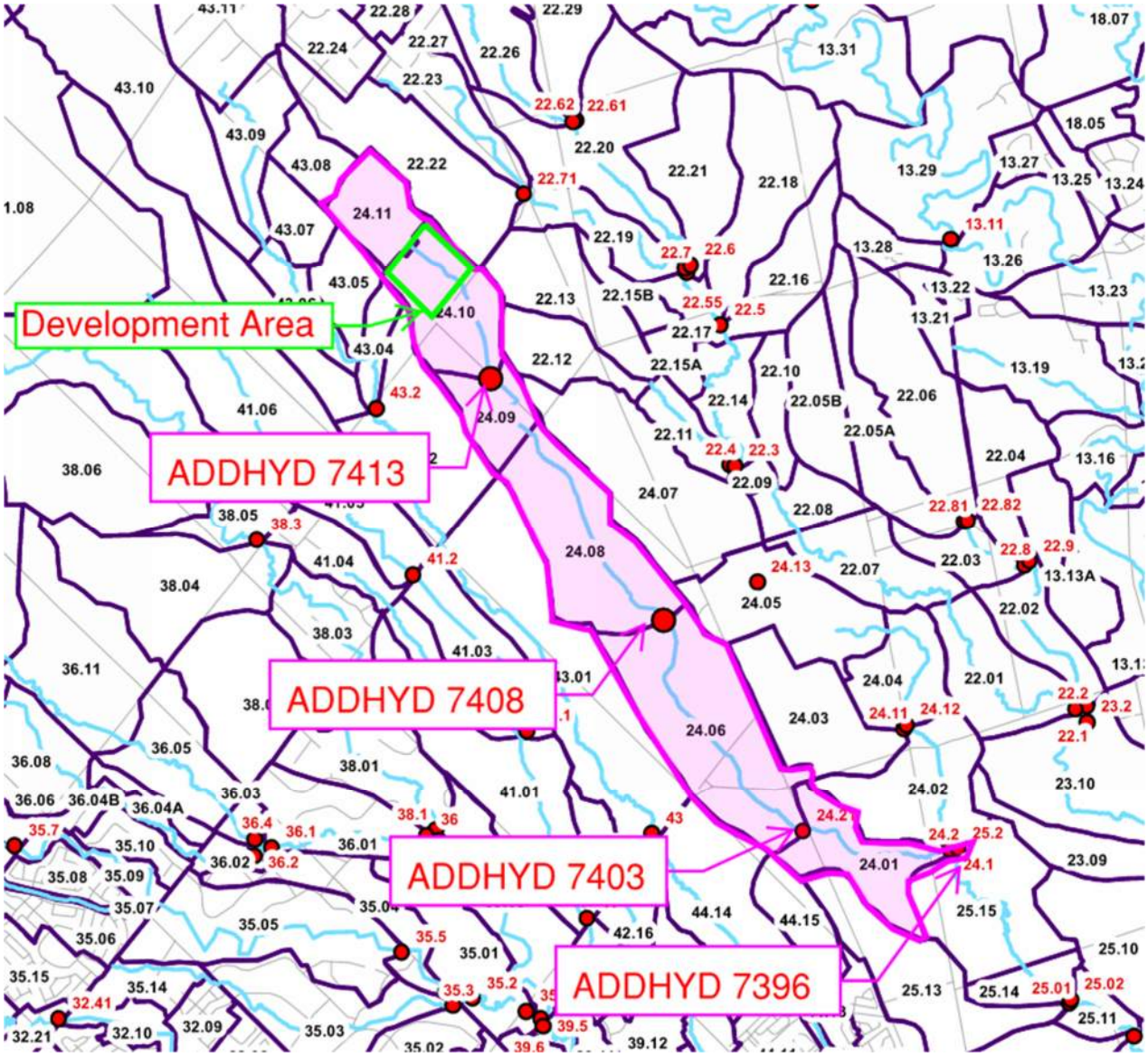


Figure 8 - Impacted Sub-watershed and Relevant Flow Nodes

TABLE 3 – REGIONAL SUB-WATERSHED FLOW IMPACT COMPARISON FOR ALTERNATIVE ROUTING

ADDYD	*Future Regional* (m^3/s)				
	Existing	**Secondary Plan Channel**		**Culvert System**	
7413	25.316	25.651	1.3%	26.059	2.9%
7408	37.666	37.65	0.0%	38.005	0.9%
7403	55.87	55.998	0.2%	56.273	0.7%
7396	122.15	122.159	0.0%	122.333	0.1%

It was found that the Regional flow governs (Regulatory) downstream of Countryside Drive. Flow increases eventually reduce to 0.1% approximately 7km downstream when the subject reach joins with another similarly sized tributary at Huntington Road and Rutherford Road (NHYD 7396).

Downstream Flood Hazard Impact Assessment

A downstream flood hazard impact assessment was completed for the proposed culvert conveyance system.

TRCA provided the following downstream hydraulic model and flood maps for the subject Rainbow Creek reach:

- Humber River Map Sheet 23 by Aquafor Beech Limited, dated 2019
- Humber River Map Sheet 150, 151 and 152 by Hatch Acres, dated 2006
- HEC-RAS Region of Peel model for the Humber River Tributaries

The flood maps are dated 2006, which makes them older than the 2018 hydrologic model by Civica. As such, flows in the HEC-RAS model had to be updated with Civica's 2018 VO model to assess downstream impacts as it pertains to flood hazard elevation.

All hydraulic modelling and updates were completed using CivilGEO GeoHEC-RAS software. GeoHEC-RAS utilizes the United States Army Corps of Engineers, HEC-RAS software. This version utilizes the 6.3.1 engine of HEC-RAS. RIVER 4 – REACH 1 corresponds to the channel downstream of the Simpson Road extension. Only this reach was assessed as part of the downstream impact analysis as **Table 3** above demonstrates that the flow impacts eventually reduce to 0.1%.

Internal flow change locations in TRCA original HEC-RAS model also had to be updated as per the VO model catchment delineation to input the new updated flows from the 2018 hydrologic modelling. Updating TRCA's existing hydraulic modelling was not the focus of this report however, it should be noted that on average the 2018 flows were 12.6% lower and resulted in average flood elevation decrease of 6cm, for the subject reach, see **Table 5** . In all instances, the new 2018 flows resulted in a greater change to flood hazard than the proposed culvert system. These changes are representative of new internal flow change locations and presumably catchment parameters such as area, imperviousness, time of concentration...etc.

Figure 9 shows a schematic of the subject reach overlaid with the VO catchments and flow data used to update the HEC-RAS model.

Figure 9:
Model Overlay

Simpson Road Extension, Bolton, Ontario

Project #: 21-717

0 0.5 1 km

Legend

- Internal Flow Change NEW
- Internal Flow Change OLD
- Cross Sections Regional
- River Reaches
- VO STANDHYD River 4 Reach 1

VO ADDHYD 7413
Future = 25.316m3/s
Future w bypass = 26.0587m3/s
HEC-RAS XS 24.49

VO ADDHYD 7408
Future = 37.6656m3/s
Future w bypass = 38.0047m3/s
HEC-RAS XS 24.42

VO ADDHYD 7403
Future = 55.8703m3/s
Future w bypass = 56.2733m3/s
HEC-RAS XS 24.30

VO ADDHYD 7581
Future = 59.0110m3/s
Future w bypass = 59.1937m3/s
HEC-RAS XS 24.145

D/S boundary condition set to TRCA's original model WSEL at HEC-RAS XS 24

Deleted internal flow changes and added purple flow changes to HEC-RAS model to account for updated Humber River Hydrology VO model catchments.

DEM Source: Land Information Ontario Lidar DTM GTA 2014 Package B

Basemap Image: Google Maps 2024

Greck

April 2024

To support our work, some minor updates to the subject reach (hydraulic model) were updated to better represent current conditions and flood results. This included shifting and re-aligning some cross sections at hydraulic crossings where bounding cross sections were cut too close to the road deck. This results in underestimating the conveyance area of the hydraulic crossing approach and exit.

Any updated cross-sections were cut using publicly available 0.5m grid generated digital terrain model (DTM) obtained through Land Information Ontario. The corresponding data package for the subject reach is “Lidar DTM GTA 2014 Package B”. The DTM has the vegetation and buildings filtered, therefore representing a “bare earth” model; the vertical datum of the DTM is CGVD2013 Geoid.

The HEC-RAS model and flood maps provided by the TRCA were prepared in the CGVD28 datum. The Vertical Datum Transformation Tool from the Government of Canada was used to adjust the DTM from the CGVD2013 to CGVD28 datum; the closest station to the subject reach is the TORT TORONTO station which is located approximately 11km southeast. The DTM was raised +0.414m to be in the CGVD28 datum.

Note that Manning’s n, expansion, and contraction coefficients were maintained as per the TRCA original model. **Table 4** provides a summary of the updated cross sections for RIVER 4 – REACH 1.

TABLE 4 – SUMMARY OF UPDATED CROSS SECTIONS

Crossing ID	Change
24.425 (culvert)	• Recut section 24.42 at the toe of road embankment to more accurately model geometry at the culvert exit. • Updated ineffective flow areas at bounding sections 24.43 and 24.42 to better model contraction and expansion at culvert approach and exit. • Shortened culvert length based on aerial imagery.
24.305 (culvert)	• Recut 24.305 road deck to account for updated Cadetta Rd alignment. • Updated culvert alignment based on aerial imagery. • Recut right bank of 24.30 to not cross realigned road deck. • Updated ineffective flow areas at bounding sections 24.31 and 24.30 to better model contraction and expansion at culvert approach and exit.
24.205 (bridge)	• Recut section 24.21 and 24.20 at the toe of road embankment to more accurately model geometry at culvert approach and exit respectively. • Recut 24.205 road deck to account for widened Castlemore Road. Bridge span of 10.3m was measured on aerial imagery; bridge opening appears to be rectangular based on Google Earth view. Bridge invert and obvert were maintained as per TRCA original model. A 1m high railing was added at the bridge opening; height was estimated based on aerial imagery and engineering judgement. • Updated ineffective flow areas at bounding sections 24.21 and 24.20 to better model contraction and expansion at culvert approach and exit. • Changed bridge methodology to “Pressure and/or weir flow” as this structure causes backwater.
24.16	• Shifted section slightly upstream such that it is at the toe of the road embankment to more accurately model geometry at culvert approach.

Table 5 shows the comparison of flows and flood elevations between the Existing Condition TRCA model (Original), the modified Existing Condition Greck model with the updated flows from the Civica VO model (New), and the Proposed Condition Greck model (New w Culvert System) with the updated flows with the Simpson Road culvert system.

TABLE 5 – COMPARISON OF FLOWS AND FLOOD ELEVATIONS FOR REGIONAL EVENT

	Flow (m^3/s)			Flood Elevation (m)			Difference (m)	
Cross Section ID	Original	New	New w Culvert System	Original	New	New w Culvert System	New - Original	New – New w Culvert
24.49	46.8	25.32	26.06	224.15	223.91	223.92	-0.24	0.01
24.48	46.8	25.32	26.06	223.24	223.16	223.17	-0.08	0.01
24.475	Culvert							
24.47	46.8	25.32	26.06	223.30	223.09	223.10	-0.21	0.01
24.46	46.8	25.32	26.06	222.99	222.72	222.73	-0.27	0.01
24.45	46.8	25.32	26.06	222.42	222.31	222.32	-0.11	0.01
24.44	46.8	25.32	26.06	221.08	220.91	220.91	-0.17	0
24.43	46.8	25.32	26.06	220.98	220.85	220.86	-0.13	0.01
24.425	Culvert							
24.42	46.8	25.32	26.06	219.72	219.46	219.47	-0.26	0.01
24.41	46.8	25.32	26.06	218.16	217.90	217.91	-0.26	0.01
24.40	46.8	25.32	26.06	217.17	216.86	216.87	-0.31	0.01
24.39	46.8	25.32	26.06	216.17	215.91	215.92	-0.26	0.01
24.38	46.8	25.32	26.06	214.91	214.64	214.65	-0.27	0.01
24.37	46.8	25.32	26.06	212.93	212.68	212.69	-0.25	0.01
24.36	46.8	25.32	26.06	212.10	211.75	211.76	-0.35	0.01
24.35	46.8	25.32	26.06	210.95	210.81	210.82	-0.14	0.01
24.34	46.8	25.32	26.06	210.33	209.98	210.00	-0.35	0.02
24.33	46.8	25.32	26.06	210.07	209.77	209.78	-0.3	0.01
24.32	48.3	25.32	26.06	209.40	208.89	208.92	-0.51	0.03
24.31	48.3	25.32	26.06	208.44	208.46	208.46	0.02	0
24.305	Culvert							
24.30	48.3	37.67	38	208.39	208.30	208.30	-0.09	0
24.29	48.3	55.87	56.27	207.69	207.74	207.74	0.05	0
24.28	48.3	55.87	56.27	207.15	207.22	207.22	0.07	0
24.27	48.3	55.87	56.27	206.14	206.22	206.22	0.08	0
24.26	48.3	55.87	56.27	205.13	205.20	205.20	0.07	0
24.25	52.3	55.87	56.27	204.21	204.24	204.25	0.03	0
24.24	52.3	55.87	56.27	204.10	204.11	204.12	0.02	0
24.235	Culvert							

24.23	52.3	55.87	56.27	203.47	203.49	203.49	0.01	0.01
24.22	52.3	55.87	56.27	203.18	203.13	203.09	-0.08	0.02
24.21	52.3	55.87	56.27	202.82	202.93	203.02	0.22	0.02
24.205	Bridge							
24.20	52.3	55.87	56.27	201.82	201.85	201.86	0.03	0.01
24.19	52.3	55.87	56.27	201.38	201.35	201.44	-0.03	0.09
24.18	52.3	55.87	56.27	199.83	200.00	200.00	0.17	0
24.17	52.3	55.87	56.27	199.81	199.98	200.00	0.17	0.02
24.16	52.3	55.87	56.27	199.72	199.86	199.88	0.14	0.02
24.155	Culvert							
24.15	52.3	55.87	56.27	198.29	198.32	198.32	0.03	0
24.145	52.3	59.01	59.19	198.32	198.34	198.35	0.02	0.01
24.14	56.2	59.01	59.19	198.18	198.20	198.20	0.02	0
24.13	56.2	59.01	59.19	198.25	198.28	198.28	0.03	0
24.12	56.2	59.01	59.19	198.25	198.27	198.28	0.02	0.01
24.11	56.2	59.01	59.19	198.24	198.26	198.27	0.02	0.01
24.105	Culvert							
24.10	56.2	59.01	59.19	195.73	195.80	195.81	0.07	0.01
24.09	56.2	59.01	59.19	194.87	194.94	194.95	0.07	0.01
24.08	56.2	59.01	59.19	194.55	194.57	194.57	0.02	0
24.07	56.2	59.01	59.19	194.63	194.66	194.66	0.03	0
24.06	56.2	59.01	59.19	194.58	194.60	194.60	0.02	0
24.055	Culvert							
24.05	56.2	59.01	59.19	191.50	191.53	191.53	0.03	0
24.04	56.2	59.01	59.19	190.79	190.81	190.81	0.02	0
24.03	56.2	59.01	59.19	190.56	190.58	190.58	0.02	0
24.02	56.2	59.01	59.19	190.54	190.56	190.56	0.02	0
24.015	Culvert							
24.01	56.2	59.01	59.19	188.67	188.70	188.69	0.03	-0.01
24.00	56.2	59.01	59.19	188.28	188.28	188.28	0	0

*Grey cells indicate a section that was updated in HEC-RAS.

Overall, the proposed culvert system results in negligible impact downstream. The maximum increase in flood elevation found was less than 9cm which is within a typical freeboard of 30cm. The majority of the reach experiences a 1cm to 3cm increase in flood elevation. The change in flood elevation reduces to less than 1cm downstream of Highway 50. A review of floodplain mapping for this reach indicates that no buildings will be directly or significantly impacted due to the proposed culvert system.

Conclusions and Recommendations

It was determined that a culvert conveyance system can be constructed as part of the proposed future Simpson Road alignment and current development plans. This culvert system includes a 526m long 1.8m by 2.4m box culvert that will conservatively convey uncontrolled regulatory flow for the entire drainage area upstream of Mayfield Road, outletting to the headwaters of Rainbow Creek. A downstream impact assessment determined that any flow increase due to lost hydrological flow attenuation (routing) would result in a negligible change in elevation and flood risk downstream.

It is recommended that the following also be considered from a feasibility, planning and approval perspective as it pertains to the proposed culvert conveyance system:

- There is no provincial minimum upstream drainage area requirement for the development of riverine flood hazard limits. However, during the 1970's and 1980's a minimum drainage area of 125 ha was deemed acceptable. We note the drainage area under study, upstream of Mayfield Road, is approximately 100ha.
- Recognition of existing development trends that have already occurred in the headwaters.
- Historically, evidence of a defined watercourse feature began south of Mayfield Road.
- Ecological factors.
- Geomorphological factors.
- Economic and Social needs.
- Land use functionality and practicality.

We trust this report offers sufficient information to assess the feasibility of a new culvert conveyance system with respect to the Simpson Road Secondary Plan.

Sincerely,
GRECK AND ASSOCIATES LIMITED

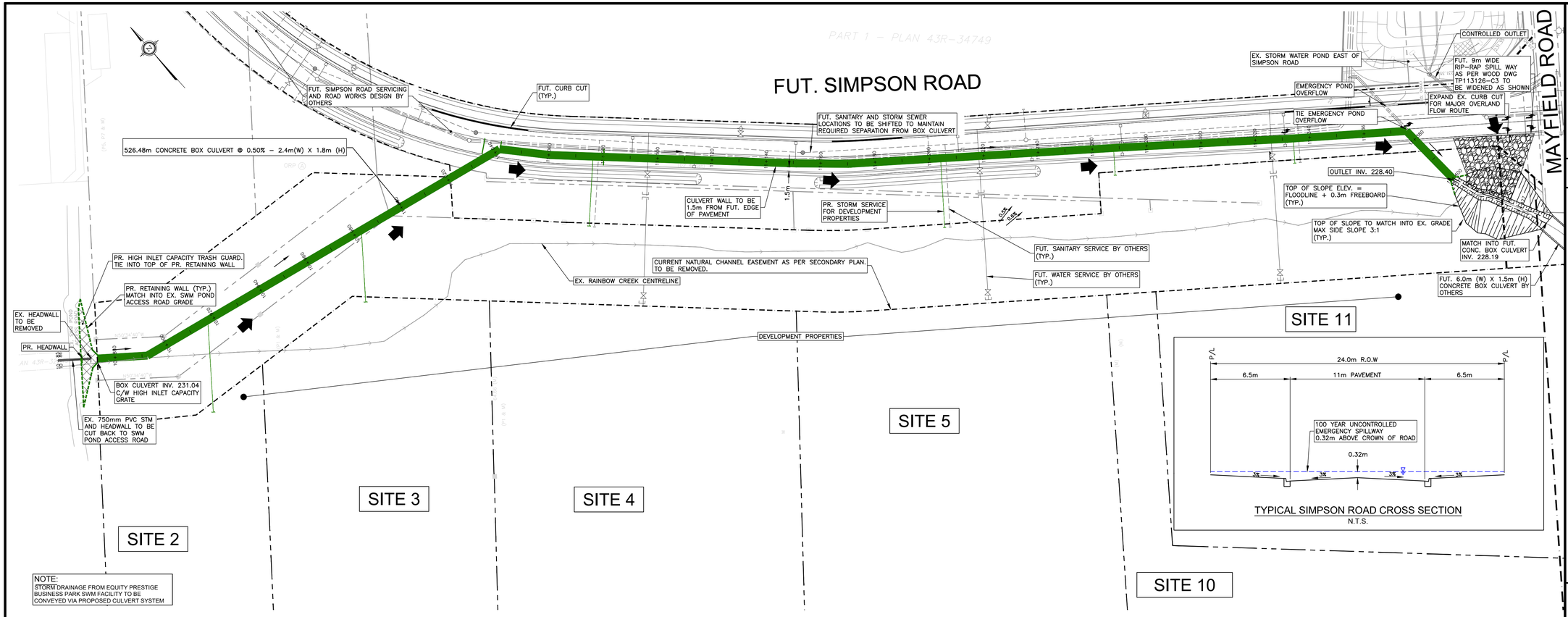
Eric Greck, P.Eng.
President

Jennifer Chan, P.Eng.
Water Resources Engineer

Attachments

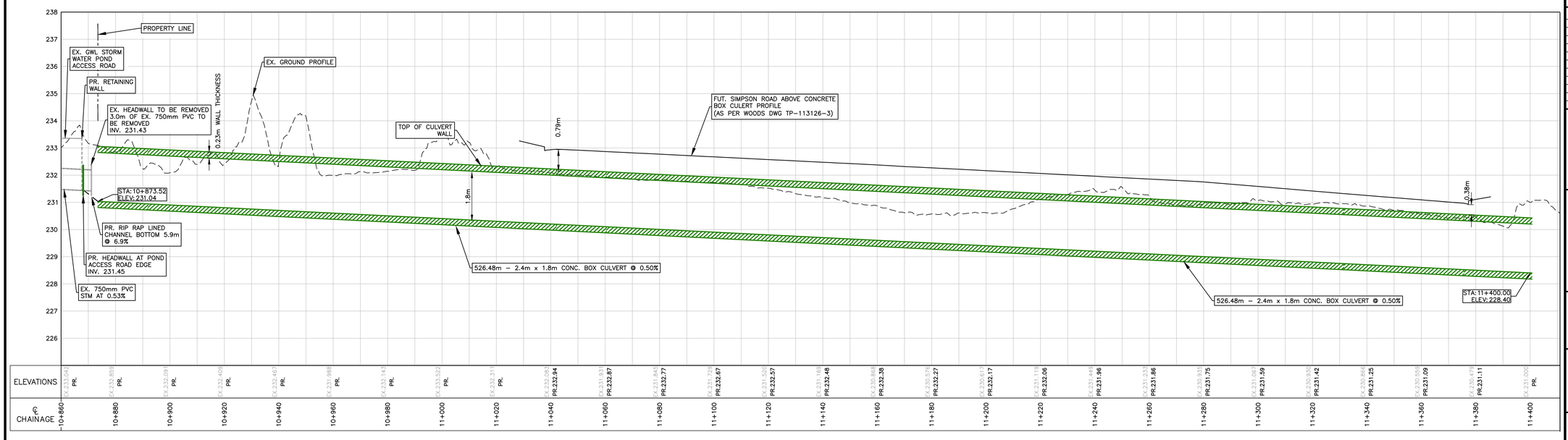
- Plan and Profile Drawing of Culvert System
  - Details of Culvert System Inlet

FUT. SIMPSON ROAD

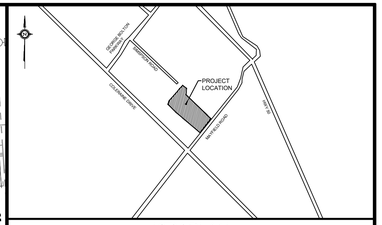


NOTE:
STORM DRAINAGE FROM EQUITY PRESTIGE BUSINESS PARK SWM FACILITY TO BE CONVEYED VIA PROPOSED CULVERT SYSTEM

PR. CULVERT CONVEYANCE SYSTEM, PROFILE



NOTE:
EQUITY PARK STORM WATER POND OUTLET ELEVATIONS ADJUSTED FROM CGVD 28:78 TO CGG2013 VIA TOWN OF CALEDON BENCHMARK 758086.



KEY PLAN
N.T.S.

LEGEND

EXISTING	PROPOSED	
MH1		STORM MANHOLE
MH1A		SANITARY MANHOLE
CB		SINGLE CATCHBASIN
DCB		DOUBLE CATCHBASIN
FD		SINGLE FLOOR DRAIN
HYD&V		FIRE HYDRANT
VB		VALVE & BOX
		STORM SEWER
		EASEMENT
		RIGHT OF WAY
		LOT LINE
		FENCE LINE
		CURB/SIDEWALK
		RETAINING WALL
		TOP OF SLOPE
		BOTTOM OF SLOPE
		MAJOR CONTOUR LABEL
		MINOR CONTOUR LABEL
		PONDING FACILITY
		DOWNSPOUT & ROOF LEADER
		SWALE
		OVERLAND FLOW
		TREE

BENCHMARK
SURVEY INFORMATION SOURCE :

EXISTING GROUND INFORMATION FROM LIDAR INFORMATION PROVIDED BY GEI CONSULTANTS IN AUGUST 2023

ALL FUTURE SIMPSON ROAD GRADING INFORMATION AS PER WOODS DRAWINGS DATED SEPTEMBER 2023

ALL SUBJECT LANDS GRADING AS PER DRAWINGS BY GEI CONSULTANTS DAATED JULY 2023

LEGAL BOUNDARIES AND LEGAL INFORMATION AS PER INFORMATION PROVIDED BY GEI CONSULTANTS

NO.	REVISION	DATE	BY	APPROVED
1	ISSUED FOR REVIEW	2024/05/17	EG	
2	ISSUED FOR REVIEW–PROFILE ADDED	2023/08/16	EG	
3	ISSUED FOR REVIEW–CULVERT UPSIZED	2023/08/25	EG	
4	ISSUED FOR REVIEW	2023/10/11	EG	

Greck
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LICENSED PROFESSIONAL ENGINEER
May 17, 2024
E.J. GRECK
100148911
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
J. K. Y. CHAN
100516103
May 17, 2024
PROVINCE OF ONTARIO

CLIENT NAME:
SIMPSON ROAD LANDOWNERS GROUP INC.
7501 KEELE STREET, SUITE 200
VAUGHAN, ON
L4K 1Y2

PROJECT NAME:
SIMPSON ROAD SECONDARY PLAN

CONCEPTUAL CULVERT CONVEYANCE SYSTEM

DESIGNED BY:	JC	SCALES:		PROJECT No.	20-717
CHECKED BY:	EG	HORIZONTAL:	1:750	DRAWING No.	C101
DRAWN BY:	DV	VERTICAL:	1:75	SHEET No.	01
DATE:	OCT 11, 2023	SHEET SIZE:	24"x36"		