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505-533 Yonge Street, City of Barrie

FUNCTIONAL SERVICING REPORT

Renaissance Barrie Retirement Trust

Document Control

File:

421422

Date:

December
14, 2021

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Issue	Date	Description
0	December 10, 2021	Draft for Client Review
1	December 14, 2021	ZBA (First Submission)

Document Contents

1	Introduction	1
1.1	Site Description & Surrounding Land Use.....	1
1.2	Proposed Development.....	1
1.3	Objectives	2
1.4	Guidelines & Background Information	2
2	Water Supply & Distribution	4
2.1	Existing Water System	4
2.2	Proposed Water Demands	4
2.3	Proposed Water System	5
2.4	Fire Protection	5
3	Sanitary Sewer Collection	6
3.1	Existing Sanitary System	6
3.2	Proposed Sanitary System	6
3.3	Downstream Capacity Analysis.....	7
4	Stormwater Management Plan.....	8
4.1	Background Information.....	8
4.2	Existing Conditions Drainage	8
4.3	Proposed Stormwater Management Plan Design Criteria.....	9
4.4	Proposed Stormwater Management Plan	10
4.5	SWM Facility Maintenance	14
4.6	Siltation & Erosion Control Plan	15
5	Grading & Landscaping	16
6	Utilities.....	17
7	Summary.....	18



7.1	Water Supply & Distribution.....	18
7.2	Sanitary Sewer Collection	18
7.3	Stormwater Management Plan.....	18
7.4	Grading & Landscaping	18
7.5	Utilities	18

Tables

Table 1: Pre-Development Peak Flow Summary.....	9
Table 2: SWM Facility #1 Operating Characteristics Summary	11
Table 3: Proposed Conditions Peak Flow Summary	12
Table 4: Phosphorous Loading Summary.....	14

Figures

Figure 1: Site Location Plan	2
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Appendices

Appendix A: Site Plan
Appendix B: Water Demand Calculations
Appendix C: Sanitary Sewage Design Calculations
Appendix D: Stormwater Management Plan Calculations
Appendix E: Drawings



1 Introduction

Tatham Engineering Limited (Tatham) has been retained by Renaissance Barrie Retirement Trust to prepare a Functional Servicing Report (FSR) in support of a Zoning By-Law Amendment (ZBA) application for the redevelopment of 505, 511, 515 and 533 Yonge Street (subject site) located in the City of Barrie (City).

This report presents a municipal servicing strategy, covering:

- water supply and distribution;
- sanitary sewage collection;
- drainage and stormwater management;
- grading and landscaping; and
- utility servicing.

1.1 SITE DESCRIPTION & SURROUNDING LAND USE

The site is located approximately 800 m northwest of the existing signalized intersection of Yonge Street and Big Bay Point Road. It is bound by existing developments to the north, Yonge Street to the west, and Lovers Creek to the east and south. The location of the property is illustrated on the Site Location Plan (Figure 1), overleaf. Under existing conditions, the site consists of buildings, parking lot area, and undisturbed treed area. The total site area is 2.70 ha, of which 1.80 ha is developed. The site topography slopes from Yonge Street towards Lovers Creek.

The site is located within the Lake Simcoe Region Conservation Authority (LSRCA) watershed and is located in their regulated area due to proximity to Lovers Creek. Therefore, the site will be subject to LSRCA review and approval. Ultimately a LSRCA works permit will be required prior to construction.

1.2 PROPOSED DEVELOPMENT

The proposed development consists of landscaped and outdoor amenity areas and four buildings (ranging from 8 – 12 storeys) with a total of 400 residential units. There will be approximately 1,075 m² of commercial space located on the ground floor of the proposed buildings. The development will be accessed from Yonge Street. The proposed site plan is provided in Appendix A.



The proposed development will be serviced by municipal water and sanitary systems. A private stormwater management system is proposed which will discharge into Lovers Creek. All existing water and sanitary services to the property will be permanently capped/cut off at the main to the satisfaction of the City of Barrie.

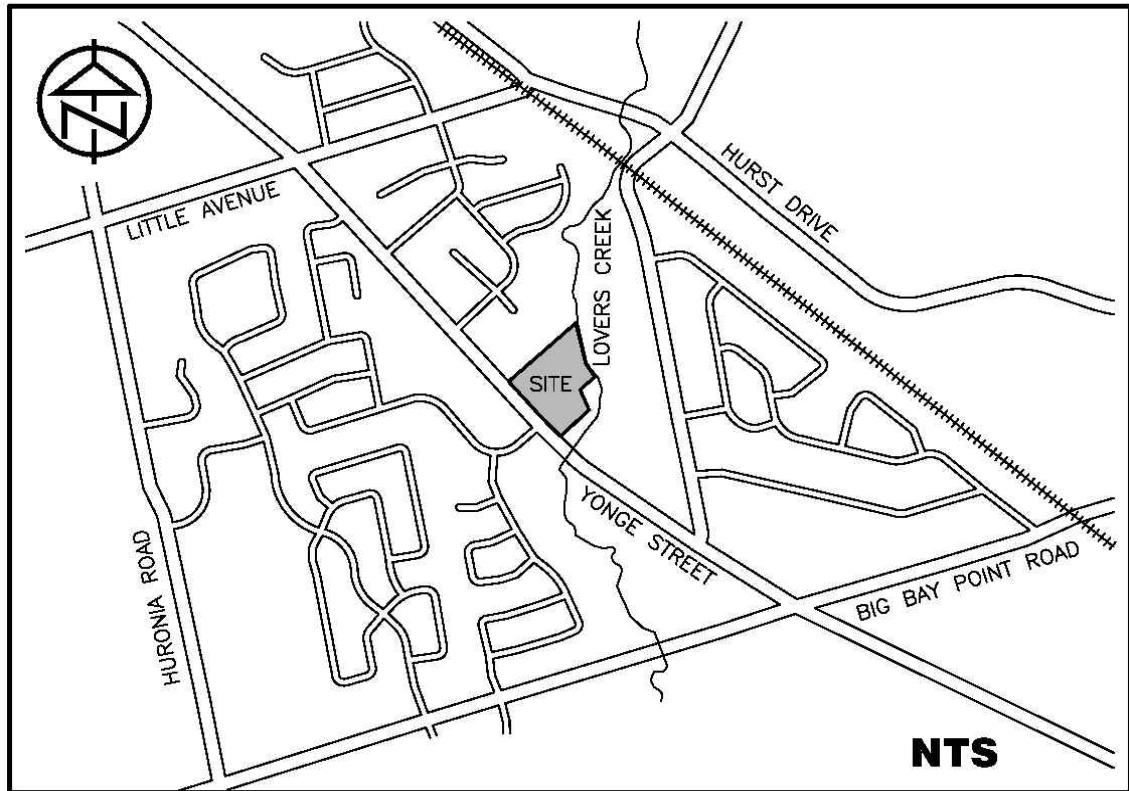


Figure 1: Site Location Plan

1.3 OBJECTIVES

The objective of this report is to present an overall servicing strategy to demonstrate the proposed development can be adequately serviced. This report will also document the preliminary stormwater management (SWM) strategy for the site, demonstrating the proposed development will not adversely affect local surface water conditions.

1.4 GUIDELINES & BACKGROUND INFORMATION

This report has been prepared in accordance with local and provincial guidelines, including the following publications:

- The Ministry of the Environment, Conservation, and Parks (MECP, formerly known as Ministry of Environment), *Stormwater Management Practices Planning and Design Manual* (2003);



- The Ministry of the Environment, Conservation, and Parks (MECP, formerly known as Ministry of Environment), Lake Simcoe Protection Plan (LSPP) (2009);
- Lake Simcoe Region Conservation Authority (LSRCA), Technical Guidelines for SWM Submissions (2016);
- Lake Simcoe Region Conservation Authority (LSRCA), Phosphorous Offsetting Policy (2019);
- City of Barrie, Storm Drainage and Stormwater Management Policies and Design Guidelines (2020);
- City of Barrie, Sanitary Sewage Collection System Policies and Design Guideline (2017); and
- City of Barrie, Water Transmission and Distribution Design Standard (2021).

Information relating to existing topography, ground cover, and drainage patterns was obtained through a review of relevant background studies, available plans, base mapping, and topographic survey.



2 Water Supply & Distribution

2.1 EXISTING WATER SYSTEM

The site is located in an area of the City which is serviced by the municipal water system. Specifically, the site is located within Pressure Zone 2S which is serviced by the City's surface water supply. There is an existing 300 mm dia. watermain on Yonge Street, which provides water supply and fire protection for the area.

According to the Water Supply Master Plan Update (2019) prepared by WSP, the surface water supply system is expected to have sufficient capacity to meet current and projected water demands up to 2035. Therefore, the system has sufficient supply capacity to service additional development in the area, including the subject site.

In addition, as per the Water Storage and Distribution Master Plan Update (2019) prepared by WSP, under existing conditions the storage systems which supply Pressure Zone 2 have a residual capacity of 11,890,000 L. There is expected to be sufficient storage volume to service Pressure Zone 2 under the 2041 growth scenario. Therefore, the system has sufficient storage volume to service additional development in the area, including the subject site.

2.2 PROPOSED WATER DEMANDS

The estimated population for the proposed development is 668 persons (applying the high-density unit population factor of 1.67 persons per unit as per the City's engineering standards). Residential water demands have been calculated using City standard values as summarized below. Demands generated by the commercial area have been estimated by applying a rate of 28 m³/ha/day for the 1,075 m² of commercial space. Water system demands have been estimated by applying Maximum Day Factor and Peak Rate factors from Table 3-1 of the MOE Design Guidelines for Drinking Water Systems.

The estimated water system demands are:

- Average Day Demand (ADD), Residential: 668 persons x 225 L/person/day = 150,300 L/day = 1.74 L/s;
- Average Day Demand (ADD), Commercial: 1,075 m² x 28 m³/ha/day = 3,010 L/day = 0.03 L/s;
- Total ADD: 153,310 L/day = 1.77 L/s;
- Total Maximum Daily Demand (MDD): 153,310 L/day x 2.75 = 421,603 L/day = 4.88 L/s; and
- Total Peak Hourly Demand (PHD): 153,310 L/day x 4.13 = 633,170 L/day = 7.33 L/s.



2.3 PROPOSED WATER SYSTEM

The proposed development will be serviced with a 150 mm dia. domestic water service and a dedicated 200 mm dia. fire service which will be connected to the existing 300 mm dia. watermain in Yonge Street which has a static pressure of 81 psi (558 kPa) based on the fire hydrant flow test referenced below. Additional preliminary water system information is provided on the Preliminary Site Servicing Plan (Drawing SS-1) provided in Appendix E. Preliminary watermain sizing is provided in Appendix B, based on the demands calculated above. The final water system design will be confirmed during the detailed design stage. Based on the preliminary calculations, there will be sufficient pressures (greater than 275 kPa) in the upper floors of the towers during PHD conditions without the need for internal booster pumps. However, the final watermain design and confirmation of need for booster pumps will be determined during the detailed design stage.

2.4 FIRE PROTECTION

Firefighting water demands have been estimated for the site using Water Supply Public Fire Protection (1999) prepared by the Fire Underwriters Survey (FUS). The required fire flow has been estimated at 200 L/s. Calculations provided in Appendix B.

A fire hydrant flow test was conducted using two nearby fire hydrants located on Essa Road, as provided in Appendix B. As shown in the test results, there was a minimal drop in residual pressures during the 3 conducted tests (i.e. system maintained a pressure of +/- 80 psi during the tests). Applying the equation provided in section 4.3.2 of the City's Water Transmission and Distribution Policies and Design Guideline, the estimated fire flow available at 20 psi is 13,684 USgpm (862 L/s), which is greater than the required maximum water demand of 204.9 L/s (MDD + fire flow).

Details of the internal sprinkler systems and demands calculated by the mechanical engineering consultant have not yet been provided. Therefore, should the mechanical engineering consultant require additional information, or should the firefighting requirements change, our assessment will be updated accordingly.



3 Sanitary Sewer Collection

3.1 EXISTING SANITARY SYSTEM

The site is located in an area of the City serviced with a municipal sanitary sewer collection system that conveys flows to the Barrie Wastewater Treatment Facility (WWTF) located at the west end of Kempenfelt Bay on Lake Simcoe.

Currently, an existing 250 mm dia. sanitary sewer on Yonge Street runs along the frontage of the site. The sewer conveys sewage flows approximately 250 m south and connects to a 1,050 mm dia. sanitary trunk sewer. The sanitary trunk sewer conveys flow towards the Barrie WWTF. This is depicted in Drawing SAN-1 provided in Appendix E. The existing 250 mm dia. sewer on Yonge Street has a full flow capacity of 37.61 L/s. This is calculated in the Sanitary Sewer Design Sheet provided in Appendix C.

According to the Wastewater Treatment Master Plan (2019) prepared by WSP, we understand the WWTF is expected to reach its current rated capacity in 2031. It was expected to reach 80% of the rated capacity in 2021, at which time it is understood annual reports are required to be prepared to assess the function of the WWTF. As such, it is understood the WWTF has sufficient existing capacity to service additional development in the City, including the subject site.

3.2 PROPOSED SANITARY SYSTEM

The proposed development will discharge sewage to the existing 250 mm dia. sanitary sewer on Yonge Street via a new 200 mm dia. sanitary service. A sanitary maintenance hole will be constructed on the property line to provide a sampling location, as per City standards. Refer to Drawing SS-1 for additional information.

The full flow capacity of the 200 mm dia. sanitary service is 20.74 L/s, which can accommodate the design peak flow of 7.43 L/s from the proposed development. Peak flows have been estimated as per the following:

Estimated sanitary design flows:

- Average Day Flow, Residential: $1.67 \text{ ppu} \times 400 \text{ units} = 668 \text{ persons} \times 225 \text{ L/cap/day} = 150,300 \text{ L/day} = 1.74 \text{ L/s}$; and
- Average Day Flow, Commercial: $1075 \text{ m}^2 \times 28 \text{ m}^3/\text{ha/day} = 3,010 \text{ L/day} = 0.03 \text{ L/s}$;
- Total Average Day Flow: $153,310 \text{ L} = 1.77 \text{ L/s}$;
- Peak Flow = 7.43 L/s (incl. infiltration – see sanitary sewer design sheet).



Therefore, there is satisfactory capacity in the proposed service connection to service the development.

3.3 DOWNSTREAM CAPACITY ANALYSIS

The capacity within the Yonge Street sewers between the site and the 1,050 mm dia. trunk have been assessed to confirm they have sufficient capacity to convey the peak flows from the subject development. The existing external drainage area has been estimated as shown on the Sanitary Catchment Plan (Drawing SAN-2). The corresponding catchment areas and land uses have been included in the Sanitary Sewer Design sheet. As shown, the peak flow in the Yonge Street local sewer (including the subject site) is estimated to be 19.36 L/s, while the minimum capacity within the existing Yonge Street sewers is 37.61 L/s. Therefore, there is sufficient capacity within the local sanitary sewers on Yonge Street to convey sewage flows to the existing trunk sewer. We understand the trunk sewer is sufficiently sized to convey the contributing peak flows.



4 Stormwater Management Plan

4.1 BACKGROUND INFORMATION

Information relating to existing topography, ground cover and drainage patterns was obtained through a review of relevant studies, available plans and base mapping. Detailed contour mapping was prepared based on a topographic survey of the site that was completed by Joe Topo Surveys and CADD Inc. in June 2021.

4.2 EXISTING CONDITIONS DRAINAGE

Under existing conditions, the site generally drains from west to east directly into Lovers Creek. Based on review of Ontario Soils Mapping data, the site is located in an area consisting of Bondhead sandy loam which is typically well draining and part of hydrologic soil group (HSG) AB. This is consistent with findings of the geotechnical report prepared by Cambium Inc.

For the purposes of this preliminary SWM plan, two existing drainage catchments (Catchment 101 & Catchment 301) have been delineated as depicted on the Pre-Development Drainage Plan (Drawing DP-1), provided in Appendix E. Catchment 101 is approximately 1.5 ha and is comprised of woodland, lawn areas, an existing commercial development and two residential dwellings. Runoff from Catchment 101 flows east at an average slope of 9.0% toward Lovers Creek. Catchment 301 is approximately 1.2 ha and located downstream of Catchment 101 and is comprised of mostly woodland area. Runoff from Catchment 301 also flows east at an approximate slope of 8.7% into Lovers Creek. Composite runoff coefficients (RC) of 0.40 and 0.18 have been calculated for Catchments 101 and 301 per Table 3.2 of the City of Barrie Storm Drainage and Stormwater Management Policies and Design Guidelines.

The Rational Method has been utilized to generate pre-development peak flow rates from the site for the 1:2-year through 1:100-year storm events utilizing City of Barrie IDF data in accordance with City standards for sites measuring less than 5.0 ha. Existing conditions peak flows have been generated for Catchment 101 as Catchment 301 will remain relatively undisturbed and will not be affected by the proposed development. A summary of existing peak flow rates is provided in Table 1 while detailed calculations are provided in Appendix D for reference.



Table 1: Pre-Development Peak Flow Summary

STORM RETURN PERIOD	PEAK FLOW RATE (m ³ /s)
1:2-Year	0.12
1:5-Year	0.16
1:10-Year	0.19
1:25-Year	0.24
1:50-Year	0.29
1:100-Year	0.33

4.3 PROPOSED STORMWATER MANAGEMENT PLAN DESIGN CRITERIA

This preliminary SWM plan is subject to the review and approval of the City and the LSRCA. Applicable SWM design criteria for the proposed development are presented below.

4.3.1 Stormwater Quantity Control

As per City and LSRCA requirements, water quantity controls must be provided to ensure post-development peak flow rates do not exceed pre-development rates at any outlet to protect against flooding and ensure no adverse impacts to downstream landowners. As mentioned, Catchment 301 will not be affected by the proposed development and, therefore, is not subject to water quantity controls (i.e. peak flows from this catchment are not considered).

4.3.2 Stormwater Quality Control

Water quality controls must be provided to satisfy the MECP's Stormwater Management Practices Planning and Design Manual. This corresponds to providing Enhanced Protection Level water quality protection of 80% total suspended solids (TSS) removal. Similar to above, Catchment 301 will remain relatively undisturbed under proposed development conditions, and therefore, is not subject to water quality controls.

4.3.3 LSRCA Volume Control & LID Design

In accordance with LSRCA policies, any works meeting the definition of 'major development' are required to meet the volume control requirements as outlined in Section 2.2.2 of the LSRCA SWM Guidelines (2016). Best efforts must be demonstrated to infiltrate, filter or re-use the 25 mm storm event runoff from impervious areas on site.



4.3.4 Water Balance

In accordance with policies outlined in the Lake Simcoe Protection Plan (LSPP), any works designated as 'major development' (where the development area is over 500 m²) must demonstrate that best efforts have been made to minimize changes in water balance due to the proposed development through the completion of a water balance assessment.

4.3.5 Phosphorous Budget

The proposed development is expected to be subject to the Lake Simcoe Phosphorous Offsetting Policy (LSPOP), which requires all 'major development' projects to control 100% of the phosphorous generated from the site. Any remaining phosphorous load that cannot be controlled/removed will require a cash contribution for off-site mitigation.

4.3.6 Siltation & Erosion Control

A siltation and erosion control strategy will be provided for implementation during construction.

4.4 PROPOSED STORMWATER MANAGEMENT PLAN

The preliminary SWM plan for the proposed development consists of an underground detention facility, storm structure and pipe storage and Jellyfish filter to achieve the required SWM criteria.

4.4.1 Proposed Drainage Conditions

One post-development drainage catchment (Catchment 201) and one existing drainage catchment (Catchment 301) have been delineated as shown on the Post Development Drainage Plan (Drawing DP-2), provided in Appendix E. Catchment 201 is approximately 1.5 ha and comprised of the proposed building, pavement and landscape areas. Runoff generated from Catchment 201 will be collected by the internal storm sewer network and conveyed to proposed underground storage chambers (SWM Facility #1) and ultimately discharge into Lovers Creek. An RC value of 0.95 has been applied to Catchment 201.

As mentioned, Catchment 301 remains relatively undisturbed under post-development conditions, and, therefore, is not subject to water quality or water quantity controls.

4.4.2 Flow Conveyance

Site runoff will be collected and conveyed to SWM Facility #1 via a network of storm sewers and catchbasins.



4.4.3 Water Quantity

Water quantity controls for Catchment 201 will be provided by a combination of underground and pipe/structure storage. Post-development peak flow attenuation of the 1:2-year through 1:100-year design storms will be provided via a control maintenance hole structure (STM MH13) located downstream of SWM Facility #1. A summary of the operation of SWM Facility #1 including storage volumes, release rates and water surface elevations for each storm event is provided in Table 2 while detailed model output and additional design details are provided in Appendix D.

Table 2: SWM Facility #1 Operating Characteristics Summary

STORM RETURN PERIOD	PEAK FLOW (m ³ /s)	STORAGE VOLUME REQUIRED (m ³)	WATER SURFACE ELEVATION (m)
1:2-Year	0.12	148	238.90
1:5-Year	0.15	204	239.26
1:10-Year	0.17	246	239.52
1:25-Year	0.23	284	239.78
1:50-Year	0.27	300	239.91
1:100-Year	0.33	302	240.11

Peak flow attenuation will be provided by a two-stage orifice control located in the control maintenance hole. Peak flow attenuation of frequent storm events will be provided by a 267 mm dia. orifice at elevation 238.16 m. Peak flow attenuation of infrequent storm events will be provided by a 285 mm dia. orifice at elevation 239.52 m. A maximum storage volume of 302 m³ is required to control post-development flow rates to pre-development rates or less. The required storage will be provided by underground stormwater storage chambers (Chamber #1 & Chamber #2) located within the landscaped amenity area as depicted on the Drawing SS-1 provided in Appendix E.

Attenuated peak flows will discharge via a 450 mm dia. storm sewer to a rip-rap splashpad directed towards Lovers Creek as depicted on Drawing SS-1.

4.4.4 Post-Development Peak Flow Summary

Due to the implementation of on-site water quantity controls, post-development peak flow rates discharging from Catchment 201 are less than or equal to pre-development rates for all storm



events. A summary of post-development peak flows is provided in Table 3 while additional details are provided in Appendix D.

Table 3: Proposed Conditions Peak Flow Summary

STORM RETURN PERIOD	PEAK FLOW (m ³ /s)
1:2-Year	0.12 (<i>0.12</i>)
1:5-Year	0.15 (<i>0.16</i>)
1:10-Year	0.17 (<i>0.19</i>)
1:25-Year	0.23 (<i>0.24</i>)
1:50-Year	0.27 (<i>0.29</i>)
1:100-Year	0.33 (<i>0.33</i>)

Note 1: Values in (italics) represent pre-development (Catchment 101) peak flow rates

4.4.5 Water Quality

Enhanced level water quality control (corresponding to 80% TSS removal) is required for the site. Water quality controls will be provided for Catchment 201 via a Jellyfish filter which has been certified under the Environmental Technology Verification (ETV) process to provide TSS removal of 87%.

Preliminary sizing calculations are provided in Appendix D.

It should also be noted that SWM Facility #1 will include a sediment header row which is expected to provide an additional level of water quality treatment.

4.4.6 LSRCA Volume Control & LID Design

In accordance with LSRCA requirements, projects defined as 'major development' are required to meet the volume control requirements outlined in Section 2.2.2 of the LSRCA 2016 SWM guidelines. As such, best efforts must be provided to infiltrate, filter, or re-use runoff generated from impervious areas on site.

Due to multiple site constraints (presented in Section 2.2.2.2 of the LSRCA SWM Guidelines) the site will not be able to provide runoff volume control for the 25 mm runoff volume. The constraints consist of:

- zoning, setbacks or other land use requirements;
- property or infrastructure restrictions; and
- high groundwater.



As such, an alternative treatment option has been proposed in accordance with LSRCA guidelines.

Based on a total impervious area of 1.4 ha, the 5 mm storm event runoff volume is approximately 70 m³. Runoff generated during the 5 mm storm event will be treated by the Jellyfish unit and will then be conveyed to an infiltration chamber (located beneath Chamber #2 in SWM Facility #1) which is comprised of StormTank ST-36 modules situated on a clear stone base. The infiltration chamber will provide a maximum infiltration volume of approximately 76 m³ which exceeds minimum volume control requirements. Preliminary design details of the chamber are provided in Appendix D while a summary is provided below.

- Total Impervious Area contributing to cell: 1.39 ha
- Target Storm Event to be Infiltrated: 5 mm
- Required Runoff Volume to be Infiltrated: 70 m³
- Footprint of Cell: 74.0 m²
- Depth of Cell: 0.91 m
- Void Ratio of Module: 97%
- Void Ratio of Clear Stone: 40%
- Approximate Infiltration Volume Provided: 75.5 m³

The base of the stone underneath the chamber system will be located at minimum 1.0 m above the groundwater table elevation. Additional design information will be provided during detailed design.

4.4.7 Water Balance

A water balance analysis has been completed by Cambium to assess the potential impact of the development on local groundwater and surface water resources. Their analysis determined the pre-development water balance condition results in approximately 4,812 m³/year of infiltration volume and 7,170 m³/year of runoff. Under post-development conditions, due to the increase in impervious area, results in approximately 2,738 m³/year of infiltration and 13,326 m³/year of runoff resulting in an infiltration deficient of 2,074 m³/year and a surplus of annual runoff of 6,155 m³/year.

As mentioned, an infiltration chamber will be provided which has been sized to infiltration the single-event volume generated during the 5 mm storm event, at minimum. Based on review of historical rainfall data for the Barrie WPCC rainfall station, the 5 mm storm event accounts for approximately 53% (490 mm) of the average annual rainfall which is equivalent to an annual



infiltration volume of 6,811 m³ and, therefore, mitigates the infiltration deficient, achieving water balance requirements.

Refer to the original report for additional details.

4.4.8 Phosphorous Mitigation

In order to comply with LSPOP requirements, an assessment of the phosphorous loading from the site under proposed conditions has been completed using the loading rates and removal efficiencies from the Sustainable Technologies Evaluation Program (STEP) Low Impact Development Treatment Train Tool (LID TTT).

Proposed Conditions

The site has been modelled as three land use categories; paved surface, roof and landscape area with loading rates of 0.23 mg/L, 0.09 mg/L, 0.32 mg/L. Applying these loading rates, the annual post-development phosphorous load is 0.19 mg/L which is equivalent to 1.94 kg/year.

Best efforts for phosphorus mitigation for the site will be provided via the Jellyfish filter and the underground storage chamber which have phosphorous removal efficiency rates of 60% and 25% respectively. As such, the combined removal efficiency rate is 70%.

Therefore, the total annual post-development phosphorous load is reduced to 0.06 mg/L which is equivalent to 0.58 kg/year. A summary of the phosphorous loading under the post-development and post-development with mitigation scenarios is provided in Table 4 below. Detailed model output is provided in Appendix D.

Table 4: Phosphorous Loading Summary

SCENARIO	AREA (ha)	PHOSPHOROUS LOADING (kg/year)
Post-Development (Without Controls)	1.45	1.94
Post-Development (With Controls)	1.45	0.58

4.5 SWM FACILITY MAINTENANCE

Ongoing maintenance of SWM facilities is necessary to ensure continued effectiveness. The storage chambers and jellyfish filter unit should be inspected regularly and particularly after large rainfall events to ensure the system and all its component parts are functioning properly and are in good repair.



4.6 SILTATION & EROSION CONTROL PLAN

Siltation and erosion controls will be implemented for all construction activities, including earthworks, material stockpiling, pavement construction, and grading operations. Details of the sedimentation and erosion control will be provided during detailed design and are summarized as follows:

- heavy duty silt control fences will be erected to control sediment movement to abutting properties and the Yonge Street right-of-way;
- a stone mud mat will be installed at the construction entrances from Yonge Street; and
- regular inspection of control measures will be implemented, and repairs made as necessary during construction.



5 Grading & Landscaping

The grading of the proposed development will match to the existing grades along the limits of the development. The site will be graded to suit the existing boundary conditions on the boulevard of Yonge Street. Consideration will be taken for the steep sloping along Lovers Creek, the proposed development will match to the existing grade at the staked top of bank limit at the north and east development limits. Refer to the Preliminary Site Grading Plan (Drawing SG-1) provided in Appendix E for additional details.



6 Utilities

All utilities (electrical, gas, telecommunications) are expected to be available from Yonge Street to service the proposed development. Further coordination will be required during the detailed design stage.



7 Summary

7.1 WATER SUPPLY & DISTRIBUTION

The site will be serviced with a 150 mm dia. domestic water service and a dedicated 250 mm dia. fire service from the existing 300 mm dia. watermain on Essa Road. The existing municipal system has sufficient pressures, capacity and storage volumes to provide service to the proposed development.

7.2 SANITARY SEWER COLLECTION

The site will be serviced via a 200 mm dia. sanitary sewer connecting to the existing 250 mm dia. sanitary sewer on Yonge Street. The existing local sanitary sewers in Yonge Street have sufficient capacity to convey the contributing peak flows to the downstream trunk sewer. The Barrie WWTP also has sufficient capacity, under existing conditions, to service the proposed development.

7.3 STORMWATER MANAGEMENT PLAN

The preliminary SWM plan demonstrates the proposed development will not result in negative impacts with respect to stormwater.

7.4 GRADING & LANDSCAPING

The grading of the proposed development will match to existing perimeter grades along the limits of the development.

7.5 UTILITIES

All utilities (electrical, gas, telecommunications) are expected to be available from Yonge Street to service the proposed development.



Appendix A: Site Plan

Appendix B: Water Demand Calculations

PROJECT	505-533 Yonge Street, Barrie	FILE	421422
		DATE	Nov. 23, 2021
SUBJECT	Preliminary Watermain Calculations	NAME	NM
		PAGE	1 OF 4

1.1 Proposed Development

Number of Units: 400
 Population Per Unit: 1.67 (per City of Barrie guidelines)
 Equivalent Population: 668
 Residential Design Rate: 225 L/p/day
 Commercial Area: 1075 m²
 Commercial Design Rate: 28 m³/Ha/day

Peaking Factors

Maximum Day = 2.75
 Peak Hour = 4.13

(Per Table 3.1 of the Ministry of the Environment, Conservation & Parks (MECP) Design Guidelines for Drinking -Water Systems)

1.2 Design Water Demands

Average Daily Demand = 153,310 L/day = 153.31 m³/day
 = 1.77 L/s
 Maximum Daily Demand = 153,310 L/day x 2.75
 = 421,603 L/day = 421.603 m³/day
 = 4.88 L/s
 Peak Hour Demand = 1.77 L/s x 4.13
 = 7.33 L/s

1.3 Fire Flows (per Fire Underwriters Study (FUS), 1999)

See attached FUS Calculation sheet

Maximum Day Plus Fire = 4.88 L/s + 200.0 L/s
 Flow = 204.9 L/s

1.4 Size of Watermain

Size of watermain required to accommodate Peak Hour Demand

Minimum Size: 75 mm dia. (per City of Barrie Water Transmission and Distribution Design Standard, 2020)

Selected size: 150 mm dia.

Therefore, Peak Hour Velocity:

$$V = \frac{Q}{A}$$

$$V = \frac{0.00733}{0.018}$$

Where:

Q = Peak Hour Demand (m³/s)

Q = 0.00733

V = 0.4147 m/s

D = Watermain Diameter (m)

D = 0.15

A = Area of Watermain (m²)

A = 0.018

PROJECT	505-533 Yonge Street, Barrie	FILE	421422
		DATE	Nov. 23, 2021
SUBJECT	Preliminary Watermain Calculations	NAME	NM
		PAGE	2 OF 4

Size of watermain to accommodate Fire Flow

Minimum Size: 150 mm dia. (per City of Barrie Water Transmission and Distribution Design Standard, 2020)

Selected size: 250 mm dia.

Therefore, Fire Flow Velocity:

$$V = \frac{Q}{A}$$

$$V = \frac{0.2}{0.049}$$

Where:

Q = Fire Flow Demand (m³/s)

Q = 0.2

V = 4.07 m/s

D = Watermain Diameter (m)

D = 0.25

A = Area of Watermain (m²)

A = 0.049

1.5 Peak Hour Headloss (Due to Friction) in Proposed 150 mm dia. Watermain

Connect to existing 300 mm dia. watermain in Yonge Street

Calculation assumes no significant change in elevation and a total length of 160 m

$$h_f = 0.54 \sqrt{\frac{Q}{0.278(C)D^{2.63}}} \times L$$

Where:

h_f = headloss in watermain due to friction

Q = Peak Hour Demand (m³/s)

Q = 0.0073

C = Friction Factor (regardless of material)

C = 130

D = Watermain Inside Diameter (m)

D = 0.15

L = Watermain Length (m)

L = 160

$$h_f = 0.54 \sqrt{\frac{0.0072}{0.278(110)0.25^{2.63}}} \times 160$$

h_f = 0.23878 m

0.33907 psi

1.64618 kPa

Where 1 m of head = 1.42 PSI

1.42 PSI = 6.8947 kPa

PROJECT	505-533 Yonge Street, Barrie	FILE	421422
		DATE	Nov. 23, 2021
SUBJECT	Preliminary Watermain Calculations	NAME	NM
		PAGE	3 OF 4

1.6 Static Loss

Surface Elevation at Point of Connection =	246	m
Building FFE (Bldng 1) =	248.6	m
Height to Building Roof =	20	m
Height of Roof Above Watermain at Point of Connection =	22.6	m
Static Pressure Loss =	32.14	psi
	221.58	kPa

1.7 Minor Losses (fittings, bends, valves etc.)

$h_v = k(V^2)/2g$		#	K
	Gate Valve	2	0.2
Where:	45° elbow - standard	1	0.35
$h_v =$ minor loss (m)	45° elbow - long radius	0	0.20
$k =$ loss coefficient	90° elbow - standard	0	0.75
$v =$ velocity (m/s)	90° elbow - long radius	0	0.45
$g =$ acceleration due to gravity (9.81 m/s ²)	tee (flow through)	1	0.4
	tee (as elbow)	0	0.95

Total k = 1.15

$$h_v = \frac{1.15 \times 0.4147^2}{2 \times 9.81}$$

$h_v =$	0.0101	m
	0.0143	psi
	0.0987	kPa

1.8 Total Head Loss (Peak Hour)

Total Head Loss	$h_f =$ Friction Loss + Static Loss + Minor Loss
	$h_f = 1.64618 + 221.58 + 0.09868$
	<u>$h_f = 223.32$ kPa</u>

1.9 Available Water Supply

Hydrant 1546/3002 Test as per Vipond Hydrant Flow Test (appended)

Normal Operating Pressure = 81 psi = 558.414 kPa

PROJECT	505-533 Yonge Street, Barrie	FILE	421422
		DATE	Nov. 23, 2021
SUBJECT	Preliminary Watermain Calculations	NAME	NM
		PAGE	4 OF 4

1.10 Serviceability of Proposed Development

$$\begin{aligned}
 \text{Minimum Available Pressure} &= \text{operating pressure at connection} - \text{total head loss} \\
 &= 558.414 - 223.32 \\
 &= 335.09 \text{ kPa}
 \end{aligned}$$

Therefore 335.09 kPa > 275 kPa

Min. Normal Operating Pressure in Yonge Street main to maintain minimum 275 kPa throughout the site (top floor) during peak hour conditions =

498 kPa

PROJECT	505-533 Yonge Street, Barrie	FILE	421422
		DATE	Oct. 15, 2021
SUBJECT	Available Fire Flow	NAME	NM
		PAGE	1 OF 1

Available Fire Flow At 20 PSI

Flow Test Completed By: Vipond Fire Protection Inc.

Date of Test: 2021-08-11

Test Location: City of Barrie Hydrants 3002 and 1546

Static Pressure 81 PSI

$$QA = QT \left(\frac{ha}{ht} \right)^{0.5}$$

Where

QA = Flow at 20 PSI

QT = Flow at Test (U.S. GPM)

ha = Pressure Drop Available (PSI) (Static - 20)

ht = Pressure Drop at Test (PSI) (Static - Residual)

Note: Equation per City of Barrie Water Transmission and Distribution Policies and Design Guidelines

Test #1

QT = 701	QA = 17,313 U.S. GPM
ha = 81-20 = 61	QA = 1,091 L/s
ht = 81-81 = 0	

Test #2

QT = 984	QA = 24,303 U.S. GPM
ha = 81-20 = 61	QA = 1,531 L/s
ht = 81-81 = 0	

Test #3

QT = 1752	QA = 13,684 U.S. GPM
ha = 81-20 = 61	QA = 862 L/s
ht = 81-80 = 1	

	Project: 505-533 Yonge Street, Barrie	Date: Oct. 15, 2021
	File No.: 421422	Designed: NM
	Subject: FUS Calculations - Largest Building	Checked
	Revisions:	

Fire Underwriters Survey Fire Flow Calculations
Long Method

Calculation Based on 1999 Publication "Water Supply for Public Fire Protection" by Fire Underwriters Survey (FUS).

Step	Description	Term	Options	Multiplier Associated with Option	Choose	Value used	Unit	Total Fire Flow (L/min)					
1	Frame Use for Construction of Unit	Coefficient related to type of construction (C)	Framing Material										
			Wood Frame	1.5	Ordinary Construction	1	-	N/A					
			Ordinary Construction	1									
			Non-combustible construction	0.8									
			Fire resistive construction (< 2 hrs)	0.7									
			Fire resistive construction (> 2 hrs)	0.6									
2	Type of Housing (if Townhouse, enter number of units per TH block)	Type of Housing	Floor Space Area										
			Single Family	1		0	Units	N/A					
			Townhouse / Apartment- inform # of units	1		6							
			Other (Comm. Ind., etc.)	1									
			2 hour Fire Separation Between Units	1	yes	1							
2.1	Number of Storeys	Number of Floors / Storeys in the unit (do not include basement)				4	Storeys	N/A					
3	Floor Area (exclude basements, per unit for townhouses, per single family dwelling or per building for apartments, commercial or institutional)		Ground Floor Area			2000	Square Metres (m2)	N/A					
			Total Floor Area - One Storey of Townhouse/Apartment Block			2000							
			Total Floor Area - All Storeys			8000							
			Does the building have fire-resistive design?		yes	6000							
			Are vertical openings/communications properly protected (1 hour rating)?		Yes	3000							
			Total Floor Area (A) - for all storeys excluding basement - Single Family			3000							
			Measurement Units	Square Feet (ft ²)	0.093	3000	m ²						
				Square Metres (m ²)	1								
				Hectares (ha)	10000								
4	Required Fire Flow without Reductions or Increases	Required Fire Flows without Reductions or Increases per FUS: (FF= 220 x C x A ^{0.5})					L/min	12,000					
5	Factors Affecting Burning	Reductions / Increases Due to Factors Affecting Burning											
5.1	Combustibility of Building Contents	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Limited combustible	-0.15	N/A	(1,800)	10,200				
			Limited combustible	-0.15									
			Combustible	0.00									
			Free burning	0.15									
			Rapid burning	0.25									
5.2	Reduction Due to Presence of Sprinklers	Sprinkler reduction	Fully supervised system	-0.5	Automatic sprinkler protection	-0.3	N/A	(3,060)	7,140				
			Water supply system/hose connections	-0.4									
			Automatic sprinkler protection	-0.3									
			None	0									
5.3	Separation Distance Between Units (Use 10% for 2 hour Fire Separation between adjacent units)	Exposure distance between units	North Side	10.1 to 20.0 m	0.15	0.5	%	5,100	12,240				
			East Side	20.1 to 30.0 m	0.10								
			South Side	20.1 to 30.0 m	0.10								
			West Side	10.1 to 20.0 m	0.15								
5.4	Combustibility of Wood Shingle or Shake Roof Material	Surcharge for potential to spread fire	Non-combustible roofing material	0	Non-combustible roofing material	0	L/min	0	12,240				
			Low risk of fire spread	2000									
			Moderate risk of fire spread	3000									
			High risk of fire spread	4000									
Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied:									12,000				
6	Required Fire Flow, Duration and Volume	Total Required Fire Flow (above) in L/s:							200				
		Required Duration of Fire Flow of 12,000 L/min (hrs):							2.5				
		Required volume for Fire Flow of 12,000 L/min (m ³):							1,800				

FLOW TEST RESULTS



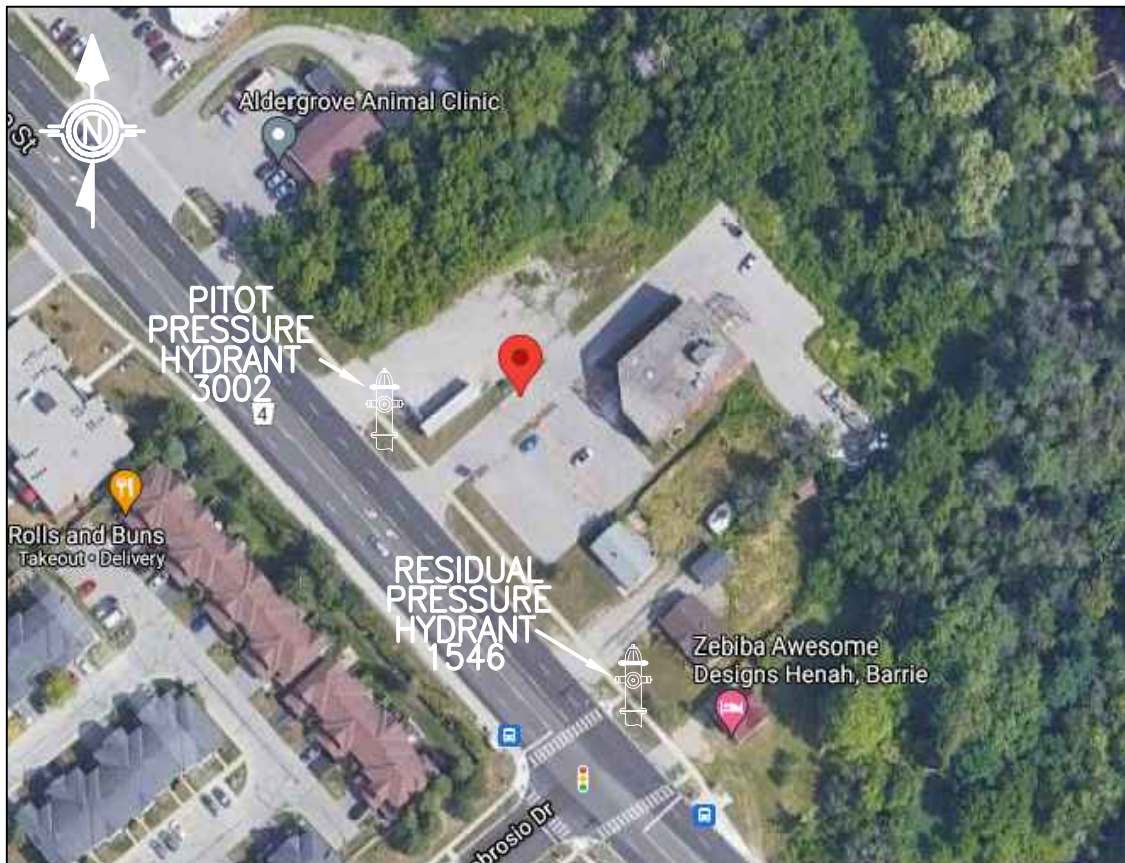
DATE : AUGUST 11, 2021 TIME : 10:00 AM

LOCATION : 503 YONGE ST.

CITY OF BARRIE

ONTARIO

TEST BY : VIPOND FIRE PROTECTION AND LOCAL PUC



STATIC PRESSURE : 81 PSI

TEST NO.	NO. OF NOZZLES	NOZZLE DIAMETER (INCHES)	DISCHARGE CO-EFFICIENT	RESIDUAL PRESSURE (PSI)	PITOT PRESSURE (PSI)	DISCHARGE (U.S.GPM)
1	1	1-3/4	0.995	81	62	701
2	1	2-1/2	0.9	81	34	984
3	2	2-1/2	0.9	80	27	1752

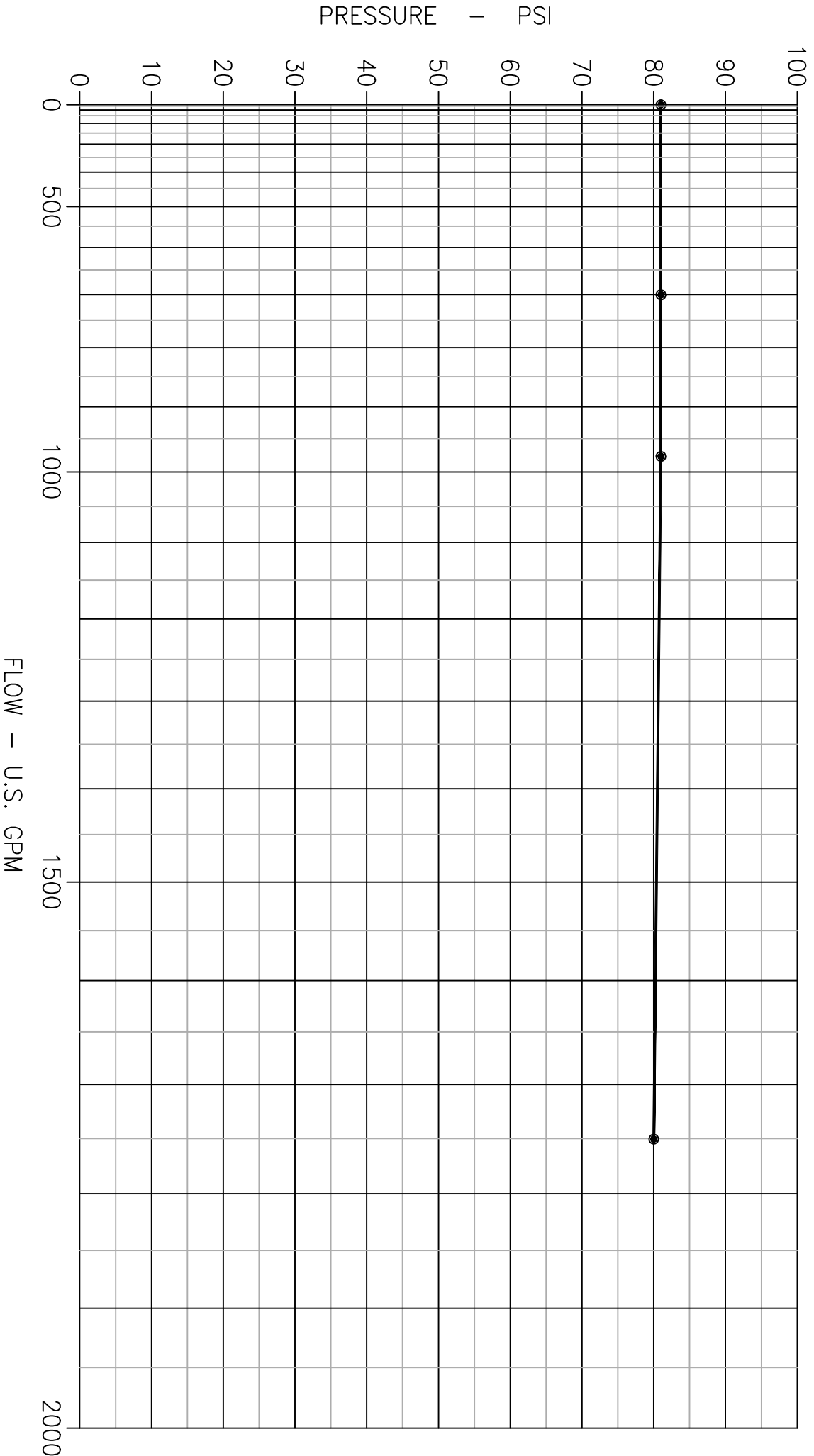


503 YONGE ST
CITY OF BARRIE
ONTARIO

BY : MIKE. P/RILEY P.
OFFICE : BARRIE
TEST BY : VIPOND & PUC
DATE : AUGUST 11, 2021

STATIC:
81 PSI

RESIDUAL: FLOW:
TEST#1 81 PSI @ 701 GPM
TEST#2 81 PSI @ 984 GPM
TEST#3 80 PSI @ 1752 GPM



Appendix C: Sanitary Sewage Design Calculations

Version Number:

1

Version Date:

11/04/2021

Project Information

505 - 533 Yonge Street	421422
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Drawing Reference

Sanitary Catchment Plan (SAN-01)	11/04/2021
----------------------------------	------------

Prepared By

LMB	11/04/2021
-----	------------

Reviewed By

NM	11/04/2021
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Municipality

City of Barrie

Population Density

Capita per Unit	Low	Medium	High
	3.13	2.34	1.67

Infiltration

Infiltration (L/s/ha)	0.1
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Flow

Development Type	Average (L/cap/day)	Peaking Factor
Residential	225	Harmon

Development Type	Average (L/ha/day)	Peaking Factor
Institution	28,000	2

Commercial	28,000	2
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Industrial High Intensity	55,000	-
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Industrial Low Intensity	50,000	-
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Manning's Coefficient

Pipe Material	Value
Concrete	0.013

PVC	0.013
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Applied	0.013
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Engineer Stamp

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Street Name	Area Label/ID	Upstream Maintenance Hole	Downstream Maintenance Hole	Development Type	Population Density	Number of Units	Population (cap)	Accumulated Population (cap)	Peaking Factor	Area (ha)	Cumulative Area (ha)	Average Flow (L/s)			Peak Flow (L/s)			Proposed Sanitary Sewer							
												Development	Infiltration	Total	Development	Infiltration	Total	Sewer Length (m)	Sewer Slope (%)	Actual Sewer Diameter (mm)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Actual Velocity (m/s)	Calculated Sewer Diameter (mm)	Percentage of Full Flow Capacity (%)
	101, 102	A	SAP13040	Residential	Low	183	572.8	572.8	3.94	13.06	13.06	1.49	1.31	2.80	5.88	1.31	7.19	2.0	2.0%	250	1.71	84.10	1.01	99	8.5%
	202	B	SAP13040	Residential	High	30	50.1	50.1	4.31	0.95	0.95	0.13	0.10	0.23	0.56	0.10	0.66	2.0	2.0%	250	1.71	84.10	0.53	41	0.8%
	302, 303	C	SAP13040	Residential	Med.	100	234.0	234.0	4.12	2.41	2.41	0.61	0.24	0.85	2.51	0.24	2.75	2.0	2.0%	250	1.71	84.10	0.78	69	3.3%
D'Ambrosio Drive	401	SAP13040	SAP13035	Residential	Low	0	0.0	856.9	3.84	0.16	16.58	2.23	1.66	3.89	8.96	1.66	10.61	92.0	2.0%	250	1.71	84.10	1.13	115	12.6%
Yonge Street	301	EX SANMH	SAP13032	Residential	Med.	19	44.5	44.5	4.32	0.64	0.64	0.12	0.06	0.18	0.50	0.06	0.56	33.7	3.4%	250	2.23	109.65	0.62	35	0.5%
Yonge Street	201	SAP13032	SAP13034	Residential	High	32	53.4	97.9	4.25	0.59	1.23	0.25	0.12	0.38	1.09	0.12	1.21	55.8	1.5%	250	1.48	72.83	0.56	54	1.7%
Yonge Street	402	SAP13034	SAP13035	Residential	Low	0	0.0	97.9	4.25	0.35	1.58	0.25	0.16	0.41	1.09	0.16	1.25	110.2	2.8%	250	2.03	99.51	0.71	48	1.3%
Subject Site	501	BLDG 1	SAN MH4	Residential	High	56	93.5	93.5	4.25	0.06	0.06	0.24	0.01	0.25	1.04	0.01	1.04	11.5	2.0%	200	1.48	46.38	0.61	48	2.2%
Subject Site	502	SAN MH4	SAN MH3	Residential	High	0	0.0	93.5	4.25	0.39	0.45	0.24	0.05	0.29	1.04	0.05	1.08	49.1	2.0%	200	1.48	46.38	0.62	49	2.3%
Subject Site	503a	COM.	BLDG 2	Commercial				0.0	2.00	0.12	0.12	0.04	0.01	0.05	0.08	0.01	0.09	15.9	2.0%	200	1.48	46.38	0.31	19	0.2%
Subject Site	503	BLDG 2	SAN MH3	Residential	High	123	205.4	205.4	4.14	0.18	0.30	0.57	0.03	0.60	2.29	0.03	2.32	15.9	2.0%	200	1.48	46.38	0.76	65	5.0%
Subject Site	504	BLDG 4	SAN MH3	Residential	High	165	275.6	275.6	4.09	0.18	0.18	0.72	0.02	0.74	2.94	0.02	2.96	31.0	2.0%	200	1.48	46.38	0.81	71	6.4%
Subject Site	505	SAN MH3	SAN MH2	Residential	High	0	0.0	574.5	3.94	0.22	1.15	1.53	0.12	1.65	6.27	0.12	6.38	49.1	1.0%	200	1.04	32.80	0.77	108	19.5%

1. Slopes highlighted red indicate assumed data.
2. Red pipe size represents existing sewer.
3. Manholes A, B, C and COMM. are arbitrary, used only to assist with the calculations.

Project Information	
505 - 533 Yonge Street	421422
Drawing Reference	
Sanitary Catchment Plan (SAN-01)	11/04/2021
Prepared By	
LMB	11/04/2021
Reviewed By	
NM	11/04/2021

Municipality			
City of Barrie			
Population Density			
Capita per Unit	Low	Medium	High
	3.13	2.34	1.67
Infiltration			
Infiltration (L/s/ha)			0.1

Flow		
Development Type	Average (L/cap/day)	Peaking Factor
Residential	225	Harmon
Development Type	Average (L/ha/day)	Peaking Factor
Institution	28,000	2
Commercial	28,000	2
Industrial High Intensity	55,000	-
Industrial Low Intensity	50,000	-

Manning's Coefficient	
Pipe Material	Value
Concrete	0.013
PVC	0.013
Applied	0.013

Engineer Stamp

Street Name	Area Label/ID	Upstream Maintenance Hole	Downstream Maintenance Hole	Development Type	Population Density	Number of Units	Population (cap)	Accumulated Population (cap)	Peaking Factor	Area (ha)	Cumulative Area (ha)	Average Flow (L/s)			Peak Flow (L/s)			Proposed Sanitary Sewer							
												Development	Infiltration	Total	Development	Infiltration	Total	Sewer Length (m)	Sewer Slope (%)	Actual Sewer Diameter (mm)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Actual Velocity (m/s)	Calculated Sewer Diameter (mm)	Percentage of Full Flow Capacity (%)
Subject Site	506	BLDG 3	SAN MH2	Residential	High	56	93.5	93.5	4.25	0.06	0.06	0.24	0.01	0.25	1.04	0.01	1.04	13.4	2.0%	200	1.48	46.38	0.61	48	2.2%
Subject Site	507	SAN MH2	SAN MH1	Residential	High	0	0.0	668.0	3.91	0.10	1.31	1.78	0.13	1.91	7.30	0.13	7.43	43.3	1.0%	200	1.04	32.80	0.80	115	22.7%
		SAN MH1	SAP13035	Residential	High	0	0.0	668.0	3.91	0.00	1.31	1.78	0.13	1.91	7.30	0.13	7.43	15.2	6.5%	200	2.66	83.56	1.59	81	8.9%
Yonge Street	403	SAP13035	SAP13036	Residential	Low	0	0.0	1622.8	3.65	0.06	19.53	4.26	1.95	6.22	17.35	1.95	19.30	21.1	6.0%	250	2.97	145.67	1.98	117	13.3%
Yonge Street	404	SAP13036	SAP13101	Residential	Low	0	0.0	1622.8	3.65	0.19	19.72	4.26	1.97	6.24	17.35	1.97	19.32	51.4	5.0%	250	2.71	132.97	1.85	121	14.5%
Yonge Street	405	SAP13101	SAP13102	Residential	Low	0	0.0	1622.8	3.65	0.39	20.11	4.26	2.01	6.28	17.35	2.01	19.36	59.5	0.4%	250	0.77	37.61	0.74	195	51.5%
		SAP13102	SAP14009	Residential	Low	0	0.0	1622.8	3.65	0.00	20.11	4.26	2.01	6.28	17.35	2.01	19.36	75.8	0.4%	250	0.77	37.61	0.74	195	51.5%

1. Slopes highlighted red indicate assumed data.

2. Red pipe size represents existing sewer.

3. Manholes A, B, C and COMM. are arbitrary, used only to assist with the calculations.

Appendix D: Stormwater Management Plan Calculations

Existing & Proposed Conditions Hydrology

Project:	505-533 Yonge Street	Date:	11-12-2021
File No.:	421422	Designed By:	LB
Subject:	RC & TC Calculator - Outlet #1	Checked By:	NHF

RUNOFF COEFFICIENTS

CATCHMENT 101 (EXISTING CONDITION)

Land Use	RC	Area (ha)
Pavement	0.95	0.28
Building Area	0.95	0.09
Pavement Area (rough)	0.95	0.11
Lawn/Landscape	0.15	0.35
Woodland	0.18	0.63
Total		1.45
Weighted RC	<u>0.40</u>	

As per City of
Barrie Table 3.2

CATCHMENT 301 (EXISTING CONDITION)

Land Use	RC	Area (ha)
Woodland	0.18	1.23
Total		1.23
Weighted RC	<u>0.18</u>	

As per City of
Barrie Table 3.2

CATCHMENT 201 (PROPOSED CONDITION)

Land Use	RC	Area (ha)
Building Rooftop Area	0.95	0.48
Driveway Area	0.95	0.91
Lawn/Landscape	0.15	0.06
Total		1.45
Weighted RC	<u>0.92</u>	Round up to 0.95

TIME OF CONCENTRATION

CATCHMENT 101 (EXISTING CONDITION)

Slope = 9.06 %
 Length 115.9 m
 RC= Total
 RC= 0.40
 Area= 1.45 ha

Airport Method tc= 11.87 minutes
 Bransby Williams Method tc= 4.10 minutes

tc= 11.87 minutes

CATCHMENT 301 (EXISTING CONDITION)

Slope = 7.74 %
 Length 108.7 m
 RC= Total
 RC= 0.18
 Area= 1.23 ha

Airport Method tc= 15.91 minutes
 Bransby Williams Method tc= 4.03 minutes

tc= 15.91 minutes

CATCHMENT 201 (PROPOSED CONDITION)

Slope = 1.79 %
 Length 103.1 m
 RC= 0.92
 Area= 1.45 ha

Airport Method tc= 5.00 minutes
 Bransby Williams Method tc= 5.04 minutes

tc= 10.00 minutes

Tc less than 10.0 m
 therefore use 10.0 m
 in accordance with
 City of Barrie Drainage
 Requirements

Modified Rational Method Calculation

Project Details

505-533 Yonge Street	421422
----------------------	--------

Prepared By

LB	November 12, 2021
----	-------------------

Municipality

City of Barrie

Pre-Development Analysis

Catchment ID:	101
Catchment Area (ha):	1.45
Runoff Coefficient:	0.40
Time of Concentration (min):	11.87

Post-Development Analysis

Controlled

Catchment ID:	201
Catchment Area (ha):	1.45
Runoff Coefficient:	0.95
Time of Concentration (min):	10.00

Design Storm	2YR	5YR	10YR	25YR	50YR	100YR	Design Storm	2YR	5YR	10YR	25YR	50YR	100YR
A	678	854	976	1146	1236	1426	i (mm/hr)	83	109	127	148	164	180
B	4.70	4.70	4.70	4.92	4.70	5.27	201 Runoff C	0.95	0.95	0.95	1.00	1.00	1.00
C	0.78	0.77	0.76	0.76	0.75	0.76	Q (m ³ /s)	0.32	0.42	0.48	0.60	0.66	0.73
i (mm/hr)	76	99	116	135	150	165	i (mm/hr)	203	261	301	343	387	404
Runoff C	0.40	0.40	0.40	0.44	0.48	0.50	0 Runoff C	0.00	0.00	0.00	0.00	0.00	0.00
Q (m ³ /s)	0.12	0.16	0.19	0.24	0.29	0.33	Q (m ³ /s)	0.00	0.00	0.00	0.00	0.00	0.00

Peak Runoff Rate (m³/s) - Rational Method ($Q=CiA/360$)

Storm	Q _{EXISTING}	Q _{NO CONTROLS}	Q _{UNCONTROLLED}	Q _{CONTROLLED}	Q _{TOTAL}	Q _{REDUCTION}
2YR	0.122	0.318	0.000	0.122	0.122	0.196 m ³ /s
5YR	0.160	0.417	0.000	0.154	0.154	0.263 m ³ /s
10YR	0.186	0.484	0.000	0.174	0.174	0.311 m ³ /s
25YR	0.240	0.597	0.000	0.234	0.234	0.363 m ³ /s
50YR	0.290	0.661	0.000	0.272	0.272	0.390 m ³ /s
100YR	0.332	0.726	0.000	0.330	0.330	0.396 m ³ /s

Required Storage Volumes (m³) - Modified Rational Method ($V_p = Q_p \times D - Q_o \times ((D + t_c)/2)$)

Dur. (min)	2YR	5YR	10YR	25YR	50YR	100YR
5	77	103	121	139	149	146
10	118	158	186	218	234	238
15	137	185	219	256	274	280
20	145	198	236	275	293	298
25	148	204	243	283	300	302
30	147	204	246	284	298	297
35	143	202	244	279	292	285
40	138	196	239	271	281	269
45	131	189	232	260	267	249

Water Quantity Control

PROJECT	505-533 Yonge Street	FILE	421422
		DATE	11-12-2021
SUBJECT	Structure Quantity Storage	NAME	LB
		PAGE	1 OF 9

Stage Storage Table Structure Quantity Storage Volume

ID	STM MH11	STM MH12	
T/G Elev.	240.74	240.88	
Inv. Elev.	239.28	238.89	
Diameter	1.5	1.5	
Area	4.71	4.71	

Elevation	Volume (m ³)		
238.80	0.00	0.00	
238.90	0.00	0.05	
239.00	0.00	0.52	
239.10	0.00	0.99	
239.20	0.00	1.46	
239.30	0.09	1.93	
239.40	0.57	2.40	
239.50	1.04	2.87	
239.60	1.51	3.35	
239.70	1.98	3.82	
239.80	2.45	4.29	
239.90	2.92	4.76	
240.00	3.39	5.23	
240.10	3.86	5.70	
240.20	4.34	6.17	
240.30	4.81	6.64	
240.40	5.28	7.12	
240.50	5.75	7.59	

PROJECT	505-533 Yonge Street	FILE	421422
		DATE	11-12-2021
SUBJECT	Pipe Quantity Storage	NAME	LB
		PAGE	2 OF 9

 Stage Storage Table Pipe Quantity Storage Volume

Pipe Location	STM MH10 to STM MH11	STM MH10 to STM MH11	STM MH12 to SWMF
Diameter (m)	0.45	0.45	0.45
U/S Inv.	243.84	239.28	238.89
D/S Inv.	239.28	239.00	238.86
Average Inv.	241.56	239.14	238.88
Length (m)	35.70	61.60	6.70

Elevation	Volume (m ³)		
238.80	0.00	0.00	0.00
238.90	0.00	0.00	0.00
239.00	0.00	0.00	0.18
239.10	0.00	0.00	0.46
239.20	0.00	0.60	0.75
239.30	0.00	2.86	1.00
239.40	0.00	5.59	1.07
239.50	0.00	8.17	1.07
239.60	0.00	9.79	1.07
239.70	0.00	9.79	1.07
239.80	0.00	9.79	1.07
239.90	0.00	9.79	1.07
240.00	0.00	9.79	1.07
240.10	0.00	9.79	1.07
240.20	0.00	9.79	1.07
240.30	0.00	9.79	1.07
240.40	0.00	9.79	1.07
240.50	0.00	9.79	1.07

PROJECT	505-533 Yonge Street	FILE	421422
		DATE	11-12-2021
SUBJECT	Underground Quantity Storage - Chamber #1	NAME	LB
		PAGE	3 OF 9

Stage Storage Table

Underground Quantity Storage Volume

Unit: Double Stacked StormTank ST-36 Module

System Footprint (m²): 131m²

Height of Chamber (m): 1.83

Void Ratio per module: 97.00%

Void Ratio of stone: 40%

Elevation	Elevation Reference	Incremental Depth (m)	Incremental Volume (m ³)	Cumulative Volume - below outlet (m ³)	Cumulative Volume - above outlet (m ³)
237.93	Base of Stone	0.00	0.00	0.00	-
238.08	Base of Chamber	0.15	7.86	7.86	-
238.16	Outlet Pipe Invert	0.08	10.17	18.03	-
238.20		0.04	5.08	-	5.08
238.30		0.10	12.71	-	17.79
238.40		0.10	12.71	-	30.50
238.50		0.10	12.71	-	43.20
238.60		0.10	12.71	-	55.91
238.70		0.10	12.71	-	68.62
238.80		0.10	12.71	-	81.32
238.90		0.10	12.71	-	94.03
239.00		0.10	12.71	-	106.74
239.10		0.10	12.71	-	119.45
239.20		0.10	12.71	-	132.15
239.30		0.10	12.71	-	144.86
239.40		0.10	12.71	-	157.57
239.50		0.10	12.71	-	170.27
239.60		0.10	12.71	-	182.98
239.70		0.10	12.71	-	195.69
239.80		0.10	12.71	-	208.39
239.90	Top of Chamber	0.10	12.71	-	221.10
240.00				-	221.10
240.10				-	221.10
240.20				-	221.10
240.30				-	221.10
240.40				-	221.10
240.50				-	221.10
240.50				-	221.10

Note: Incremental volume calculated per incremental depth, footprint area of system and applicable void ratio for stone and StormTank module

System footprint area/volumes exclude all stone area/volumes

PROJECT	505-533 Yonge Street	FILE	421422
		DATE	11-12-2021
SUBJECT	Underground Quantity Storage - Chamber #2	NAME	LB
		PAGE	4 OF 9

Stage Storage Table Underground Quantity Storage Volume

Unit: StormTank ST-36 Module
 System Footprint: 74m²
 Height of Chamber: 0.914
 Void Ratio per module: 97.00%
 Void Ratio of stone: 40%

Elevation	Elevation Reference	Incremental Depth (m)	Incremental Volume (m ³)	Accumulative Volume - below outlet (m ³)	Accumulate Volume - above outlet (m ³)
238.08	Base of Module	0.00	0.00	0.00	-
238.16	Outlet Pipe Invert	0.08	5.74	5.74	-
238.20		0.04	2.87	-	2.87
238.30		0.10	7.18	-	10.05
238.40		0.10	7.18	-	17.23
238.50		0.10	7.18	-	24.41
238.60		0.10	7.18	-	31.58
238.70		0.10	7.18	-	38.76
238.80		0.10	7.18	-	45.94
238.90		0.10	7.18	-	53.12
238.99	Top of Chamber	0.09	6.75	-	59.86
239.00				-	59.86
239.10				-	59.86
239.20				-	59.86
239.30				-	59.86
239.40				-	59.86
239.50				-	59.86
239.60				-	59.86
239.70				-	59.86
239.80				-	59.86
239.90				-	59.86
240.00				-	59.86
240.10				-	59.86
240.20				-	59.86
240.30				-	59.86
240.40				-	59.86
240.50				-	59.86

Note: Incremental volume calculated per incremental depth, footprint area of system and applicable void ratio for stone and StormTank module

System footprint footprint/volumes exclude all stone area/volumes

Shaded cumulative volume below outlet to be infiltrated

PROJECT	505-533 Yonge Street	FILE	421422
		DATE	11-8-2021
SUBJECT	Total Quantity Storage Summary	NAME	LB
		PAGE	5 OF 9

Stage Storage Table Summary Table

Elevation	MH & CB Storage (m ³)	Pipe Storage (m ³)	U/G Chamber #1 (m ³)	U/G Chamber #2 (m ³)	Total Storage (m ³)
238.00	0	0	0	0	0
238.10	0	0	0	0	0
238.20	0	0	5	3	8
238.30	0	0	18	10	28
238.40	0	0	30	17	48
238.50	0	0	43	24	68
238.60	0	0	56	32	87
238.70	0	0	69	39	107
238.80	0	0	81	46	127
238.90	0	0	94	53	147
239.00	1	0	107	60	167
239.10	1	0	119	60	181
239.20	1	1	132	60	195
239.30	2	4	145	60	211
239.40	3	7	158	60	227
239.50	4	9	170	60	243
239.60	5	11	183	60	259
239.70	6	11	196	60	272
239.80	7	11	208	60	286
239.90	8	11	221	60	300
240.00	9	11	221	60	300
240.10	10	11	221	60	301
240.20	11	11	221	60	302
240.30	11	11	221	60	303
240.40	12	11	221	60	304
240.50	13	11	221	60	305

PROJECT	505-533 Yonge Street	FILE	421422
		DATE	11-10-2021
SUBJECT	Stage Storage Discharge Summary	NAME	LB
		PAGE	6 OF 9

Stage Discharge Table Summary Table

Orifice Control

Orifice #1

Orifice Dia. (mm)	267
Orifice Invert (m)	238.16
Orifice Area (m ²)	0.056
Orifice Coef.	0.63

Orifice #2

Orifice Dia. (mm)	285
Orifice Invert (m)	239.52
Orifice Area (m ²)	0.064
Orifice Coef.	0.63

Orifice Equation

$$Q = C \times A \times (2gH)^{0.5}$$

Q = flow rate (m³/s)

C = constant

A = area of opening (m²)

H = net head on the orifice

g = Acceleration due to gravity

Values in shaded cells have been calculated using partially full orifice outlet control equations (Hydraulic Structures, C.D. Smith, University of Saskatchewan)

Elevation	Head (m)	Orifice #1 Discharge (m ³ /s)	Head (m)	Orifice #2 Discharge (m ³ /s)	Total Discharge (m ³ /s)	Total Storage (m ³)
238.00	0.00	0.00	0.00	0.00	0.00	0
238.10	0.00	0.00	0.00	0.00	0.00	0
238.20	0.00	0.00	0.00	0.00	0.00	8
238.30	0.01	0.01	0.00	0.00	0.01	28
238.40	0.11	0.04	0.00	0.00	0.04	48
238.50	0.21	0.06	0.00	0.00	0.06	68
238.60	0.31	0.09	0.00	0.00	0.09	87
238.70	0.41	0.10	0.00	0.00	0.10	107
238.80	0.51	0.11	0.00	0.00	0.11	127
238.90	0.61	0.12	0.00	0.00	0.12	147
239.00	0.71	0.13	0.00	0.00	0.13	167
239.10	0.81	0.14	0.00	0.00	0.14	181
239.20	0.91	0.15	0.00	0.00	0.15	195
239.30	1.01	0.16	0.00	0.00	0.16	211
239.40	1.11	0.16	0.00	0.00	0.16	227
239.50	1.21	0.17	0.00	0.00	0.17	243
239.60	1.31	0.18	0.00	0.00	0.18	259
239.70	1.41	0.19	0.04	0.02	0.21	272
239.80	1.51	0.19	0.14	0.05	0.24	286
239.90	1.61	0.20	0.24	0.07	0.27	300
240.00	1.71	0.20	0.34	0.10	0.31	300
240.10	1.81	0.21	0.44	0.12	0.33	301
240.20	1.91	0.22	0.54	0.13	0.35	302
240.30	2.01	0.22	0.64	0.14	0.36	303
240.40	2.11	0.23	0.74	0.15	0.38	304
240.50	2.21	0.23	0.84	0.16	0.40	305



Project:	505-533 Yonge Street	Designed By:	LB
File:	421422	Checked By:	NHF
Municipality:	City of Barrie	Date:	11-12-2021

Outlet Hydraulics - Partially Full Orifice - Orifice #1

$$Orifice\ Plate = C \times A \times (2gH)^{0.5}$$

$$C = 0.63$$

Water Elevation m	Depth From Min Elev m	Pipe Partially Full Inlet Control (Smith) m ³ /s
238.16	0	
238.20	0.1	0.0015
238.30	0.2	0.0136
238.40	0.3	0.0351
238.50	0.4	0.0562
238.60	0.5	0.0865

	(invert of Control)	(Top of Ponding)
Depth Increment m	Min Elevation m	Max Elevation Max
0.1	238.16	238.60

Pipe Flowing Partially Full or full	
Coefficient Metric = 1, Imperial=1.49	1
Pipe Diameter (m)	0.267
Mannings N Full	0.013
Pipe Slope (m/m)	
Elevation (m)	238.16
Inlet Type: 1= Projecting 2= Flush	1

Inlet Control (Smith) Projecting Inlet	
MMF Model: $y = (a \cdot b + c \cdot x^d) / (b + x^d)$	
Coefficient Data:	
a =	1.68E-02
b =	1.77E+00
c =	3.06E+00
d =	2.27E+00
Inlet Control (Smith) Flush Inlet	
MMF Model: $y = (a \cdot b + c \cdot x^d) / (b + x^d)$	
Coefficient Data:	
a =	-1.08E-03
b =	2.30E+00
c =	3.95E+00
d =	2.08E+00



Project:	505-533 Yonge Street	Designed By:	LB
File:	421422	Checked By:	NHF
Municipality:	City of Barrie	Date:	11-12-2021

Outlet Hydraulics - Partially Full Orifice - Orifice #2

$$Orifice\ Plate = C \times A \times (2gH)^{0.5}$$

$$C = 0.63$$

Water Elevation m	Depth From Min Elev m	Pipe Partially Full Inlet Control (Smith) m ³ /s
239.52	0	
239.60	0.1	0.0048
239.70	0.2	0.0226
239.80	0.3	0.0472
239.90	0.4	0.0696
240.00	0.5	0.1034

	(invert of Control)	(Top of Ponding)
Depth Increment m	Min Elevation m	Max Elevation Max
0.1	239.52	241.00

Pipe Flowing Partially Full or full	
Coefficient Metric = 1, Imperial=1.49	1
Pipe Diameter (m)	0.285
Mannings N Full	0.013
Pipe Slope (m/m)	
Elevation (m)	239.52
Inlet Type: 1= Projecting 2= Flush	1

Inlet Control (Smith) Projecting Inlet	
MMF Model: $y = (a \cdot b + c \cdot x^d) / (b + x^d)$	
Coefficient Data:	
a =	1.68E-02
b =	1.77E+00
c =	3.06E+00
d =	2.27E+00
Inlet Control (Smith) Flush Inlet	
MMF Model: $y = (a \cdot b + c \cdot x^d) / (b + x^d)$	
Coefficient Data:	
a =	-1.08E-03
b =	2.30E+00
c =	3.95E+00
d =	2.08E+00

PROJECT	505-533 Yonge Street	FILE	421422
		DATE	11-12-2021
SUBJECT	SWM Facility Operating Characteristics	NAME	LB
		PAGE	9 OF 9

Operation Summary

STORM EVENT	Volume	Peak Flow	Elevation
	m ³	m ³ /s	m
1:2-year	148	0.122	238.90
1:5-year	204	0.154	239.26
1:10-year	246	0.174	239.52
1:25-year	284	0.234	239.78
1:50-year	300	0.272	239.91
1:100-year	302	0.330	240.11

Water Quality Control

PROJECT	505-533 Yonge Street	FILE	421422
		DATE	11-12-2021
SUBJECT	Water Quality - Treatment Train Calculation	NAME	LB
		PAGE	1 OF 1

Water Quality Treatment Train Calculation

Catchment 201

Drainage Area to Controls= 1.45 ha Imperviousness of Drainage Area to Controls= 96%

Device	Target Total Suspended Solids (TSS) Removal
Primary Treatment* Jellyfish	87
Secondary Treatment*	

*Imbrium Systems Inc. Jellyfish Filter Verification Statement (2020) (Verified between 79.3% to 87.2% TSS removal) & Imbrium Jellyfish Filter Sizing Report - November 10, 2021

$$TSS\ Removal = (R_P + R_S) - [(R_P \times R_S)/100]$$

where:

R_P = % TSS Removal provided by Primary Treatment Strategy

R_S = % TSS Removal provided by Secondary Treatment Strategy

TSS Removal Provided By Controls = 87 %



STANDARD OFFLINE Jellyfish Filter Sizing Report

Project Information

Date	Wednesday, November 10, 2021
Project Name	505-533 Yonge Street
Project Number	
Location	Barrie

Jellyfish Filter Design Overview

This report provides information for the sizing and specification of the Jellyfish Filter. When designed properly in accordance to the guidelines detailed in the Jellyfish Filter Technical Manual, the Jellyfish Filter will exceed the performance and longevity of conventional horizontal bed and granular media filters.

Please see www.ImbriumSystems.com for more information.

Jellyfish Filter System Recommendation

The Jellyfish Filter model JF8-7-2 is recommended to meet the water quality objective by treating a flow of 40.4 L/s, which meets or exceeds 90% of the average annual rainfall runoff volume based on 36 years of BARRIE WPCC rainfall data for this site. This model has a sediment capacity of 455 kg, which meets or exceeds the estimated average annual sediment load.

Jellyfish Model	Number of High-Flo Cartridges	Number of Draindown Cartridges	Manhole Diameter (m)	Treatment Flow Rate (L/s)	Sediment Capacity (kg)
JF8-7-2	7	2	2.4	40.4	455

The Jellyfish Filter System

The patented Jellyfish Filter is an engineered stormwater quality treatment technology featuring unique membrane filtration in a compact stand-alone treatment system that removes a high level and wide variety of stormwater pollutants. Exceptional pollutant removal is achieved at high treatment flow rates with minimal head loss and low maintenance costs. Each lightweight Jellyfish Filter cartridge contains an extraordinarily large amount of membrane surface area, resulting in superior flow capacity and pollutant removal capacity.

Maintenance

Regular scheduled inspections and maintenance is necessary to assure proper functioning of the Jellyfish Filter. The maintenance interval is designed to be a minimum of 12 months, but this will vary depending on site loading conditions and upstream pretreatment measures. Quarterly inspections and inspections after all storms beyond the 5-year event are recommended until enough historical performance data has been logged to comfortably initiate an alternative inspection interval.

Please see www.ImbriumSystems.com for more information.

Thank you for the opportunity to present this information to you and your client.

Performance

Jellyfish efficiently captures a high level of Stormwater pollutants, including:

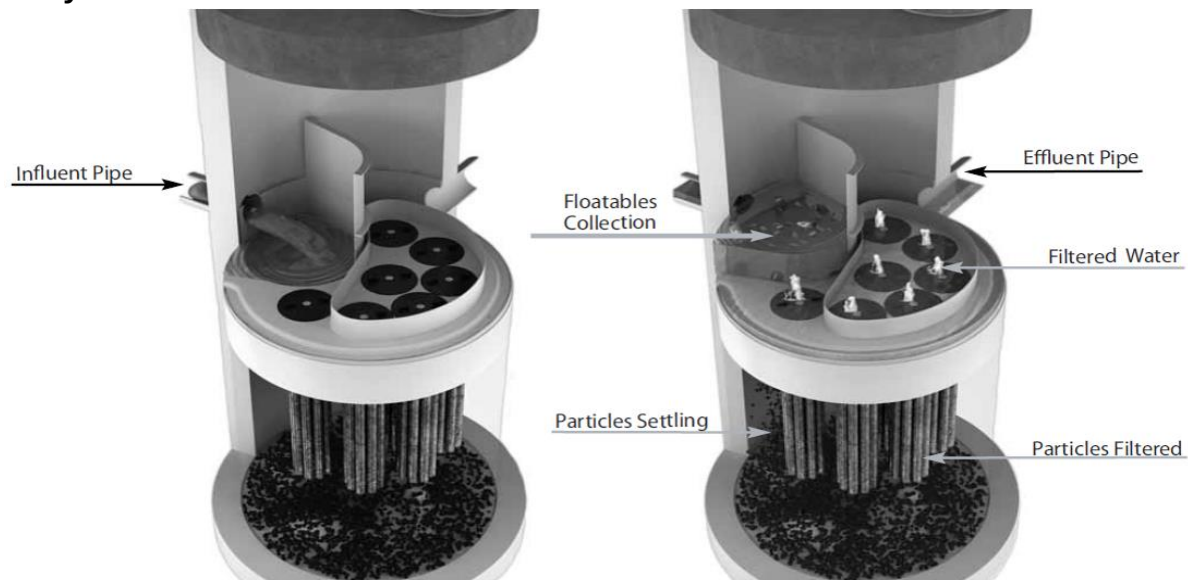
- ☑ 89% of the total suspended solids (TSS) load, including particles less than 5 microns
- ☑ 59% TP removal & 51% TN removal
- ☑ 90% Total Copper, 81% Total Lead, 70% Total Zinc
- ☑ Particulate-bound pollutants such as nutrients, toxic metals, hydrocarbons and bacteria
- ☑ Free oil, Floatable trash and debris

Field Proven Performance

The Jellyfish filter has been field-tested on an urban site with 25 TARP qualifying rain events and field monitored according to the TARP field test protocol, demonstrating:

- A median TSS removal efficiency of 89%, and a median SSC removal of 99%;
- The ability to capture fine particles as indicated by an effluent d50 median of 3 microns for all monitored storm events, and a median effluent turbidity of 5 NTUs;
- A median Total Phosphorus removal of 59%, and a median Total Nitrogen removal of 51%.

Jellyfish Filter Treatment Functions



Pre-treatment and Membrane Filtration

Project Information

Date:	Wednesday, November 10, 2021
Project Name:	505-533 Yonge Street
Project Number:	
Location:	Barrie

Designer Information

Company:	Tatham Engineering Limited
Contact:	Lauren Buss, B.Eng., EIT
Phone #:	

Notes

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Design System Requirements

Flow Loading	90% of the Average Annual Runoff based on 36 years of BARRIE WPCC rainfall data:	38.1 L/s
Sediment Loading	Treating 90% of the average annual runoff volume, 4414 m ³ , with a suspended sediment concentration of 60 mg/L.	265 kg

Recommendation

The Jellyfish Filter model JF8-7-2 is recommended to meet the water quality objective by treating a flow of 40.4 L/s, which meets or exceeds 90% of the average annual rainfall runoff volume based on 36 years of BARRIE WPCC rainfall data for this site. This model has a sediment capacity of 455 kg, which meets or exceeds the estimated average annual sediment load.

Jellyfish Model	Number of High-Flo Cartridges	Number of Draindown Cartridges	Manhole Diameter (m)	Wet Vol Below Deck (L)	Sump Storage (m ³)	Oil Capacity (L)	Treatment Flow Rate (L/s)	Sediment Capacity (kg)
JF4-1-1	1	1	1.2	2313	0.34	379	7.6	85
JF4-2-1	2	1	1.2	2313	0.34	379	12.6	142
JF6-3-1	3	1	1.8	5205	0.79	848	17.7	199
JF6-4-1	4	1	1.8	5205	0.79	848	22.7	256
JF6-5-1	5	1	1.8	5205	0.79	848	27.8	313
JF6-6-1	6	1	1.8	5205	0.79	848	28.6	370
JF8-6-2	6	2	2.4	9252	1.42	1469	35.3	398
JF8-7-2	7	2	2.4	9252	1.42	1469	40.4	455
JF8-8-2	8	2	2.4	9252	1.42	1469	45.4	512
JF8-9-2	9	2	2.4	9252	1.42	1469	50.5	569
JF8-10-2	10	2	2.4	9252	1.42	1469	50.5	626
JF10-11-3	11	3	3.0	14456	2.21	2302	63.1	711
JF10-12-3	12	3	3.0	14456	2.21	2302	68.2	768
JF10-12-4	12	4	3.0	14456	2.21	2302	70.7	796
JF10-13-4	13	4	3.0	14456	2.21	2302	75.7	853
JF10-14-4	14	4	3.0	14456	2.21	2302	78.9	910
JF10-15-4	15	4	3.0	14456	2.21	2302	78.9	967
JF10-16-4	16	4	3.0	14456	2.21	2302	78.9	1024
JF10-17-4	17	4	3.0	14456	2.21	2302	78.9	1081
JF10-18-4	18	4	3.0	14456	2.21	2302	78.9	1138
JF10-19-4	19	4	3.0	14456	2.21	2302	78.9	1195
JF12-20-5	20	5	3.6	20820	3.2	2771	113.6	1280
JF12-21-5	21	5	3.6	20820	3.2	2771	113.7	1337
JF12-22-5	22	5	3.6	20820	3.2	2771	113.7	1394
JF12-23-5	23	5	3.6	20820	3.2	2771	113.7	1451
JF12-24-5	24	5	3.6	20820	3.2	2771	113.7	1508
JF12-25-5	25	5	3.6	20820	3.2	2771	113.7	1565
JF12-26-5	26	5	3.6	20820	3.2	2771	113.7	1622
JF12-27-5	27	5	3.6	20820	3.2	2771	113.7	1679

Rainfall

Name:	BARRIE WPCC
State:	ON
ID:	557
Record:	1968 to 2003
Co-ords:	44°23'N, 79°41'W

Drainage Area

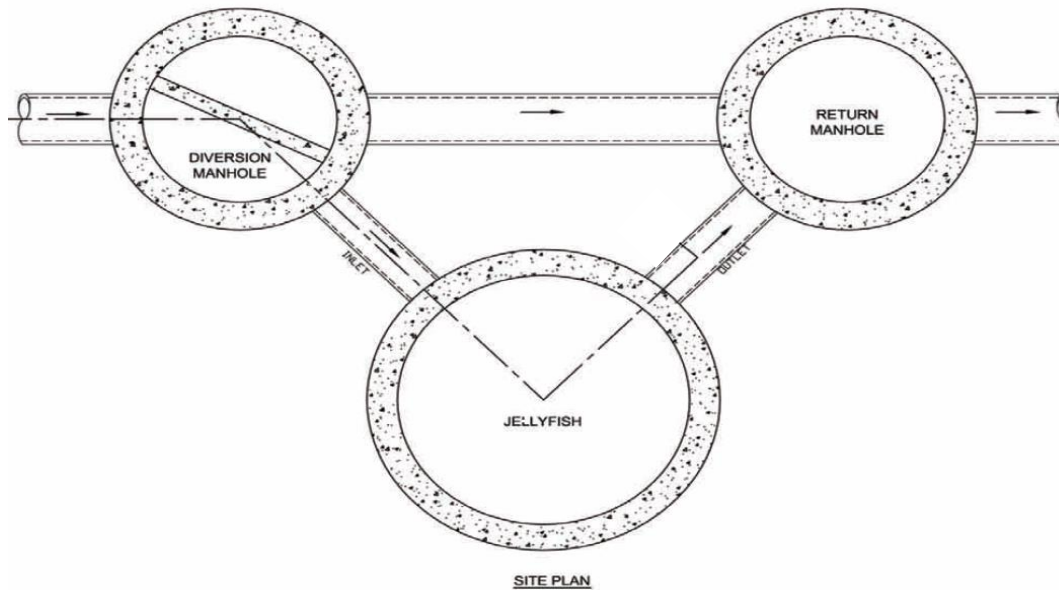
Total Area:	1.52 ha
Imperviousness:	100%

Upstream Detention

Peak Release Rate:	n/a
Pretreatment Credit:	n/a

Jellyfish Filter Design Notes

- Typically the Jellyfish Filter is designed in an offline configuration, as all stormwater filter systems will perform for a longer duration between required maintenance services when designed and applied in off-line configurations. Depending on the design parameters, an optional internal bypass may be incorporated into the Jellyfish Filter, however note the inspection and maintenance frequency should be expected to increase above that of an off-line system. Speak to your local representative for more information.



Jellyfish Filter Typical Layout

- Typically, 18 inches (457 mm) of driving head is designed into the system, calculated as the difference in elevation between the top of the diversion structure weir and the invert of the Jellyfish Filter outlet pipe. Alternative driving head values can be designed as 12 to 24 inches (305 to 610mm) depending on specific site requirements, requiring additional sizing and design assistance.
- Typically, the Jellyfish Filter is designed with the inlet pipe configured 6 inches (150 mm) above the outlet invert elevation. However, depending on site parameters this can vary to an optional configuration of the inlet pipe entering the unit below the outlet invert elevation.
- The Jellyfish Filter can accommodate multiple inlet pipes within certain restrictions.
- While the optional inlet below deck configuration offers 0 to 360 degree flexibility between the inlet and outlet pipe, typical systems conform to the following:

Model Diameter (m)	Minimum Angle Inlet / Outlet Pipes	Minimum Inlet Pipe Diameter (mm)	Minimum Outlet Pipe Diameter (mm)
1.2	62°	150	200
1.8	59°	200	250
2.4	52°	250	300
3.0	48°	300	450
3.6	40°	300	450

- The Jellyfish Filter can be built at all depths of cover generally associated with conventional stormwater conveyance systems. For sites that require minimal depth of cover for the stormwater infrastructure, the Jellyfish Filter can be applied in a shallow application using a hatch cover. The general minimum depth of cover is 36 inches (915 mm) from top of the underslab to outlet invert.
- If driving head calculations account for water elevation during submerged conditions the Jellyfish Filter will function effectively under submerged conditions.
- Jellyfish Filter systems may incorporate grated inlets depending on system configuration.
- For sites with water quality treatment flow rates or mass loadings that exceed the design flow rate of the largest standard Jellyfish Filter manhole models, systems can be designed that hydraulically connect multiple Jellyfish Filters in series or alternatively Jellyfish Vault units can be designed.

STANDARD SPECIFICATION STORMWATER QUALITY – MEMBRANE FILTRATION TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

Specifies requirements for construction and performance of an underground stormwater quality membrane filtration treatment device that removes pollutants from stormwater runoff through the unit operations of sedimentation, floatation, and membrane filtration.

1.2 REFERENCE STANDARDS

ASTM C 891: Specification for Installation of Underground Precast Concrete Utility Structures
ASTM C 478: Specification for Precast Reinforced Concrete Manhole Sections
ASTM C 443: Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM D 4101: Specification for Copolymer steps construction

CAN/CSA-A257.4-M92

Joints for Circular Concrete Sewer and Culvert Pipe, Manhole Sections and Fittings Using Rubber Gaskets

CAN/CSA-A257.4-M92

Precast Reinforced Circular Concrete Manhole Sections, Catch Basins and Fittings

Canadian Highway Bridge Design Code

1.3 SHOP DRAWINGS

Shop drawings for the structure and performance are to be submitted with each order to the contractor. Contractor shall forward shop drawing submittal to the consulting engineer for approval. Shop drawings are to detail the structure's precast concrete and call out or note the fiberglass (FRP) internals/components.

1.4 PRODUCT SUBSTITUTIONS

No product substitutions shall be accepted unless submitted 10 days prior to project bid date, or as directed by the engineer of record. Submissions for substitutions require review and approval by the Engineer of Record, for hydraulic performance, impact to project designs, equivalent treatment performance, and any required project plan and report (hydrology/hydraulic, water quality, stormwater pollution) modifications that would be required by the approving jurisdictions/agencies. Contractor to coordinate with the Engineer of Record any applicable modifications to the project estimates of cost, bonding amount determinations, plan check fees for changes to approved documents, and/or any other regulatory requirements resulting from the product substitution.

1.5 HANDLING AND STORAGE

Prevent damage to materials during storage and handling.

PART 2 – PRODUCTS

2.1 GENERAL

- 2.1.1 The device shall be a cylindrical or rectangular, all concrete structure (including risers), constructed from precast concrete riser and slab components or monolithic precast structure(s), installed to conform to ASTM C 891 and to any required state highway, municipal or local specifications; whichever is more stringent. The device shall be watertight.
- 2.1.2 Cartridge Deck The cylindrical concrete device shall include a fiberglass deck. The rectangular concrete device shall include a coated aluminum deck. In either instance, the insert shall be bolted and sealed watertight inside the precast concrete chamber. The deck shall serve as: (a) a horizontal divider between the lower treatment zone and the upper treated effluent zone; (b) a deck for attachment of filter cartridges such that the membrane filter elements of each cartridge extend into the lower treatment zone; (c) a platform for maintenance workers to service the filter cartridges (maximum manned weight = 450 pounds (204 kg)); (d) a conduit for conveyance of treated water to the effluent pipe.
- 2.1.3 Membrane Filter Cartridges Filter cartridges shall be comprised of reusable cylindrical membrane filter elements connected to a perforated head plate. The number of membrane filter elements per cartridge shall be a minimum of eleven 2.75-inch (70-mm) diameter elements. The length of each filter element shall be a minimum 15 inches (381 mm). Each cartridge shall be fitted into the cartridge deck by insertion into a cartridge receptacle that is permanently mounted into the cartridge deck. Each cartridge shall be secured by a cartridge lid that is threaded onto the receptacle, or similar mechanism to secure the cartridge into the deck. The maximum treatment flow rate of a filter cartridge shall be controlled by an orifice in the cartridge lid, or on the individual cartridge itself, and based on a design flux rate (surface loading rate) determined by the maximum treatment flow rate per unit of filtration membrane surface area. The maximum design flux rate shall be 0.21 gpm/ft² (0.142 lps/m²).

Each membrane filter cartridge shall allow for manual installation and removal. Each filter cartridge shall have filtration membrane surface area and dry installation weight as follows (if length of filter cartridge is between those listed below, the surface area and weight shall be proportionate to the next length shorter and next length longer as shown below):

Filter Cartridge Length (in / mm)	Minimum Filtration Membrane Surface Area (ft ² / m ²)	Maximum Filter Cartridge Dry Weight (lbs / kg)
15	106 / 9.8	10.5 / 4.8
27	190 / 17.7	15.0 / 6.8
40	282 / 26.2	20.5 / 9.3
54	381 / 35.4	25.5 / 11.6

- 2.1.4 Backwashing Cartridges The filter device shall have a weir extending above the cartridge deck, or other mechanism, that encloses the high flow rate filter cartridges when placed in their respective cartridge receptacles within the cartridge deck. The weir, or other mechanism, shall collect a pool of filtered water during inflow events that backwashes the high flow rate cartridges when the inflow

event subsides. All filter cartridges and membranes shall be reusable and allow for the use of filtration membrane rinsing procedures to restore flow capacity and sediment capacity; extending cartridge service life.

- 2.1.5 Maintenance Access to Captured Pollutants The filter device shall contain an opening(s) that provides maintenance access for removal of accumulated floatable pollutants and sediment, removal of and replacement of filter cartridges, cleaning of the sump, and rinsing of the deck. Access shall have a minimum clear vertical clear space over all of the filter cartridges. Filter cartridges shall be able to be lifted straight vertically out of the receptacles and deck for the entire length of the cartridge.
- 2.1.6 Bend Structure The device shall be able to be used as a bend structure with minimum angles between inlet and outlet pipes of 90-degrees or less in the stormwater conveyance system.
- 2.1.7 Double-Wall Containment of Hydrocarbons The cylindrical precast concrete device shall provide double-wall containment for hydrocarbon spill capture by a combined means of an inner wall of fiberglass, to a minimum depth of 12 inches (305 mm) below the cartridge deck, and the precast vessel wall.
- 2.1.8 Baffle The filter device shall provide a baffle that extends from the underside of the cartridge deck to a minimum length equal to the length of the membrane filter elements. The baffle shall serve to protect the membrane filter elements from contamination by floatables and coarse sediment. The baffle shall be flexible and continuous in cylindrical configurations, and shall be a straight concrete or aluminum wall in rectangular configurations.
- 2.1.9 Sump The device shall include a minimum 24 inches (610 mm) of sump below the bottom of the cartridges for sediment accumulation, unless otherwise specified by the design engineer. Depths less than 24 inches may have an impact on the total performance and/or longevity between cartridge maintenance/replacement of the device.

2.2 PRECAST CONCRETE SECTIONS

All precast concrete components shall be manufactured to a minimum live load of HS-20 truck loading or greater based on local regulatory specifications, unless otherwise modified or specified by the design engineer, and shall be watertight.

2.3 JOINTS All precast concrete manhole configuration joints shall use nitrile rubber gaskets and shall meet the requirements of ASTM C443, Specification C1619, Class D or engineer approved equal to ensure oil resistance. Mastic sealants or butyl tape are not an acceptable alternative.

2.4 GASKETS Only profile neoprene or nitrile rubber gaskets in accordance to CSA A257.3-M92 will be accepted. Mastic sealants, butyl tape or Conseal CS-101 are not acceptable gasket materials.

2.5 FRAME AND COVER Frame and covers must be manufactured from cast-iron or other composite material tested to withstand H-20 or greater design loads, and as approved by the

local regulatory body. Frames and covers must be embossed with the name of the device manufacturer or the device brand name.

- 2.6 DOORS AND HATCHES If provided shall meet designated loading requirements or at a minimum for incidental vehicular traffic.
- 2.7 CONCRETE All concrete components shall be manufactured according to local specifications and shall meet the requirements of ASTM C 478.
- 2.8 FIBERGLASS The fiberglass portion of the filter device shall be constructed in accordance with the following standard: ASTM D-4097: Contact Molded Glass Fiber Reinforced Chemical Resistant Tanks.
- 2.9 STEPS Steps shall be constructed according to ASTM D4101 of copolymer polypropylene, and be driven into preformed or pre-drilled holes after the concrete has cured, installed to conform to applicable sections of state, provincial and municipal building codes, highway, municipal or local specifications for the construction of such devices.
- 2.10 INSPECTION All precast concrete sections shall be inspected to ensure that dimensions, appearance and quality of the product meet local municipal specifications and ASTM C 478.

PART 3 – PERFORMANCE

3.1 GENERAL

- 3.1.1 Verification – The stormwater quality filter must be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV).
- 3.1.2 Function - The stormwater quality filter treatment device shall function to remove pollutants by the following unit treatment processes; sedimentation, floatation, and membrane filtration.
- 3.1.3 Pollutants - The stormwater quality filter treatment device shall remove oil, debris, trash, coarse and fine particulates, particulate-bound pollutants, metals and nutrients from stormwater during runoff events.
- 3.1.4 Bypass - The stormwater quality filter treatment device shall typically utilize an external bypass to divert excessive flows. Internal bypass systems shall be equipped with a floatables baffle, and must avoid passage through the sump and/or cartridge filtration zone.
- 3.1.5 Treatment Flux Rate (Surface Loading Rate) – The stormwater quality filter treatment device shall treat 100% of the required water quality treatment flow based on a maximum design treatment flux rate (surface loading rate) across the membrane filter cartridges of 0.21 gpm/ft² (0.142 lps/m²).

3.2 FIELD TEST PERFORMANCE

At a minimum, the stormwater quality filter device shall have been field tested and verified with a minimum 25 TARP qualifying storm events and field monitoring shall have been conducted according to the TARP 2009 NJDEP TARP field test protocol, and have received NJCAT verification.

- 3.2.1 Suspended Solids Removal - The stormwater quality filter treatment device shall have demonstrated a minimum median TSS removal efficiency of 85% and a minimum median SSC removal efficiency of 95%.
- 3.2.2 Runoff Volume – The stormwater quality filter treatment device shall be engineered, designed, and sized to treat a minimum of 90 percent of the annual runoff volume determined from use of a minimum 15-year rainfall data set.
- 3.2.3 Fine Particle Removal - The stormwater quality filter treatment device shall have demonstrated the ability to capture fine particles as indicated by a minimum median removal efficiency of 75% for the particle fraction less than 25 microns, an effluent d_{50} of 15 microns or lower for all monitored storm events.
- 3.2.4 Turbidity Reduction - The stormwater quality filter treatment device shall have demonstrated the ability to reduce the turbidity from influent from a range of 5 to 171 NTU to an effluent turbidity of 15 NTU or lower.
- 3.2.5 Nutrient (Total Phosphorus & Total Nitrogen) Removal - The stormwater quality filter treatment device shall have demonstrated a minimum median Total Phosphorus removal of 55%, and a minimum median Total Nitrogen removal of 50%.
- 3.2.6 Metals (Total Zinc & Total Copper) Removal - The stormwater quality filter treatment device shall have demonstrated a minimum median Total Zinc removal of 55%, and a minimum median Total Copper removal of 85%.

3.3 INSPECTION and MAINTENANCE

The stormwater quality filter device shall have the following features:

- 3.3.1 Durability of membranes are subject to good handling practices during inspection and maintenance (removal, rinsing, and reinsertion) events, and site specific conditions that may have heavier or lighter loading onto the cartridges, and pollutant variability that may impact the membrane structural integrity. Membrane maintenance and replacement shall be in accordance with manufacturer's recommendations.
- 3.3.2 Inspection which includes trash and floatables collection, sediment depth determination, and visible determination of backwash pool depth shall be easily conducted from grade (outside the structure).
- 3.3.3 Manual rinsing of the reusable filter cartridges shall promote restoration of the flow capacity and sediment capacity of the filter cartridges, extending cartridge service life.

- 3.3.4 The filter device shall have a minimum 12 inches (305 mm) of sediment storage depth, and a minimum of 12 inches between the top of the sediment storage and bottom of the filter cartridge tentacles, unless otherwise specified by the design engineer. Variances may have an impact on the total performance and/or longevity between cartridge maintenance/replacement of the device.
- 3.3.5 Sediment removal from the filter treatment device shall be able to be conducted using a standard maintenance truck and vacuum apparatus, and a minimum one point of entry to the sump that is unobstructed by filter cartridges.
- 3.3.6 Maintenance access shall have a minimum clear height that provides suitable vertical clear space over all of the filter cartridges. Filter cartridges shall be able to be lifted straight vertically out of the receptacles and deck for the entire length of the cartridge.
- 3.3.7 Filter cartridges shall be able to be maintained without the requirement of additional lifting equipment.

PART 4 – EXECUTION

4.1 INSTALLATION

4.1.1 PRECAST DEVICE CONSTRUCTION SEQUENCE

The installation of a watertight precast concrete device should conform to ASTM C 891 and to any state highway, municipal or local specifications for the construction of manholes, whichever is more stringent. Selected sections of a general specification that are applicable are summarized below.

4.1.1.1 The watertight precast concrete device is installed in sections in the following sequence:

- aggregate base
- base slab
- treatment chamber and cartridge deck riser section(s)
- bypass section
- connect inlet and outlet pipes
- concrete riser section(s) and/or transition slab (if required)
- maintenance riser section(s) (if required)
- frame and access cover

4.1.2 The precast base should be placed level at the specified grade. The entire base should be in contact with the underlying compacted granular material. Subsequent sections, complete with joint seals, should be installed in accordance with the precast concrete manufacturer's recommendations.

4.1.3 Adjustment of the stormwater quality treatment device can be performed by lifting the upper sections free of the excavated area, re-leveling the base, and re-installing the sections. Damaged sections and gaskets should be repaired or replaced as necessary to restore original condition and watertight seals. Once the stormwater quality treatment device has been constructed, any/all lift holes must be plugged watertight with mortar or non-shrink grout.

4.1.4 Inlet and Outlet Pipes Inlet and outlet pipes should be securely set into the device using approved pipe seals (flexible boot connections, where applicable) so that the structure is watertight, and such that any pipe intrusion into the device does not impact the device functionality.

4.1.5 Frame and Cover Installation Adjustment units (e.g. grade rings) should be installed to set the frame and cover at the required elevation. The adjustment units should be laid in a full bed of mortar with successive units being joined using sealant recommended by the manufacturer. Frames for the cover should be set in a full bed of mortar at the elevation specified.

4.2 MAINTENANCE ACCESS WALL

In some instances the Maintenance Access Wall, if provided, shall require an extension attachment and sealing to the precast wall and cartridge deck at the job site, rather than at the precast facility. In this instance, installation of these components shall be performed according to instructions provided by the manufacturer.

4.3 FILTER CARTRIDGE INSTALLATION Filter cartridges shall be installed in the cartridge deck only after the construction site is fully stabilized and in accordance with the manufacturer's guidelines and recommendations. Contractor to contact the manufacturer to schedule cartridge delivery and review procedures/requirements to be completed to the device prior to installation of the cartridges and activation of the system.

PART 5 – QUALITY ASSURANCE

5.1 FILTER CARTRIDGE INSTALLATION Manufacturer shall coordinate delivery of filter cartridges and other internal components with contractor. Filter cartridges shall be delivered and installed complete after site is stabilized and unit is ready to accept cartridges. Unit is ready to accept cartridges after it has been cleaned out and any standing water, debris, and other materials have been removed. Contractor shall take appropriate action to protect the filter cartridge receptacles and filter cartridges from damage during construction, and in accordance with the manufacturer's recommendations and guidance. For systems with cartridges installed prior to full site stabilization and prior to system activation, the contractor can plug inlet and outlet pipes to prevent stormwater and other influent from entering the device. Plugs must be removed during the activation process.

5.2 INSPECTION AND MAINTENANCE

5.2.1 The manufacturer shall provide an Owner's Manual upon request.

5.2.2 After construction and installation, and during operation, the device shall be inspected and cleaned as necessary based on the manufacturer's recommended inspection and maintenance guidelines and the local regulatory agency/body.

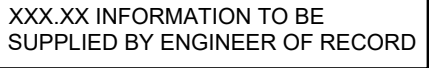
5.3 REPLACEMENT FILTER CARTRIDGES When replacement membrane filter elements and/or other parts are required, only membrane filter elements and parts approved by the manufacturer for use with the stormwater quality filter device shall be installed.

END OF SECTION

1. ALL DIMENSIONS INDICATED ARE IN MILLIMETERS (INCHES) UNLESS OTHERWISE SPECIFIED.
2. JELLYFISH STRUCTURE INLET AND OUTLET PIPE SIZE AND ORIENTATION SHOWN FOR INFORMATIONAL PURPOSES ONLY.
3. UNLESS OTHERWISE NOTED, BYPASS INFRASTRUCTURE, SUCH AS ALL UPSTREAM DIVERSION STRUCTURES, CONNECTING STRUCTURES, OR PIPE CONDUITS CONNECTING TO COMPLETE THE JELLYFISH SYSTEM SHALL BE PROVIDED AND ADDRESSED SEPARATELY.
4. DRAWING FOR INFORMATION PURPOSES ONLY. REFER TO ENGINEER'S SITE/UTILITY PLAN FOR STRUCTURE ORIENTATION.
5. NO PRODUCT SUBSTITUTIONS SHALL BE ACCEPTED UNLESS SUBMITTED 10 DAYS PRIOR PROJECT BID DATE OR AS DIRECTED BY THE ENGINEER OF RECORD.

- A. ANY SUB-BASE BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
- B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STRUCTURE (LIFTING CLUTCHES PROVIDED)
- C. CONTRACTOR WILL INSTALL AND LEVEL THE STRUCTURE, SEALING THE JOINTS, LINE ENTRY AND EXIT POINTS (NON-SHRINK GROUT WITH APPROVED WATERSTOP OR FLEXIBLE BOOT)
- D. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM CONSTRUCTION-RELATED EROSION RUNOFF.
- E. CARTRIDGE INSTALLATION, BY IMBRIUM, SHALL OCCUR ONLY AFTER SITE HAS BEEN STABILIZED AND THE JELLYFISH UNIT IS CLEAN AND FREE OF DEBRIS. CONTACT IMBRIUM TO COORDINATE CARTRIDGE INSTALLATION WITH SITE STABILIZATION.

FOR SITE SPECIFIC DRAWINGS PLEASE CONTACT YOUR LOCAL JELLYFISH FILTER REPRESENTATIVE. SITE SPECIFIC DRAWINGS ARE BASED ON THE BEST AVAILABLE INFORMATION AT THE TIME. SOME FIELD REVISIONS TO THE SYSTEM LOCATION OR CONNECTION PIPING MAY BE NECESSARY BASED ON AVAILABLE SPACE OR SITE CONFIGURATION REVISIONS. ELEVATIONS SHOULD BE MAINTAINED EXCEPT WHERE NOTED ON BYPASS STRUCTURE.



* PER ENGINEER OF RECORD

JELLYFISH TREATMENT CAPACITY IS A FUNCTION OF THE CARTRIDGE SELECTION AND THE NUMBER OF CARTRIDGES. THE STANDARD MANHOLE JELLYFISH TREATMENT CAPACITY IS 55.5 L/s (1.96 CFS). TREATMENT FLOW RATE IS BASED ON 457 MM (18") OF HEAD PRESSURE.

Jellyfish

JF8 STANDARD

Scale = 1:50

www.umbraunsystems.com

info@umbraunsystems.com

www.imbriumsystems.com

DATE: 10/01/14

DESIGNED:

DESIGNED:	DRAWN: BSF
-----------	---------------

CHECKED:
BSF

PROJECT #:	PROJECT NAME:
#####	#####

SHEET:

1 OF 2

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NOTES	BSF
INITIAL RELEASE	BSF

1	08/01/2015
0	10/01/2014

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Runoff Volume Control

PROJECT	505-533 Yonge Street	FILE	421422
		DATE	11-12-2021
SUBJECT	Infiltration Chamber Volume	NAME	LB
		PAGE	1 OF 1

Stage Storage Table Underground Infiltration Chamber Volume

Unit: StormTank ST-36 Module
 System Footprint: 74m²
 Height of Chamber: 0.914
 Void Ratio per module: 97.00%
 Void Ratio of stone: 40%

Elevation	Elevation Reference	Incremental Depth (m)	Incremental Volume (m ³)	Accumulative Volume - below outlet (m ³)	Accumulate Volume - above outlet (m ³)
237.02	Base of Stone	0.00	0.00	0.00	-
237.17	Base of Chamber	0.15	4.44	4.44	
237.20		0.03	2.15	-	2.15
237.30		0.10	7.18	-	9.33
237.40		0.10	7.18	-	16.51
237.50		0.10	7.18	-	23.69
237.60		0.10	7.18	-	30.87
237.70		0.10	7.18	-	38.04
237.80		0.10	7.18	-	45.22
237.90		0.10	7.18	-	52.40
238.00		0.10	7.18	-	59.58
238.08	Top of Chamber	0.08	5.74	-	65.32

Note: Incremental volume calculated per incremental depth, footprint area of system and applicable void ratio for stone and StormTank module

Assumed groundwater elevation of infiltraiton chamber: 236.00 masl

System footprint area exclude all stone area

Phosphorous Mitigation

Summary

Site	Project Name	Project Title	Storm Type	Runoff Continuity Error (%)	Flow Routing Continuity Error (%)
post-development	Post_505-533 Yonge Street with LID	Post_505_533 Yonge Street with LID	avg-annual	-0.002	-0.377
post-development	Post_505-533 Yonge Street	Post_505_533 Yonge Street	avg-annual	-0.002	-0.038

These continuity errors represent the percent difference between initial storage+ total inflow for the entire drainage system versus final storage + total outflow for the entire drainage system. If the continuity error exceed some reasonable level, such as 10 percent, then the validity of the analysis results must be questioned. The most common reasons for an excessive continuity error are conduits that are too short, abrupt changes in storage (very small or very large storage areas), or flooding losses in the model (insufficient node depth).

Loading Summary TP | Post_505_533 Yonge Street

Catchment	Total Catchment TP Removal	Peak Outflow	Generated	Outgoing
			Total Flow (m ³)	Total Flow (m ³)
			Average Concentration (mg/l)	Average Concentration (mg/l)
			Total Load (kg)	Total Load (kg)
Catchment 1	-0.039 %	0.191 m ³ /s	13,698.15 m ³ 0.191 mg/l 2.616 kg	10,166 m ³ 0.191 mg/l 1.942 kg
Total	25.756 %	0.191 m ³ /s	13,698.15 m ³ 0.191 mg/l 2.616 kg	10,166 m ³ 0.191 mg/l 1.942 kg

Loading Summary TP | Post_505_533 Yonge Street with LID

Catchment	Total Catchment TP Removal	Peak Outflow	Generated	Outgoing
			Total Flow (m ³)	Total Flow (m ³)
			Average Concentration (mg/l)	Average Concentration (mg/l)
			Total Load (kg)	Total Load (kg)
Catchment 1	70.1 %	0.191 m ³ /s	13,698.15 m ³ 0.191 mg/l 2.616 kg	10,204 m ³ 0.057 mg/l 0.583 kg
Total	77.727 %	0.191 m ³ /s	13,698.15 m ³ 0.191 mg/l 2.616 kg	10,204 m ³ 0.057 mg/l 0.583 kg

Peak Flow | Post_505_533 Yonge Street with LID

Catchment	Element	Description	Peak outflow
1	201	PEAK RUNOFF FLOW from	0.19 m ³ /s
	Jellyfish	MAXIMUM LATERAL INFLOW at	0.191 m ³ /s
	Site Outlet	MAXIMUM FLOW at	0.191 m ³ /s
	U/G Chamber	MAXIMUM OUTFLOW from	0.191 m ³ /s
	Pipe_1	MAXIMUM FLOW in	0.191 m ³ /s
	Pipe_2	MAXIMUM FLOW in	0.191 m ³ /s

Peak Flow | Post_505_533 Yonge Street

Catchment	Element	Description	Peak outflow
1	201	PEAK RUNOFF FLOW from	0.19 m ³ /s
	Site Outlet	MAXIMUM FLOW at	0.191 m ³ /s

Detailed Report Parameters | Post_505_533 Yonge Street

201

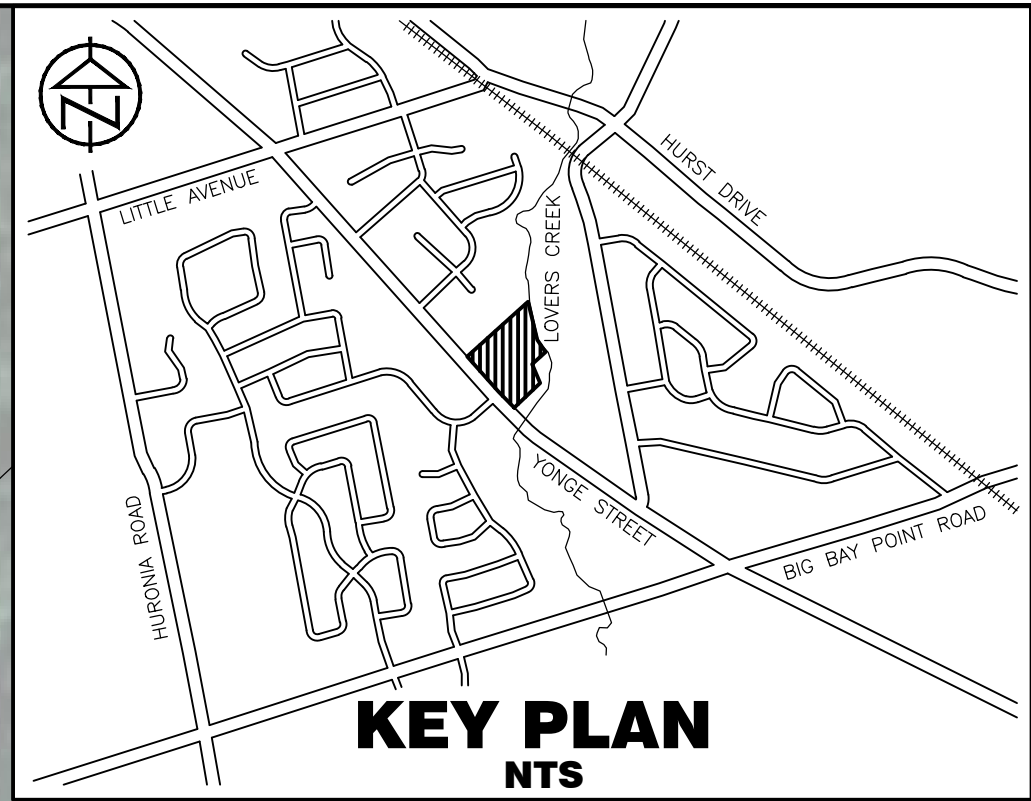
Field	Value
Subcatchment name	201
Catchment	1
Soil type	Fine Sand
Weighted EMC TSS (mg/L)	63.41
Weighted EMC TP (mg/L)	0.19
Total AREA (HA)	1.45
Impervious area (HA)	0.8554999999999999
Roof area (HA)	0.4785
Landscaped area (HA)	0.11599999999999999
Row Crop area (HA)	0
Open Space / Parkland area (HA)	0
Forest area (HA)	0
Wetland area (HA)	0
Other area (HA)	0

Detailed Report Parameters | Post_505_533 Yonge Street with LID

201

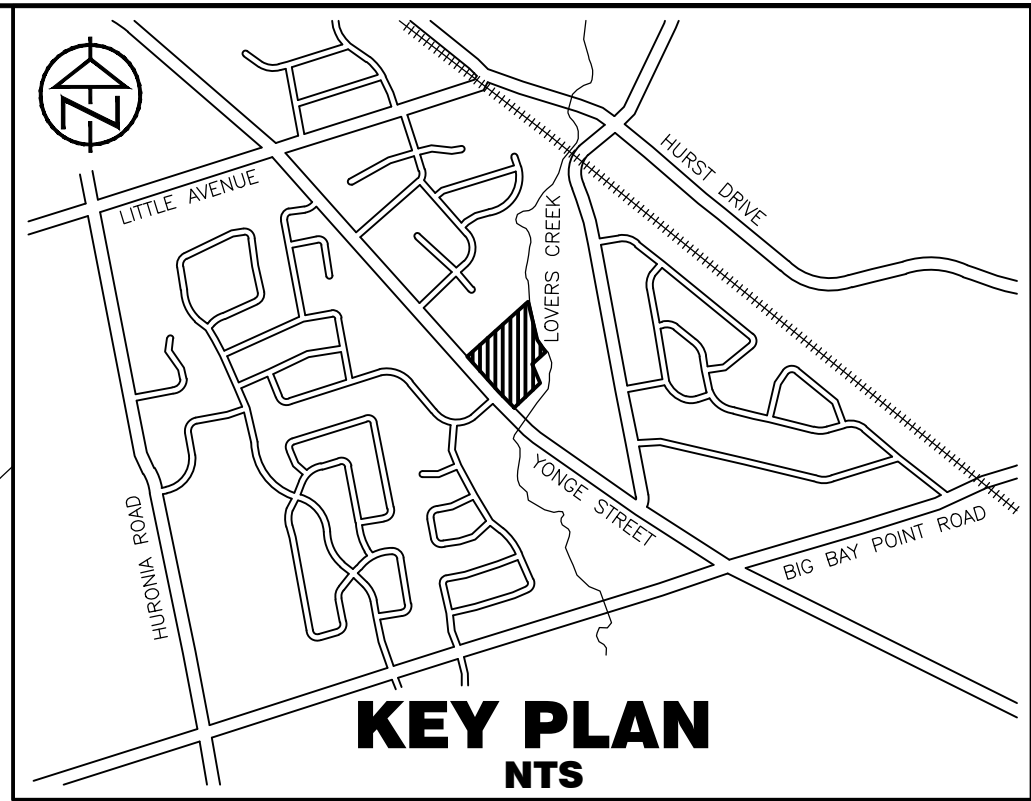
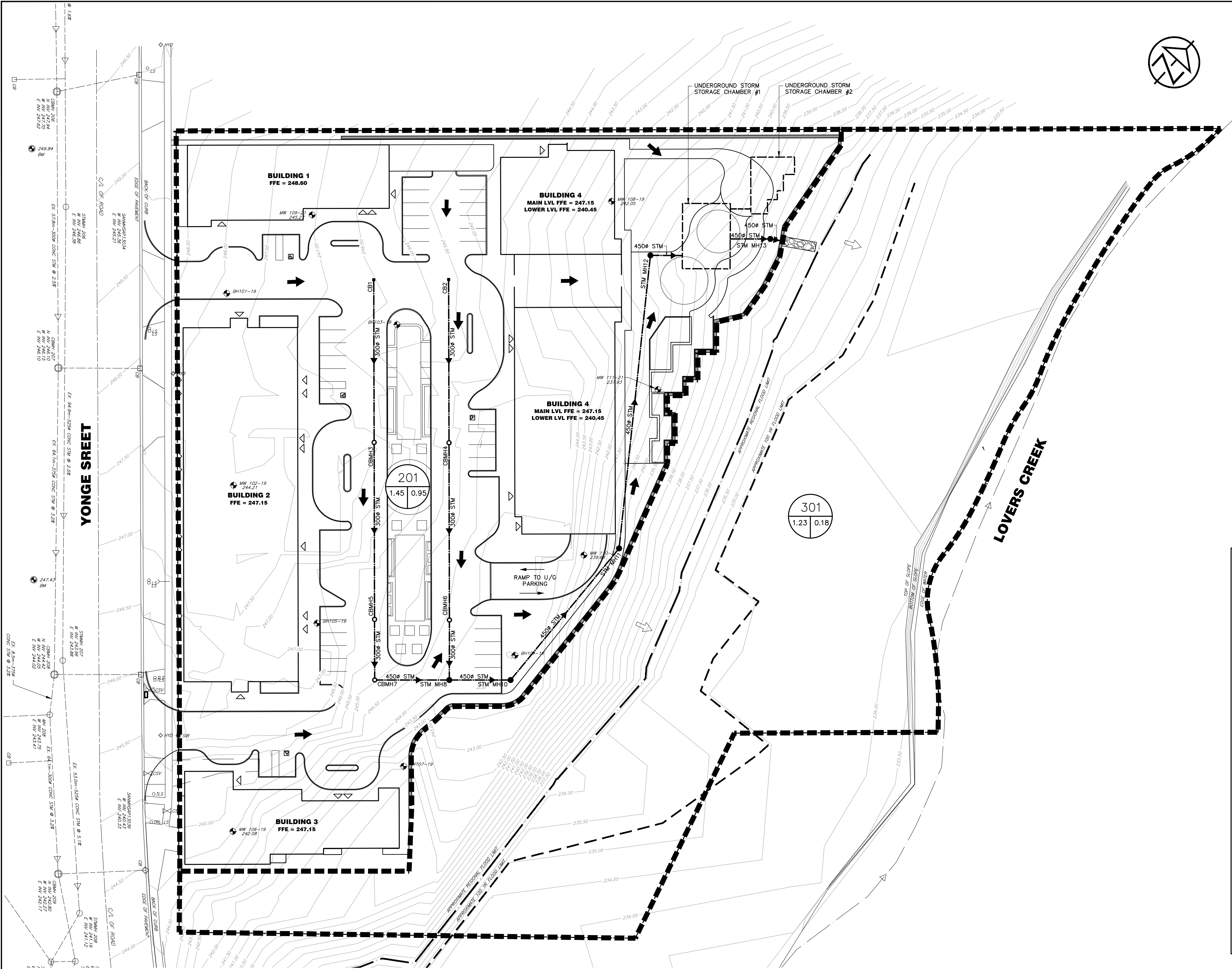
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Landscaped area (HA)	0.11599999999999999
Row Crop area (HA)	0
Open Space / Parkland area (HA)	0
Forest area (HA)	0
Wetland area (HA)	0

Appendix E: Drawings



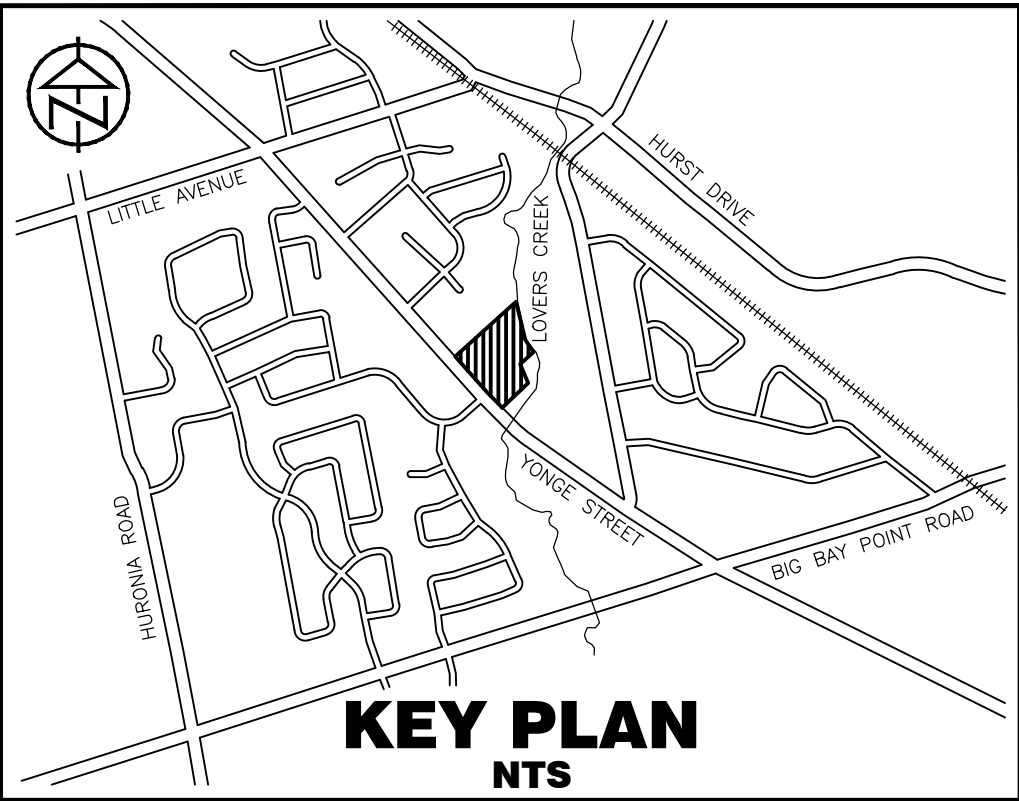
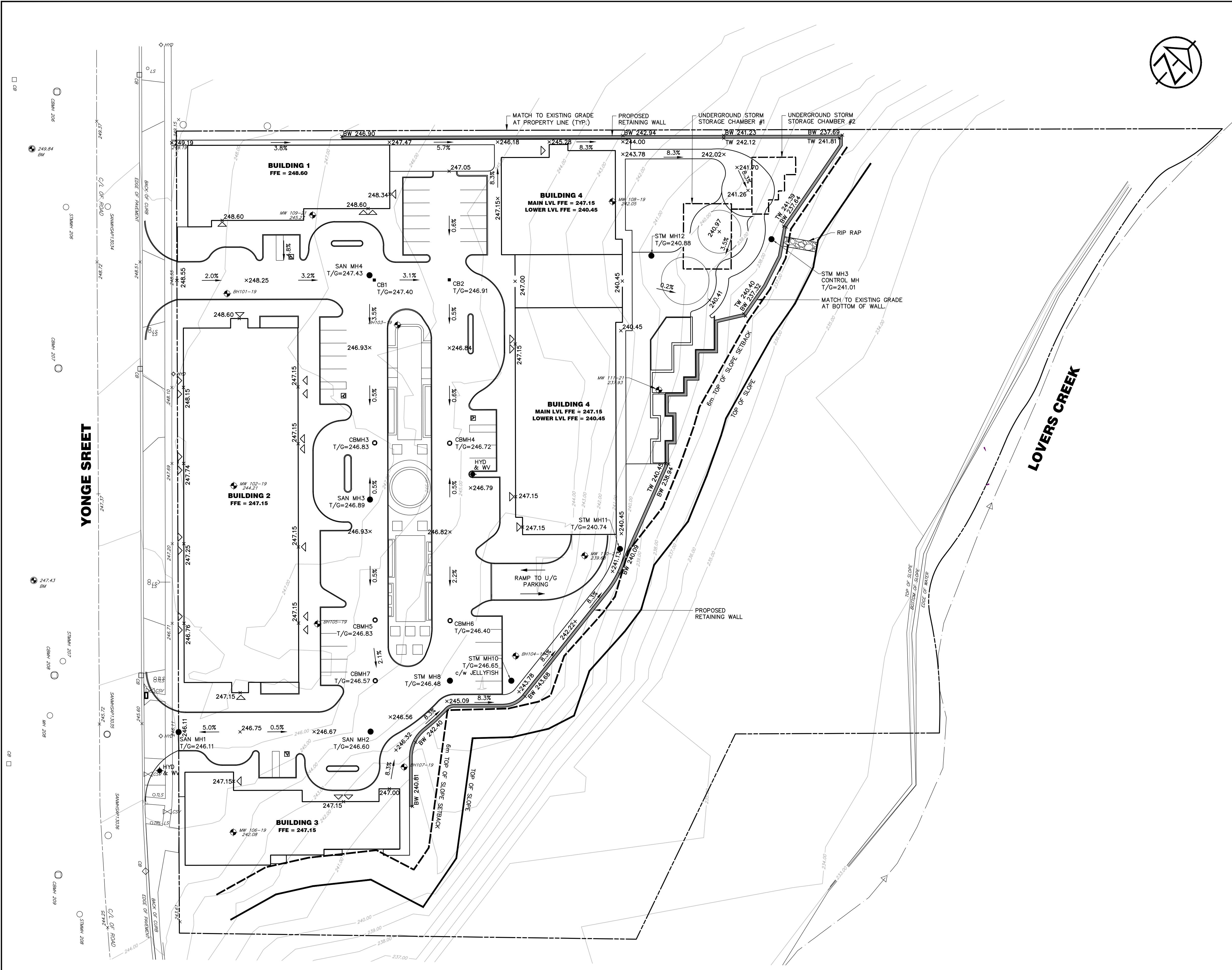
LEGEND	
	EXISTING CONTOUR
	EXISTING PROPERTY LINE
	EXISTING EDGE OF PAVEMENT
	EXISTING EDGE OF GRAVEL
	EXISTING C/L DITCH
	EXISTING FENCE LINE
	EXISTING BANKS
	EXISTING EDGE OF VEGETATION
	EXISTING BELL LINE
	EXISTING HYDRO
	EXISTING STORM SEWER
	EXISTING HYDRO POLE
	EXISTING CATCHBASIN
	EXISTING HYDRO POLE
	EXISTING ROAD SIGN
	EXISTING BELL PEDESTAL
	EXISTING TEMPORARY BENCHMARK
	EXISTING TREES
	EXISTING HEADWALL
	EXISTING CULVERT
	EXISTING OVERLAND FLOW DIRECTION
	PROPOSED STORM MANHOLE
	PROPOSED CATCHBASIN
	CATCHMENT ID
	AREA (ha)
	RUNOFF COEFFICIENT
	APPROXIMATE REGIONAL FLOODLINE
	APPROXIMATE 100-YEAR FLOODLINE
	CATCHMENT BOUNDARY

DISCLAIMER AND COPYRIGHT CONTRACTOR MUST VERIFY ALL DIMENSIONS AND BE RESPONSIBLE FOR SAME. ANY DISCREPANCIES MUST BE REPORTED TO THE ENGINEER BEFORE COMMENCING WORK. DRAWINGS ARE NOT TO BE SCALED. TATHAM ENGINEERING LIMITED CLAIMS COPYRIGHT TO THIS DRAWING WHICH MAY NOT BE USED FOR ANY PURPOSE OTHER THAN THAT PROVIDED IN THE CONTRACT BETWEEN THE OWNER/CLIENT AND THE ENGINEER WITHOUT THE EXPRESS CONSENT OF TATHAM ENGINEERING LIMITED.	BENCHMARKS ELEVATIONS SHOWN ARE GEODETIC BASED ON NAD83 (CANADA) AND ARE DERIVED FROM GPS REAL TIME NETWORK OBSERVATIONS USING THE 'CAN-NET' VRS NETWORK, IN UTM 17N. BENCHMARK: NAILS IN HYDRO POLES, OPPOSITE SIDE OF YONGE STREET	NOTES TOPOGRAPHIC SURVEY SHOWN ON THIS PLAN PREPARED BY JOE TOPO SURVEYS AND CADD INC., DATED JUNE 4, 2021 SITE PLAN PREPARED BY SALTER PILON ARCHITECTURE, DATED NOVEMBER 5, 2021	No.	REVISION DESCRIPTION	DATE	ENGINEER STAMP	505 - 533 YONGE STREET CITY OF BARRIE 	DESIGN: LMB DRAWN: LMB CHECK: NM	FILE: 421422 DATE: AUG 2021 SCALE: 1:400	DWG: DP-1
			1.	ISSUED FOR ZBA – FIRST SUBMISSION	DEC 14/21					



LEGEND	
	EXISTING CONTOUR
	EXISTING PROPERTY LINE
	EXISTING EDGE OF PAVEMENT
	EXISTING EDGE OF GRAVEL
	EXISTING C/L DITCH
	EXISTING FENCE LINE
	EXISTING BANKS
	EXISTING EDGE OF VEGETATION
	EXISTING BELL LINE
	EXISTING HYDRO
	EXISTING STORM SEWER
	EXISTING SANITARY SEWER
	EXISTING WATERMAIN
	EXISTING HYDRO POLE
	EXISTING CATCHBASIN
	EXISTING HYDRO POLE
	EXISTING HYDRO POLE
	EXISTING ROAD SIGN
	EXISTING BELL PEDESTAL
	EXISTING TEMPORARY BENCHMARK
	EXISTING TREES
	EXISTING HEADWALL
	EXISTING CULVERT
	PROPOSED OVERLAND FLOW DIRECTION
	EXISTING OVERLAND FLOW DIRECTION
	PROPOSED STORM MANHOLE
	PROPOSED CATCHBASIN
	CATCHMENT ID
	AREA (ha)
	RUNOFF COEFFICIENT
	APPROXIMATE REGIONAL FLOODLINE
	APPROXIMATE 100-YEAR FLOODLINE
	UNDERGROUND PARKING LIMIT
	CATCHMENT BOUNDARY
	PROPOSED STORM SEWER

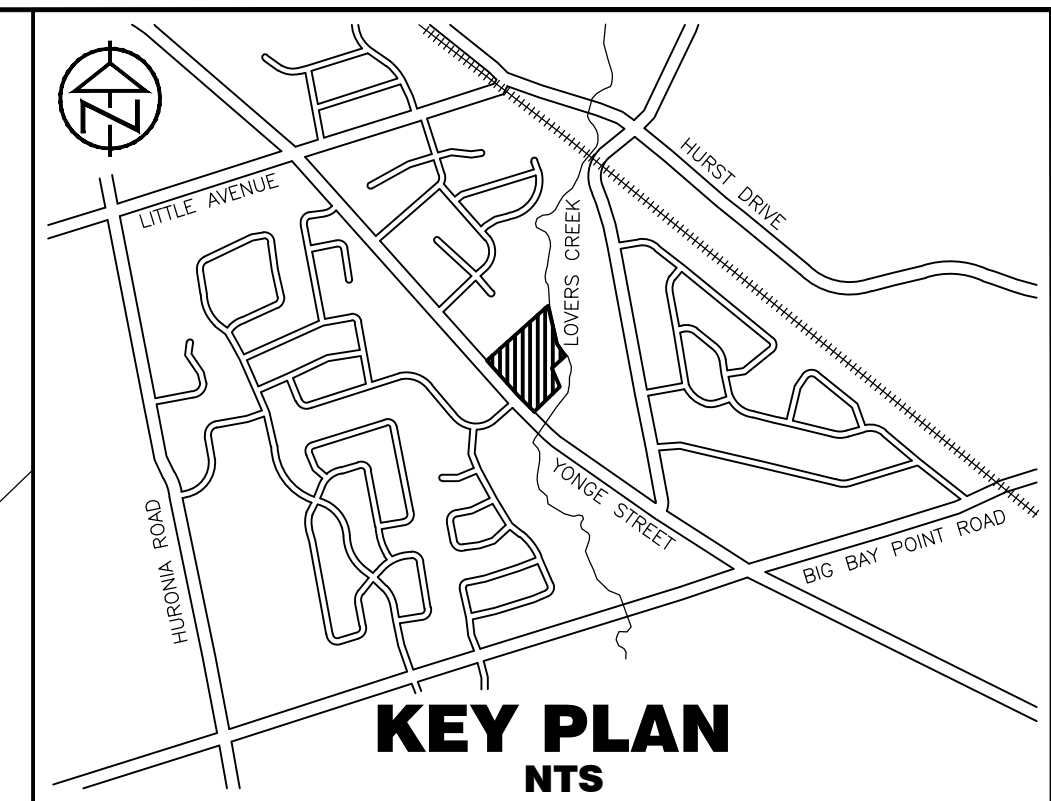
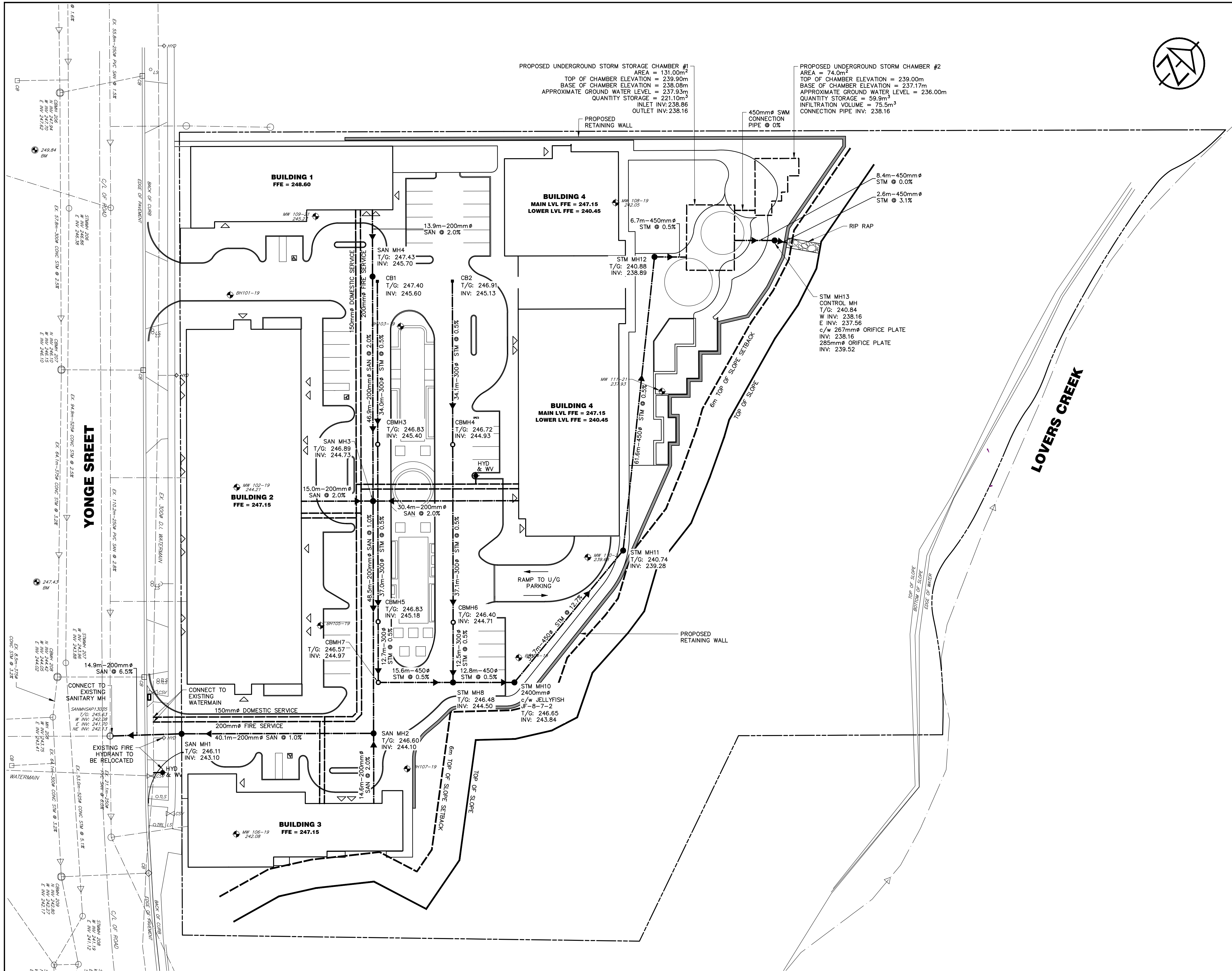
DISCLAIMER AND COPYRIGHT CONTRACTOR MUST VERIFY ALL DIMENSIONS AND BE RESPONSIBLE FOR SAME. ANY DISCREPANCIES MUST BE REPORTED TO THE ENGINEER BEFORE COMMENCING WORK. DRAWINGS ARE NOT TO BE SCALED. TATHAM ENGINEERING LIMITED CLAIMS COPYRIGHT TO THIS DRAWING WHICH MAY NOT BE USED FOR ANY PURPOSE OTHER THAN THAT PROVIDED IN THE CONTRACT BETWEEN THE OWNER/CLIENT AND THE ENGINEER WITHOUT THE EXPRESS CONSENT OF TATHAM ENGINEERING LIMITED.	BENCHMARKS ELEVATIONS SHOWN ARE GEODETIC BASED ON NAD83 (CANADA) AND ARE DERIVED FROM GPS REAL TIME NETWORK OBSERVATIONS USING THE "CAN-NET" VRS NETWORK, IN UTM 17N. BENCHMARK: NAILS IN HYDRO POLES, OPPOSITE SIDE OF YONGE STREET	NOTES TOPOGRAPHIC SURVEY SHOWN ON THIS PLAN PREPARED BY JOE TOPO SURVEYS AND CADD INC., DATED JUNE 4, 2021 SITE PLAN PREPARED BY SALTER PILON ARCHITECTURE, DATED NOVEMBER 5, 2021	No.	REVISION DESCRIPTION	DATE	ENGINEER STAMP	505 - 533 YONGE STREET CITY OF BARRIE			
			1.	ISSUED FOR ZBA – FIRST SUBMISSION	DEC 14/21					
POST DEVELOPMENT DRAINAGE PLAN							DESIGN: LMB	FILE: 421422	DWG: DP-2	
							DRAWN: LMB	DATE: AUG 2021		
							CHECK: NM	SCALE: 1:400		



LEGEND	
	EXISTING CONTOUR
	EXISTING PROPERTY LINE
	EXISTING EDGE OF PAVEMENT
	EXISTING EDGE OF GRAVEL
	EXISTING C/L DITCH
	EXISTING FENCE LINE
	EXISTING BANKS
	EXISTING HYDRO POLE
	EXISTING CATCHBASIN
	EXISTING HYDRO POLE
	EXISTING HYDRO POLE
	EXISTING ROAD SIGN
	EXISTING BELL PEDESTAL
	EXISTING TEMPORARY BENCHMARK
	EXISTING TREES
	EXISTING HEADWALL
	EXISTING CULVERT
	EXISTING OVERLAND FLOW DIRECTION
	PROPOSED STORM MANHOLE
	PROPOSED CATCHBASIN
	PROPOSED SANITARY MANHOLE
	EXISTING GROUND ELEVATION
	PROPOSED GROUND ELEVATION
	PROPOSED GRADE
	TOP OF SLOPE (AS PER CAMBIUM)
	TOP OF SLOPE SETBACK (6m)
	UNDERGROUND PARKING LIMIT

NOT FOR CONSTRUCTION

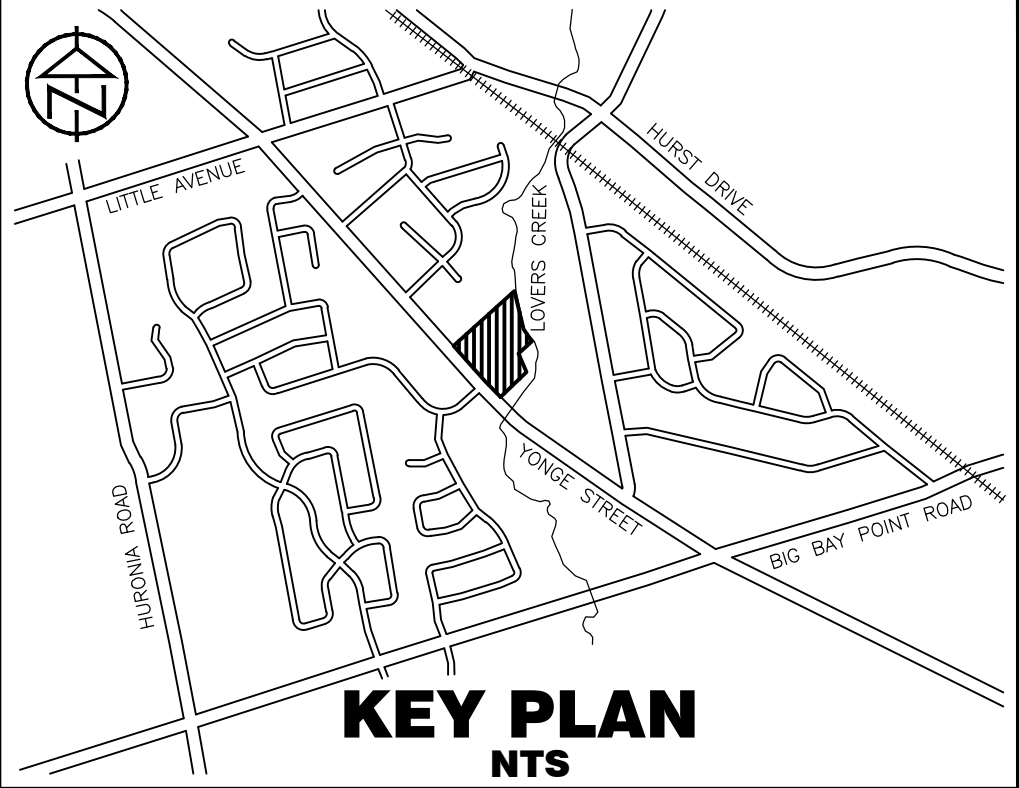
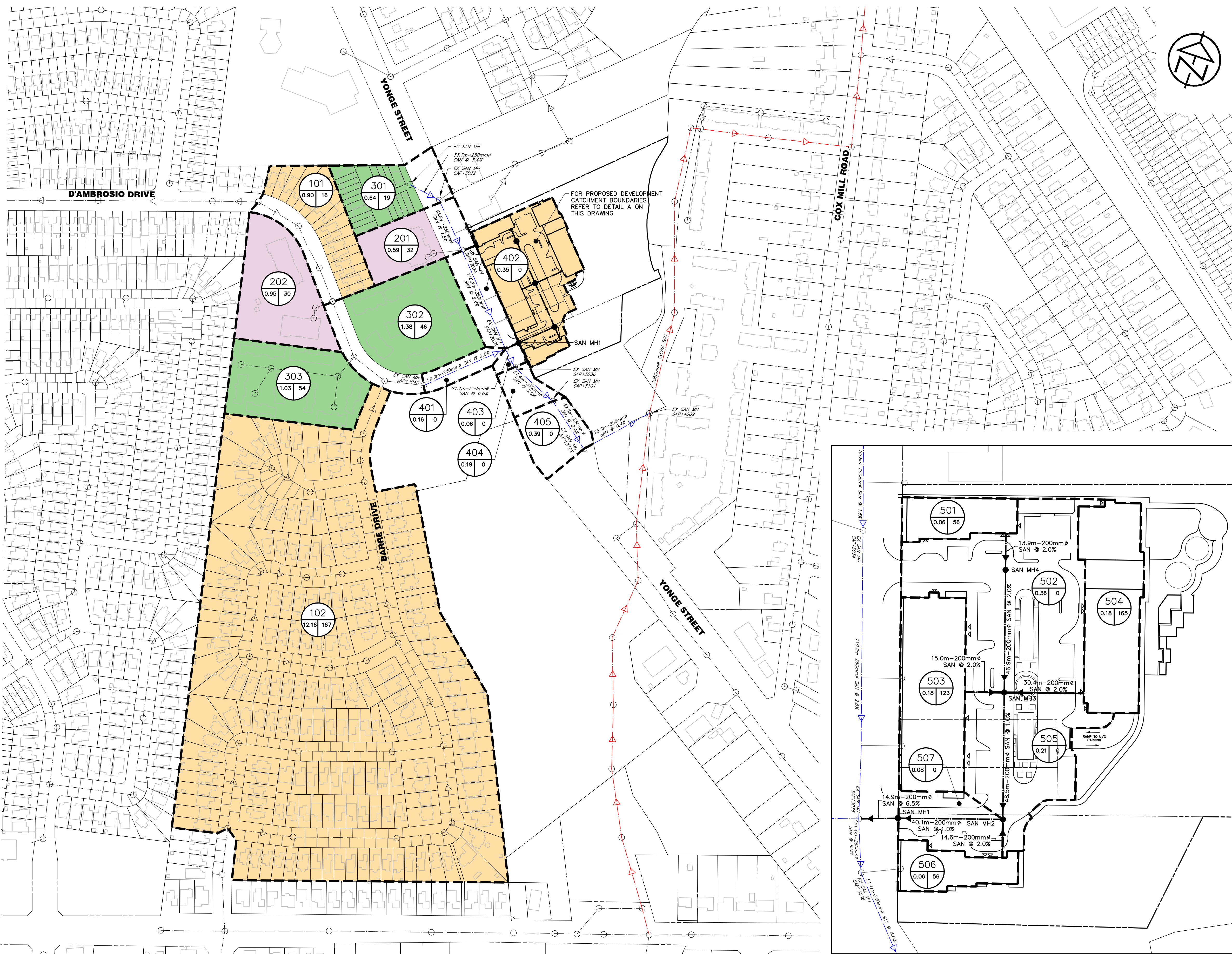
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			1.	ISSUED FOR ZBA – FIRST SUBMISSION	DEC 14/21						
PRELIMINARY GRADING PLAN							DESIGN: LMB	FILE: 421422	DWG:	SG-1	
							DRAWN: LMB	DATE: AUG 2021			
							CHECK: NM	SCALE: 1:400			



LEGEND	
	EXISTING CONTOUR
	EXISTING PROPERTY LINE
	EXISTING EDGE OF PAVEMENT
	EXISTING EDGE OF GRAVEL
	EXISTING C/L DITCH
	EXISTING FENCE LINE
	EXISTING BANKS
	EXISTING BELL LINE
	EXISTING HYDRO
	EXISTING STORM SEWER
	EXISTING SANITARY SEWER
	EXISTING WATERMAIN
	EXISTING HYDRO POLE
	EXISTING CATCHBASIN
	EXISTING HYDRO POLE
	EXISTING HYDRO POLE
	EXISTING ROAD SIGN
	EXISTING BELL PEDESTAL
	EXISTING TEMPORARY BENCHMARK
	EXISTING TREES
	EXISTING HEADWALL
	EXISTING CULVERT
	EXISTING OVERLAND FLOW DIRECTION
	PROPOSED STORM MANHOLE
	PROPOSED CATCHBASIN
	PROPOSED SANITARY MANHOLE
	TOP OF SLOPE SETBACK
	TOP OF SLOPE
	UNDERGROUND PARKING LIMIT
	PROPOSED STORM SEWER
	PROPOSED SANITARY SEWER
	PROPOSED WATERMAIN

NOT FOR CONSTRUCTION

DISCLAIMER AND COPYRIGHT CONTRACTOR MUST VERIFY ALL DIMENSIONS AND BE RESPONSIBLE FOR SAME. ANY DISCREPANCIES MUST BE REPORTED TO THE ENGINEER BEFORE COMMENCING WORK. DRAWINGS ARE NOT TO BE SCALED. TATHAM ENGINEERING LIMITED CLAIMS COPYRIGHT TO THIS DRAWING WHICH MAY NOT BE USED FOR ANY PURPOSE OTHER THAN THAT PROVIDED IN THE CONTRACT BETWEEN THE OWNER/CLIENT AND THE ENGINEER WITHOUT THE EXPRESS CONSENT OF TATHAM ENGINEERING LIMITED.	BENCHMARKS ELEVATIONS SHOWN ARE GEODETIC BASED ON NAD83 (CANADA) AND ARE DERIVED FROM GPS REAL TIME NETWORK OBSERVATIONS USING THE "CAN-NET" VRS NETWORK, IN UTM 17N. BENCHMARK: NAILS IN HYDRO POLES, OPPOSITE SIDE OF YONGE STREET	NOTES TOPOGRAPHIC SURVEY SHOWN ON THIS PLAN PREPARED BY JOE TOPO SURVEYS AND CADD INC., DATED JUNE 4, 2021 SITE PLAN PREPARED BY SALTER PILON ARCHITECTURE, DATED NOVEMBER 5, 2021	No.	REVISION DESCRIPTION	DATE	ENGINEER STAMP	505 - 533 YONGE STREET CITY OF BARRIE		TATHAM ENGINEERING		
			1.	ISSUED FOR ZBA - FIRST SUBMISSION	DEC 14/21						
								PRELIMINARY SITE SERVICING PLAN	DESIGN: LMB	FILE: 421422	DWG:
									DRAWN: LMB	DATE: AUG 2021	SS-1
									CHECK: NM	SCALE: 1:400	



LEGEND

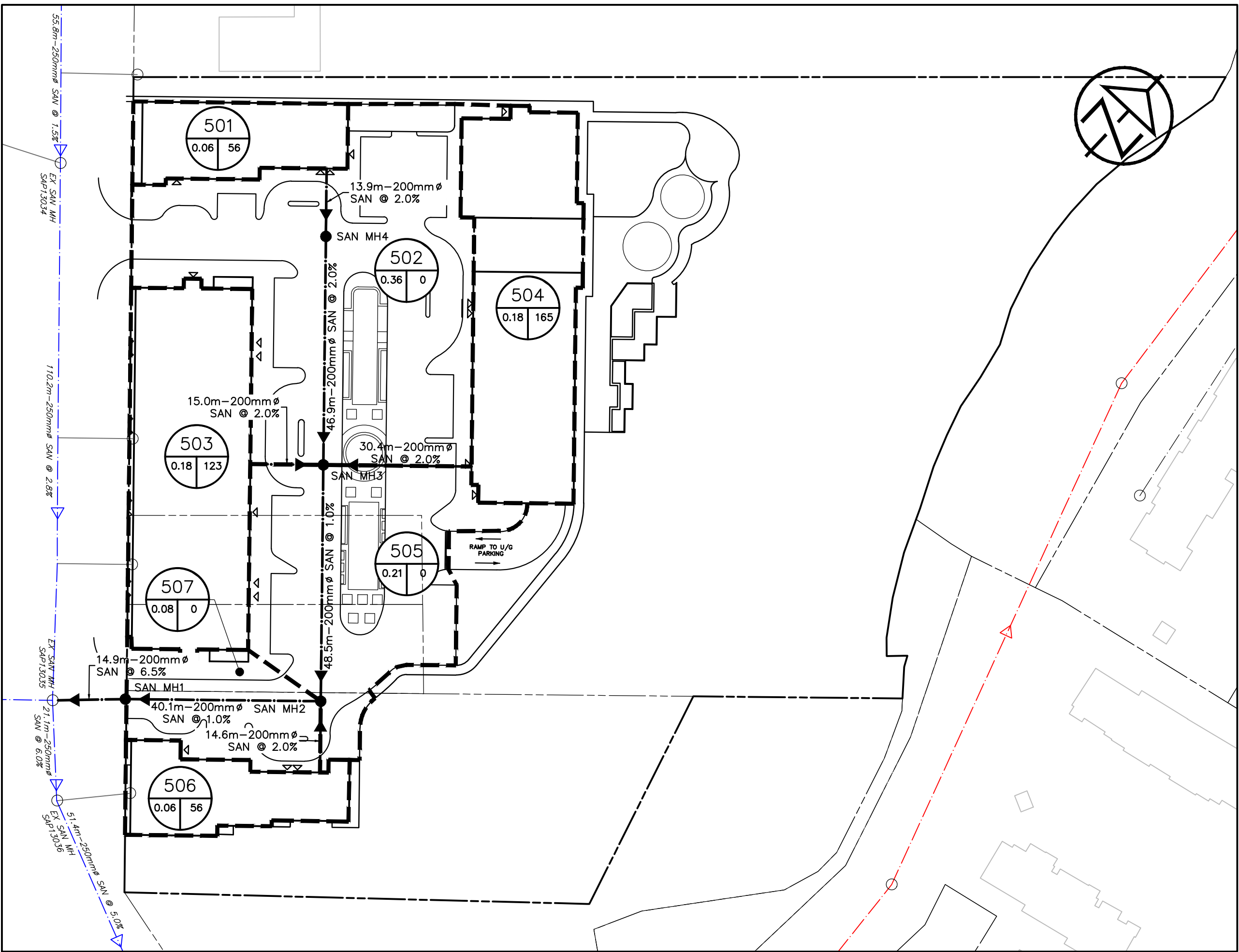
- EXISTING PROPERTY LINE
- EXISTING SANITARY SEWER
- EXISTING LOCAL SANITARY SEWER
- EXISTING TRUNK SANITARY SEWER
- EXISTING SANITARY MANHOLE
- CATCHMENT BOUNDARY

CATCHMENT ID
101
0.00 0.00
AREA (ha) | # OF UNITS

LOW DENSITY POPULATION

MEDIUM DENSITY POPULATION

HIGH DENSITY POPULATION



DETAIL A
SCALE 1:750

DISCLAIMER AND COPYRIGHT

CONTRACTOR MUST VERIFY ALL DIMENSIONS AND BE RESPONSIBLE FOR SAME. ANY DISCREPANCIES MUST BE REPORTED TO THE ENGINEER BEFORE COMMENCING WORK. DRAWINGS ARE NOT TO BE SCALED.

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BENCHMARKS

ELEVATIONS SHOWN ARE GEODETIC BASED ON NAD83 (CANADA) AND ARE DERIVED FROM GPS REAL TIME NETWORK OBSERVATIONS USING THE 'CAN-NET' VRS NETWORK, IN UTM 17N.

BENCHMARK:
NAILS IN HYDRO POLES, OPPOSITE SIDE OF YONGE STREET

NOTES

TOPOGRAPHIC SURVEY SHOWN ON THIS PLAN PREPARED BY JOE TOPO SURVEYS AND CADD INC., DATED JUNE 4, 2021.

SITE PLAN PREPARED BY SALTER PILON ARCHITECTURE, DATED NOVEMBER 5, 2021

No.	REVISION DESCRIPTION	DATE	ENGINEER STAMP
1.	ISSUED FOR ZBA - FIRST SUBMISSION	DEC 14/21	

505 - 533 YONGE STREET
CITY OF BARRIE

SANITARY CATCHMENT PLAN



DESIGN: LMB	FILE: 421422	DWG:
DRAWN: LMB	DATE: OCT 2021	SAN-1
CHECK: NM	SCALE: 1:2000	