Stormwater Management Report
115 Bayfield Street

Coral-Sophia Lane Housing Inc.

P/N 3103 | Revised May 26, 2021

Skelton Brumwell & Associates Inc.
ENGINEERING PLANNING ENVIRONMENTAL CONSULTANTS

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Stormwater Management Report

Coral Sophia Lane Housing Inc.

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P/N 17-3103 Revised May 26, 2021

1.0 Introduction

Skelton, Brumwell & Associates Inc. (SBA) were retained by Coral Sophia Lane Housing Inc. (Coral) to prepare civil design drawings and reports for an 8–storey multi-residential rental building at the above noted address. The property is legally described as Part of Lots 9, 10, and 11 on the East Side of Bayfield Street, Registered Plan 31, in the City of Barrie, County of Simcoe. The site address is 113 & 117 Bayfield Street and 6, 8 & 12 Sophia Street East. The subject property has an approximate area of 3,729 m^2. The subject property is located on the northeast corner of Bayfield Street and Sophia Street East, and is also bounded by Drury Lane on the east side of the property.

The proposed 8–storey building will include approximately 284 m2 of amenity (lobby, lounge, and indoor amenity area), and one hundred and eight (108) residential units. Figure 1 shows the location of the project.

In support of the application for Site Plan Approval for the property, the City of Barrie requires a Stormwater Management Report to be prepared in order to demonstrate that the proposed development can be completed in accordance with City of Barrie and Lake Simcoe Region Conservation Authority requirements.

2.0 Existing Conditions

The property currently had five (5) commercial businesses on it and two (2) entrances, onto Sophia Street East and Drury Lane, respectively. Three (3) of the businesses are serviced from Sophia Street East, and the other two (2) are serviced from Bayfield Street. There is also an existing onsite storm sewer consisting of two (2) catch basins which collect onsite drainage and convey it to the existing storm sewer on Sophia Street East. The site was cleared of the previous buildings and parking in approximately 2017 as part of the re-development an is now vacant. However, this former use will be considered to represent pre-development conditions.

The residential rear yard of the property to the north of the site drains to the site in the existing condition. This 0.6 Ha drainage area consists of approximately half of the residential roof, with the rest of the catchment consisting of grass and landscaping.

CORAL SOPHIA HOUSING
117 BAYFIELD ST.
BARRIE, ONTARIO

FIGURE 1
LOCATION PLAN

Scale 1:7500

P/N	3103	NOV 2020

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Geotechnical and Hydrogeological studies have been undertaken by WSP Group. These studies have indicated the site soils are a silty sand mix with generally low permeability. Seasonal high groundwater on the site has been noted to be shallow which has significantly influenced the design of the building to-date, precluding the inclusion of a basement for vehicular parking and building mechanical servicing.

3.0 Project Stormwater Impacts and Controls

3.1 Quantity Control

Given that the subject property was developed for commercial use with storm sewer drainage, the net impact on stormwater quality, quantity and water balance is moderate. The overall site imperviousness will increase however and as such, stormwater detention will be required to maintain peak flows at pre-development levels. This is despite the fact that project will make use of permeable pavers around much of the building perimeter for volume control and reduction in winter maintenance requirements. The permeable pavers are intended to reduce runoff quantity but is not allowed to be accounted for same by the LSRCA in the event of a lack of maintenance. Similarly, the project had proposed to include a section of green roof to reduce runoff, but as this is not credited by the LSRCA for runoff reduction, it has been removed. Instead, the roof and permeable pavers are modelled as fully impervious.

3.2 Quality Control

Stormwater quality controls will be required to implemented in accordance with requirements of the City of Barrie (COB) and Lake Simcoe Region Conservation Authority (LSRCA) with a targeted Total Suspended Solids (TSS) removal of 80% in accordance with provincial policy. With vehicular parking indoors on the ground and second floors, the site impervious area will be largely building roof and permeable pedestrian walkways, which produce lower amounts of contaminates found in stormwater. The site will also have a stormwater filter treatment system for phosphorous control which will also be highly effective in reducing TSS. The change in land use reducing impermeable surfaces used by automobiles (driveways and parking) and the addition of a stormwater treatment system will result in net cleaner runoff leaving the proposed development site than the current condition.

3.3 Water Balance

The water balance analysis for the project has been completed by WSP and will be summarized in their report dated June 2021 (Ref Proj No: 191-04692-00). Their analysis shows a net increase in infiltration on the site of 39 cu.m./year (54%) without implementation of site-specific infiltration measures. Correspondence from WSP's office on water balance is included with this report in Appendix G.

3.4 Phosphorous Loading

LSRCA policies call for zero net phosphorous discharge from development sites, over and above requirements of the Lake Simcoe Protection Act. To achieve this, several LID measures can be implemented, with infiltration being the only one that can potentially reduce phosphorous loading to zero. As discussed above however, infiltration features cannot be employed due to proximity to foundations. Instead, the site will rely on a Permeable Paving with underdrains and a Hydro International Upflo filter system (UFF-7) installed in an on-line configuration. This unit will treat runoff from the majority of the site and external drainage area and is rated to capture 43.9% of phosphorous on an annual basis.

We have also completed a phosphorus budget analysis of the pre-development condition to compare to the proposed condition per the Lake Simcoe Protection Plan 4.8-DP. This comparison shows that the proposed development reduces the net annual phosphorus load from the site to less than the pre-development condition. As such, the overall development is considered an improvement with respect to phosphorous loading of Lake Simcoe. This is discussed further in Section 4.5.

The LSRCA policy is focused on net proposed development loading. Like water balance, the LSRCA policy allows for the paying financial compensation where a net zero phosphorus export cannot be met. This compensation is calculated as follows:

Annual Phosphorous Load kg/yr x 2.5 x $35,000.00/kg/yr or simplified; $87,500.00 per Kg/yr loading, plus a 15% administration fee.

4.0 Proposed Stormwater Management

4.1 Quantity Control

In accordance with COB policies, the existing and proposed drainage conditions for the site have been analysed using the rational method. Peak flows were calculated for the existing condition treating the development site and external area as a single composite catchment. The same approach was taken in an initial analysis of the proposed condition. Flows were both existing and proposed were calculated for the 1 in 2, 5, 10, 25, 50 and 100 year return periods using current COB IDF curve parameters that are increased from historical records by 15% to account for climate change. For all storm events, the calculated post-development peak flows are higher than pre-development. Please refer to Appendix A for calculations. The existing and proposed drainage conditions are illustrated on drawings SWM1 and SWM2 which are included with this report.

In order to control peak flows, most of the site will drain to a below grade detention storage system (Stormtech) installed on the north side of the site. This system will be located under the grade level amenity space and loading space. This will collect runoff from the building roof, amenity space, loading space and the external drainage area. The system will drain through a pair of orifice plates in a downstream control catch basin manhole structure, which in turn will drain via storm sewers to connect to the existing trunk sewer on Sophia Street.

The west, south and east perimeter of the site will not drain to this system, and as such the peak flows from these areas is subtracted from the existing condition flows to determine the allowable flows from detention. These calculations are detailed in Appendix A.

Sizing of the detention storage volume and control orifices was completed through iterative calculations completed with the MTO storage method. Using volume calculation spreadsheets provided by Stormtech and the orifice equation, a stage-storage rating curve for the detention system was developed. This curve then allowed for interpolation of peak flows and storage to determine an accurate estimate of the peak flows resulting for each storm event. These calculations are detailed in Appendix B. The results are summarised in Table 1 below:

Table 1 – Summary of Existing and Proposed Peak Flow Rates

Storm	Existing (cms)	Proposed Uncontrolled (cms)	Proposed Controlled (cms)	Total Proposed (cms)	Change Ext to Prop (cms)
2 year	0.073	0.010	0.042	0.052	-0.021
5 year	0.096	0.013	0.064	0.077	-0.019
10 year	0.111	0.015	0.079	0.094	-0.017
25 year	0.137	0.019	0.104	0.123	-0.014
50 year	0.154	0.022	0.120	0.142	-0.012
100 year	0.170	0.024	0.132	0.156	-0.014

As illustrated the proposed development with controls, will result in a reduction in peak flows for all return periods analysed.

4.1.1 Detention System Description

As stated above, the site is proposed to utilize the Stormtech Detention system. In general terms, this will consist of sections of plastic pipe arches installed linearly between two catch basin manholes (CBMH). The downstream CBMH#2 will be fitted with a 250mm diameter high and 150mm diameter low flow orifice plate to restrict discharge out of the system. Each of these orifices will drain to one of pair of vertically twined storm sewer pipes routed to the next downstream storm structure, STMH#3. Flows to the system will be introduced via the CBMHs upstream (CBMH#1) and downstream (CBMH#2), which will collect runoff from the external drainage area, grade level amenity space and loading space. Flows from the building roof will flow to CBMH #1 via the building storm sewer connection.

The total storage volume in the Stormtech system is made up of the space under the arches as well as the void space in the surrounding clear stone. Storage in the storm sewer pipes and structures upstream of the control orifices is not included in the storage volume calculations to be conservative. The entire system will be enclosed in an impermeable liner to ensure that collected runoff does not infiltrate and negatively impact the building foundation.

The calculated maximum storage volume used for the 1 in 100 year even is approximately 25 cu.m. compared to the provide 30 cu.m of available storage volume. The calculated top water level is 235.30m compared to a top of grate at CBMH#2 of 236.11m.

Please refer to drawings 3103-SS and 3103-DET4 for details of the Stormtech system.

4.2 Quality Control

The proposed site has a relatively low proportion of area that is considered to required quality treatment in terms of contaminates (oils, trash, suspended solids). The only exterior area subject to vehicular traffic is the loading space and driveway entrance with a total area of 109 sq.m (0.0109 Ha) which amounts to about 2.95% of the total site area.

Pedestrian hardscape is included in the project; however, this is intended to be surfaced with permeable pavement with an underdrain. This will greatly reduce surface flows and will serve to trap a portion of sediment in the pavement structure itself (which will then necessitate maintenance). The under drains below the permeable pavement will be routed such that flows are directed through the downstream control device described below.

Regardless of low proportions of site area considered to generate contaminates for treatment, all noted areas and the building roof will be routed through an Upflo filter for treatment. The only area to completely by-pass this unit for quality control is the area on the east side of the site. This is largely grassed and is not considered to produce runoff needing treatment for oils and TSS. There is also a small section of pavement within the site boundary, 11 sq.m., in this catchment area at the entrance to the under-building parking that is proposed to be allowed to drain uncontrolled.

The Upflo Filer unit has been specified primarily for phosphorous treatment but it also provides substantial treatment for TSS as well as trash and oil like a more conventional hydro-dynamic filter system. It is rated to trap in the order of 85% of TSS on an average annual basis, thus meeting requirements for quality control by it self.

The Stormtech system includes an “Isolator Row” the provides TSS treatment for incoming flows. The both provides protection for the system from sediment loading and at the same time reduces sediment loads downstream. In this particular installation, the majority of inflow is from the building roof and rear yard areas, so the expected sediment load will be generally low.

4.3 Permeable Paving

In order to minimize the nutrient discharge off site it was determined that exterior pedestrian areas should be designed with permeable paving. In an ideal scenario, this paving would be designed to infiltrate at least the first flush (25mm) rainfall event for both water balance and nutrient management. Instead, due to the proximity to the foundation, this project will include an under drain below the permeable paving to collect infiltrating runoff and convey it to the downstream drainage system on site. The paving will also have an impermeable liner to ensure to runoff infiltrates near the foundation.

The pavement is intended to capture the 25mm first flush rainfall event. The pavement will be made up of interlock stone, either with porous pavers or pavers with significant gaps filled with pea gravel as opposed to sand. The pavers will be supported on 500mm of clear stone. Assuming this provides 40% of void space, this thickness of stone will provide the equivalent of 200 mm of storage depth compared to the 25mm of targeted rainfall depth. A typical section view of the permeable pavers is included on drawing 3103-SS1.

As shown on the site plan, the permeable pavers are largely located adjacent to the building. The exception is the paver section on the north side of the loading space. In all cases, the pavers will be collecting runoff from direct rainfall or from landscaped areas adjacent. No other impermeable surfaces will drain to these pavers, greatly reducing concerns of getting plugged with sand and sediment.

The permeable pavement provides the following net benefits to stormwater quality control

1) Filtration of runoff from the surface, trapping sediments in the joints between the stones.

2) Capturing the 25mm storm event and directing it via under drains to the downstream Upflo filter for further treatment.

3) Reduction of winter salt application requirements due to the free draining surface being resistant to icing conditions as compared to conventional asphalt or concrete.

4.4 Nutrient Management – Phosphorous Removal

As previously noted, the project site is unable to make use of infiltration measures for nutrient management. Instead, in order to minimize the amount of phosphorous being discharged from the site pedestrian surfaces will be surfaced with permeable pavers with under drain. Using guidelines in the LID TTT model, phosphorus removal for this type of feature is 60%. The under drains will then discharge to the site storm sewer system upstream of the Upflo Filter. This treatment unit has been specified due to its ability to treat phosphorus. According to manufacture's information, this is rated to remove 43.9% of phosphorus. Sizing information for the specified Upflo filter is included in Appendix C.

Modelling of the site shows the net removal efficiency for the site with the two systems in place is estimated to be 54.5% and remaining annual phosphorous load of 0.161 Kg/year. As this is greater than the zero-loading required by the LSRCA, the project will be required to pay compensation in accordance to their policies. The amount of compensation required will be 0.161 Kg/yr x 2.5 x $35,000/Kg/yr = $14,087.50 and an additional 15% administration fee of $2,113.13 for a total of **$16,200.63.**

Please note, the LSRCA policies provide compensation fees for both water balance and phosphorus loading shortfalls. Only the larger of the two values is actually collected by the LSRCA.

4.5 Low Impact Development Treatment Train Tool Summary

Modelling results for the LID TTT model are included in Appendix D. Table 2 below summarizes the modelling results for Total Phosphorus (TP) The water balance and TSS results from the LID TTT modelling are ignored as the LSRCA does not accept them.

Note: There is an external drainage area from the neighboring rear yard area that drains through the site. This has not been modelled in LID TTT as this project is not responsible for treatment of this runoff in terms of TP.

Table 2 – LID TTT Modelling Summary

Development Condition	TP Loading (Kg/yr)	TP Removal (%)
Pre	0.422	
Post (no controls)	0.354	
Post (with controls)	0.161	54.5

It should be noted that the change in land use for the proposed development which significantly reduces the exterior impermeable surface for vehicles provides a net reduction in both TSS and TP before controls are even considered.

4.6 Volume Control

LSRCA development guidelines include requirements for stormwater runoff volume control. The ideal target would be capture and infiltrate the runoff from a 25mm rainfall event. Alternative options are provided for sites with adverse conditions which cannot achieve this preferred option.

Alternative #1: retaining runoff from a 12.5mm rainfall event for all impervious surfaces from a site.
Alternative #2: retaining runoff from a 5mm rainfall event for all impervious surfaces from site.
Alternative #3: equivalent to 25mm runoff volume reduction on an off-site location.

For volume reduction techniques considered by the LSRCA may include: infiltration, reuse/rainwater harvesting, canopy interception, evapotranspiration etc. Priority is given to methods that include actual volume reduction. Secondary preferences is for methods that include filtration techniques followed by rate control features (collect and cause the 25mm runoff volume to drain down over a time frame of 24-48 hours.

The following means of achieving this requirement were considered:

Infiltration: not feasible due to the proximity of the building foundation to the property line. This applies to alternative #1 and #2.

Rainwater capture and re-use: it has been determined to not be financially feasible for a project targeting affordable housing. This applies to Alternative #1 and #2.

Equivalent volume reduction on another site in the area: the proponent for this project does not have access to other lands to perform volume reduction.

Rate control, collecting and causing runoff from a 25mm rainfall event to discharge over 24-48 hours: The volume requirement for this actually greatly exceeds the detention volume requirement for the overall site (which is small due to the previously developed nature of the site). Capture of smaller event volumes (12.5mm and 5mm) and delaying discharge over this period of time would require an orifice less than 50mm in diameter which would then be prone to plugging.

Filtering: All site runoff will be routed through an Upflo Filter which provides sediment and oil capture as well as reducing phosphorous. Through discussions with LSRCA technical staff, it has been determined that this will be sufficient on this specific site.

Runoff from the pervious pavers will also be filtered through the clear stone base and through the filter wrapped subdrain, all upstream of the Upflo Filter.

Portions of the roof runoff will also be similarly filtered through the 150mm thick clear stone base layer of the Stormtech system, after passing through the filter fabric in the system's Isolator Row.

For reference, correspondence regarding this aspect of design is included in Appendix F.

5.0 Conveyance

5.1 Storm Sewers

The majority of the site will drain via a storm sewer system sized for the peak 1 in 100-year flow from the contributing catchment area. This is a conservative design approached based on previous design iterations that involved below grade detention. The pipe sizing resulting is not particularly large so cost savings to size the sewers for a 5-year event would be minimal. Sizing the sewers for the 1 in 100-year event provides great protection to the building as a whole in the event of this magnitude of storm event.

The building sewer will outlet at the north side, and then be routed east to the Storm Tech detention system under the grade level amenity space and on a MH near Drury Lane. From here the site sewer will be routed south parallel to Drury Lane, crossing under a portion of the grade level parking entrance.

At the south east corner of the building, sewer flows will enter the Upflo filter. This structure has been located on the potential future R.O.W. limit for Sophia Street. The filter structure includes an internal by-pass which conveys flows greater than the treatment flow rate through the device and to the downstream system.

From the filter, flow will be conveyed to the trunk storms sewer on Sophia Street. Connection will require breaking into the wall of the concrete box structure that encloses the former Sophia Creek.

Sizing calculations for the storms sewer system are included in Appendix B. Please also refer to drawing 3103-SS1 and SWM3, which are included with this report for a view of the proposed storm sewer.

5.2 Sheet flow, Pavers and Landscaped Area

There will be a vegetated landscaped area on the east side of the site that is proposed to be allowed to drain uncontrolled via sheet flow to the adjacent right-of-way on Drury Lane and Sophia Street.

The proposed permeable pavers on the west and south side of the site will be drained by a 100mm under drain pipe with the intent of collecting runoff from the 25mm rainfall event. It is expected that the actual collection and conveyance may be greater than this, however to be conservative in the sizing of flow controls it will be assumed that all return period storm events (2-100 year) will simply sheet to the Sophia Street right-of-way. Drawing 3103-GP1 shows the proposed grading for the landscaped areas, permeable pavers, amenity space and loading space. Drawing 3103-SS1 provides a typical detail of the permeable paving construction.

We have not completed flow calculations for the underdrain. It is surrounded by clear stone storage media which is well in excess of the volume requirement for a 25mm event. In the event that flow rates from the stone storage to the underdrain are greater than the pipe flow capacity, collected runoff will simply be stored into the stone and drainage will take place over time.

6.0 Maintenance Requirements

In order to ensure continued operation of the site stormwater management features, regular maintenance will be required. The following summaries the expected maintenance measures:

a) Annual inspection and cleaning of the Upflo filter.

b) Annual vacuum cleaning of permeable pavers.

c) Annual inspection of Stormtech Isolator Row & site Catch Basin structures.

d) Hydro-vac cleaning of the above when required (inspection can be done when Upflo inspection is completed and if determined to be required, cleaning at the same time.

7.0 Erosion and Sediment Control During Construction

The construction phase of the project will provide the most significant risk for the site to discharge silt and sediment to the surrounding environment. In order to mitigate this risk, several measures are proposed to employed:

a) Sediment control fence is to be installed around the perimeter of the site to contain silt and sediment being discharged during rainfall events. The City of Barrie detail for siltation fence calls for filter fabric supported on wire mesh fencing and steel t-bars. It is expected that the site will have hoarding around the perimeter and this can then also be used to support the sediment control fence.

b) Existing and proposed catch basins and catch basin manholes are to be protected with Silt Sack sediment control devices which will act to intercept sediment carried in surface runoff.

c) Stone mud mats are to be employed at all construction vehicle entrances to the site. This is intended to cause mud and sediment to fall off vehicle tires before existing the site and tracking on area roads. However, give the amount of the site covered by the building, it is not anticipated that vehicles will be traversing the site for much of the construction phase.

d) Periodic sweeping of area roads may be required in the even that mud and silt are tracked from the site.

All of these measures are to remain in place and be maintained by the project contractor until the site is ready to be reinstated.

Timing of construction for drainage works is a key consideration with respect to sediment control and impacts on the system. The permeable paving, and Upflo Filter cannot operate as intended if they are allowed to become impacted with sediment during construction.

e) Permeable pavement construction to the scheduled immediately prior to final restatement of the site. Permeable pavers are not to be subject to construction traffic or used as a work surface during construction. This timing is important to ensure that the clear stone base of the permeable pavers does not become inundated with silt and sediment which will impede drainage and reduce storage space.

f) Following site reinstatement, the entire site storm sewer system is to be flushed and cleaned. This includes specifically the Upflo Filter structure.

g) The filter modules for the Upflo Filter are not to be installed until the site has been reinstated and the Upstream storm sewer system flushed and cleaned.

8.0 Conclusions and Recommendations

Based on the analysis summarized in this report, we conclude that the proposed development at 117 Bayfield Street can be completed while meeting the stormwater management requirements of the City of Barrie, Lake Simcoe Conservation Authority and Ministry of Environment, Conservation and Parks. To this end we recommend the following measures be employed:

a) No infiltration LID techniques be employed due to proximity to proposed and existing foundations.

b) Pedestrian walking spaces be surfaced with permeable pavers with under drains.

c) Storm sewers in site be sized for the peak flow from the 1 in 100-year event.

d) Flow from site storm sewers and permeable paver under drain be routed through a Hydro International Upflo filter for quality and nutrient management treatment.

e) Connect site storm sewers to the Sophia Street Trunk storm sewer.

f) Stormwater peak flow control be provided with a 30 cu.m. Stormtech ADS detention system installed at the north side of the site to collect and detain runoff from the building roof as well as the north limit of the site and external rear yard areas.

   Flows will be restricted with a 150mm low flow and 250mm high flow orifice at CBMH#4.

g) Site landscaped and permeable paver areas on the west, south and east side of the site be allowed to sheet flow to the Sophia Street and Drury Lane right-of-way.

h) Erosion and Sediment controls as detailed in Section 7.0 be employed during the construction phase of the project.

i) Maintenance actives as summarised in Section 5.0 be employed once site works are completed.

j) Financial compensation be paid to the LSRCA for the shortfall in phosphorous loading requirements (post-development phosphorus loading greater than zero).

9.0 Disclaimer of Responsibilities to Third Parties

This report was prepared by Skelton, Brumwell & Associates Inc. for the account of Coral-Sophia Housing Inc. in support of the property rezoning application and future site plan approval from the City of Barrie and Lake Simcoe Region Authority.

The material in it reflects Skelton, Brumwell & Associates Inc.'s best judgement in light of the information available to it at the time of preparation. Any use which a third party, not listed above, makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties.

Skelton, Brumwell & Associates Inc. accepts no responsibility for damages, if any, suffered by a third party as a result of decisions made or actions based on this report.

All of which is respectfully submitted,

SKELTON, BRUMWELL & ASSOCIATES INC.

per:

Bryan W. Bolivar, P.Eng

Senior Project Engineer, Partner

Appendix A

Rational Method Analysis

PN 17-3103
117 Bayfield Street - Coral / Sophia Development

Skelton Brumwell & Associates Inc.
ENGINEERING PLANNING ENVIRONMENTAL CONSULTANTS

DATE April 24, 2020
CALCS BDD/BWB
Revised May 10, 2021

Soils investigation on site indicates silt at surface, though soils investigation is localized.

CATCHMENT EXT		AREA =	0.06	Ha					
GROUND COVER TYPE				PROPORTION	C 2-5 YR	C 10 YR	C 25 YR	C 50 YR	C 100 YR
IMPERVIOUS	0.0066			0.102	0.95	0.95	1.00	1.00	1.00
GRASS	0.058			0.898	0.25	0.25	0.28	0.30	0.31
TOTAL	0.06	Ha		WEIGHTED C	0.32	0.32	0.35	0.37	0.38

PREDEVELOPMENT SITE

DEVELOPMENT SITE (ext)		AREA =	0.37	Ha					
GROUND COVER TYPE				PROPORTION	C 2-5 YR	C 10 YR	C 25 YR	C 50 YR	C 100 YR
IMPERVIOUS	0.2870			0.772	0.95	0.95	1.00	1.00	1.00
Grassed	0.085			0.228	0.25	0.25	0.28	0.30	0.31
TOTAL	0.372	Ha		WEIGHTED C	0.79	0.79	0.83	0.84	0.84

COMBINED EXISTING DRAINAGE AREA		AREA =	0.44	Ha					
GROUND COVER TYPE				PROPORTION	C 2-5 YR	C 10 YR	C 25 YR	C 50 YR	C 100 YR
IMPERVIOUS	0.2936			0.673	0.95	0.95	1.00	1.00	1.00
Grassed	0.1424			0.327	0.25	0.25	0.28	0.30	0.31
TOTAL	0.44	Ha		WEIGHTED C	0.72	0.72	0.76	0.77	0.78

City of Barrie IDF Curve Parameters			2 yr	5 yr	10 yr	25 yr	50 yr	100 yr	
		a	678.085	856.608	975.855	1146.28	1236.15	1426.41	
		b	4.699	4.699	4.699	4.92	4.70	5.27	
		c	0.781	0.766	0.76	0.76	0.75	0.76	
t =	10.00								
i= a/(t+b)^c		i=	83.1	109.3	126.5	148.2	164.2	180.2	(mm/hr)
Q = 0.00278 C*I*A		Q =	0.073	0.096	0.111	0.137	0.154	0.170	cms

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DATE April 24, 2020
CALCS BDD/BWB

POSTDEVELOPMENT SITE

DEVELOPMENT SITE		AREA =	0.37 Ha					
GROUND COVER TYPE			PROPORTION	C 2-5 YR	C 10 YR	C 25 YR	C 50 YR	C 100 YR
IMPERVIOUS	0.2515		0.680	0.95	0.95	1.00	1.00	1.00
Green Roof	0.0340		0.092	0.95	0.55	1.05	1.14	1.19
Grassed	0.0506		0.137	0.25	0.25	0.28	0.30	0.31
Pervious Paving	0.0339		0.092	0.95	0.45	1.05	1.14	1.19
			1.000					
TOTAL	**0.370**	**Ha**	**WEIGHTED C**	**0.85**	**0.77**	**0.91**	**0.93**	**0.94**

COMBINED PROPOSED DRAINAGE AREA		AREA =	0.43 Ha					
GROUND COVER TYPE			PROPORTION	C 2-5 YR	C 10 YR	C 25 YR	C 50 YR	C 100 YR
IMPERVIOUS	0.2581		0.594	0.95	0.95	1.00	1.00	1.00
Green Roof	0.0340		0.078	0.95	0.55	1.05	1.14	1.19
Grassed	0.1084		0.250	0.25	0.25	0.28	0.30	0.31
Pervious Paving	0.0339		0.078	0.95	0.45	1.05	1.14	1.19
			1.000					
TOTAL	**0.43**	**Ha**	**WEIGHTED C**	**0.79**	**0.71**	**0.84**	**0.86**	**0.87**

City of Barrie IDF Curve Parameters			2 yr	5 yr	10 yr	25 yr	50 yr	100 yr	
		a	678.085	856.608	975.855	1146.28	1236.15	1426.41	
		b	4.699	4.699	4.699	4.92	4.70	5.27	
		c	0.781	0.766	0.76	0.76	0.75	0.76	
t =	10.00								
i= a/(t+b)^c		i=	83.1	109.3	126.5	148.2	164.2	180.2	(mm/hr)
Q = 0.00278 C*I*A		**Q =**	**0.079**	**0.104**	**0.109**	**0.150**	**0.171**	**0.190**	**cms**

Runof Coefficient from: Table 3.2 City of Barrie Storm Drainage and Stormwater Management Policies and Design Guidelines

Change from Existing to Proposed (cms)	0.006	0.008	-0.002	0.013	0.017	0.020

Detention Storage is required maintain peak flows at pre-development magnitudes

3. *Option 3 – Gravity drain or sump pump with discharge to third pipe (foundation drain collector - FDC).* A third pipe (FDC) shall be constructed in the right-of-way (ROW) to collect foundation drain flow by gravity (or using a sump pump if grades do not permit) and to convey the flow to a nearby watercourse or other acceptable receiving body. Similar to the option above, an FDC eliminates the risk of basement flooding and surface discharge and nuisance flooding.
4. *Option 4 – Sump pump discharge piping in boulevard (retrofit option only).* In the event of overactive sump pump activity, a 150 mm diameter PVC DR-28 sewer may be installed, when so directed by the City, along the frontages of designated lots, with an offset of 0.6 m from back of curb. This sewer is to have a cleanout at the upstream end and is to outlet into the nearest catchbasin downstream. The depth of sewer is to be equal to the subdrain depth. The discharge piping shall not be directly connected to the foundation drains.

3.2 Minor System

Storm sewers shall be provided on all roads with curb and gutter. Storm sewers shall be designed to convey, as a minimum, the 1:5 year design storm.

3.2.1 Service Area

The drainage system shall be designed to accommodate all upstream drainage areas plus any external area tributary to the system for the existing, interim and ultimate development conditions, as determined by the delineation of appropriate topographic mapping and the preparation of drainage plans.

3.2.2 Design Flow

Storm sewer systems with a drainage area ≤ 50 ha shall be designed to convey the 1:5 year (minimum) design storm using the Rational Method and the City's IDF regression equation for rainfall intensity unless otherwise approved or directed by the City. Storm sewer systems with a drainage area > 50 ha shall be designed using an approved computer program and verified with the Rational Method. The storm sewer design shall be based on the larger of the two flows calculated using the computer model and the Rational Method. Under no circumstances shall the storm system be designed in a surcharged condition.

The design of the storm sewers shall be computed using the City of Barrie's Storm Sewer Design Sheet as provided in **Appendix A.**

All storm sewers shall be designed according to the Rational Formula where:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow in (m^3/s)

C = the site specific runoff coefficient

A = the drainage area (ha)

i = rainfall intensity (mm/hr)

The rainfall intensity shall be calculated in accordance with the following table and equation:

Table 3.1: Barrie WPCC IDF Curve Parameters - Adjusted to Account for Climate Change

Parameter	**Return Period**					
	2-Yr	**5-Yr**	**10-Yr**	**25-Yr**	**50-Yr**	**100-Yr**
A	678.085	853.608	975.865	1146.275	1236.152	1426.408
B	4.699	4.699	4.699	4.922	4.699	5.273
C	0.781	0.766	0.760	0.757	0.751	0.759

Rainfall Intensity, I (mm/hr) = $A/(t+B)^C$, where t is time duration in minutes

Parameters based on rain gauge data for the period 1979 – 2003 for the Barrie WPCC Station #6110557

Based on a review of the literature, the IDF intensity values for Barrie WPCC Station were increased by 15% before calculating a, b, c values to account for climate change.

$$i = \frac{A}{(t_d + B)^C}$$

where,

i = the rainfall intensity (mm/hr)

t_d = the storm duration (minutes)

A, B, C = a function of the local intensity-duration data.

The storm duration is set to the time of concentration (i.e. the sewer inlet time plus the time of travel in the pipe or channel) for the total cumulative drainage area to the node of interest. The maximum inlet time for the first pipe of a storm sewer system is 10 minutes.

The runoff coefficient shall be calculated in accordance with the following table:

Table 3.2: Runoff Coefficients (Rational C) (5-yr to 10-yr) Based on Hydrologic Soil Group

Land Use	Runoff Coefficient "C"		
	A-AB	B-BC	C-D
Cultivated Land, 0 - 5% grade	0.22	0.35	0.55
Cultivated Land, 5 - 10% grade	0.30	0.45	0.60
Cultivated Land, 10 - 30% grade	0.40	0.65	0.70
Pasture Land, 0 - 5% grade	0.10	0.28	0.40
Pasture Land, 5 - 10% grade	0.15	0.35	0.45
Pasture Land, 10 - 30% grade	0.22	0.40	0.55
Woodlot or Cutover, 0 – 5% grade	0.08	0.25	0.35
Woodlot or Cutover, 5 - 10% grade	0.12	0.30	0.42
Woodlot or Cutover, 10 - 30% grade	0.18	0.35	0.52
Lakes and Wetlands	0.05	0.05	0.05
Impervious Area (i.e., buildings, roads, parking lots, etc.)	0.95	0.95	0.95
Gravel (not to be used for proposed parking or storage areas)	0.40	0.50	0.60
Residential – Single Family	0.30	0.40	0.50
Residential – Multiple (i.e., semi, townhouse, apartment)	0.50	0.60	0.70
Industrial – light	0.55	0.65	0.75
Industrial – heavy	0.65	0.75	0.85
Commercial	0.60	0.70	0.80
Unimproved Areas	0.10	0.20	0.30
Lawn, < 2% grade	0.05	0.11	0.17
Lawn, 2 - 7% grade	0.10	0.16	0.22
Lawn, > 7% grade	0.15	0.25	0.35

Adapted from Design Chart 1.07, Ontario Ministry of Transportation, "MTO Drainage Management Manual," MTO. (1997)

An approximation of the runoff coefficient can be calculated based on the following relationship with:

$$c = (0.7)(TIMP) + 0.2$$

where,

c = the runoff coefficient

TIMP = total impervious fraction (dimensionless)

The runoff coefficient shall be adjusted for return period events greater than the 10-yr storm per the following table:

Table 3.3: Runoff Coefficient Adjustment for 25-yr to 100-yr Storms

Return Period	Runoff Coefficient "C"
25 years	$C_{25} = 1.1^*C_5$
50 years	$C_{50} = 1.2^*C_5$
100 years	$C_{100} = 1.25^*C_5$

Adapted from Design Chart 1.07, Ontario Ministry of Transportation,"MTO Drainage Management Manual," MTO. (1997).

Note: When applying the runoff coefficient adjustment, the maximum c-value should not exceed 1.0.

Given that the direct connection of foundation drains to the storm sewer is not permitted, a detailed HGL analysis is typically not required unless deemed otherwise by the City due to special circumstances. Refer to **Section 7.3** for details regarding HGL analysis requirements.

The calculation of total percent impervious (TIMP) values for modeling shall be in accordance with **Section 7.2.5 (Table 7.6)**.

3.2.3 Pipe Capacity and Size

The storm sewer capacity shall be calculated using the Manning's equation assuming the pipe is flowing full as follows:

$$Q=\left[\frac{1}{n}\right]A(R)^{\frac{2}{3}}(S)^{\frac{1}{2}}$$

where,

Q = the pipe capacity (m3/s)

n = the Manning roughness value

R = the hydraulic radius (m)

S = the sewer pipe slope (m/m).

A maximum inlet time of 10 minutes shall be used for the first pipe of a storm sewer system.

The velocity of flow in the storm sewer (assuming pipe flowing full) shall be calculated as follows:

$$v=\left[\frac{Q}{A}\right]$$

where,

Q = flow in the pipe when flowing full (m3/s)

A = cross sectional area of the pipe (m2)

The appropriate roughness coefficients shall be used as identified in **Table 3.4**.

The minimum size for a storm sewer (within a street) shall be 300 mm in diameter. No decrease of pipe size from a larger size upstream to a smaller size downstream shall be allowed regardless of the increase in grade.

3.2.4 Roughness Coefficients

The following roughness coefficients shall be used for hydraulic calculations of storm sewers:

Table 3.4: Sewer Pipe Manning's Coefficient

Material	Manning's "n"
Concrete, PVC, Profile Rib Pipe	0.013
Corrugated Metal with 25% Paved Invert	0.021
Corrugated Metal 68 x 13 mm Corrugations	0.024

3.2.5 Flow Velocity

The minimum flow velocity in the storm sewer shall be 0.75 m/s (full flow conditions).

The maximum flow velocity in the storm sewer shall be 4.0 m/s (full flow conditions).

3.2.6 Minimum Slope

The minimum storm sewer slope shall be not less than 0.5% unless specifically approved by the Director of Infrastructure.

3.2.7 Sewer Alignment

The storm sewers shall be laid as per City standard drawings **BSD-01, 03, 04, 06A, 06B, 07A, 07B and 07C** in a straight line between maintenance holes unless radius pipe has been designed.

3.2.8 Curved Sewers (radius pipe)

Curved pipe (radius pipe) shall be allowed for storm sewers 1200 mm in diameter and larger. The minimum center line radius allowable shall be in accordance with the minimum radii table as provided by the manufacturer.

Appendix B

Detention Storage Calculations

PN 17-3103
117 Bayfield Street - Coral / Sophia Development

Skelton Brumwell & Associates Inc.
ENGINEERING PLANNING ENVIRONMENTAL CONSULTANTS

DATE April 24, 2020
CALCS BDD/BWB
Revised May 4, 2021

Soils investigation on site indicates silt at surface, though soils investigation is localized.

CATCHMENT EXT		AREA =	**0.06**	**Ha**				
GROUND COVER TYPE			**PROPORTION**	**C 2-5 YR**	**C 10 YR**	**C 25 YR**	**C 50 YR**	**C 100 YR**
IMPERVIOUS	0.0066		0.102	0.95	0.95	1.00	1.00	1.00
GRASS	0.058		0.898	0.25	0.25	0.28	0.30	0.31
TOTAL	**0.06**	**Ha**	**WEIGHTED C**	**0.32**	**0.32**	**0.35**	**0.37**	**0.38**

			PREDEVELOPMENT SITE					
DEVELOPMENT SITE (ext)		AREA =	**0.37**	**Ha**				
GROUND COVER TYPE			**PROPORTION**	**C 2-5 YR**	**C 10 YR**	**C 25 YR**	**C 50 YR**	**C 100 YR**
IMPERVIOUS	0.2870		0.772	0.95	0.95	1.00	1.00	1.00
Grassed	0.085		0.228	0.25	0.25	0.28	0.30	0.31
TOTAL	**0.372**	**Ha**	**WEIGHTED C**	**0.79**	**0.79**	**0.83**	**0.84**	**0.84**
COMBINED EXISTING DRAINAGE AREA		AREA =	**0.44**	**Ha**				
GROUND COVER TYPE			**PROPORTION**	**C 2-5 YR**	**C 10 YR**	**C 25 YR**	**C 50 YR**	**C 100 YR**
IMPERVIOUS	0.2936		0.673	0.95	0.95	1.00	1.00	1.00
Grassed	0.1424		0.327	0.25	0.25	0.28	0.30	0.31
TOTAL	**0.44**	**Ha**	**WEIGHTED C**	**0.72**	**0.72**	**0.76**	**0.77**	**0.78**

City of Barrie IDF Curve Parameters			**2 yr**	**5 yr**	**10 yr**	**25 yr**	**50 yr**	**100 yr**	
		a	678.085	856.608	975.855	1146.28	1236.15	1426.41	
		b	4.699	4.699	4.699	4.92	4.70	5.27	
		c	0.781	0.766	0.76	0.76	0.75	0.76	
t =	10.00								
i= a/(t+b)^c		i=	83.1	109.3	126.5	148.2	164.2	180.2	(mm/hr)
Q = 0.00278 C*I*A		**Q =**	**0.073**	**0.096**	**0.111**	**0.137**	**0.154**	**0.170**	**cms**

PN 17-3103
117 Bayfield Street - Coral / Sophia Development

Skelton Brumwell & Associates Inc.
ENGINEERING PLANNING ENVIRONMENTAL CONSULTANTS

DATE April 24, 2020
CALCS BDD/BWB

POSTDEVELOPMENT SITE

DEVELOPMENT SITE		AREA =	**0.37**	**Ha**					
GROUND COVER TYPE				**PROPORTION**	**C 2-5 YR**	**C 10 YR**	**C 25 YR**	**C 50 YR**	**C 100 YR**
IMPERVIOUS	0.2515			0.680	0.95	0.95	1.00	1.00	1.00
Green Roof	0.0340			0.092	0.95	0.55	1.05	1.14	1.19
Grassed	0.0506			0.137	0.25	0.25	0.28	0.30	0.31
Pervious Paving	0.0339			0.092	0.95	0.45	1.05	1.14	1.19
				1.000					
TOTAL	**0.370**	**Ha**		**WEIGHTED C**	**0.85**	**0.77**	**0.91**	**0.93**	**0.94**

COMBINED PROPOSED DRAINAGE AREA		AREA =	**0.43**	**Ha**					
GROUND COVER TYPE				**PROPORTION**	**C 2-5 YR**	**C 10 YR**	**C 25 YR**	**C 50 YR**	**C 100 YR**
IMPERVIOUS	0.2581			0.594	0.95	0.95	1.00	1.00	1.00
Green Roof	0.0340			0.078	0.95	0.55	1.05	1.14	1.19
Grassed	0.1084			0.250	0.25	0.25	0.28	0.30	0.31
Pervious Paving	0.0339			0.078	0.95	0.45	1.05	1.14	1.19
				1.000					
TOTAL	**0.43**	**Ha**		**WEIGHTED C**	**0.79**	**0.71**	**0.84**	**0.86**	**0.87**

City of Barrie IDF Curve Parameters			**2 yr**	**5 yr**	**10 yr**	**25 yr**	**50 yr**	**100 yr**	
		a	678.085	856.608	975.855	1146.28	1236.15	1426.41	
		b	4.699	4.699	4.699	4.92	4.70	5.27	
		c	0.781	0.766	0.76	0.76	0.75	0.76	
t =	10.00								
i= a/(t+b)^c		i=	83.1	109.3	126.5	148.2	164.2	180.2	(mm/hr)
Q = 0.00278 C*I*A		**Q =**	**0.079**	**0.104**	**0.109**	**0.150**	**0.171**	**0.190**	**cms**

Runof Coefficient from: Table 3.2 City of Barrie Storm Drainage and Stormwater Management Policies and Design Guidelines

Change from Existing to Proposed (cms)	**0.006**	**0.008**	**-0.002**	**0.013**	**0.017**	**0.020**

Detention Storage is required maintain peak flows at pre-development magnitudes

PN 17-3103
117 Bayfield Street - Coral / Sophia Development

Skelton Brumwell & Associates Inc.
ENGINEERING PLANNING ENVIRONMENTAL CONSULTANTS

DATE	April 24, 2020
CALCS	BWB
Revised	May 11, 2021

Soils investigation on site indicates silt at surface, though soils investigation is localized.

EXTERNAL CATCHMENT		AREA =	0.06	Ha					
GROUND COVER TYPE			PROPORTION		C 2-5 YR	C 10 YR	C 25 YR	C 50 YR	C 100 YR
IMPERVIOUS	0.0066		0.102		0.95	0.95	1.00	1.00	1.00
GRASS	0.058		0.898		0.25	0.25	0.28	0.30	0.31
TOTAL	0.06	Ha		WEIGHTED C	0.32	0.32	0.35	0.37	0.38

PREDEVELOPMENT SITE

PROJECT SITE (exisitng)		AREA =	0.37	Ha					
GROUND COVER TYPE			PROPORTION		C 2-5 YR	C 10 YR	C 25 YR	C 50 YR	C 100 YR
IMPERVIOUS	0.2870		0.772		0.95	0.95	1.00	1.00	1.00
Grassed	0.085		0.228		0.25	0.25	0.28	0.30	0.31
TOTAL	0.372	Ha		WEIGHTED C	0.79	0.79	0.83	0.84	0.84

COMBINED EXISTING DRAINAGE AREA		AREA =	0.44	Ha					
GROUND COVER TYPE			PROPORTION		C 2-5 YR	C 10 YR	C 25 YR	C 50 YR	C 100 YR
IMPERVIOUS	0.2936		0.673		0.95	0.95	1.00	1.00	1.00
Grassed	0.1424		0.327		0.25	0.25	0.28	0.30	0.31
TOTAL	0.44	Ha		WEIGHTED C	0.72	0.72	0.76	0.77	0.78

City of Barrie IDF Curve Parameters			2 yr	5 yr	10 yr	25 yr	50 yr	100 yr	
		a	678.085	856.608	975.855	1146.28	1236.15	1426.41	
		b	4.699	4.699	4.699	4.92	4.70	5.27	
		c	0.781	0.766	0.76	0.76	0.75	0.76	
t =	10.00								
i= a/(t+b)^c		i=	83.1	109.3	126.5	148.2	164.2	180.2	(mm/hr)
Q = 0.00278 C*I*A		Q =	0.073	0.096	0.111	0.137	0.154	0.170	cms

Existing Condition Peak Flows

Skelton Brumwell & Associates Inc.
ENGINEERING PLANNING ENVIRONMENTAL CONSULTANTS
DATE April 24, 2020

POSTDEVELOPMENT SITE

Uncontrolled Catchment 201 -East, South and West Perimeter AREA = **0.07** **Ha**

GROUND COVER TYPE			PROPORTION		C 2-5 YR	C 10 YR	C 25 YR	C 50 YR	C 100 YR
IMPERVIOUS	0.0071		0.101		0.95	0.95	1.00	1.00	1.00
Vegetated	0.0325		0.464		0.25	0.25	0.28	0.30	0.31
Pervious Paving	0.0304		0.434		0.95	0.95	1.00	1.00	1.00
			1.000						
TOTAL	**0.070**	**Ha**		**WEIGHTED C**	**0.63**	**0.63**	**0.66**	**0.68**	**0.68**

City of Barrie IDF Curve Parameters			**2 yr**	**5 yr**	**10 yr**	**25 yr**	**50 yr**	**100 yr**	
		a	678.085	856.608	975.855	1146.28	1236.15	1426.41	
		b	4.699	4.699	4.699	4.92	4.70	5.27	
		c	0.781	0.766	0.76	0.76	0.75	0.76	
t =	10.00								
i= a/(t+b)^c		i=	83.1	109.3	126.5	148.2	164.2	180.2	(mm/hr)
Q = 0.00278 C*I*A		**Q =**	**0.010**	**0.013**	**0.015**	**0.019**	**0.022**	**0.024**	**cms**

Runof Coefficient from: Table 3.2 City of Barrie Storm Drainage and Stormwater Management Policies and Design Guidelines

Allowable Flow from site detention = Existing flow - Uncontrolled Post flow	0.063	0.083	0.096	0.118	0.132	0.146	cms

External Area - assume that external area to be drained to site with drainage over top of retaining wall or via weepers

CATCHMENT EXT AREA = **0.06** **Ha**

GROUND COVER TYPE			PROPORTION		C 2-5 YR	C 10 YR	C 25 YR	C 50 YR	C 100 YR
Impervious	0.0066		0.102		0.95	0.95	1.00	1.00	1.00
Vegetated	0.058		0.898		0.25	0.25	0.28	0.30	0.31
TOTAL	**0.06**	**Ha**		**WEIGHTED C**	**0.32**	**0.32**	**0.35**	**0.37**	**0.38**

Catchment 202 -Buidling, Dog Park, Loading Space AREA = **0.31** **Ha**

GROUND COVER TYPE			PROPORTION		C 2-5 YR	C 10 YR	C 25 YR	C 50 YR	C 100 YR
IMPERVIOUS	0.2826		0.912		0.95	0.95	1.00	1.00	1.00
Vegetated	0.0177		0.057		0.25	0.25	0.28	0.30	0.31
Pervious Paving	0.0097		0.031		0.95	0.95	1.00	1.00	1.00
			1.000						
TOTAL	**0.310**	**Ha**		**WEIGHTED C**	**0.91**	**0.91**	**0.96**	**0.96**	**0.96**

COMBINED DRAINAGE AREA TO DETENTION AREA = **0.37** **Ha**

GROUND COVER TYPE			PROPORTION		C 2-5 YR	C 10 YR	C 25 YR	C 50 YR	C 100 YR
Impervious	0.2892		0.772		0.95	0.95	1.00	1.00	1.00
Vegetated	0.0755		0.202		0.25	0.25	0.28	0.30	0.31
Pervious Paving	0.0097		0.026		0.95	0.95	1.00	1.00	1.00
TOTAL	**0.37**	**Ha**		**WEIGHTED C**	**0.81**	**0.81**	**0.85**	**0.86**	**0.86**

Inputs for Combined area utilized for sizing of detention to volumes to meeting allowable flows from site detention

PN 3103

CORAL SOPHIA AFFORDABLE HOUSING

Skelton Brumwell & Associates Inc.
ENGINEERING PLANNING ENVIRONMENTAL CONSULTANTS

SITE STORMWATER DETENTION RATING CURVE POND (STORMTECH CHAMBERS)

DATE April 24, 2020
CALCS BWB
Revised **May 11, 2021**

Low Flow Outlet: 234.3 m Elevation, 150 mm Orifice pipe

High Flow Outlet 234.80 m Elevation, 250 mm Orifice pipe

		LOW FLOW OUTLET				HIGH FLOW OUTLET					RATING CURVE		Stormtech
	TWL (m)	Height Above Invert (m)	Orifice Diameter (mm)	Orifice C	Q Low Pipe (cms)	Height Above Invert (m)	Orifice Diameter (mm)	Orifice C	Q High Pipe (cms)	Total Out flow (cms)	Storage Volume (cu.m.)	TWL (m)	Calculated Volume (cu.m.)
1	234.30	0.00	150	0.63	0.000		250	0.63	0	0.000	0.00	234.30	0
2	234.45	0.15	150	0.63	0.014		250	0.63	0.000	0.014	2.34	234.45	2.341
3	234.60	0.30	150	0.63	0.023		250	0.63	0.000	0.023	7.00	234.60	6.996
4	234.65	0.35	150	0.63	0.026		250	0.63	0.000	0.026	8.64	234.65	8.643
5	234.80	0.50	150	0.63	0.032		250	0.63	0.000	0.032	13.44	234.80	13.442
6	234.90	0.60	150	0.63	0.036	0.10	250	0.63	0.000	0.036	16.49	234.90	16.486
7	235.01	0.71	150	0.63	0.039	0.21	250	0.63	0.029	0.069	19.36	235.01	19.364
8	235.11	0.81	150	0.63	0.042	0.31	250	0.63	0.059	0.101	22.00	235.11	21.997
9	235.21	0.91	150	0.63	0.045	0.41	250	0.63	0.073	0.118	24.18	235.21	24.184
10	235.31	1.01	150	0.63	0.048	0.51	250	0.63	0.085	0.133	26.07	235.31	26.066
11	235.41	1.11	150	0.63	0.050	0.61	250	0.63	0.095	0.146	27.94	235.41	27.938
12	235.54	1.24	150	0.63	0.053	0.74	250	0.63	0.107	0.161	30.28	235.54	30.279

Notes:
1. Orifice flow rates calculated from the centroid of the orifice.
2. Low Flow orifice constant per MTO

Project: 117 Bayfield St. (Coral Sophia Housing)

Chamber Model -	SC-740	
Units -	Metric	Click Here for Imperial
Number of chambers -	10	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	234.32	m
Amount of Stone Above Chambers -	350	mm
Amount of Stone Below Chambers -	152	mm

☑ Include Perimeter Stone in Calculations

46.1 sq.meters Min. Area - 31.4 sq.meters

StormTech SC-740 Cumulative Storage Volumes

Height of System (mm)	Incremental Single Chamber (cubic meters)	Incremental Total Chamber (cubic meters)	Incremental Stone (cubic meters)	Incremental Ch & St (cubic meters)	Cumulative Chamber (cubic meters)	Elevation (meters)
1270	0.00	0.00	0.47	0.47	31.216	235.59
1245	0.00	0.00	0.47	0.47	30.748	235.56
1219	0.00	0.00	0.47	0.47	30.279	235.54
1194	0.00	0.00	0.47	0.47	29.811	235.51
1168	0.00	0.00	0.47	0.47	29.343	235.49
1143	0.00	0.00	0.47	0.47	28.875	235.46
1118	0.00	0.00	0.47	0.47	28.407	235.44
1092	0.00	0.00	0.47	0.47	27.938	235.41
1067	0.00	0.00	0.47	0.47	27.470	235.39
1041	0.00	0.00	0.47	0.47	27.002	235.36
1016	0.00	0.00	0.47	0.47	26.534	235.34
991	0.00	0.00	0.47	0.47	26.066	235.31
965	0.00	0.00	0.47	0.47	25.598	235.29
940	0.00	0.00	0.47	0.47	25.129	235.26
914	0.00	0.02	0.46	0.48	24.661	235.23
889	0.00	0.05	0.45	0.50	24.184	235.21
864	0.01	0.08	0.44	0.52	23.688	235.18
838	0.02	0.17	0.40	0.57	23.172	235.16
813	0.02	0.23	0.38	0.60	22.601	235.13
787	0.03	0.27	0.36	0.63	21.997	235.11
762	0.03	0.30	0.35	0.65	21.367	235.08
737	0.03	0.33	0.33	0.67	20.716	235.06
711	0.04	0.36	0.32	0.68	20.048	235.03
686	0.04	0.38	0.31	0.70	19.364	235.01
660	0.04	0.41	0.30	0.72	18.666	234.98
635	0.04	0.43	0.30	0.73	17.951	234.96
610	0.04	0.45	0.29	0.74	17.223	234.93
584	0.05	0.47	0.28	0.75	16.486	234.90
559	0.05	0.48	0.28	0.76	15.739	234.88
533	0.05	0.50	0.27	0.77	14.982	234.85
508	0.05	0.51	0.26	0.77	14.216	234.83
483	0.05	0.53	0.26	0.78	13.442	234.80
457	0.05	0.54	0.25	0.79	12.659	234.78
432	0.05	0.55	0.25	0.80	11.869	234.75
406	0.06	0.56	0.24	0.80	11.072	234.73
381	0.06	0.57	0.24	0.81	10.268	234.70
356	0.06	0.58	0.24	0.82	9.459	234.68
330	0.06	0.59	0.23	0.82	8.643	234.65
305	0.06	0.60	0.23	0.83	7.822	234.62
279	0.06	0.60	0.23	0.83	6.996	234.60
254	0.06	0.61	0.22	0.83	6.166	234.57
229	0.06	0.62	0.22	0.84	5.332	234.55
203	0.06	0.62	0.22	0.84	4.494	234.52
178	0.06	0.63	0.22	0.84	3.652	234.50
152	0.00	0.00	0.47	0.47	2.809	234.47
127	0.00	0.00	0.47	0.47	2.341	234.45
102	0.00	0.00	0.47	0.47	1.873	234.42
76	0.00	0.00	0.47	0.47	1.405	234.40
51	0.00	0.00	0.47	0.47	0.936	234.37
25	0.00	0.00	0.47	0.47	0.468	234.35

PN 19-3245
220 Fairview Drive, Barrie

Skelton Brumwell & Associates Inc.
ENGINEERING PLANNING ENVIRONMENTAL CONSULTANTS

MTO Storage Sizing Method

Storm: 2 year
Area: 0.37 hectares
Max Permissible Ouflow Rate: 0.063 cms
Design Outflow Rate: **0.041 cms**
Runoff Coefficient: 0.81
Depression Storage: 0 mm

TIME	Rainfall Rate (mm/hr)	Rainfall Volume (cu.m.)	Runoff Volume (cu.m.)	Outflow (cu.m.)	Storage (cu.m.)
5 min	114.99	35.5	28.7	12.3	16.4
10 min	83.11	51.2	41.5	24.6	16.9
15 min	66.12	61.2	49.5	36.9	12.6
20 min	55.41	68.3	55.4	49.2	6.2
25 min	47.98	74.0	59.9	61.5	0.0
30 min	42.49	78.6	63.7	73.8	0.0
35 min	38.25	82.6	66.9	86.1	0.0
40 min	34.87	86.0	69.7	98.4	0.0
45 min	32.09	89.1	72.1	110.7	0.0
50 min	29.78	91.8	74.4	123.0	0.0
55 min	27.81	94.3	76.4	135.3	0.0
1 hr	26.12	96.6	78.3	147.6	0.0
2 hr	15.65	115.8	93.8	295.2	0.0
3 hr	11.51	127.8	103.5	442.8	0.0
4 hr	9.24	136.8	110.8	590.4	0.0
5 hr	7.79	144.1	116.7	738.0	0.0
6 hr	6.77	150.2	121.7	885.6	0.0
7 hr	6.01	155.6	126.0	1033.2	0.0
8 hr	5.42	160.4	129.9	1180.8	0.0
9 hr	4.95	164.7	133.4	1328.4	0.0
10 hr	4.56	168.7	136.6	1476.0	0.0
11 hr	4.23	172.3	139.6	1623.6	0.0
12 hr	3.96	175.7	142.4	1771.2	0.0
13 hr	3.72	178.9	144.9	1918.8	0.0
14 hr	3.51	181.9	147.3	2066.4	0.0
15 hr	3.33	184.7	149.6	2214.0	0.0
16 hr	3.17	187.4	151.8	2361.6	0.0
17 hr	3.02	190.0	153.9	2509.2	0.0
18 hr	2.89	192.4	155.8	2656.8	0.0
19 hr	2.77	194.7	157.7	2804.4	0.0
20 hr	2.66	196.9	159.5	2952.0	0.0
21 hr	2.56	199.1	161.3	3099.6	0.0
22 hr	2.47	201.2	162.9	3247.2	0.0
23 hr	2.39	203.1	164.6	3394.8	0.0
24 hr	2.31	205.1	166.1	3542.4	0.0

Skelton, Brumwell and Associates Inc.
DATE April 24, 2020
CALCS BWB
Revised **May 11, 2021**

Max volume required: 16.9

Volume @ Design Flow: 16.9

Interpolate Volume from rating curve

Flow	Volume	TWL
0.036	16.49	234.90
0.069	19.36	235.01
0.041	16.9	234.92

Rainfall Intensity $I = A/ (t+B)^{C}$

	2 year
A	678.085
B	4.699
C	0.781
t	min

PN 19-3245
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Skelton Brumwell & Associates Inc.
ENGINEERING PLANNING ENVIRONMENTAL CONSULTANTS

MTO Storage Sizing Method

Storm:	5 year
Area:	0.37 hectares
Max Permissible Ouflow Rate:	0.083 cms
Design Outflow Rate:	**0.062 cms**
Runoff Coefficient:	0.81
Depression Storage:	0 mm

TIME	Rainfall Rate (mm/hr)	Rainfall Volume (cu.m.)	Runoff Volume (cu.m.)	Outflow (cu.m.)	Storage (cu.m.)
5 min	149.77	46.2	37.4	18.6	18.8
10 min	108.92	67.2	54.4	37.2	17.2
15 min	87.04	80.5	65.2	55.8	9.4
20 min	73.19	90.3	73.1	74.4	0.0
25 min	63.55	98.0	79.4	93.0	0.0
30 min	56.41	104.4	84.5	111.6	0.0
35 min	50.89	109.8	89.0	130.2	0.0
40 min	46.47	114.6	92.8	148.8	0.0
45 min	42.84	118.9	96.3	167.4	0.0
50 min	39.81	122.7	99.4	186.0	0.0
55 min	37.23	126.3	102.3	204.6	0.0
1 hr	35.00	129.5	104.9	223.2	0.0
2 hr	21.18	156.7	126.9	446.4	0.0
3 hr	15.67	174.0	140.9	669.6	0.0
4 hr	12.63	187.0	151.5	892.8	0.0
5 hr	10.68	197.6	160.1	1116.0	0.0
6 hr	9.31	206.6	167.4	1339.2	0.0
7 hr	8.28	214.5	173.8	1562.4	0.0
8 hr	7.48	221.6	179.5	1785.6	0.0
9 hr	6.84	227.9	184.6	2008.8	0.0
10 hr	6.32	233.8	189.4	2232.0	0.0
11 hr	5.88	239.2	193.7	2455.2	0.0
12 hr	5.50	244.2	197.8	2678.4	0.0
13 hr	5.18	248.9	201.6	2901.6	0.0
14 hr	4.89	253.4	205.2	3124.8	0.0
15 hr	4.64	257.6	208.6	3348.0	0.0
16 hr	4.42	261.5	211.8	3571.2	0.0
17 hr	4.22	265.3	214.9	3794.4	0.0
18 hr	4.04	269.0	217.9	4017.6	0.0
19 hr	3.88	272.4	220.7	4240.8	0.0
20 hr	3.73	275.8	223.4	4464.0	0.0
21 hr	3.59	279.0	226.0	4687.2	0.0
22 hr	3.47	282.1	228.5	4910.4	0.0
23 hr	3.35	285.0	230.9	5133.6	0.0
24 hr	3.24	287.9	233.2	5356.8	0.0

Skelton, Brumwell and Associates Inc.

DATE	April 24, 2020
CALCS	BWB
Revised	**May 11, 2021**

Max volume required:	18.8
Volume @ Design Flow:	18.8

Interpolate Volume from rating curve

Flow	Volume	TWL
0.036	16.5	234.90
0.069	19.4	235.01
0.062	18.8	234.99

Rainfall Intensity $I = A/(t+B)^{\wedge C}$

	5 year
A	853.608
B	4.699
C	0.766
t	min

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Skelton, Brumwell and Associates Inc.

DATE	April 24, 2020
CALCS	BWB
Revised	**May 11, 2021**

MTO Storage Sizing Method

Storm:	10 year
Area:	0.37 hectares
Max Permissible Ouflow Rate:	0.096 cms
Design Outflow Rate:	**0.078 cms**
Runoff Coefficient:	0.81
Depression Storage:	0 mm

TIME	Rainfall Rate (mm/hr)	Rainfall Volume (cu.m.)	Runoff Volume (cu.m.)	Outflow (cu.m.)	Storage (cu.m.)
5 min	173.57	53.5	43.3	23.4	19.9
10 min	126.55	78.0	63.2	46.8	16.4
15 min	101.30	93.7	75.9	70.2	5.7
20 min	85.30	105.2	85.2	93.6	0.0
25 min	74.15	114.3	92.6	117.0	0.0
30 min	65.88	121.9	98.7	140.4	0.0
35 min	59.47	128.4	104.0	163.8	0.0
40 min	54.35	134.1	108.6	187.2	0.0
45 min	50.14	139.1	112.7	210.6	0.0
50 min	46.61	143.7	116.4	234.0	0.0
55 min	43.62	147.9	119.8	257.4	0.0
1 hr	41.03	151.8	123.0	280.8	0.0
2 hr	24.92	184.4	149.4	561.6	0.0
3 hr	18.49	205.2	166.2	842.4	0.0
4 hr	14.93	220.9	179.0	1123.2	0.0
5 hr	12.64	233.8	189.4	1404.0	0.0
6 hr	11.02	244.7	198.2	1684.8	0.0
7 hr	9.82	254.3	206.0	1965.6	0.0
8 hr	8.88	262.9	212.9	2246.4	0.0
9 hr	8.13	270.6	219.2	2527.2	0.0
10 hr	7.51	277.7	225.0	2808.0	0.0
11 hr	6.99	284.3	230.3	3088.8	0.0
12 hr	6.54	290.4	235.3	3369.6	0.0
13 hr	6.16	296.2	239.9	3650.4	0.0
14 hr	5.82	301.6	244.3	3931.2	0.0
15 hr	5.53	306.7	248.4	4212.0	0.0
16 hr	5.26	311.6	252.4	4492.8	0.0
17 hr	5.03	316.2	256.1	4773.6	0.0
18 hr	4.81	320.6	259.7	5054.4	0.0
19 hr	4.62	324.9	263.2	5335.2	0.0
20 hr	4.45	329.0	266.5	5616.0	0.0
21 hr	4.28	332.9	269.6	5896.8	0.0
22 hr	4.14	336.7	272.7	6177.6	0.0
23 hr	4.00	340.3	275.7	6458.4	0.0
24 hr	3.87	343.9	278.5	6739.2	0.0

Max volume required:	19.9
Volume @ Design Flow:	20.1

Interpolate Volume from rating curve

Flow	**Volume**	**TWL**
0.069	19.36	235.01
0.101	22.00	235.11
0.078	20.1	235.04

Rainfall Intensity $I = A/ (t+B)^{C}$

	10 year
A	975.865
B	4.699
C	0.76
t	min

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MTO Storage Sizing Method

Storm:	25 year
Area:	0.37 hectares
Max Permissible Ouflow Rate:	0.118 cms
Outflow Rate:	**0.103 cms**
Runoff Coefficient:	0.85
Depression Storage:	0 mm

TIME	Rainfall Rate (mm/hr)	Rainfall Volume (cu.m.)	Runoff Volume (cu.m.)	Outflow (cu.m.)	Storage (cu.m.)
5 min	201.77	62.2	52.9	30.9	22.0
10 min	148.15	91.4	77.7	61.7	15.9
15 min	119.04	110.1	93.6	92.6	1.0
20 min	100.48	123.9	105.3	123.5	0.0
25 min	87.49	134.9	114.6	154.4	0.0
30 min	77.83	144.0	122.4	185.2	0.0
35 min	70.33	151.8	129.0	216.1	0.0
40 min	64.32	158.7	134.9	247.0	0.0
45 min	59.39	164.8	140.1	277.8	0.0
50 min	55.25	170.3	144.8	308.7	0.0
55 min	51.72	175.4	149.1	339.6	0.0
1 hr	48.68	180.1	153.1	370.4	0.0
2 hr	29.66	219.5	186.5	740.9	0.0
3 hr	22.04	244.6	207.9	1111.3	0.0
4 hr	17.82	263.7	224.1	1481.8	0.0
5 hr	15.09	279.2	237.3	1852.2	0.0
6 hr	13.17	292.5	248.6	2222.6	0.0
7 hr	11.74	304.1	258.5	2593.1	0.0
8 hr	10.62	314.4	267.3	2963.5	0.0
9 hr	9.72	323.8	275.3	3334.0	0.0
10 hr	8.99	332.5	282.6	3704.4	0.0
11 hr	8.36	340.4	289.4	4074.8	0.0
12 hr	7.84	347.9	295.7	4445.3	0.0
13 hr	7.38	354.9	301.6	4815.7	0.0
14 hr	6.98	361.4	307.2	5186.2	0.0
15 hr	6.62	367.6	312.5	5556.6	0.0
16 hr	6.31	373.6	317.5	5927.0	0.0
17 hr	6.03	379.2	322.3	6297.5	0.0
18 hr	5.77	384.6	326.9	6667.9	0.0
19 hr	5.54	389.7	331.3	7038.4	0.0
20 hr	5.33	394.7	335.5	7408.8	0.0
21 hr	5.14	399.4	339.5	7779.2	0.0
22 hr	4.96	404.0	343.4	8149.7	0.0
23 hr	4.80	408.5	347.2	8520.1	0.0
24 hr	4.65	412.8	350.8	8890.6	0.0

Skelton, Brumwell and Associates Inc.

DATE	April 24, 2020
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Max volume required: 22.0

Volume @ Design Flow: 22.2

Interpolate Volume from rating curve

Flow	Volume	TWL
0.101	22.00	235.11
0.118	24.18	235.21
0.1029	22.2	235.12

Rainfall Intensity $I = A/(t+B)^{C}$

	25 year
A	1146.275
B	4.922
C	0.757
t	min

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MTO Storage Sizing Method

Storage:	50 year
Area:	0.37 hectares
Max Permissible Ouflow Rate:	0.132 cms
Outflow Rate:	**0.118 cms**
Runoff Coefficient:	0.86
Depression Storage:	0 mm

TIME	Rainfall Rate (mm/hr)	Rainfall Volume (cu.m.)	Runoff Volume (cu.m.)	Outflow (cu.m.)	Storage (cu.m.)
5 min	224.41	69.2	59.5	35.4	24.1
10 min	164.22	101.3	87.1	70.8	16.3
15 min	131.81	121.9	104.9	106.2	0.0
20 min	111.22	137.2	118.0	141.6	0.0
25 min	96.84	149.3	128.4	177.0	0.0
30 min	86.16	159.4	137.1	212.4	0.0
35 min	77.87	168.1	144.5	247.8	0.0
40 min	71.24	175.7	151.1	283.2	0.0
45 min	65.78	182.5	157.0	318.6	0.0
50 min	61.21	188.7	162.3	354.0	0.0
55 min	57.32	194.4	167.2	389.4	0.0
1 hr	53.96	199.7	171.7	424.8	0.0
2 hr	32.97	244.0	209.8	849.6	0.0
3 hr	24.54	272.4	234.3	1274.4	0.0
4 hr	19.87	294.1	252.9	1699.2	0.0
5 hr	16.85	311.8	268.1	2124.0	0.0
6 hr	14.73	326.9	281.1	2548.8	0.0
7 hr	13.13	340.2	292.5	2973.6	0.0
8 hr	11.89	352.0	302.7	3398.4	0.0
9 hr	10.89	362.8	312.0	3823.2	0.0
10 hr	10.07	372.7	320.5	4248.0	0.0
11 hr	9.38	381.8	328.4	4672.8	0.0
12 hr	8.79	390.4	335.7	5097.6	0.0
13 hr	8.28	398.4	342.6	5522.4	0.0
14 hr	7.84	405.9	349.1	5947.2	0.0
15 hr	7.44	413.1	355.2	6372.0	0.0
16 hr	7.09	419.9	361.1	6796.8	0.0
17 hr	6.78	426.3	366.7	7221.6	0.0
18 hr	6.49	432.5	372.0	7646.4	0.0
19 hr	6.24	438.5	377.1	8071.2	0.0
20 hr	6.00	444.2	382.0	8496.0	0.0
21 hr	5.79	449.7	386.7	8920.8	0.0
22 hr	5.59	455.0	391.3	9345.6	0.0
23 hr	5.41	460.1	395.7	9770.4	0.0
24 hr	5.24	465.0	399.9	10195.2	0.0

Skelton, Brumwell and Associates Inc.

DATE	April 24, 2020
CALCS	BWB
Revised	**May 11, 2021**

Max volume:	24.1
Volume @ Design Flow:	24.2

Interpolate Volume from rating curve

Flow	Volume	TWL
0.118	24.18	235.21
0.133	26.07	235.31
0.118	24.2	235.21

Rainfall Intensity $I = A/(t+B)^{C}$

	50 year
A	1236.152
B	4.699
C	0.751
t	min

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Skelton, Brumwell and Associates Inc.

DATE	April 24, 2020
CALCS	BWB
Revised	May 11, 2021

MTO Storage Sizing Method

Storm:	100 year
Area:	0.37 hectares
Max Permissible Ouflow Rate:	0.146 cms
Outflow Rate:	**0.131 cms**
Runoff Coefficient:	0.86
Depression Storage:	0 mm

TIME	Rainfall Rate (mm/hr)	Rainfall Volume (cu.m.)	Runoff Volume (cu.m.)	Outflow (cu.m.)	Storage (cu.m.)
5 min	243.43	75.1	64.5	39.3	25.2
10 min	180.15	111.1	95.5	78.6	16.9
15 min	145.31	134.4	115.6	117.9	0.0
20 min	122.92	151.6	130.4	157.2	0.0
25 min	107.18	165.2	142.1	196.5	0.0
30 min	95.44	176.6	151.8	235.8	0.0
35 min	86.31	186.3	160.2	275.1	0.0
40 min	78.97	194.8	167.5	314.4	0.0
45 min	72.93	202.4	174.1	353.7	0.0
50 min	67.87	209.3	180.0	393.0	0.0
55 min	63.55	215.5	185.4	432.3	0.0
1 hr	59.82	221.3	190.4	471.6	0.0
2 hr	36.47	269.9	232.1	943.2	0.0
3 hr	27.10	300.8	258.7	1414.8	0.0
4 hr	21.90	324.2	278.8	1886.4	0.0
5 hr	18.55	343.2	295.1	2358.0	0.0
6 hr	16.19	359.4	309.1	2829.6	0.0
7 hr	14.42	373.6	321.3	3301.2	0.0
8 hr	13.05	386.3	332.2	3772.8	0.0
9 hr	11.94	397.7	342.1	4244.4	0.0
10 hr	11.03	408.3	351.1	4716.0	0.0
11 hr	10.27	418.0	359.5	5187.6	0.0
12 hr	9.62	427.1	367.3	5659.2	0.0
13 hr	9.06	435.6	374.6	6130.8	0.0
14 hr	8.56	443.6	381.5	6602.4	0.0
15 hr	8.13	451.2	388.0	7074.0	0.0
16 hr	7.74	458.4	394.2	7545.6	0.0
17 hr	7.40	465.2	400.1	8017.2	0.0
18 hr	7.08	471.8	405.7	8488.8	0.0
19 hr	6.80	478.1	411.1	8960.4	0.0
20 hr	6.54	484.1	416.3	9432.0	0.0
21 hr	6.31	489.9	421.3	9903.6	0.0
22 hr	6.09	495.5	426.1	10375.2	0.0
23 hr	5.89	500.9	430.8	10846.8	0.0
24 hr	5.70	506.1	435.3	11318.4	0.0

Max volume required:	25.2
Volume @ Design Flow:	25.8

Interpolate Volume from rating curve

Flow	Volume	TWL
0.133	26.066	235.31
0.146	27.938	235.41
0.131	25.822	235.30

Rainfall Intensity $I = A/(t+B)^{C}$

	100 year
A	1426.408
B	5.273
C	0.759
t	min

Appendix C

Storm Sewer Sizing

PN 17-3103

Skelton Brumwell & Associates Inc.
ENGINEERING PLANNING ENVIRONMENTAL CONSULTANTS

117 Bayfield Street - Coral / Sophia Development

DATE	April 23, 2020
CALCS	BWB
Revised	**May 4, 2021**

PROPOSED CONDITION CATCHMENTS

CATCHMENT 301		**AREA =**	**0.052**	**Ha**	(Drains via Permeable Pavement w underdrain)			
GROUND COVER TYPE			**PROPORTION**	**C 2-5 YR**	**C 10 YR**	**C 25 YR**	**C 50 YR**	**C 100 YR**
Impervious	0.0049		0.094	0.95	0.95	1.00	1.00	1.00
Vegetated	0.017		0.331	0.25	0.25	0.28	0.30	0.31
Permiable Paving	0.030		0.575	0.95	0.95	1.00	1.00	1.00
TOTAL	**0.052**	**Ha**	**WEIGHTED C**	**0.72**	**0.72**	**0.76**	**0.77**	**0.77**

CATCHMENT 302		**AREA =**	**0.265**	**Ha**				
GROUND COVER TYPE			**PROPORTION**	**C 2-5 YR**	**C 10 YR**	**C 25 YR**	**C 50 YR**	**C 100 YR**
Impervious	0.2310		0.872	0.95	0.95	1.00	1.00	1.00
Green Roof	0.0340		0.128	0.55	0.55	0.61	0.66	0.69
Vegetated	0.000		0.000	0.25	0.25	0.28	0.30	0.31
Permiable Paving	0.000		0.000	0.95	0.95	1.00	1.00	1.00
TOTAL	**0.265**	**Ha**	**WEIGHTED C**	**0.90**	**0.90**	**0.95**	**0.96**	**0.96**

CATCHMENT 303		**AREA =**	**0.024**	**Ha**				
GROUND COVER TYPE			**PROPORTION**	**C 2-5 YR**	**C 10 YR**	**C 25 YR**	**C 50 YR**	**C 100 YR**
Impervious	0.0014		0.059	0.95	0.95	1.00	1.00	1.00
Vegetated	0.015		0.628	0.25	0.25	0.28	0.30	0.31
Permiable Paving	0.008		0.314	0.95	0.95	1.00	1.00	1.00
TOTAL	**0.024**	**Ha**	**WEIGHTED C**	**0.51**	**0.51**	**0.54**	**0.56**	**0.57**

CATCHMENT EXT		**AREA =**	**0.06**	**Ha**				
GROUND COVER TYPE			**PROPORTION**	**C 2-5 YR**	**C 10 YR**	**C 25 YR**	**C 50 YR**	**C 100 YR**
Impervious	0.0022		0.037	0.95	0.95	1.00	1.00	1.00
Vegetated	0.058		0.963	0.25	0.25	0.28	0.30	0.31
TOTAL	**0.06**	**Ha**	**WEIGHTED C**	**0.28**	**0.28**	**0.30**	**0.33**	**0.34**

CATCHMENT 303 + EXT DRAIN TO CB#1 - CALCULATE COMBINED INPUTS								
		AREA =	**0.084**	**Ha**				
GROUND COVER TYPE			**PROPORTION**	**C 2-5 YR**	**C 10 YR**	**C 25 YR**	**C 50 YR**	**C 100 YR**
Impervious	0.0036		0.043	0.95	0.95	1.00	1.00	1.00
Vegetated	0.0728		0.868	0.25	0.25	0.28	0.30	0.31
Permiable Paving	0.008		0.089	0.95	0.95	1.00	1.00	1.00
TOTAL	**0.084**	**Ha**	**WEIGHTED C**	**0.34**	**0.34**	**0.37**	**0.39**	**0.40**

CATCHMENT 304		**AREA =**	**0.015**	**Ha**				
GROUND COVER TYPE			**PROPORTION**	**C 2-5 YR**	**C 10 YR**	**C 25 YR**	**C 50 YR**	**C 100 YR**
Impervious	0.0105		0.682	0.95	0.95	1.00	1.00	1.00
Vegetated	0.003		0.175	0.25	0.25	0.28	0.30	0.31
Permiable Paving	0.002		0.143	0.95	0.95	1.00	1.00	1.00
TOTAL	**0.015**	**Ha**	**WEIGHTED C**	**0.83**	**0.83**	**0.87**	**0.88**	**0.88**

CATCHMENT 305		**AREA =**	**0.020**	**Ha**	(Drains Uncontrolled to Street)			
GROUND COVER TYPE			**PROPORTION**	**C 2-5 YR**	**C 10 YR**	**C 25 YR**	**C 50 YR**	**C 100 YR**
Impervious	0.0012		0.060	0.95	0.95	1.00	1.00	1.00
Vegetated	0.019		0.940	0.25	0.25	0.28	0.30	0.31
Permiable Paving	0.000		0.000	0.95	0.95	1.00	1.00	1.00
TOTAL	**0.020**	**Ha**	**WEIGHTED C**	**0.29**	**0.29**	**0.32**	**0.34**	**0.35**

PN 17-3103
117 Bayfield Street

Skelton Brumwell & Associates Inc.
ENGINEERING PLANNING ENVIRONMENTAL CONSULTANTS

Skelton, Brumwell and Associates Inc.

DATE	April 24, 2020
CALCS	BWB
Revised	**May 12, 2021**

Rational Method Storm Sewer Design

100 year STORM FLOWS - SEWER SIZING

Q = 0.00278 C.I.A. - IN C.M.S. (CUBIC METRES /SEC)
C =RUNNOFF COEFFICIENT
A = AREA - IN HECTARES
i = RAINFALL INTENSITY (mm/hr) = A / (t+B)^C

A (idf) =	1426.41
B (idf) =	5.27
C (idf) =	0.76
t =	flow time

intial t = 10 minutes

AREA	LOCATION		PIPE LENGTH (METRES)	INCREMENT		CA	TOTAL CA	FLOW TIME (MIN)		I	TOTAL PEAK Q (CMS)	S (%)	D (mm)	Mannings 'n' for pipe	Q PIPE FULL (CMS)	V PIPE FULL (m/sec)	REMARKS	PIPE CAPACITY GREATER THAN FLOW RATE?
	FROM	TO		C	A			TO SECTION	IN SECTION									
302	Building	STMH#1	1.8	0.96	0.265	0.254	0.254	10.00	0.02	180.15	0.127	2.00	300	0.013	0.137	1.933	PVC 100 YR FLOW	OK
	STMH#1	CBMH#1	8.3				0.254	10.02	0.11	180.02	0.127	0.60	375	0.013	0.136	1.229	PVC 100 YR FLOW	OK
303+EXT	CBMH#1	Detention		0.40	0.084	0.034	0.288	10.00		180.15	0.144							
			Detention System Includes CBMH#1, Stormtech, STMH#2, CBMH#2 and storm sewer between STMH#2 and CBMH#2															
304	CBMH#2	Detention	Flow controls for detetion at the outlet of CBMH#2, it is part of the detention system so no pipe sizing is required															
Low Flow	Detention	STMH#3	5.4								0.049	0.50	300	0.013	0.068	0.967	PVC 100 YR FLOW	OK
High Flow	Detention	STMH#3	5.4								0.131	1.50	375	0.013	0.215	1.943	PVC 100 YR FLOW	OK
	STMH#3	Filter	36.1								0.131	0.50	450	0.013	0.201	1.267	PVC 100 YR FLOW	OK
	Filter	Sophia	5.5								0.131	1.00	450	0.013	0.285	1.791	PVC 100 YR FLOW	OK

Note: Peak flows from detention shown are max flows through the respective orifices if water level in detetion reaches max elevation. Calculated peak 1 in 100 year flow is 0.131 cms

Appendix D

Hydro International Upflo Filter Sizing

PN 17-3103
117 Bayfield Street - Coral / Sophia Development

Skelton Brumwell & Associates Inc.
ENGINEERING PLANNING ENVIRONMENTAL CONSULTANTS

Storm Catchment to Filter

DATE	April 17, 2020
CALCS	BWB
Revised	November 3, 2020

Soils investigation on site indicates silt at surface, though soils investigation is localized.

CATCHMENT EXT		AREA =	**0.06**	**Ha**					
GROUND COVER TYPE				**PROPORTION**	**C 2-5 YR**	**C 10 YR**	**C 25 YR**	**C 50 YR**	**C 100 YR**
IMPERVIOUS	0.0066			0.102	0.95	0.95	1.00	1.00	1.00
GRASS	0.058			0.898	0.25	0.25	0.28	0.30	0.31
TOTAL	**0.06**	**Ha**		**WEIGHTED C**	**0.32**	**0.32**	**0.35**	**0.37**	**0.38**

POSTDEVELOPMENT SITE

DEVELOPMENT SITE		AREA =	**0.37**	**Ha**					
GROUND COVER TYPE				**PROPORTION**	**C 2-5 YR**	**C 10 YR**	**C 25 YR**	**C 50 YR**	**C 100 YR**
IMPERVIOUS	0.2786			0.753	0.95	0.95	1.00	1.00	1.00
Grassed	0.0513			0.139	0.25	0.25	0.28	0.30	0.31
Pervious Paving	0.0401			0.108	0.95	0.95	1.05	1.14	1.19
				1.000					
TOTAL	**0.370**	**Ha**		**WEIGHTED C**	**0.85**	**0.85**	**0.90**	**0.92**	**0.93**

DRAINAGE TO JELLYFISH FILTER - 25mm EVENTS

COMBINED PROPOSED DRAINAGE AREA		AREA =	**0.43**	**Ha**					
GROUND COVER TYPE				**PROPORTION**	**C 2-5 YR**	**C 10 YR**	**C 25 YR**	**C 50 YR**	**C 100 YR**
IMPERVIOUS + Pervious Paving	0.3253			0.749	0.95	0.95	1.00	1.00	1.00
Grassed	0.1091			0.251	0.25	0.25	0.28	0.30	0.31
TOTAL	**0.43**	**Ha**		**WEIGHTED C**	**0.77**	**0.77**	**0.82**	**0.82**	**0.83**

November 2, 2020

ADS UFF Sizing Summary

Project Name: Coral Sophia (117 Bayfield St.)
Consulting Engineer: Skelton Brumwell & Associates
Location: Barrie, ON
Sizing Completed By: C. Neath **Email:** cody.neath@ads-pipe.com

Recommended Unit	
Recommended Model:	UFF-5
TSS Removal Percentage:	83.0%
Total Site Volume Treated:	92.6%

Site Details	
Site Area:	0.44 ha
% Impervious:	76%
Rational C:	0.76
Rainfall Station:	Barrie, ONT
Particle Size Distribution:	ETV / NJDEP
Peak Storm Flowrate:	170 L/s

Unit Specifications:	
Number of Filter Modules:	5
Maximum Treatment Flowrate:	8 L/s
Inlet - Outlet Drop:	300 mm*
Max. Pipe Diameter:	600 mm

* Drop across unit can be reduced when required.

Site Elevations:	
Rim Elevation:	235.62
Inlet Pipe Elevation:	233.90
Outlet Pipe Elevation:	233.60

Consult approved shop drawings for final elevations. Riser sections (and/or grade rings) may be required to reach final grade on site.

Rainfall Intensity(1)	Fraction of Rainfall(1)	Removal Efficiency(2)	Weighted Net-Annual Removal Efficiency
mm/hr	%	%	%
0.50	0.1%	92.3%	0.1%
1.00	18.0%	91.4%	16.5%
1.50	7.5%	90.5%	6.8%
2.00	13.7%	89.6%	12.2%
2.50	4.3%	88.7%	3.8%
3.00	5.1%	87.8%	4.4%
3.50	7.8%	86.9%	6.8%
4.00	3.4%	86.0%	2.9%
4.50	3.2%	85.2%	2.7%
5.00	5.3%	84.3%	4.4%
6.00	4.7%	82.5%	3.8%
7.00	5.4%	80.7%	4.3%
8.00	4.6%	78.9%	3.7%
9.00	2.5%	77.1%	2.0%
10.00	2.8%	75.3%	2.1%
20.00	9.9%	57.4%	5.7%
30.00	1.3%	39.5%	0.5%
40.00	0.2%	21.6%	0.1%
50.00	0.0%	3.8%	0.0%
100.00	0.0%	0.0%	0.0%
Net Annual Treatment			83.0%
Total Runoff Volume Treated:			92.6%

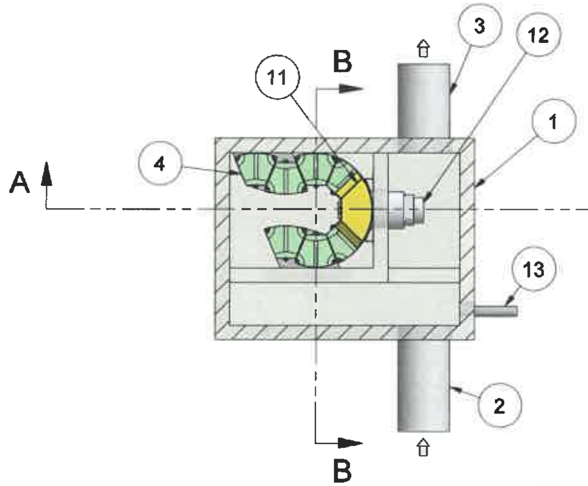
Rainfall Data: 1978:2007, HLY03, Barrie, ONT, 6110557.

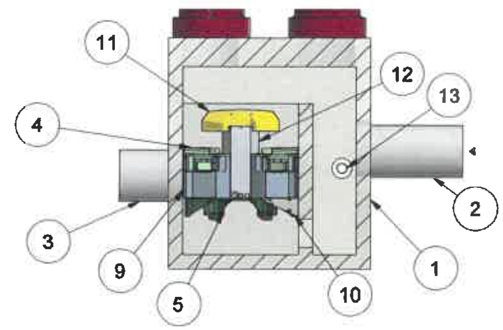
Notes:

Removal efficiencies are based on NJDEP Test Protocols and independently verified.

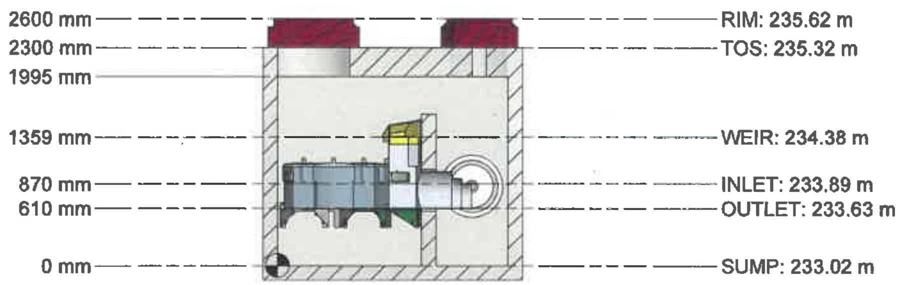
TSS removal based on ETV/NJDEP particle size distribution.

All units supplied by ADS have numerous local, provincial, and international certifications (copies of which can be provided upon request). The design engineer is responsible for ensuring compliance with applicable regulations.





SECTION B-B
SCALE 1:50



SECTION A-A
SCALE 1:50

CAPACITIES:

1. Minimum performance: 80% removal. NJDEP - NJDEP Blend; NJCAT, Sil-Co-Sil 106 (d50 = 22 microns) at the peak treatment flow.
2. Maximum number of modules per outlet module: 38 **
3. NJDEP peak treatment flow: .056 cfs (25 gpm) per module, CPZ

ADDITIONAL DESIGN INFORMATION:

1. * Normal operating W.S.E. is 2.46' above the outlet invert at the peak treatment flow of .056 cfs (25 gpm) per module. For a given flow the head requirement can be reduced by adding additional filters.
2. ** Treatment flows that require more modules will require a larger vault design or different arrangement.
3. Media Types Available: New Jersey - Ribbons; Elsewhere - CPZ

PARTS LIST

ITEM	QTY	DESCRIPTION	TYPE	SIZE (mm)
1	1	PRECAST VAULT		1800x2400
2	1	UFF INLET PIPE	HDPE	450
3	1	UFF OUTLET PIPE	HDPE	450
4	7	MODULE LID		
5	4	SUPPORT FRAME		
6	1	COVER 30 IN		750
7	2	COVER 24 IN		600
8	2	WEDGE WALL MOUNT		
9	7	MODULE BODY		
10	2	SUPPORT FRAME LH		
11	1	BYPASS HOOD-S		
12	1	OUTLET MODULE		
13	1	AUX PIPE 1	PVC	100

PROJECTION

IF IN DOUBT ASK

COMMENTS:

1. STRUCTURE WALL AND SLAB THICKNESSES ARE NOT TO SCALE.

2. CONTACT HYDRO INTERNATIONAL FOR A BOTTOM OF STRUCTURE ELEVATION PRIOR TO SETTING THE STRUCTURE

REVISION HISTORY

REV	BY	DESCRIPTION	DATE
-	JLL3	FIRST RELEASE	11/9/2020

DATE: 11/9/2020 | SCALE: 1:50

DRAWN BY: JLL3 | CHECKED BY: | APPROVED BY:

Title
UP-FLO FILTER
1800x2400

7 MODULES

WQCD
CORAL SOPHIA HOUSING
BARRIE, ON

Patent: www.hydro-int.com/patents

Hydro International®
hydro-int.com
HYDRO INTERNATIONAL

DO NOT SCALE DRAWING
STEEL FABRICATION TOLERANCES
UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES.

LINEAR
000 - 012in = ±0.04in
012 - 024in = ±0.06in
024 - 048in = ±0.08in
048 - 120in = ±0.12in
120in >>>> = ±0.20in

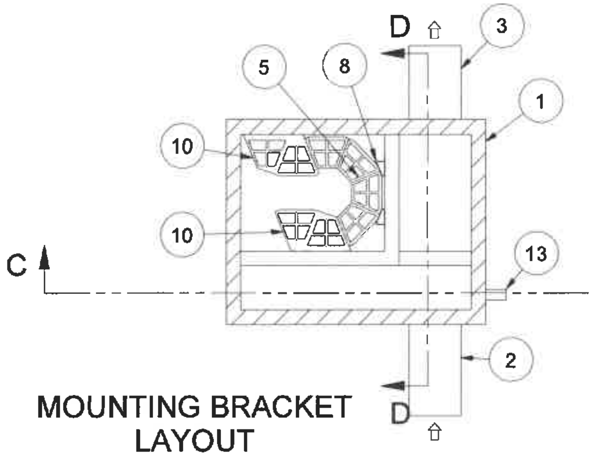
ANGULAR
000 - 120in = ±1°
120 - 240in = ±0.5°
240in >>>> = ±0.25°

WEIGHT: | MATERIAL:

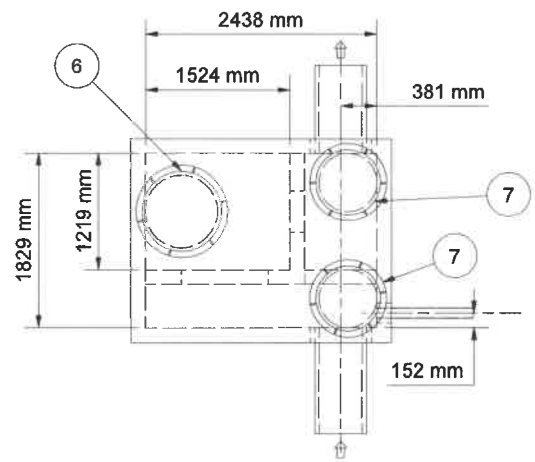
STOCK NUMBER: 1

DRAWING NO.: 20_12_3727-UFF-1

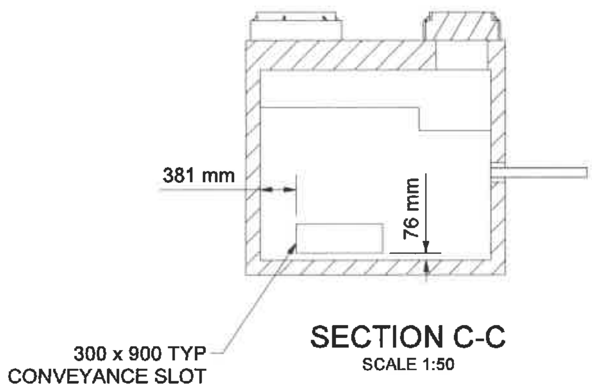
SHEET SIZE: B | SHEET: 1 OF 2 | Rev: -



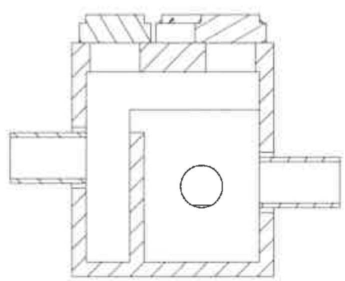
MOUNTING BRACKET LAYOUT



PRECAST DETAIL



SECTION C-C
SCALE 1:50



SECTION D-D
SCALE 1:50

PARTS LIST			
ITEM	QTY	DESCRIPTION	SIZE (in)
1	1	PRECAST VAULT	1800x2400
2	1	UFF INLET PIPE	450
3	1	UFF OUTLET PIPE	450
4	7	MODULE LID	
5	4	SUPPORT FRAME	
6	1	COVER 30 IN	750
7	2	COVER 24 IN	600
8	2	WEDGE WALL MOUNT	
9	7	MODULE BODY	
10	2	SUPPORT FRAME LH	
11	1	BYPASS HOOD-S	
12	1	OUTLET MODULE	
13	1	AUX PIPE 1	100

PROJECTION

IF IN DOUBT ASK

COMMENTS:

1. STRUCTURE WALL AND SLAB THICKNESSES ARE NOT TO SCALE.

2. CONTACT HYDRO INTERNATIONAL FOR A BOTTOM OF STRUCTURE ELEVATION PRIOR TO SETTING THE STRUCTURE

DATE: 11/9/2020
SCALE: 1:50
DRAWN BY: JLL3
CHECKED BY:
APPROVED BY

Title
UP-FLO FILTER
1800x2400

7 MODULES

WQCD
CORAL SOPHIA HOUSING
BARRIE, ON

Hydro International®
hydro-int.com
HYDRO INTERNATIONAL

DO NOT SCALE DRAWING
STEEL FABRICATION TOLERANCES
UNLESS OTHERWISE SPECIFIED,
DIMENSIONS ARE IN INCHES.

LINEAR
000 - 012in = ±0.04in
012 - 024in = ±0.06in
024 - 048in = ±0.08in
048 - 120in = ±0.12in
120in >>>> = ±0.20in

ANGULAR
000 - 120in = ±1°
120 - 240in = ±0.5°
240in >>>> = ±0.25°

WEIGHT:
MATERIAL:
STOCK NUMBER: 1
DRAWING NO.: 20_12_3727-UFF-1
SHEET SIZE: B
SHEET: 2 OF 2
Rev: -

Verification Statement

Hydro International Up-Flo® Filter with CPZ™ Media

Registration number: (V-2019-06-01)
Date of issue: (2019-June-28)

Technology type	Stormwater Filtration Device		
Application	Technology to remove sediment, nutrients and metals from stormwater runoff		
Company	Hydro International	**Website**	https://www.hydro-int.com
Address	94 Hutchins Drive, Portland, Maine USA 04102		
E-mail	TechSupport@hydro-int.com	**Phone**	+1-207-756 6200

This Verification Statement was prepared by VerifiGlobal to summarize the results reported in the Verification Report for the Hydro International Up-Flo® Filter with CPZ™ Media, dated June 26, 2019. The Verification Report was prepared by Good Harbour Laboratories Inc. (GHL) for VerifiGlobal in accordance with the requirements of the International Organization for Standardization (ISO) 14034 Environmental Technology Verification (ETV) standard and the VerifiGlobal Performance Verification Protocol. All the information provided in this Statement are based on the independent, third-party review and verification of technical information, performance test reports, performance data and specific performance claims documented in the Verification Report.

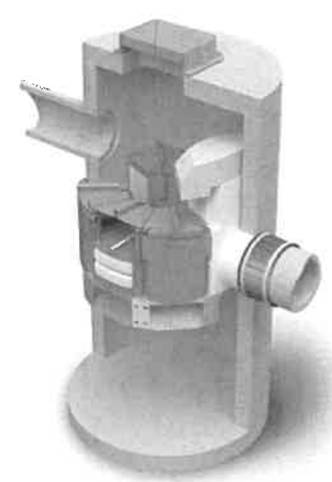


Figure 1: Up-Flo® Filter with CPZ™ Media

Technology Description

The ***Up-Flo® Filter with CPZ™ Media*** is a stormwater remedial device that incorporates gravitational separation of floating and settling materials, screening, and filtration of polluted stormwater to offer treatment train capabilities in a standalone device. Each Up-Flo® Filter consists of a highly configurable array of modules that are typically supplied as a complete system housed in a 4-ft (1.2 m) diameter manhole or precast vault. Manhole configurations consist of a single ring assembly containing one to six modules. Vaulted systems are highly configurable and may contain single or multiple arrays each consisting of one to 18 Filter Modules depending on availability of vault sizes.

Verified Performance Claims

Verification of the Hydro International Up-Flo® Filter with CPZ™ Media is based on existing performance test data from two different locations with different rainfall characteristics, catchment areas and pollutant loadings. Supporting data were obtained from three independent perfomance monitoring studies. One was conducted by Engineering School of Sustainable Infrastructure and Environment (ESSIE) at the University of Florida (UF) under the supervision of Dr. John Sansalone and two were conducted by Department of Civil, Construction, and Environmental Engineering (CCEE) at the University of Alabama (UA) under the supervision of Dr. Bob Pitt.

All three studies were guided by the New Jersey Department of Environmental Protection (NJDEP) Technology Acceptance Reciprocity Partnership (TARP) Tier II Protocol for Stormwater Best Management Practice Demonstrations (2003) and its 2006 and 2009 amendments. In total, there were 66[1] storms assessed to verify that an Up-Flo® Filter with CPZ™ Media achieves the performance listed in Tables 1 and 2, when designed to the following parameters:

- System hydraulic loading rate of 25 gpm (1.58 L/s) per filter module, with bypass of higher flows.
- Filter flux rate of 22.7 gpm/ft2 (15.4 L/s/m2)
- Operating head of ≤30 in. (76.2 cm)
- Effective Sedimentation/ Filtration Treatment Area (ESA/EFTA) –12.6/6.6 (1.91)
- Maximum sediment storage volume of 16.8 ft3 (0.476 m3) at a sediment depth of 16 inches (0.41m).

Table 1. Up-Flo® Filter with CPZ™ Media – Verified Concentration Removal Efficiency

Constituent	Lower 95% Confidence Interval	Median	Upper 95% Confidence Interval
SSC *	85.9%	92.8%	94.7%
SSC **	73.9%	82.8%	86.3%
TSS *	79.0%	89.2%	91.0%
TSS **	72.0%	78.3%	85.2%
TN *	9.0%	28.5%	64.7%
TP *	33.8%	43.9%	50.9%
Zn **	39.4%	50.0%	62.1%
Cu **	72.6%	80.7%	85.2%

* Based on ESSIE (UF) Performance monitoring results
** Based on CCEE (UA) Performance monitoring results

Table 2. Up-Flo® Filter with CPZ™ Media – Verified Flow Weighted Mass Removal Efficiency

Constituent	ESSIE (UF) Performance monitoring results		CCEE (UA) Performance monitoring results
	6-month	12-month	12-month
SSC	93%	92%	86%
TSS*	89%	87%	87%
TN **	68%	39%	***
TP **	48%	48%	***
Zn	***	***	59%
Cu	***	***	70%

* TSS results for UF are a function of SSC.
** TN and TP load data was time dependent after 6-months
*** No data submitted

[1]Of the total 66 storms (16 storms from UF and 50 storms from UA), 62 were identified as qualifying events having quality data for TSS, and 59 for SSC. Fewer events with metals detected in the runoff limited the metals data sets. There were a total of 28 and 17 storms for Zn and Cu, respectively, solely from the UA data. Total Nitrogen and Total Phosphorous claims were based on the 16 storms recorded solely from the UF data.

Description of Test Procedure

Table 3 shows the target criteria as outlined by the TARP and TAPE programs as well as the results achieved at the two locations. Table 4 provides a more detailed description of the observed operating conditions over the testing period. At the time of testing, the TARP and TAPE programs both allowed for field testing data to be used to obtain certification in participating states. They were the most widely used protocols and were generally accepted as industry standards. The TARP program has since stopped accepting field data, but the TAPE program remains in effect and is currently referenced to benchmark the quality of data obtained from stormwater monitoring programs.

Table 3. Up-Flo® Filter with CPZ™ Media Performance Testing - Specified TARP & TAPE criteria, and achieved results, for storm selection and sampling

Description	TARP Criteria	TAPE Criteria	Achieved value	
			ESSIE - UF	**CCEE - UA**
Total rainfall/storm	≥2.5 mm (0.1")	≥3.81 mm (0.15")	>2.5 mm (0.1")	≥4.6 mm (0.18")
Minimum inter-event period	6 h	6 h	≥ 6 h	≥ 6 h
Minimum flow-weighted composite sample storm coverage	70% including as much of the first 20% of the storm	75% including as much of the first 20% of the storm	100%	87.6%
Minimum influent/effluent samples	10, but a minimum of 5 subsamples for composite samples	12, but a minimum of 10 subsamples for composite samples	5, whole manual samples	11
Total sampled rainfall	≥ 381 mm (15")	NA	195 mm (7.66")	765 mm (30.07")
Total sampled storms	≥ 20	≥ 12	16	29

Table 4. Up-Flo® Filter with CPZ™ Media Performance Testing - Observed operational conditions for events monitored over each performance test period

Operating parameter	Observed range	
	ESSIE - UF	**CCEE - UA Total***
Storm duration	0.35-5.78 h	0.67-64.7 h
Previous dry hours**	6-213	> 6 hrs for the 20 storms in 1st study and 12-632 hrs for 30 storms in second study
Rainfall depth	0.10-1.64 in	0.18-2.44 in
Runoff volume	223-4095 gal (0.84-15.5 m^3)	2,065-61,131 gal(7.82-231 m^3)
Peak rainfall intensity (5 min)	1.2-5.4 in/h (3.0-13.7 cm)	0.24-4.68 in/h (0.61-11.9 cm)
Peak runoff flow rate	27.7-233 gpm (1.75-14.7 L/s)	68-1023 gpm (4.29-64.5 L/s)
Event median flow rate	2.4-21.4 gpm (0.15-1.35 L/s)	28-175 gpm (1.75-11.0 L/s)

* The UA data ranges cover the storms for both studies; ranges for individual studies might be narrower.
** This is the same as the time period between events, or time since it last rained a qualifying event.

For the UF study, performance monitoring was conducted at the Reitz Union surface parking lot, which had a drainage area of 0.12-0.20 acres (0.049-0.081 ha),which was 76% impervious, depending on storm intensity and wind direction. The area generated a flow rate in excess of the 150 gpm (9.55 L/s) maximum treatment flow rate (MTFR) in 3 of the 16 storms. The 4-ft diameter (1.2 m) test unit was installed above ground in a temporary installation at the bottom of a hill sloping down from the lot. An inlet catch basin conveyed runoff from the parking lot through a Pashall flume into the filter. Monitoring occurred over a period of 12 months and the UF team recovered the captured mass at the end of the perfomance monitoring study. No maintenance was required or conducted during the year long monitoring period from 12 September 2015 through 1 September 2016.

The UA perfomance monitoring studies covered a total of 50 storms, but not all of them yielded useful data for all parameters. The site used in both cases was the Riverwalk parking lot near the Bama Belle in Tuscaloosa, Alabama. The drainage area was about 0.9 acres (0.36 ha), 68% impervious. The unit was installed in a 4 ft. (1.2 m) diameter below-grade catch basin inlet manhole on the site. Monitoring occurred in two stages of approximately 12 months each over a total of 32 months. The first round of testing occurred from July 16, 2010 to April 11, 2011 and the second from May 31st, 2012 to March 30th, 2013.

The UA perfomance monitoring study used autosamplers to generate the flow-weighted composite samples and the event mean concentration data. This data was used to calculate removal efficiencies. However, in the UF performance monitoring study, sediment removal performance was assessed by taking full cross section samples of the influent and effluent streams at regular intervals for the duration of the storm and combining the samples into flow-weighted composites. The data was converted into event mean concentrations for the purposes of calculating removals.

The following approved analytical methods were used:

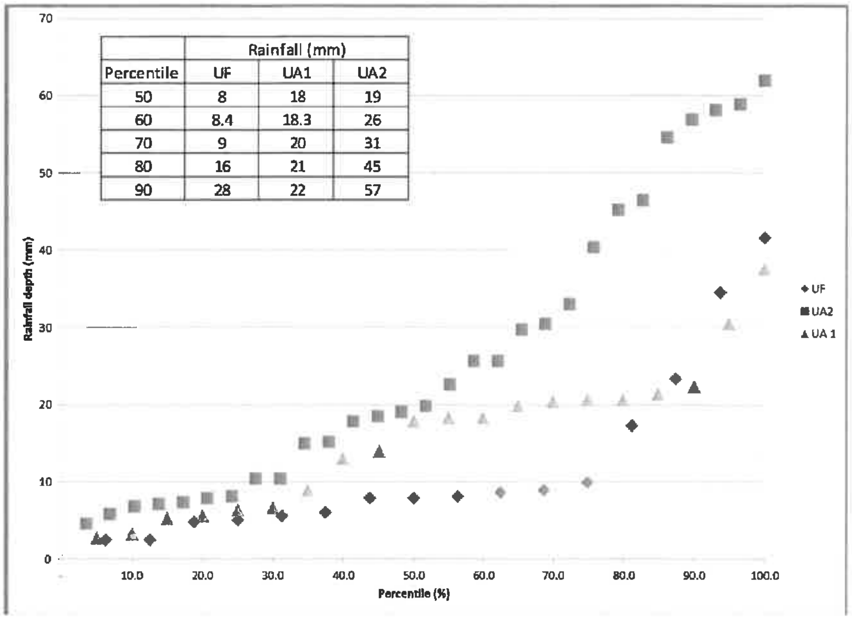
- TSS – ASTM D2540
- SSC – ASTM D3977-97(2013) Standard Test Methods for Determining Sediment Concentration in Water Samples
- PSD – ASTM D422 – 63 Standard Test Method for Particle-Size Analysis of Soils and ASTM C136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
- PSD – ASTM 2560- C, D (UF used 2560D laser diffraction or light-scattering method and UA used 2560C Coulter Counter or light-blocking method)
- TP – S.M.4500-P-B Acid Hydrolysis
- TN – Persulfate Digestion Method
- Cu – EPA 200.8 Determination of Trace Elements in Waters and Wastes by Inductively Coupled Plasma – Mass Spectrometry
- Zn - EPA 200.8 Determination of Trace Elements in Waters and Wastes by Inductively Coupled Plasma – Mass Spectrometry

As part of the mass balance measurements, the UF team allowed all samples to sit for an hour and reported concentrations of suspended solids, measured using ASTM 2540D, as TSS, in addition to the usual SSC measurement using SM3977. In order to be able to report a TSS comparable to other perfomance monitoring studies, Dr. Sansalone developed a correlation equation for TSS* = f(SSC) as well as equations for the 95% confidence limits of TSS*.

Summary of Verification Results

The cumulative frequency of rainfall depths monitored during the three perfomance monitoring studies is presented in Figure 2. The median rainfall depths in the three perfomance monitoring studies were 0.31, 0.71, and 0.75 inches (8, 18 & 19 mm) while the 90th percentile rainfall depths were 1.1, 0.9 and 2.2 inches (28, 22 and 57 mm). Thus the data presented covers a comparatively wide range of rain events.

Figure 2. Rainfall depth frequency curves



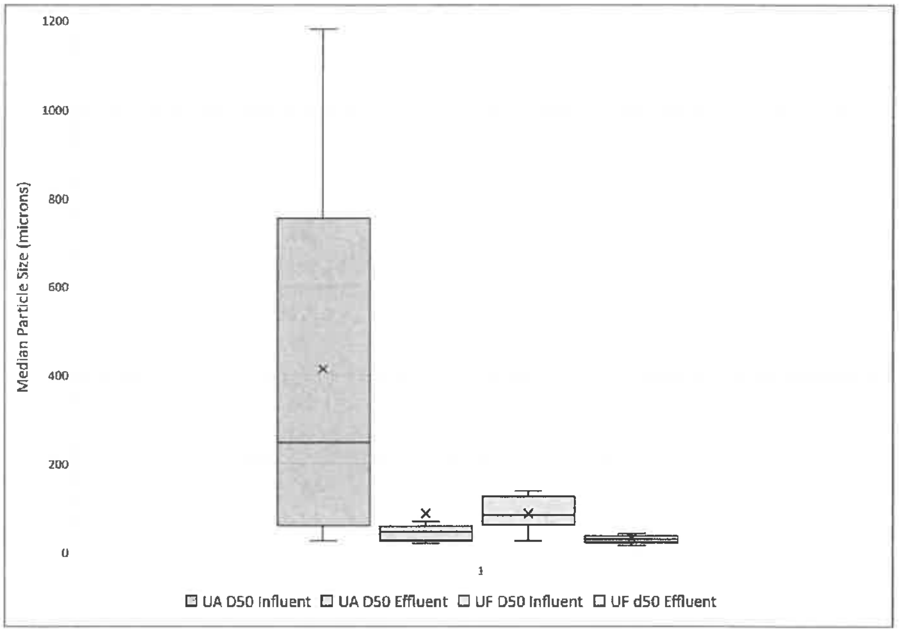
For UF monitoring, a total of 16 storm events, with varying rainfall intensity and runoff volume from event to event, were monitored. The cumulative rainfall depth was 7.66 inches (195 mm) and the cumulative influent runoff volume was 20,022 gallons (7.65 m^3). The entire volume was treated by the Up-Flo® Filter system. Of the 16 storms treated, three storms generated flow rates exceeding the MTFR of 150 gpm (9.55 L/s) but there was no bypass, because the excess was not sufficient to top the overflow weir, and all sampled flows passed through the filtration media. Median driving head difference for an event never exceeded 13.1 inches (33.3 cm) and peak driving head difference never exceeded 27.1 inches (68.8 cm), which indicates the media was not occluded.

For the UA site, all of the storm events from May 31st, 2012 to March 30th, 2013 were monitored for flow but only 30 events were sampled. The total rainfall depth for this period was 49 inches (124.5 cm) or 982,192 gal. (3,718 m^3) of runoff volume that was routed through the filter. Actual storm data from the monitoring period showed about 624,503 gal. (2,364 m^3) of runoff (from about 30 inches or 76.2 cm of rainfall) was treated by the media filter system. This included about 28.5 % of bypass flow volume, which was sampled and included in the performance results. Given that the total bypassed volume was almost three times the expected bypass volume at the UA site, the UA results are considered conservative.

Influent particle sizes varied considerably between the two monitored locations and between storm events. Catchment characteristics and available sources, sampling methods (auto sampling vs. grab sampling), storm intensities, duration and volumes all influence the particle size range. The particle size analyses were completed for just the median particle size for each storm. A comparison of statistical descriptive values for influent and effluent median particle sizes for the two monitored sites is illustrated with the Whisker-Box-Plot shown in Figure 3.

Due to larger storm events and curbside erosion, the median UA influent particle size range and d_{50} were substantially the larger of the two monitored sites. The interquartile range for the influent median particles sizes was 659 µm for UA compared to 59 µm for UF and the UA d50 was 247 µm compared to 85 µm for UF. However, despite the influent particle size differences between locations, the median UA and UF effluent particle size range and d50 were similar. The interquartile range for the effluent median particles sizes was 33 µm for UA compared to 13 µm for UF and the UA d50 was 48 µm compared to 30 µm for UF.

Figure 3. UF and UA Summary of Influent and Effluent Median Particle Sizes



Summary statistics for the influent and effluent concentration removal efficiencies as well as the overall mass load reductions are shown in Table 4 and Table 5 for UF and UA, respectively.

While the flow weighted removal efficiency for TP and TN were 48% and 39%, respectively, TP and TN reduction tended to decrease with the overall volume treated. Results showed that if the filter maintnenance cycle is limited to 6-8 months, the long-term load reduction for TP and TN would have been 50% and 70%, respectively.

Table 4: Up-Flo® Filter with CPZ™ Media Performance Testing - Summary statistics for influent and effluent event mean concentrations (EMCs) and the overall mass load reductions for selected constituents (UF Test)

Parameter	Sample Location	Min	Max	Median	SD	Mass Load Reduction
SSC	Influent	146	1584	487	360	92%
	Effluent	19.9	96.5	43.25	20.2	
TSS*	Influent	93.3	870	277	194	87%
	Effluent	25.0	66.4	37.6	10.9	
TP	Influent	0.79	6.05	1.9	1.70	48%
	Effluent	.56	2.19	1.1	0.56	
TN	Influent	.41	7.89	2.1	2.18	39%
	Effluent	.52	3.84	1.2	1.21	

Table 5. Up-Flo® Filter with CPZ™ Media Performance Testing - Summary statistics for influent and effluent event mean concentrations (EMCs) and the overall mass load reductions for selected constituents (UA Tests)

Parameter	Sample Location	Min	Max	Median	SD	Mass Load Reduction
SSC (mg/L)	Influent	23	879	88	166	86%
	Effluent	3	69	17	18	
TSS (mg/L)	Influent	11	571	89	128	87%
	Effluent	3	64	19	22	
Total Zn (μg/L)	Influent	7.0	157	22.0	0.71	59%
	Effluent	2.5*	72	14.0	0.68	
Total Cu (μg/L)	Influent	6	181	9	42	70%
	Effluent	1.3**	42	1.3	20.9	

* There was a single effluent value that was non-detect (ND). Since it was only 1 value ½ the detection limit 1.3 μg/L, was substituted when calculating statistics.
**The Cu data was highly censored (many non-detect, ND, effluents). Statistics were calculated by substituting ½ the detection limit, 1.3 μg/L, for all ND data then bootstrapping as usual.

As the independent verifier, GHL has confirmed that

- The Hydro International Up-Flo® Filter with CPZ™ Media is based on sound scientific and engineering principles, providing a net environmental benefit.
- Performance testing of the Hydro International Up-Flo® Filter with CPZ™ Media was based on defined parameters and quality-assured performance test results.
- Performance testing of the Hydro International Up-Flo® Filter with CPZ™ Media was performed by a qualified testing organization.
- Sample analyses were carried out as part of the test plan by a third-party analytical laboratory in a manner that meets the quality requirements of ISO 17025. Operating conditions and performance during each testing run were documented.
- Frequency of sampling and duration of each performance test were determined based on the specifications in a credible test plan and the requirements to produce sufficient data to support the performance claim at a 95% confidence level.
- Performance measurements and calculations were based on the technology application and relevant performance parameters as outlined in the Verification Plan.
- Performance calculations were done according to generally accepted test methods described in the test design, including the applicable mathematical and statistical principles and procedures.
- Data storage, transfer and control were adequate, carried out in accordance with the intent of ISO 9001 enabling control and retrieval of documents and records.
- Quality assurance requirements were addressed throughout the performance testing process and in the generation of performance test results. This confirmation included reviewing all data sheets and data downloads, as well as overall management of test system quality.

Quality Assurance

Performance testing and verification of the Hydro International Up-Flo® Filter with CPZ™ Media were performed in accordance with the requirements of ISO 14034:2016 and the VerifiGlobal Performance Verification Protocol. The verifier, Good Harbour Laboratories, has confirmed that quality assurance requirements were addressed throughout the performance testing process and in the generation of performance test results. This includes reviewing all data sheets and data downloads, as well as overall management of the test system, quality control and data integrity.

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Particulate Matter Fraction Analyses. (Sansalone & Kim: Transport of Particulate Matter Fractions in Runoff, Journal of Environmental Quality • Volume 37 • September–October 2008)

New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Filtration Manufactured Treatment Device, January 2013

2009 Urban Stormwater BMP Performance Monitoring Guidelines
http://www.bmpdatabase.org/contacts.html

Description of Up-Flo® Filter

Up-Flo® Filter Design Manual https://www.hydroint.com/sites/default/files/uff_dg_nashville_f1504.pdf

Up-Flo® Filter Verification Brochure

ISO/IEC 14034, Environmental management – Environmental technology verification

ISO/IEC 17025, General requirements for the competence of testing and calibration laboratories

ISO/IEC 9001, Quality Management Systems.

VerifiGlobal Performance Verification Protocol (Applying ISO 14034:2016)

VerifiGlobal Test Body Assessment – Guidance (2018)

What is ISO 14034?

The purpose of environmental technology verification is to provide a credible and impartial account of the performance of environmental technologies. Environmental technology verification is based on a number of principles to ensure that verifications are performed and reported accurately, clearly, unambiguously and objectively. The International Organization for Standardization (ISO) standard for environmental technology verification (ETV) is ISO 14034, which was published in November 2016.

Benefits of ETV

ETV contributes to protection and conservation of the environment by promoting and facilitating market uptake of innovative environmental technologies, especially those that perform better than relevant alternatives. ETV is particularly applicable to those environmental technologies whose innovative features or performance cannot be fully assessed using existing standards. Through the provision of objective evidence, ETV provides an independent and impartial confirmation of the performance of an environmental technology based on reliable test data. ETV aims to strengthen the credibility of new, innovative technologies by supporting informed decision-making among interested parties.

For more information on the Hydro International Up-Flo® Filter, contact:	For more information on VerifiGlobal, contact:
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Signed for Hydro International: *Original signed by:* *Dave Scott* David Scott Technical Product Manager, Americas Stormwater	Signed for VerifiGlobal: *Original signed by:* *Thomas Bruun* Thomas Bruun, Managing Director *Original signed by:* *John Neate* John Neate, Managing Director

Appendix E

LID TTT Modelling Results

PN 17-3103

117 Bayfield Street - Coral / Sophia Development

Skelton Brumwell & Associates Inc.
ENGINEERING PLANNING ENVIRONMENTAL CONSULTANTS

DATE	April 23, 2020
CALCS	BWB
Revised	**May 10, 2021**

PROPOSED LID Catchments

Perm Pave #1		AREA =	**0.035**	**Ha**	Permiable Pavement and west landscape area draining to filter					
GROUND COVER TYPE			**PROPORTION**		Berm:	0		**Soil**	nil	
					Pavement	70	mm	Storage	500	mm
Permable Paved	0.0248		71.9%		Slope	2.50	%	Void	0.4	
Grassed Open Space	0.010		28.1%		Void	0.40		Seepage	10	mm/hr
					Imp Ratio	0.9		Draw down	48	hrs
TOTAL	**0.035**	**Ha**			Permiability	10.00	mm/hr	**Drain**	yes	

Perm Pave #2		AREA =	**0.016**	**Ha**	Permiable Pavement on North side of building and areas that drain to it, drains to filter					
GROUND COVER TYPE			**PROPORTION**		Berm:	0		**Soil**	nil	
					Pavement	70	mm	Storage	500	mm
Permeable Paved	0.0121		75.8%		Slope	2.50	%	Void	0.4	
Grassed Open Space	0.004		24.2%		Void	0.50		Seepage	10	mm/hr
					Imp Ratio	0.9		Draw down	48	hrs
TOTAL	**0.016**	**Ha**			Permiability	10.00	mm/hr	**Drain**	yes	

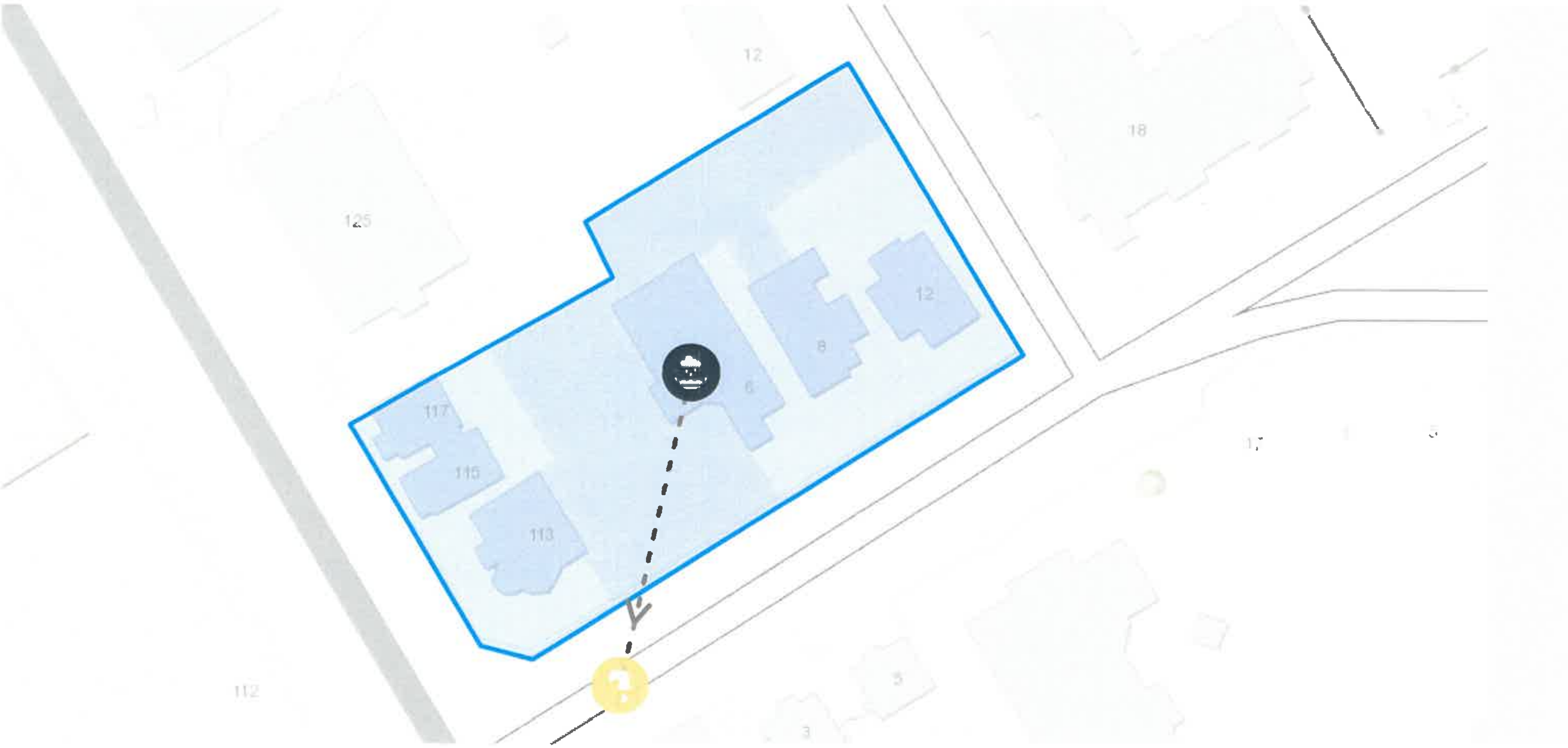
East& South Landscaped Area		AREA =	**0.038**	**Ha**	Grass, Landscaped, Sidewalk @ South and East limit of site Does not drain to any control features
GROUND COVER TYPE			**PROPORTION**		
Paved	0.0165		44.0%		
Grassed Open Space	0.021		56.0%		
TOTAL	**0.038**	**Ha**			

Building, Dog Park, Loading		AREA =	**0.284**	**Ha**	Building Roof, grassed surface at dog park, paved loading space, drains to filter
GROUND COVER TYPE			**PROPORTION**		
Paved	0.0100		3.5%		
Roof Area	0.2650		93.3%		
Grassed Open Space	0.009		3.2%		
TOTAL	**0.284**	**Ha**			

Summary

Site	Project Name	Project Title	Storm Type
Pre-Development	3103	Coral Sophia	avg-annual
Post-Development	3103 Coral Sophia Proposed	Coral Sophia Proposed	avg-annual

Map | Pre-Development



Map | Post-Development

LID Summary | Post-Development

Element	Type	LID Area	Drawdown Time	Effective Impervious to Pervious Ratio	FLOW	TSS	TP
					Flow In (m^3)	Load In (kg)	Load In (kg)
					Flow Out (m^3)	Load Out (kg)	Load Out (kg)
					Actual Reduction (%)	Actual Reduction (%)	Actual Reduction (%)
Filter	Sorbitive-Media				2,220.000 m^3	25.463 kg	0.221 kg
					2,220.000 m^3	3.819 kg	0.124 kg
					0.000 %	85.000 %	43.900 %
Per pave#1	Perm-Pavement	0.035 ha	20.000 hrs	1.000	330.645 m^3	23.905 kg	0.073 kg
					110.000 m^3	1.988 kg	0.010 kg
					66.732 %	91.683 %	86.693 %
Perm Pave #2	Perm-Pavement	0.016 ha	20.000 hrs	1.000	151.152 m^3	10.918 kg	0.033 kg
					10.000 m^3	0.181 kg	0.001 kg
					93.384 %	98.346 %	97.354 %

Loading Summary TP | Pre Development

Catchment	Total Catchment TP Removal	Peak Outflow	Generated Total Flow (m^3) Average Concentration (mg/l) Total Load (kg)	Outgoing Total Flow (m^3) Average Concentration (mg/l) Total Load (kg)
Catchment 1	0.000 %	0.047 m^3/s	2,330.000 m^3 0.190 mg/l 0.442 kg	2,327.000 m^3 0.190 mg/l 0.442 kg
Total	**0.000 %**	**0.047 m^3/s**	**2,330.000 m^3** **0.190 mg/l** **0.442 kg**	**2,327.000 m^3** **0.190 mg/l** **0.442 kg**

Loading Summary TP | Post Development

Catchment	Total Catchment TP Removal	Peak Outflow	Generated Total Flow (m^3) / Average Concentration (mg/l) / Total Load (kg)	Outgoing Total Flow (m^3) / Average Concentration (mg/l) / Total Load (kg)
Catchment 1	54.500 %	0.049 m^3/s	2,751.797 m^3	2,384.000 m^3
			0.129 mg/l	0.068 mg/l
			0.354 kg	0.161 kg
Total	**54.500 %**	**0.049 m^3/s**	**2,751.797 m^3**	**2,384.000 m^3**
			0.129 mg/l	**0.068 mg/l**
			0.354 kg	**0.161 kg**

Loading TP | Pre Development

TP - Catchment 1

Name	LID Type	Peak Outflow	Incoming Total Flow (m^3) Concentration (mg/l) Total Load (kg)	Outgoing Total Flow (m^3) Concentration (mg/l) Total Load (kg)
Pre-Development Site	0 %	0.05 m^3/s	3,514.284 m^3 0.190 mg/l 0.666 kg	2,330.000 m^3 0.190 mg/l 0.442 kg
Sophia Street Storm	0 %	0.047 m^3/s	2,327.000 m^3 0.190 mg/l 0.442 kg	2,327.000 m^3 0.190 mg/l 0.442 kg

Loading TP | Post Development

TP - Catchment 1

Name	LID Type	Peak Outflow	Incoming Total Flow (m^3) Concentration (mg/l) Total Load (kg)	Outgoing Total Flow (m^3) Concentration (mg/l) Total Load (kg)
Building, Dog Patch, Loading Bay	0 %	0.04 m^3/s	2,692.395 m^3 0.100 mg/l 0.268 kg	2,110.000 m^3 0.100 mg/l 0.210 kg
East & South Landscaped Area	0 %	0 m^3/s	349.539 m^3 0.233 mg/l 0.082 kg	160.000 m^3 0.233 mg/l 0.037 kg
Per pave#1	60 %	0 m^3/s	330.645 m^3 0.222 mg/l 0.073 kg	110.000 m^3 0.089 mg/l 0.010 kg
Perm Pave #2	60 %	0 m^3/s	151.152 m^3 0.222 mg/l 0.033 kg	10.000 m^3 0.089 mg/l 0.001 kg
Filter	43.9 %	0.045 m^3/s	2,220.000 m^3	2,220.000 m^3

			0.099 mg/l 0.221 kg	0.056 mg/l 0.124 kg
Storm Outfall	0 %	0.045 m^3/s	2,220.000 m^3 0.056 mg/l 0.124 kg	2,220.000 m^3 0.056 mg/l 0.124 kg
Sophia Street Storm	0 %	0.049 m^3/s	2,384.000 m^3 0.068 mg/l 0.161 kg	2,384.000 m^3 0.068 mg/l 0.161 kg

Detailed Report Parameters | Pre Development

Sophia Street Storm

Field	Value
Name	Sophia Street Storm
Catchment	1
Outfall Elevation (m)	232.9

Pre-Development Site

Field	Value
Subcatchment name	Pre-Development Site
Catchment	1
Total AREA (HA)	0.372
Impervious area (HA)	0.197346
Roof area (HA)	0.0888708
Landscaped area (HA)	0
Row Crop area (HA)	0
Open Space / Parkland area (HA)	0.0857832
Forest area (HA)	0
Wetland area (HA)	0

Other area (HA)	0
Manning's n for impervious areas	0.01
Manning's n for pervious areas	0.1
Depression storage for impervious areas (mm)	2
Depression storage for pervious areas (mm)	2.54
Weighted Curve Number	76

Detailed Report Parameters | Post Development

Sophia Street Storm

Field	Value
Name	Sophia Street Storm
Catchment	1
Outfall Elevation (m)	232.9

Filter

Field	Value
Name	Filter
Junction Type	sorbitive-media
Catchment	1
Invert Elevation (m)	233
Depth to Surface (m)	1.5

Storm Outfall

Field	Value
Name	Storm Outfall
Catchment	1
Upstream Node	Filter

Downstream Node	Sophia-Street-Storm
Length (m)	14
Manning's Roughness	0.013
Upstream Invert (m)	233
Downstream Invert (m)	232.9
Pipe Diameter (m)	0.3

Per pave#1

Field	Value
Name	Per pave#1
LID type	perm-pavement
Catchment	1
Outlet (name)	5
% Imperv	100
Width (m)	4
Paved surface (HA)	0.025165000000000007
Roof (HA)	0
Landscaped Area (HA)	0
Row Crop (HA)	0
Open Space/Parkland (HA)	0.009835000000000002
Forest (HA)	0

Wetland (HA)	0
(HA)	0
Berm Height (mm)	0
Surface Slope (%)	2.5
Thickness (mm)	500
Void Ratio	0.4
Impervious Surface Fraction	0.9
Permeability (mm/hr)	10
Clogging Factor	0
Soil	
Porosity (Fraction)	0.5
Field Capacity (Fraction)	0.3
Wilting Point (Fraction)	0.1
Conductivity (mm/hr)	10
Conductivity Slope (Dimensionless)	45
Suction Head (mm)	200
Seepage Rate (mm/hr)	10
Flow Coefficient	1
Flow Exponent	1
Offset Height (mm)	0
Mannings Roughness	

Building, Dog Patch, Loading Bay

Field	Value
Subcatchment name	Building, Dog Patch, Loading Bay
Catchment	1
Total AREA (HA)	0.285
Impervious area (HA)	0.011399999999999999
Roof area (HA)	0.26333999999999996
Landscaped area (HA)	0
Row Crop area (HA)	0
Open Space / Parkland area (HA)	0.01026
Forest area (HA)	0
Wetland area (HA)	0
Other area (HA)	0
Manning's n for impervious areas	0.01
Manning's n for pervious areas	0.1
Depression storage for impervious areas (mm)	2
Depression storage for pervious areas (mm)	2.54
Weighted Curve Number	76

East & South Landscaped Area

Field	Value

Subcatchment name	East & South Landscaped Area
Catchment	1
Total AREA (HA)	0.037
Impervious area (HA)	0.01628
Roof area (HA)	0
Landscaped area (HA)	0
Row Crop area (HA)	0
Open Space / Parkland area (HA)	0.02442
Forest area (HA)	0
Wetland area (HA)	0
Other area (HA)	0
Manning's n for impervious areas	0.01
Manning's n for pervious areas	0.1
Depression storage for impervious areas (mm)	2
Depression storage for pervious areas (mm)	2.54
Weighted Curve Number	76

Perm Pave #2

Field	Value
Name	Perm Pave #2
LID type	perm-pavement

Catchment	1
Outlet (name)	5
% Imperv	100
Width (m)	100
Paved surface (HA)	0.011488
Roof (HA)	0
Landscaped Area (HA)	0
Row Crop (HA)	0
Open Space/Parkland (HA)	0.0045119999999999995
Forest (HA)	0
Wetland (HA)	0
(HA)	0
Berm Height (mm)	0
Surface Slope (%)	1
Thickness (mm)	500
Void Ratio	0.4
Impervious Surface Fraction	0.9
Permeability (mm/hr)	10
Clogging Factor	0
Soil	
Porosity (Fraction)	0.5

Field Capacity (Fraction)	0.3
Wilting Point (Fraction)	0.1
Conductivity (mm/hr)	10
Conductivity Slope (Dimensionless)	45
Suction Head (mm)	200
Seepage Rate (mm/hr)	10
Flow Coefficient	1
Flow Exponent	1
Offset Height (mm)	50
Mannings Roughness	

Appendix F

Bryan Bolivar

From:	Stephen Troan <S.Troan@lsrca.on.ca>
Sent:	January 29, 2021 3:03 PM
To:	Bryan Bolivar
Subject:	RE: 3103 Coral Sophia - D11-026-2020: Volume Control

Bryan;

We will this time.

Please document the volume control as per the instructions in the LSRCA Guidelines.

Please note: the LSRCA Board of Directors approved a change to our Fee Policy. The new fees will take effect on January 1, 2021. Please click here for the new fee schedule.

Stephen Troan, C.E.T.
Engineering Technologist
Lake Simcoe Region Conservation Authority
120 Bayview Parkway,
Newmarket, Ontario L3Y 3W3
905-895-1281, ext. 306 | 1-800-465-0437
s.troan@LSRCA.on.ca | www.LSRCA.on.ca

From: Bryan Bolivar <bbolivar@skeltonbrumwell.ca>
Sent: January 29, 2021 2:00 PM
To: Stephen Troan <S.Troan@lsrca.on.ca>
Subject: RE: 3103 Coral Sophia - D11-026-2020: Volume Control

Steve

Per our discussion, the problem with trying to detain the 5mm rainfall for 24 hours is that it's such a small volume to begin with, the size of the flow restriction becomes impractically small. Well under 25mm on such small site.

Now, from my reading of the guidelines, filtration is acceptable and the site is using an Up Flo Filter for phosphorus reduction. This is a filter.
Can the LSRCA accept this as filtration in the context of volume reduction?

Bryan W. Bolivar, P.Eng | Senior Project Engineer, Associate
Skelton, Brumwell & Associates Inc.
Engineering Planning Environmental Consultants
93 Bell Farm Rd, Suite 107, Barrie, ON L4M 5G1

Tel: 705-726-1141*106 | Toll Free: 877-726-1141
Cell: 705-715-6997
www.skeltonbrumwell.ca
"innovation with integrity"

Due to the Covid-19 outbreak many staff are now working remotely. Skelton, Brumwell remains open for business and continues to provide quality service to our clients.

From: Stephen Troan <S.Troan@lsrca.on.ca>
Sent: January 29, 2021 1:37 PM
To: Bryan Bolivar <bbolivar@skeltonbrumwell.ca>
Subject: RE: 3103 Coral Sophia - D11-026-2020: Volume Control

Bryan;

Could you do alternative #2 for 5mm?

Please note: the LSRCA Board of Directors approved a change to our Fee Policy. The new fees will take effect on January 1, 2021. Please click here for the new fee schedule.

Stephen Troan, C.E.T.
Engineering Technologist
Lake Simcoe Region Conservation Authority
120 Bayview Parkway,
Newmarket, Ontario L3Y 3W3
905-895-1281, ext. 306 | 1-800-465-0437
s.troan@LSRCA.on.ca | www.LSRCA.on.ca

From: Bryan Bolivar <bbolivar@skeltonbrumwell.ca>
Sent: January 29, 2021 9:44 AM
To: Stephen Troan <S.Troan@lsrca.on.ca>
Cc: Melinda Bessey <M.Bessey@lsrca.on.ca>; Gary Matthie <Gary.Matthie@barrie.ca>; rduhamel@jonesconsulting.com; Nick Savino (nsavino@dmsproperty.com) <nsavino@dmsproperty.com>
Subject: RE: 3103 Coral Sophia - D11-026-2020: Volume Control

Steve

We can also get some delayed draw down from the permeable pavement at the west and south sides, but this does not amount to much of the site, so it really doesn't achieve what is intended.

I think the option this is feasible is to restrict the roof flows to drain a 25mm rain event over 24 hours.
We don't have enough room outside the building below grade to store that much runoff.

Would that be acceptable in principle to your office?

Bryan W. Bolivar, P.Eng | Senior Project Engineer, Associate
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Engineering Planning Environmental Consultants
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Cell: 705-715-6997
www.skeltonbrumwell.ca
"innovation with integrity"

From: Bryan Bolivar
Sent: January 28, 2021 3:21 PM
To: s.troan@lsrca.on.ca
Cc: Melinda Bessey <M.Bessey@lsrca.on.ca>; Gary Matthie <Gary.Matthie@barrie.ca>; rduhamel@jonesconsulting.com; Nick Savino (nsavino@dmsproperty.com) <nsavino@dmsproperty.com>; Scott Brumwell <sbrumwell@skeltonbrumwell.ca>
Subject: 3103 Coral Sophia - D11-026-2020: Volume Control

Steve

Thank-you for the call. We will investigate options to demonstrate reducing 25mm runoff rates such that this volume drains over a 24 hour time frame.

We understand that this will be an acceptable alternative method to address Section 2.2.2 Volume Control from the LSRCA Technical Guidelines.

Bryan W. Bolivar, P.Eng | Senior Project Engineer, Associate
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Appendix G

WSP, Water Balance

Bryan Bolivar

From:	Lemon, Lloyd <Lloyd.Lemon@wsp.com>
Sent:	May 25, 2021 5:12 PM
To:	Bryan Bolivar
Cc:	Nick Savino; Bernard, Valyn; Peterson, Tanya; Dolan, Jay; rduhamel@jonesconsulting.com
Subject:	RE: Review of potential need for Water Balance Update - Coral Sophia - 113-117 Bayfield Street, Barrie
Attachments:	191-04694-00 Table 6 Summary of Water Balance Calculations .May 2021.pdf

Hi Bryan

Thank you for your patience. We have revisited the water balance calculations using the distribution of impervious and pervious surfaces as per the updated Site Plan that you sent. The major differences were changes to the areas of imperviousness by lining the pavers (already considered as imperviousness) and the pervious areas (grass).

As anticipated the changes in recharge and runoff relative to the previous iteration are relatively minor. The infiltration surplus at the Site has been increased from 45% (65 m3/yr) to 54% (78 m3/yr) and the total runoff has been decreased from 1.1% (32 m3/yr) to -0.3% (-9m3/yr). I have provided our summary table (Table 6) to document the values.

The larger areas of grass on the west side of the building are a factor in the magnitude of this change. The observed infiltration surplus will not result in a requirement for a recharge off-setting fee.

I also wish to remind you that the pre-development condition for this site reflected the conditions prior to removal of buildings, driveways and parking areas. This is why the amount of change due to the proposed development appears minor.

As per the requirements of the Comments from the City of Barrie – we will be reissuing our Hydrogeological Study to reflect the findings of the Phase Two ESA as well as these new calculations (for consistency). Please make reference to our report with a June date – I do not anticipate that we will have it prepared to be issued in May. 25, 21

Thanks

Lloyd

Lloyd Lemon, M.Sc., P.Geo.

T+ 1 226-279-0326
M +1 905-751-6609

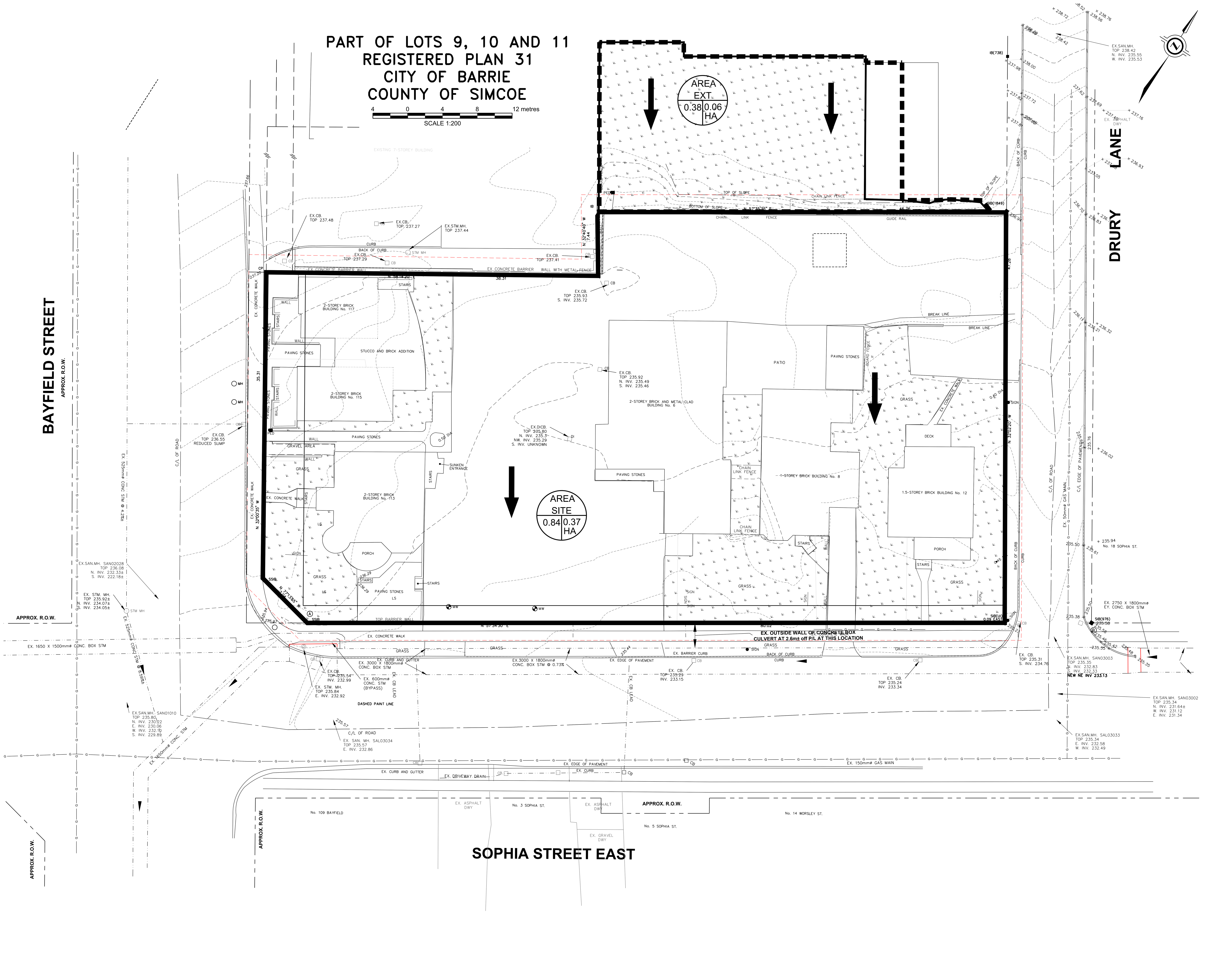
wsp

From: Bryan Bolivar <bbolivar@skeltonbrumwell.ca>
Sent: May 25, 2021 3:31 PM
To: Lemon, Lloyd <Lloyd.Lemon@wsp.com>
Cc: Nick Savino <nsavino@dmsproperty.com>; Bernard, Valyn <Valyn.Bernard@wsp.com>; Peterson, Tanya

TABLE 6 WATER BALANCE SUMMARY
HYDROGEOLOGICAL INVESTIGATION
113-117 BAYFIELD STREET, BAYFIELD

Characteristics		Pre-development		Post-development (No Recharge mitigation)		Change	
		Volume (m^3/yr)	mm/yr	Volume (m^3/yr)	mm/yr	Volume (m^3/yr)	%
Input	Precipitation	3,479	933	3,479	933	0	0%
	Runon	199	53	199	53	0	0.0%
	Total In	**3,678**	**986**	**3,678**	**986**	**0**	**0.00%**
Output	Total Infiltration	144	39	222	59	78	**54%**
	Total Run-off	2,875	771	2,866	768	-9	-0.3%
	Evapotranspiration	659	177	591	158	-69	-10.4%
	Total Out	**3,678**	**986**	**3,678**	**986**	**0**	**0.00%**

3103 – SWM1



KEY MAP
N.T.S.

LEGEND

- DEVELOPMENT BOUNDARY
- EXISTING LIMIT OF R.O.W.
- FOUND IRON BAR
- FOUND SQUARE IRON BARS
- EXISTING ELEVATIONS
- EXISTING CATCH BASIN
- EXISTING STORM MANHOLE
- EXISTING STORM SEWER
- EXISTING SIGN
- EXISTING TREE WITH TRUNK DIAMETER
- EXISTING 1.00 m CONTOUR
- EXISTING 0.50 m CONTOUR
- EXISTING MONITOURING WELL
- AREA 106 — CATCHMENT ID
- 0.95 0.09 HA — CATCHMENT AREA
- RATIONAL C FACTOR (100 YEAR)
- CATCHMENT BOUNDARY
- EXTERNAL CATCHMENT BOUNDARY
- OVERLAND FLOW DIRECTION
- PERVIOUS AREA

SCHEDULE OF REVISIONS

NO.	DATE	DESCRIPTION	CHECKED
1	APRIL 2020	SUBMISSION FOR REZONING	BWB
2	2020 11 16	ISSUED FOR SITE PLAN APPROVAL	BWB
3	2021 02 25	RE-ISSUED FOR SITE PLAN APPROVAL	BWB

LICENSED PROFESSIONAL ENGINEER
B. W. BOLIVAR
100017873
PROVINCE OF ONTARIO

CORAL SOPHIA HOUSING
115 BAYFIELD ST.
BARRIE, ONTARIO
COUNTY OF SIMCOE

EXISTING DRAINAGE CATCHMENT PLAN

PROJECT NO. 17-3103 | DRWG NO. SWM1
DATE APRIL 2020 | SCALE: 1:200 HOR.
DRAWN: BDD/BWB | CHECKED: | APPROVED:

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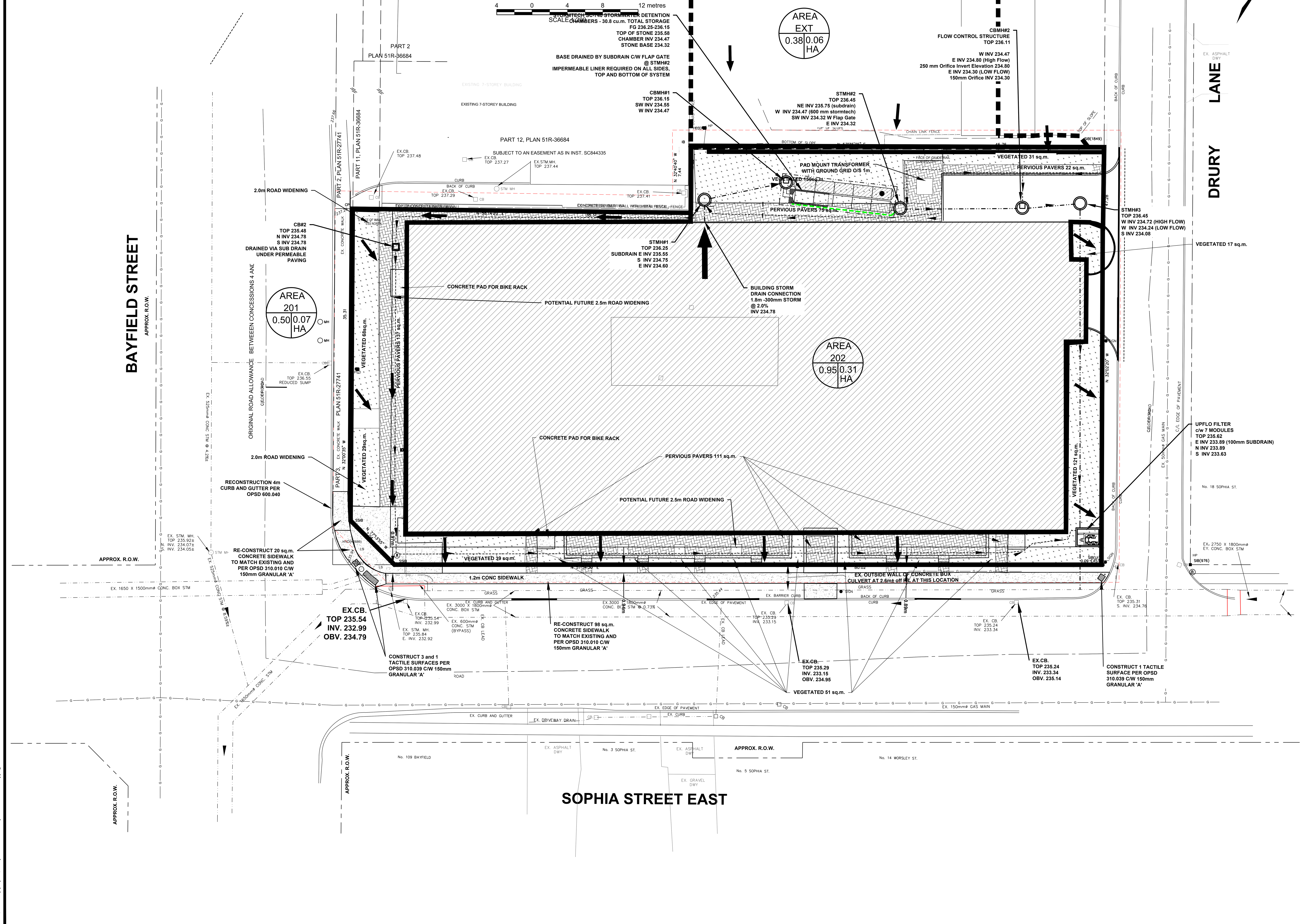
FAX (705) 726-0331
TOLL FREE (877) 726-1141

3103 – SWM2

PART OF LOTS 9, 10 AND 11
REGISTERED PLAN 31
CITY OF BARRIE
COUNTY OF SIMCOE



KEY MAP
N.T.S.

LEGEND

	DEVELOPMENT BOUNDARY
	EXISTING LIMIT OF R.O.W.
	FOUND IRON BAR
	FOUND SQUARE IRON BARS
× 263.20	EXISTING ELEVATIONS
CB	EXISTING CATCH BASIN
STM MH	EXISTING STORM MANHOLE
	EXISTING STORM SEWER
SIGN	EXISTING SIGN
0.XX DIA	EXISTING TREE WITH TRUNK DIAMETER
	EXISTING 1.00 m CONTOUR
	EXISTING 0.50 m CONTOUR
MW	EXISTING MONITOURING WELL
AREA 106	CATCHMENT ID
0.95 0.09 HA	CATCHMENT AREA
RATIONAL C FACTOR (100 YEAR)	
	CATCHMENT BOUNDARY
	EXTERNAL CATCHMENT BOUNDARY
	OVERLAND FLOW DIRECTION
	PERVIOUS AREA
	PROPOSED BUILDING

SCHEDULE OF REVISIONS

NO.	DATE	DESCRIPTION	CHECKED
1	APRIL 2020	SUBMISSION FOR REZONING	BWB
2	2020 11 16	ISSUED FOR SITE PLAN APPROVAL	BWB
3	2021 02 25	RE-ISSUED FOR SITE PLAN APPROVAL	BWB
4	2021 05 13	SWM REVISIONS	BWB

LICENSED PROFESSIONAL ENGINEER
B. W. BOLIVAR
100017873
PROVINCE OF ONTARIO
May 13, 2021

CORAL SOPHIA HOUSING
115 BAYFIELD ST.
BARRIE, ONTARIO
COUNTY OF SIMCOE

PROPOSED CATCHMENT PLAN

PROJECT NO. 17-3103	DRWG NO. SWM2
DATE APRIL 2020	SCALE: 1:200 HOR.
DRAWN: BDD/BWB CHECKED:	APPROVED:

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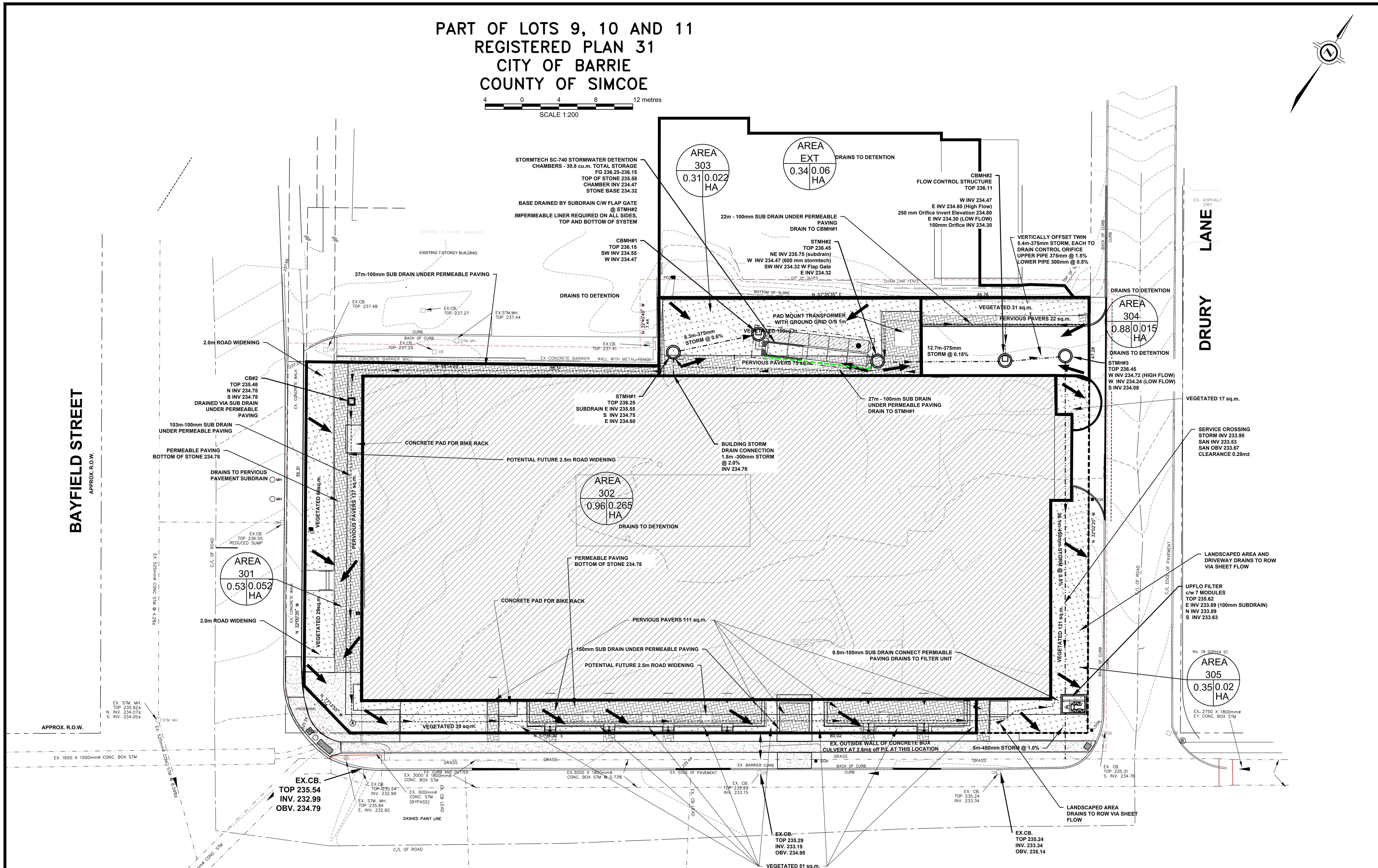
TOLL FREE (877) 726-1141

3103 – SWM3

PART OF LOTS 9, 10 AND 11
REGISTERED PLAN 31
CITY OF BARRIE
COUNTY OF SIMCOE

SCALE 1:200 (4 0 4 8 12 metres)



KEY MAP
N.T.S.

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- RATIONAL C FACTOR (100 YEAR)
- CATCHMENT BOUNDARY
- EXTERNAL CATCHMENT BOUNDARY
- OVERLAND FLOW DIRECTION
- PERVIOUS AREA
- PROPOSED BUILDING

SCHEDULE OF REVISIONS

NO.	DATE	DESCRIPTION	CHECKED
1	APRIL 2020	SUBMISSION FOR REZONING	BWB
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3	2021 02 25	RE-ISSUED FOR SITE PLAN APPROVAL	BWB
4	2021 05 13	SWM REVISIONS	BWB

LICENSED PROFESSIONAL ENGINEER B. W. BOLIVAR 100017873 PROVINCE OF ONTARIO

CONTROL MONUMENTS

HORIZONTAL CONTROL MONUMENT

THE HORIZONTAL MONUMENT 01019860463

THE HORIZONTAL MONUMENT IS LOCATED IN PAVED DRIVEWAY UNDER WATER VALVE COVER ON THE WEST SIDE OF MULCASTER STREET IMMEDIATELY NORTH OF #108 MULCASTER STREET.

NORTHING (SECOND ORDER): 4916487.811
EASTING (SECOND ORDER): 604671.596

HORIZONTAL MONUMENT 03120040046

THE HORIZONTAL MONUMENT 03120040046 IS LOCATED IN QUEEN'S PARK ON SOUTH-EAST CORNER OF ROSS STREET AND PARKSIDE DRIVE. NOTE: A PROTECTIVE WATER VALVE COVER HAS BEEN PLACED OVER MONUMENT CAP.

NORTHING (SECOND ORDER): 4916082.772
EASTING (SECOND ORDER): 603662.430

NOTES

TOPOGRAPHIC INFORMATION PROVIDED BY J. D. BARNES LIMITED REFERENCE NUMBER 17-11-571-00 DATED MARCH 22, 2017

1. BEARINGS ARE UTM GRID, DERIVED FROM OBSERVED REFERENCE POINTS A AND B, BY REAL TIME NETWORK (RTN) OBSERVATIONS, UTM ZONE 17, NAD83 (CSRS) (2010.0).
2. DISTANCES ARE GROUND AND CAN BE CONVERTED TO GRID BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.999702.
3. ELEVATIONS SHOWN ON THIS PLAN ARE RELATED TO GEODETIC DATUM AND ARE DERIVED FROM BENCH MARK No 03120080022 HAVING A PUBLISHED ELEVATION OF 222.437 METRES.

UNDERGROUND SERVICES AND UTILITIES LOCATION AND ELEVATIONS SHOWN ARE APPROXIMATE ONLY AND COMPILED FROM COUNTY OF SIMCOE DRAWING NUMBER 2002-02 SHEET PP7, SHEET PP2 AND CONTRACT NUMBER 71-31 DRAWING NO. 71-41.

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115 BAYFIELD ST.
BARRIE, ONTARIO
COUNTY OF SIMCOE

STORM SEWER CATCHMENT PLAN

PROJECT NO. 17-3103		DRWG NO. SWM3	
DATE	APRIL 2020	SCALE:	1:200 HOR.
DRAWN: BDD/BWB	CHECKED:	APPROVED:	

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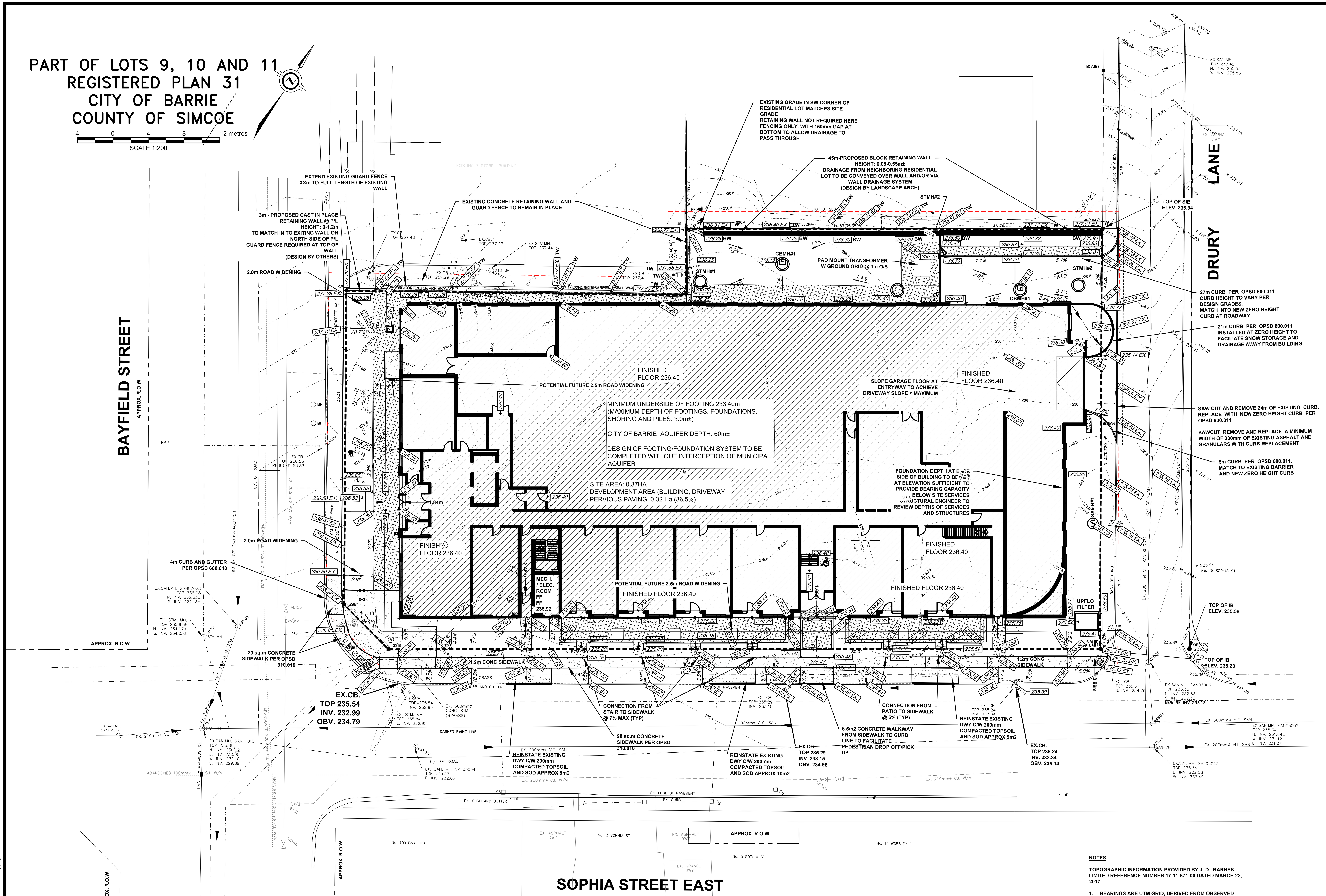

KEY MAP
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- EXISTING STORM MANHOLE
- EXISTING STORM SEWER
- EXISTING SANITARY MANHOLE
- EXISTING SANITARY SEWER
- EXISTING SANITARY SERVICE
- EXISTING FIRE HYDRANT PER TOPO SURVEY
- EXISTING WATER VALVE PER TOPO SURVEY
- EXISTING CURB STOP PER TOPO SURVEY
- EXISTING WATERMAIN
- EXISTINGELECTRICAL MANHOLE
- EXISTING LIGHT STANDARD
- EXISTING HYDRO POLE
- EXISTING OVERHEAD HYDRO
- EXISTING BELL PEDESTAL
- EXISTING SIGN
- EXISTING 1.00 m CONTOUR
- EXISTING 0.50 m CONTOUR
- EXISTING MONITOURING WELL
- PROP. SPOT ELEVATION
- PROP. TOP OF CURB SPOT ELEVATION
- PROP. TOP OF WALL SPOT ELEVATION
- PROP. BOTTOM OF WALL SPOT ELEVATION
- PROPOSED GRADE
- PROPOSED TREES AND/OR SHRUBS
- PROPOSED VEGETATED SURFACE
- PROPOSED PERMEABLE PAVING WITH UNDERDRAIN

SCHEDULE OF REVISIONS

NO.	DATE	DESCRIPTION	CHECKED
1.	MARCH 20, 2020	ISSUED FOR PRE-CONSULTATION	BWB
2.	APRIL 2020	SUBMISSION FOR REZONING	BWB
3.	2020 11 16	ISSUED FOR SITE PLAN APPROVAL	BWB
4.	2021 02 25	RE-ISSUED FOR SITE PLAN APPROVAL	BWB
5.	2021 05 13	SWM REVISIONS	BWB

LICENSED PROFESSIONAL ENGINEER
May 13, 2021
B. W. BOLIVAR
100017873
PROVINCE OF ONTARIO

CONTROL MONUMENTS

HORIZONTAL CONTROL MONUMENT

THE HORIZONTAL MONUMENT 01019860463

THE HORIZONTAL MONUMENT IS LOCATED IN PAVED DRIVEWAY UNDER WATER VALVE COVER ON THE WEST SIDE OF MULCASTER STREET IMMEDIATELY NORTH OF #108 MULCASTER STREET.

NORTHING (SECOND ORDER): 4916487.811
EASTING (SECOND ORDER): 604671.596

COMBINED CONTROL MONUMENTS

THE HORIZONTAL MONUMENT 03120080022

LOCATED ON THE SE CORNER OF INNISFIL STREET AND VESPRA STREET APPROXIMATELY 18.5M FROM CENTERLINE OF INNISFIL STREET AND APPROXIMATELY 13M FROM CENTERLINE OF VESPRA STREET.
NOTE: A PROTECTIVE WATER VALVE COVER HAS BEEN PLACED OVER MONUMENT CAP.

NORTHING (SECOND ORDER): 4915161.491
EASTING (SECOND ORDER): 603825.428
VERTICAL (SECOND ORDER): 222.437

NOTES

TOPOGRAPHIC INFORMATION PROVIDED BY J. D. BARNES LIMITED REFERENCE NUMBER 17-11-571-00 DATED MARCH 22, 2017

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CORAL SOPHIA HOUSING
115 BAYFIELD ST.
BARRIE, ONTARIO
COUNTY OF SIMCOE

SITE GRADING PLAN

PROJECT NO. 17-3103	DRWG NO. 3103-GP1
DATE APRIL 2020	SCALE: 1:200 HOR.

DRAWN: BDD/BWB | CHECKED: | APPROVED:

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BARRIE, ONTARIO L4M 5G1
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FAX (705) 726-0331
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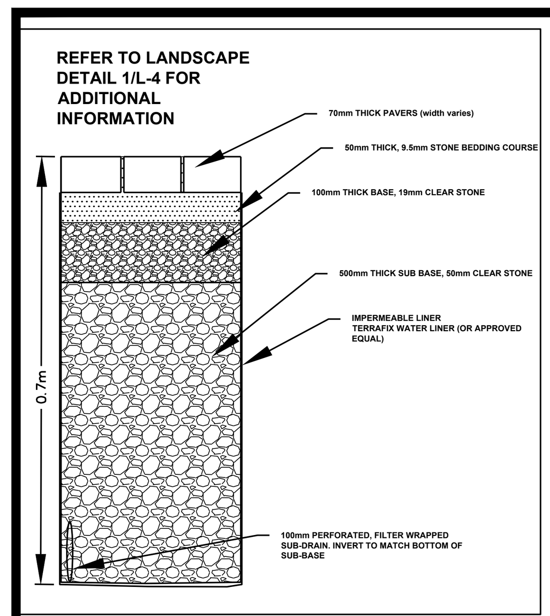
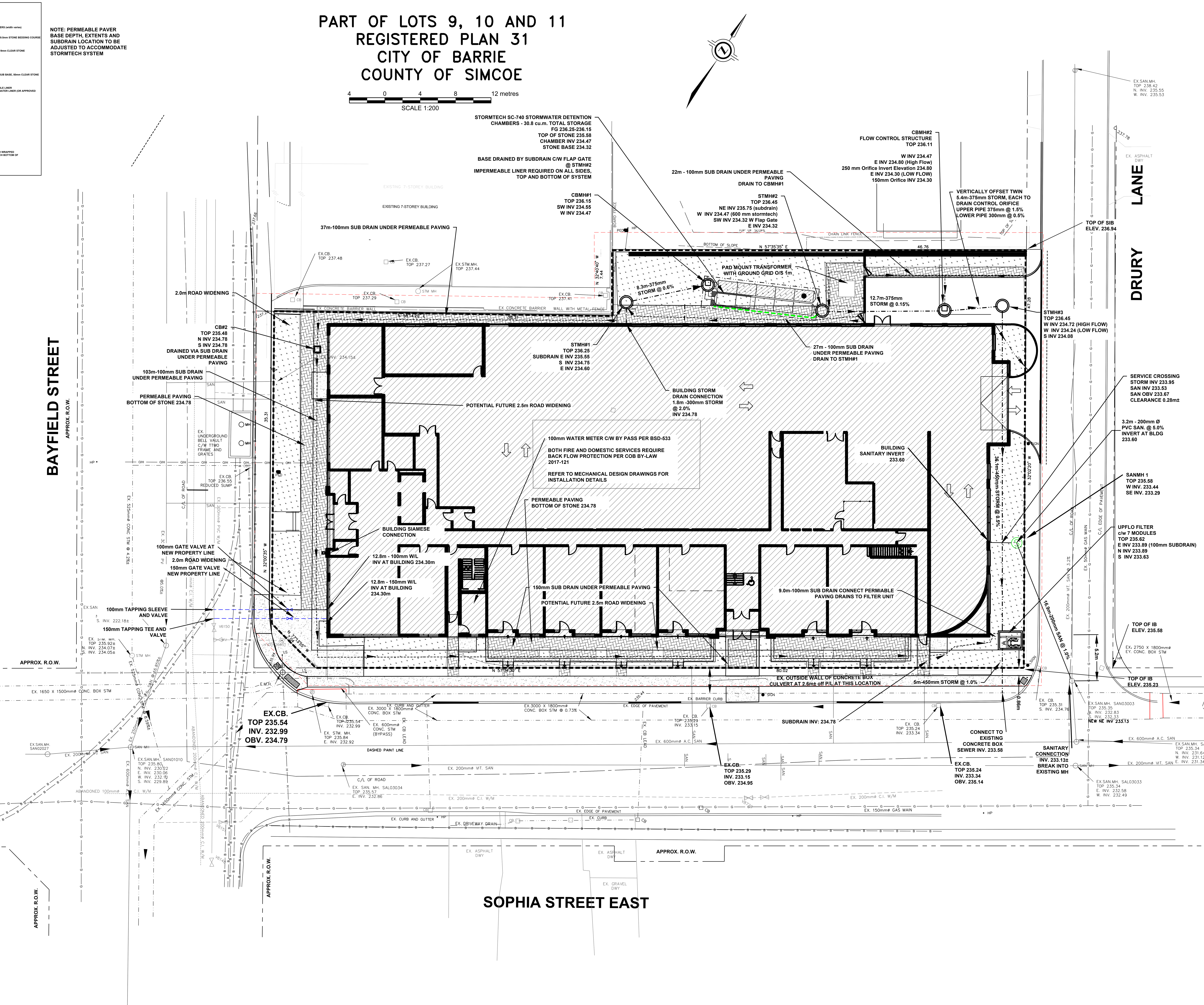
3103 – SS1





KEY MAP
N.T.S.

LEGEND

- DEVELOPMENT BOUNDARY
- EXISTING LIMIT OF R.O.W.
- FOUND IRON BAR
- FOUND SQUARE IRON BARS
- EXISTING CATCH BASIN
- EXISTING STORM MANHOLE
- EXISTING STORM SEWER
- EXISTING SANITARY MANHOLE
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- EXISTING SANITARY SERVICE
- EXISTING FIRE HYDRANT PER TOPO SURVEY
- EXISTING WATER VALVE PER TOPO SURVEY
- EXISTING CURB STOP PER TOPO SURVEY
- EXISTING WATERMAIN
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- EXISTING LIGHT STANDARD
- EXISTING HYDRO POLE
- EXISTING OVERHEAD HYDRO
- EXISTING BELL PEDESTAL
- EXISTING GAS
- EXISTING UNDERGROUND BELL
- EXISTING SIGN
- PROP. SANITARY MANHOLE
- PROP. SANITARY SEWER
- PROP. STORM SEWER
- PROP. STORM MANHOLE
- PROP. CATCH BASIN MANHOLE
- PROP. SUBDRAIN
- PROPOSED PERMEABLE PAVING WITH UNDERDRAIN

SCHEDULE OF REVISIONS

NO.	DATE	DESCRIPTION	CHECKED
1.	MARCH 20, 2020	ISSUED FOR PRE-CONSULTATION	BWB
2.	APRIL 2020	PRE-DEVELOPMENT SUBMISSION	BWB
3.	2020 11 16	ISSUED FOR SITE PLAN APPROVAL	BWB
4.	2021 02 25	RE-ISSUED FOR SITE PLAN APPROVAL	BWB
5.	2021 05 13	SWM REVISIONS	BWB

LICENSED PROFESSIONAL ENGINEER
B. W. BOLIVAR
100017873
PROVINCE OF ONTARIO

CORAL SOPHIA HOUSING
115 BAYFIELD ST.
BARRIE, ONTARIO
COUNTY OF SIMCOE

SITE SERVICING PLAN ABOVE GROUND

PROJECT NO. 17-3103 DRWG NO. 3103-SS1
DATE APRIL 2020 SCALE: 1:200 HOR.
DRAWN: BDD/BWB CHECKED: APPROVED:

SBA Skelton Brumwell & Associates Inc.
ENGINEERING PLANNING ENVIRONMENTAL CONSULTANTS
93 BELL FARM ROAD, SUITE 107
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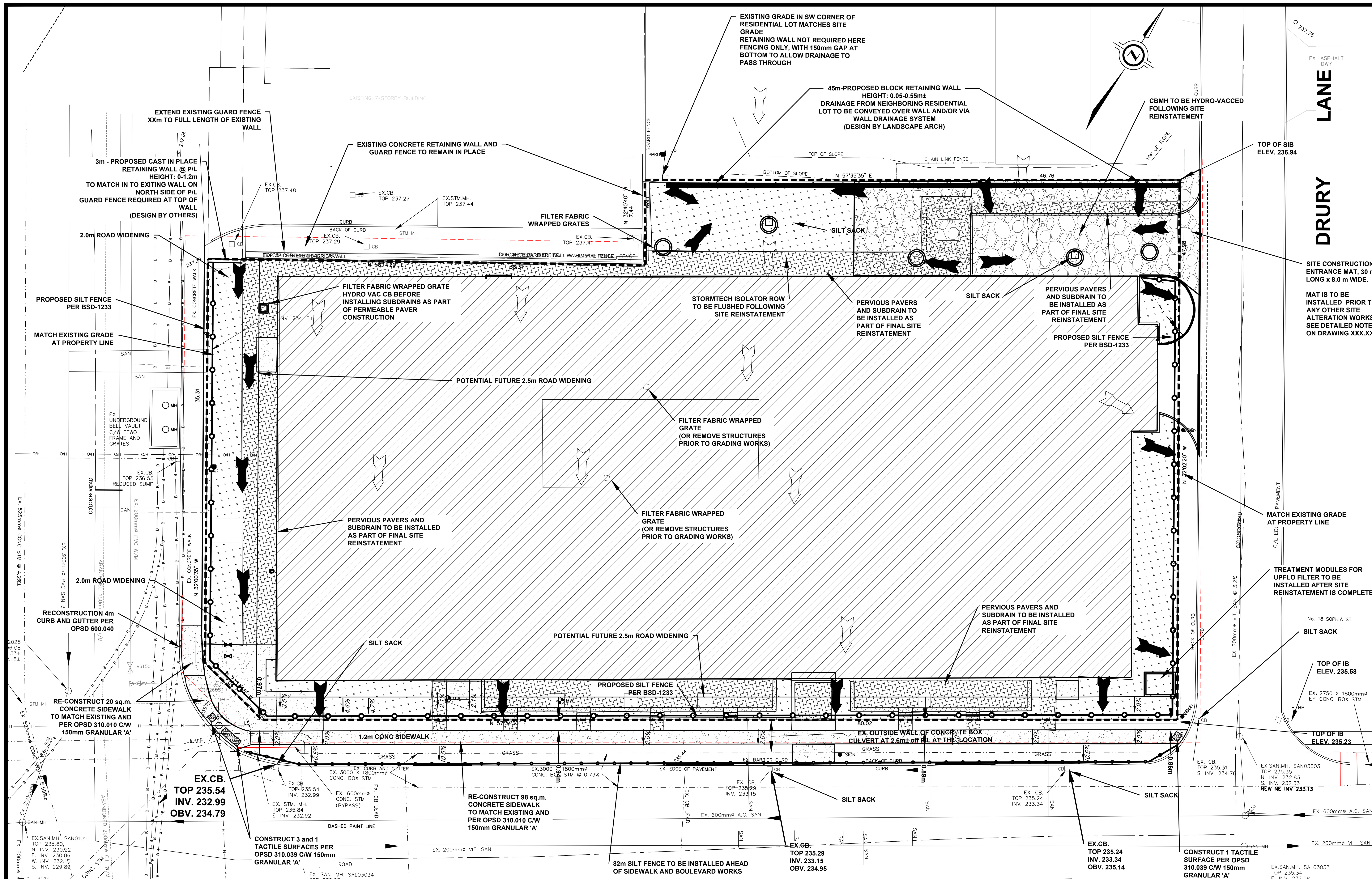
TELEPHONE (705) 726-1141
FAX (705) 726-0331
TOLL FREE (877) 726-1141

3103 – SCP



PART OF LOTS 9, 10 AND 11
REGISTERED PLAN 31
CITY OF BARRIE
COUNTY OF SIMCOE

4 0 4 8 12 metres
SCALE 1:200

KEY MAP
N.T.S.

LEGEND

	DEVELOPMENT BOUNDARY
	EXISTING LIMIT OF R.O.W.
IB	FOUND IRON BAR
SIB	FOUND SQUARE IRON BARS
× 263.20	EXISTING ELEVATIONS
CB	EXISTING CATCH BASIN
STM MH	EXISTING STORM MANHOLE
	EXISTING STORM SEWER
SAN MH	EXISTING SANITARY MANHOLE
	EXISTING SANITARY SEWER
SAN	EXISTING SANITARY SERVICE
HYD	EXISTING FIRE HYDRANT PER TOPO SURVEY
WV	EXISTING WATER VALVE PER TOPO SURVEY
WSO	EXISTING CURB STOP PER TOPO SURVEY
	EXISTING WATERMAIN
E.M.H.	EXISTINGELECTRICAL MANHOLE
LS	EXISTING LIGHT STANDARD
HP	EXISTING HYDRO POLE
O/H O/H O/H	EXISTING OVERHEAD HYDRO
PED	EXISTING BELL PEDESTAL
G G G G	EXISTING GAS
B B B B	EXISTING UNDERGROUND BELL
SIGN	EXISTING SIGN
271	EXISTING 1.00 m CONTOUR
271.5	EXISTING 0.50 m CONTOUR
MW	EXISTING MONITOURING WELL
	PROPOSED SITL FENCE
	PROPOSED OVERLAND FLOW
	EXISTING OVERLAND FLOW

EROSION AND SILTATION CONTROLS

THE CONTRACTOR SHALL:

1. BE RESPONSIBLE FOR ALL SILT CONTROL MEASURES THROUGHOUT THE DURATION OF THE PROJECT.
2. BE RESPONSIBLE FOR THE CONTROL OF ONSITE SURFACE AND GROUNDWATER AT ALL TIMES.
3. PROMPTLY MAINTAIN, REPAIR, AND/OR REPLACE ALL EROSION AND SILTATION CONTROLS, AS WELL AS REMOVE AND DISPOSE OF ALL ACCUMULATED SEDIMENTS AS NECESSARY.
4. PROMPTLY REMOVE ALL MUD AND DEBRIS FROM THE CONSTRUCTION ACCESS MAT AND ALL ROADS, AS NECESSARY. REMOVAL METHOD SHALL INCLUDE FLUSHING AND SWEEPING.
5. CONSTRUCTION AREAS THAT EXCEED 30 DAYS OF INACTIVITY SHALL BE STABLIZED BY SEEDING. THIS SHALL INCLUDE STOCKPILES OF FILL AND TOPSOIL.
6. BE RESPONSIBLE FOR IMPLEMENTATION AND ADHERENCE TO THE STAGING PLAN, AS SHOWN ON THIS DRAWING.
7. NOT ALLOW EFFLUENT FROM SITE DEWATERING OPERATIONS TO DISCHARGE DIRECTLY INTO RECEIVING BODIES OF WATER OR STREAMS.
8. MAINTAIN ALL ROADS AFFECTED BY CONSTRUCTION FREE OF SEDIMENT BY SWEEPING AS NECESSARY OR AS DIRECTED BY THE CONTRACT ADMINISTRATOR OR TOWNSHIP
9. IMPLEMENT APPROPRIATE DUST CONTROL MEASURES TO PREVENT EXCESSIVE DUST ON SITE OR MIGRATION OF DUST OT ADJACENT PROPERTIES
10. MAINTAIN ON SITE AT ALL TIMES AT LEAST 50m OF ADDITIONAL FENCING AND SUPPORTS TO BE ABLE TO CONDUCT EMERGENCY REPAIRS OF PERIMETER SILTATION FENCE

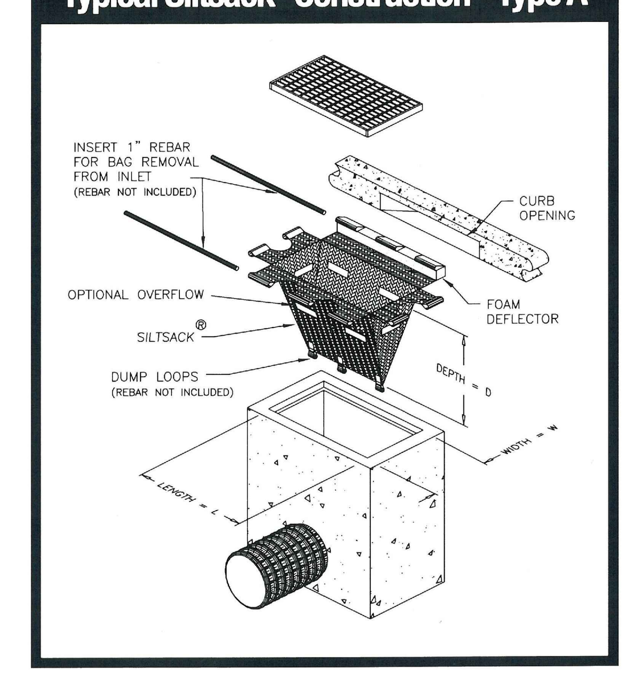
THE ENGINEER MAY, AT HIS DISCRETION, DIRECT THE CONTRACTOR TO MAINTAIN, REPAIR, REPLACE, AND/OR UPGRADE ANY AND ALL EROSION AND SILTATION CONTROL MEASURES.

THE ENGINEER MAY, AT HIS DISCRETION DIRECT THE CONTRACTOR TO SWEEP ADJACENT ROADS THAT ARE ADVERSELY IMPACTED BY CONSTRUCTION TRAFFIC.

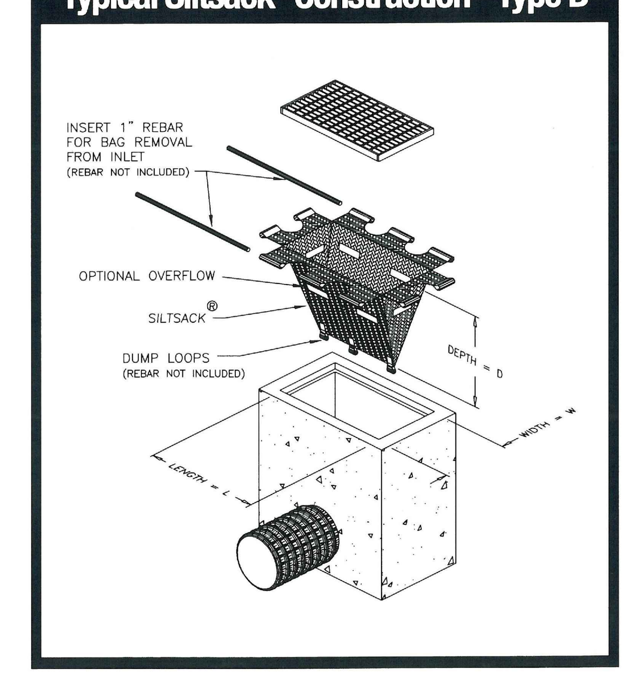
THE ENGINEER SHALL DETERMINE WHEN THE SITE IS SUFFICIENTLY STABLE AND EROSION AND SILTATION CONTROLS ARE NO LONGER REQUIRED.

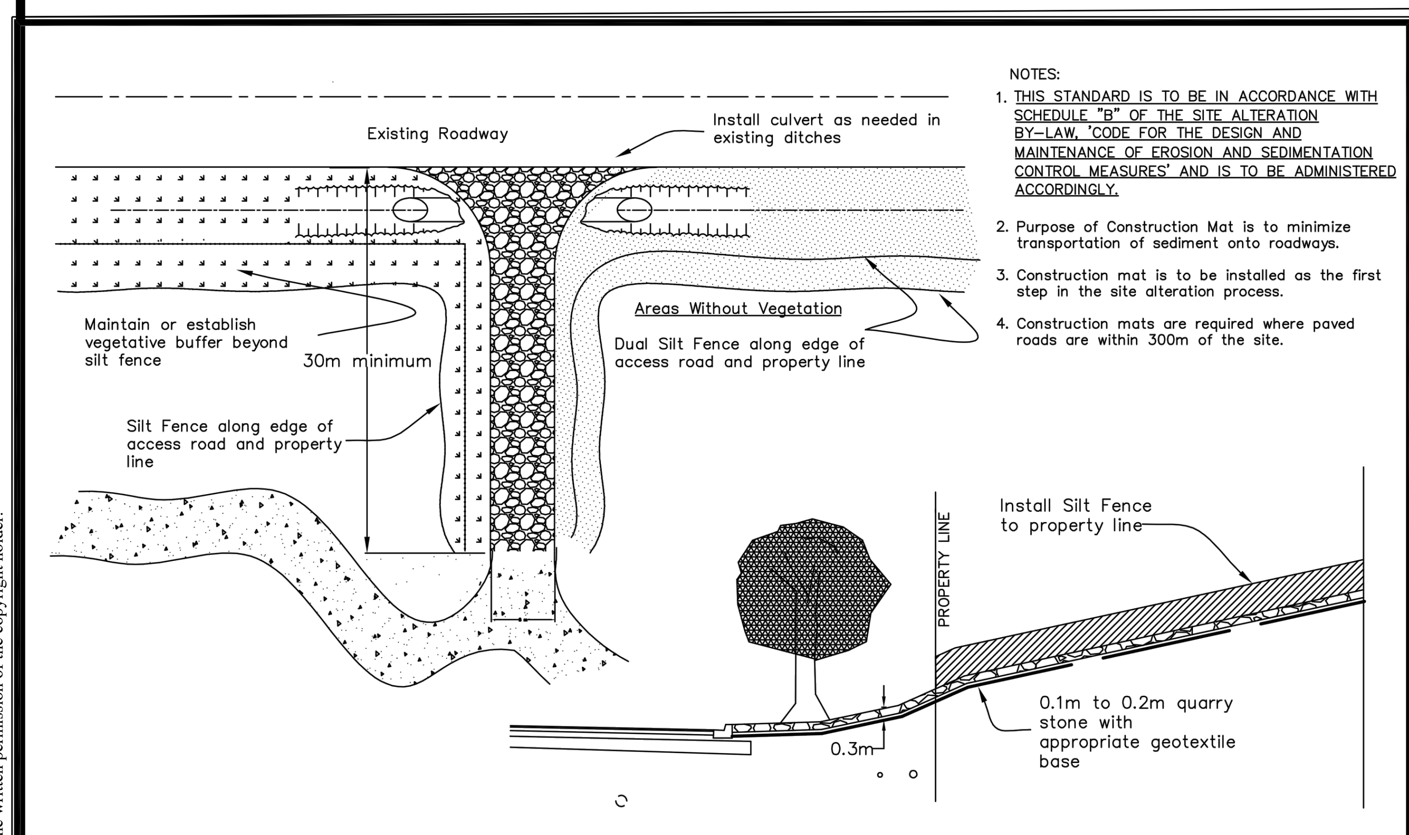
ALL DISTURBED AREAS ARE TO BE REINSTATED TO THEIR ORIGINAL CONDITION OR BETTER.

Typical Siltsack® Construction - Type A



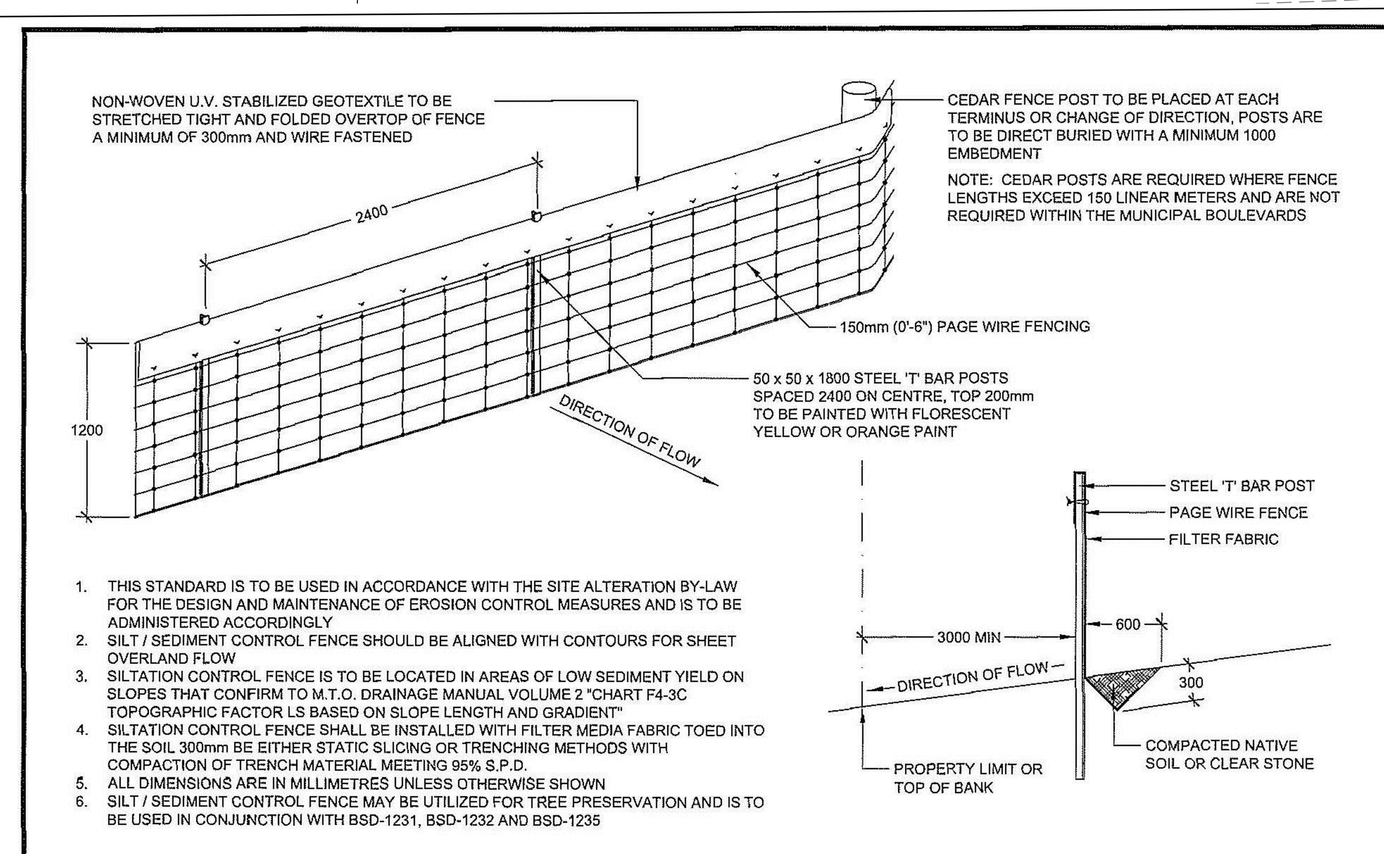
Typical Siltsack® Construction - Type B





NOTES:
1. THIS STANDARD IS TO BE IN ACCORDANCE WITH SCHEDULE "B" OF THE SITE ALTERATION BY-LAW, "CODE FOR THE DESIGN AND MAINTENANCE OF EROSION AND SEDIMENTATION CONTROL MEASURES" AND IS TO BE ADMINISTERED ACCORDINGLY.
2. Purpose of Construction Mat is to minimize transportation of sediment onto roadways.
3. Construction mat is to be installed as the first step in the site alteration process.
4. Construction mats are required where paved roads are within 300m of the site.

CITY OF BARRIE STANDARD	1.	Standardized Dimension Text	J.S.	05.10.28	APP'D: R.G.N.	DATE: 04.03.16
CONSTRUCTION ENTRANCE MAT					DRAWN: A.S.C	SCALE: N.T.S
	NO.	REVISION	APP'D	DATE	BSD-23D	



1. THIS STANDARD IS TO BE USED IN ACCORDANCE WITH THE SITE ALTERATION BY-LAW FOR THE DESIGN AND MAINTENANCE OF EROSION CONTROL MEASURES AND IS TO BE ADMINISTERED ACCORDINGLY
2. SILT / SEDIMENT CONTROL FENCE SHOULD BE ALIGNED WITH CONTOURS FOR SHEET OVERLAND FLOW
3. SILTATION CONTROL FENCE IS TO BE LOCATED IN AREAS OF LOW SEDIMENT YIELD ON SLOPES THAT CONFIRM TO M.T.O. DRAINAGE MANUAL VOLUME 2 "CHART F4-3C TOPOGRAPHIC FACTOR LS BASED ON SLOPE LENGTH AND GRADIENT"
4. SILTATION CONTROL FENCE SHALL BE INSTALLED WITH FILTER MEDIA FABRIC TOED INTO THE SOIL 300MM BE EITHER STATIC SLICING OR TRENCHING METHODS WITH COMPACTION OF TRENCH MATERIAL MEETING 95% S.P.D.
5. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN
6. SILT / SEDIMENT CONTROL FENCE MAY BE UTILIZED FOR TREE PRESERVATION AND IS TO BE USED IN CONJUNCTION WITH BSD-1231, BSD-1232 AND BSD-1235

Barrie STANDARD DETAIL	SILTATION CONTROL FENCING	REV No. 1	DATE: OCT 2017 / SCALE: N.T.S.	APPROVED
		BSD-1233	FORMERLY BSD-23A	DATE: Oct 10/17 DIRECTOR OF ENGINEERING

SEQUENCE OF CONTROLS

PRIOR TO DISTURBING SOILS ON SITE FOR CONSTRUCTION RELATED ACTIVITIES

1. INSTALL SILT SACKS ON SURROUNDING AREA CATCH BASINS.
2. INSTALL FILTER FABRIC WRAP ON EXISTING CATCH BASINS INTERIOR TO SITE. CUT AND PLUG EXISTING STORM LEADS AS EARLY AS POSSIBLE IN THE CONSTRUCTION SEQUENCE.
3. INSTALL PERIMETER SILTATION FENCING. THIS MAY BE AFFIXED TO SITE HOARDING.
4. INSTALL MUD MAT AT CONSTRUCTION VEHICLE ENTRANCE.
5. INSTALL SILT SACKS ON NEW INTERIOR SITE CATCH BASINS AND CATCH BASIN MANHOLES AS THEY ARE INSTALLED.
6. PERVIOUS PAVER CONSTRUCTION (INCLUDING SUBDRAINS AND STONE BASE) TO BE SCHEDULED IMMEDIATELY PRIOR TO SITE REINSTATEMENT TO PREVENT SILT AND SEDIMENT IMPACTING THE STONE DRAINAGE LAYERS. PERMEABLE PAVERS ARE NOT TO BE SUBJECT TO CONSTRUCTION TRAFFIC NOR USED AS A WORKING SURFACE DURING CONSTRUCTION.
7. SITE EROSION CONTROLS MAY BE REMOVED ONCE THE SITE IS BEING PREPARED FOR FINAL REINSTATEMENT.
8. CLEAN SITE STORM STRUCTURES ONCE SITE HAS BEEN REINSTATED
9. INSTALL TREATMENT MODULES IN FILTER UNIT ONCE STORM SYSTEM HAS BEEN CLEANED.

MUD MAT

MUD MATS ARE TO BE USED FOR ALL CONSTRUCTION ENTRANCES AND EXIT LOCATIONS. THEY ARE TO BE A MINIMUM OF 30m LONG, 5m WIDE AND 450mm THICK.

MAT TO BE CONSTRUCTED WITH 50mm CLEAR STONE FOR 10m FROM THE STREET. THE BALANCE TO BE CONSTRUCTED WITH 150mm RIP RAP STONE.

SCHEDULE OF REVISIONS

NO.	DATE	DESCRIPTION	CHECKED
1.	2020 11 16	ISSUED FOR SITE PLAN APPROVAL	BWB
2.	2021 02 25	RE-ISSUED FOR SITE PLAN APPROVAL	BWB
3.	2021 05 13	SWM REVISIONS	BWB

CORAL SOPHIA HOUSING
115 BAYFIELD ST.
BARRIE, ONTARIO
COUNTY OF SIMCOE

SEDIMENT AND EROSION CONTROL PLAN

PROJECT NO. 17-3103		DRWG NO. 3103-SCP	
DATE	APRIL 2020	SCALE:	1:200 HOR.
DRAWN: BDD/BWB	CHECKED:		APPROVED:

SBA Skelton Brumwell & Associates Inc.
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3103 – DET4

PROJECT INFORMATION	
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ADS SALES REP:	RYAN MARTIN 705-207-3059 RYAN.MARTIN@ADS-PIPE.COM
PROJECT NO:	S180483
ADS SITE COORDINATOR:	MATTHEW BEGHIN 519-710-3687 MATTHEW.BEGHIN@ADS-PIPE.COM

ADVANCED DRAINAGE SYSTEMS, INC.

SiteASSIST by StormTech — FOR STORMTECH INSTRUCTIONS, DOWNLOAD THE INSTALLATION APP

117 BAYFIELD STREET
BARRIE, ON.

SC-740 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH SC-740.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBERS SHALL BE CERTIFIED TO CSA B184, "POLYMERIC SUB-SURFACE STORMWATER MANAGEMENT STRUCTURES", AND MEET THE REQUIREMENTS OF ASTM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE ...

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF THE SC-740 SYSTEM

1. STORMTECH SC-740 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH SC-740 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR AN EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.

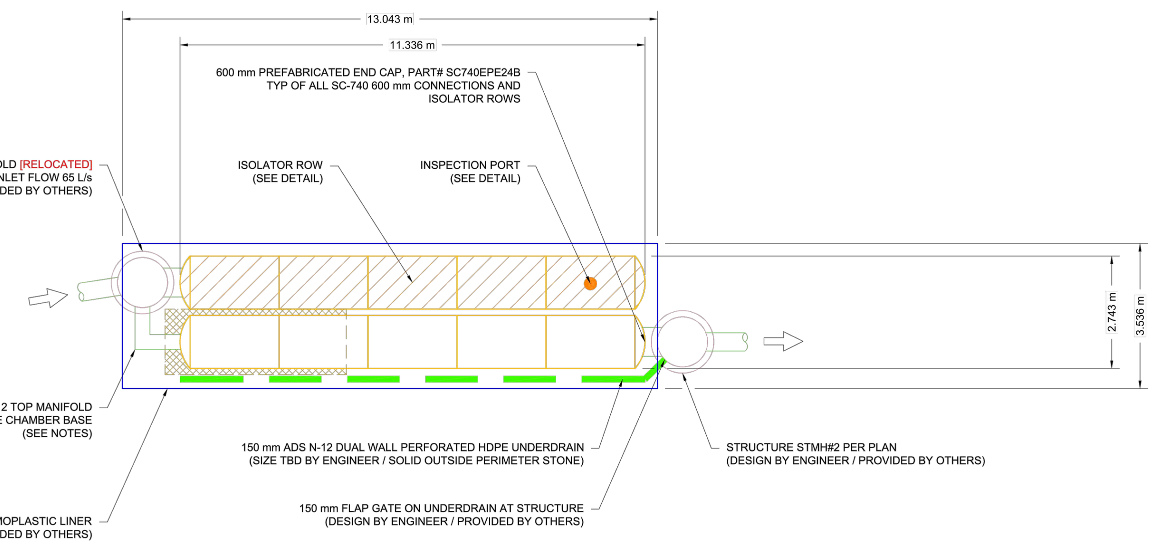
NOTES FOR CONSTRUCTION EQUIPMENT

PROPOSED LAYOUT

PROPOSED ELEVATIONS

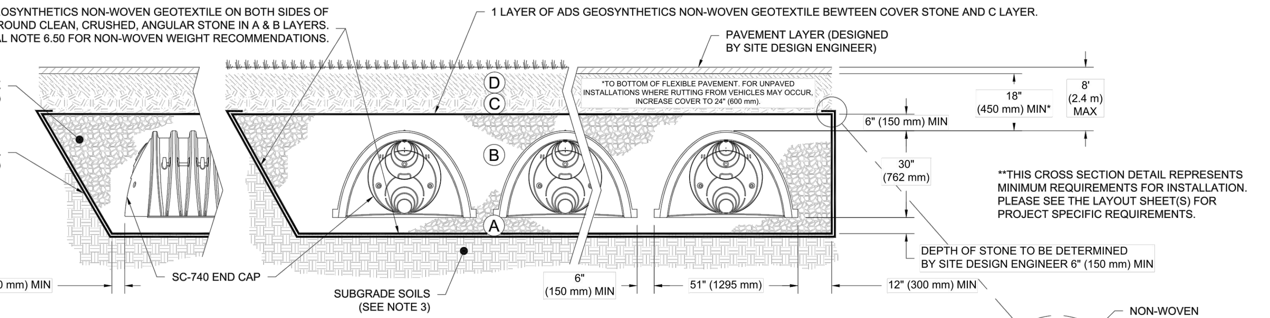
NOTES

NOT FOR CONSTRUCTION: THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.



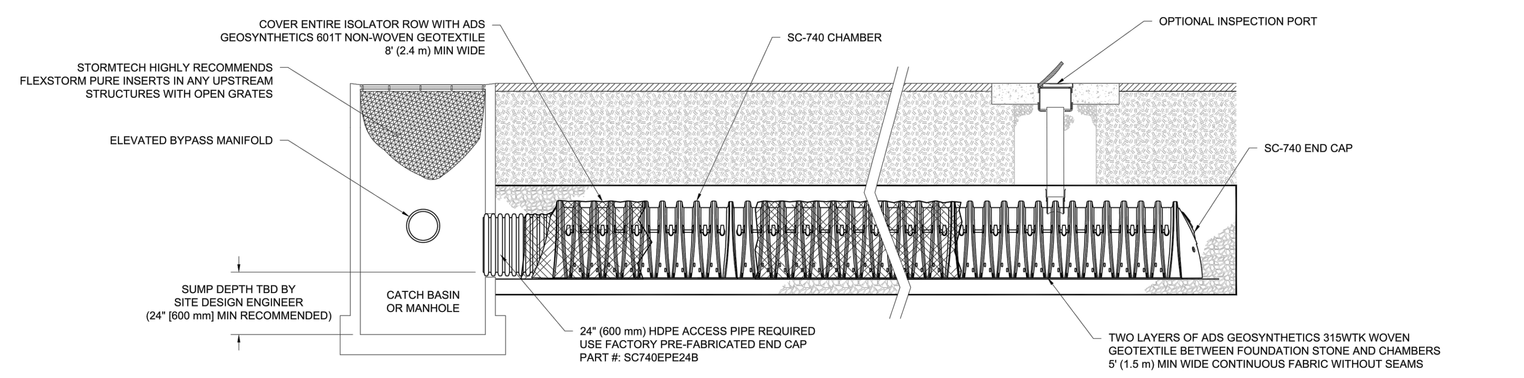
117 BAYFIELD STREET, BARRIE, ON — SCALE = 1 : 100 — SHEET 2 OF 5

ACCEPTABLE FILL MATERIALS: STORMTECH SC-740 CHAMBER SYSTEMS



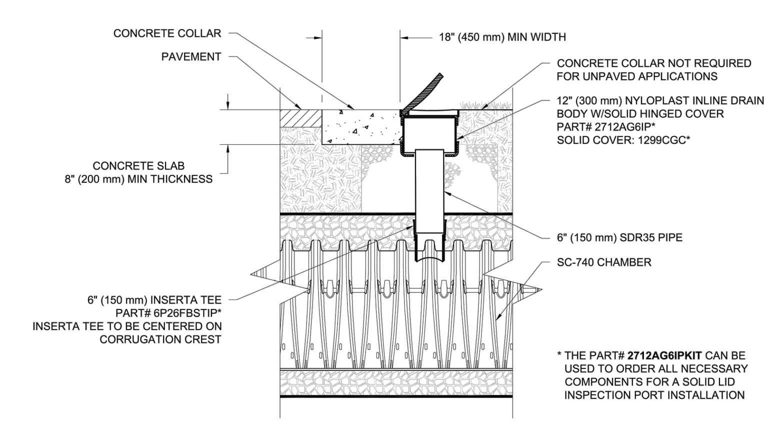
NOTES:

SHEET 3 OF 5



SC-740 ISOLATOR ROW DETAIL

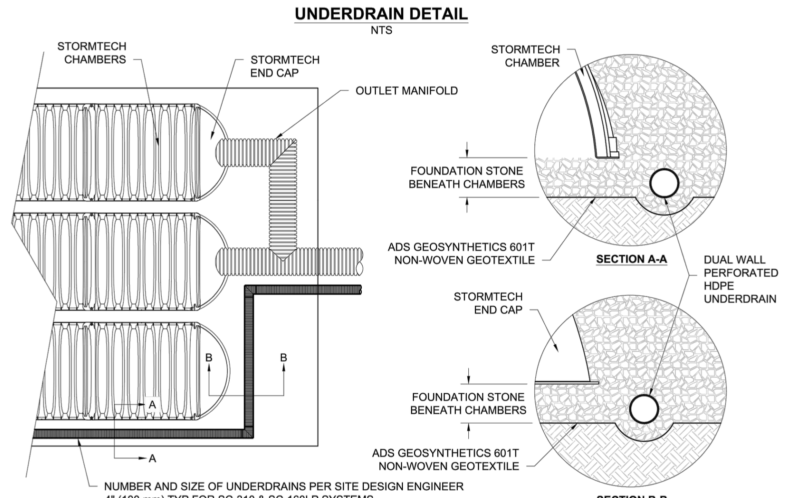
INSPECTION & MAINTENANCE



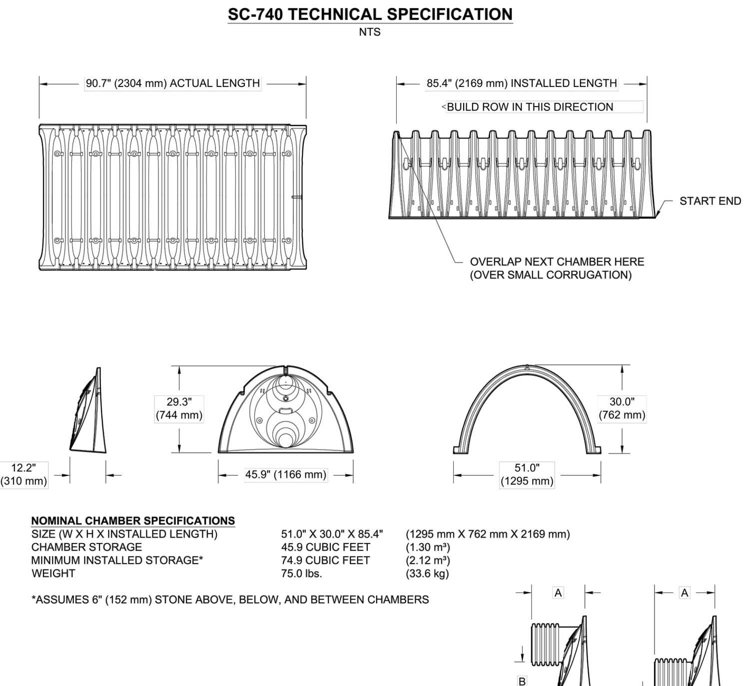
SC-740 6" (150 mm) INSPECTION PORT DETAIL

SHEET 4 OF 5

UNDERDRAIN DETAIL



SC-740 TECHNICAL SPECIFICATION



SHEET 5 OF 5

TECHNICAL NOTE
Thermoplastic Liners for Detention Systems — StormTech TN 6.50

General

Membrane Materials

Geotextile Materials

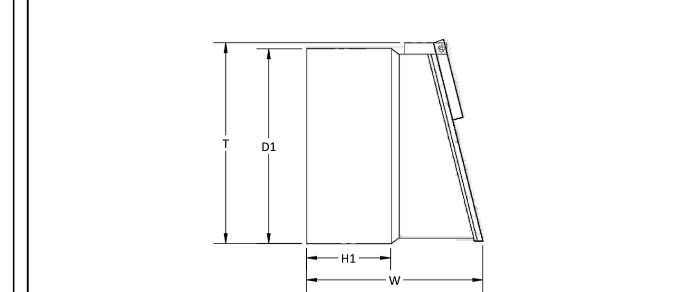
Seaming Options

3. Heat Welded [redacted]

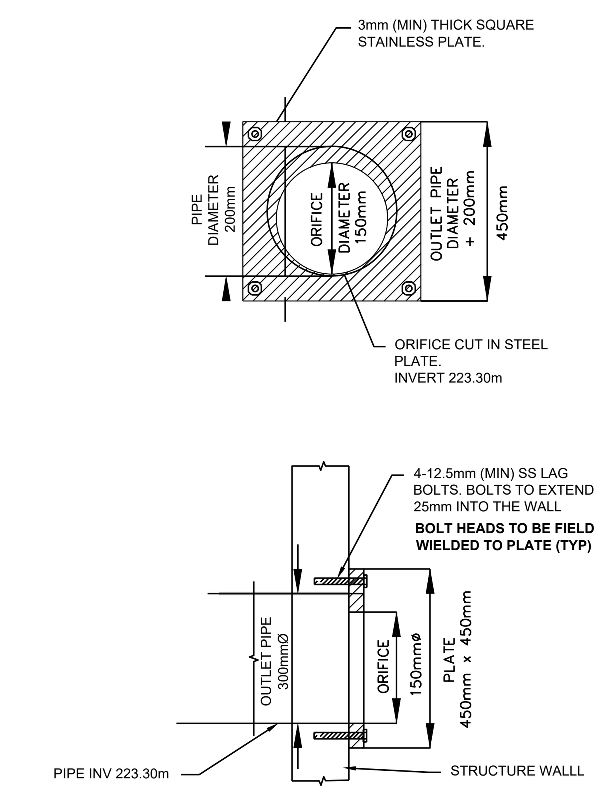
4. [redacted]

Terminal Backwater Valves

ROYAL Building Products

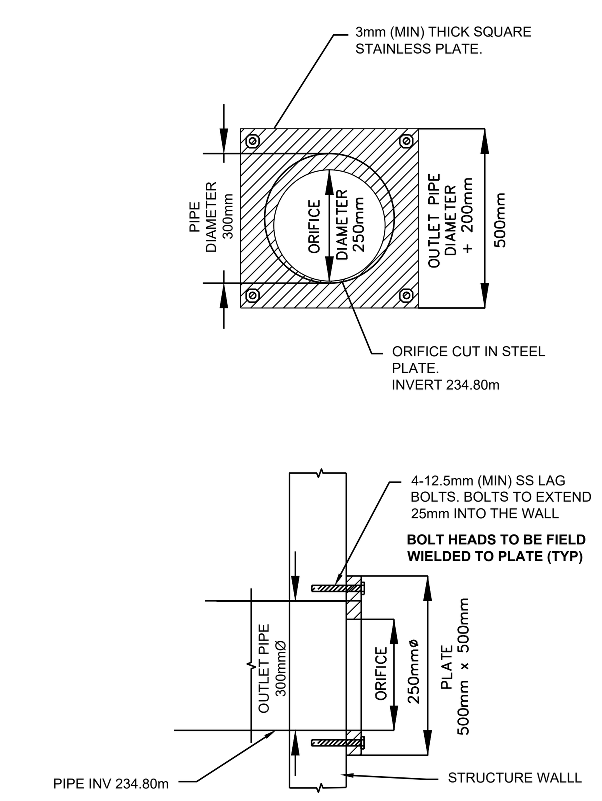


TERMINAL BACKWATER VALVE (H) PVC SOLVENT WELD DWV



LOW FLOW ORIFICE PLATE DETAIL

SCALE: NTS



HIGH FLOW ORIFICE PLATE DETAIL

SCALE: NTS

SCHEDULE OF REVISIONS			
NO.	DATE	DESCRIPTION	CHECKED
1.	2020 11 16	ISSUED FOR SITE PLAN APPROVAL	BWB
2.	2021 05 13	SWM REVISIONS	BWB

LICENSED PROFESSIONAL ENGINEER
May 13, 2021
B. W. BOLIVAR
100017873
PROVINCE OF ONTARIO

CORAL SOPHIA HOUSING
115 BAYFIELD ST.
BARRIE, ONTARIO
COUNTY OF SIMCOE

DETENTION SYSTEM DETAILS

PROJECT NO. 17-3103	DRWG NO. 3103-DET4
DATE APRIL 2020	SCALE: N.T.S.
DRAWN: BDD/BWB	CHECKED: / APPROVED:

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